EXCHANGE RATES, ECONOMIC INTEGRATION AND THE INTERNATIONAL ECONOMY

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EXCHANGE RATES, ECONOMIC INTEGRATION AND THE INTERNATIONAL ECONOMY

Edited by

Leo Michelis
Ryerson University

Mark Lovewell
Ryerson University

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The organization of the conference benefited from the support and involvement of many people. We are most grateful to our colleague Thomas Barbiero, who along with Leo Michelis co-organized the conference, and the Department Chair Ingrid Bryan, whose support and active participation added great value to the conference. We also owe debts of gratitude to the University President Claude Lajeunesse, the Provost and Vice-President Academic Errol Aspevig, and the Dean of Arts Carla Cassidy for their participation and material support, to our departmental assistant Leah Espineda for her tireless and professional work, and to the volunteer students at the conference for their help and enthusiasm.

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Foreword

This book presents a generous sampling of the papers presented at a conference which addressed monetary issues of considerable theoretical and practical interest, not just to Canadian economists, but to the profession in general. That is enough to commend it to any reader, but even more important, the conference from which it has grown also marked the appearance on the Canadian academic landscape of the economics department of a new university.

To launch a new university is challenging under any circumstances, but when, as in the case of Ryerson, it was a matter of converting an already going concern into something different, the task must have been especially daunting. After all, had a certain polytechnic institute not already been doing outstanding work, no one would have thought of granting it university status in the first place; but the job descriptions of the two types of institution are not quite the same, and Ryerson's very success in its old role required that the qualities that marked its earlier endeavours had to be blended into its new activities rather than superseded. No one was free to start from scratch in this case. Furthermore, Ryerson is Toronto's third university, and it faces a considerable amount of friendly competition from its already established neighbours.

The contribution of Ryerson's economics department to the new university's success in meeting these challenges is epitomised by this book, and the conference that generated it. The department has chosen to carve out for itself a particular niche in the Canadian profession, specializing in international economics. Given the openness of the Canadian economy, the decision is a shrewd one. International economics is of great practical relevance, and always will be in this country, but an old fashioned academic cannot help but notice another, perhaps even more important, virtue in this particular selection. It is impossible to study and contribute to international economics without a thorough grounding in general economic theory and econometrics. Thus Ryerson's department has sacrificed nothing in its ability to provide a thorough education in the discipline's basics to its students by deciding to specialise in this area. In the classroom they will encounter teachers who are applying the ideas they teach to their research, as should always be the case in a university, and the fact that their research will be both timely and relevant will only add to their effectiveness as teachers.

There is no need to provide an overview of what follows in this foreword. The editors have done that in their introduction, and readers will, in any event, quickly proceed to the book itself. But a little attention might be drawn at this stage to the particular strength of this collection. For the last four or five years now, Canadians have been debating the future of monetary arrangements within North America, wondering whether the continent's already high degree of economic integration might be better served by some kind of integrated monetary system, rather than by a trio of independent national regimes. Too often in this debate, however, there has been a tendency to overlook certain important facts of economic and political life elsewhere in the world, and there has also been a tendency to rely on anecdotal evidence rather than the careful analysis of systematically collected data.

Canadians have, of course, hardly ignored the fact that North American monetary integration would necessarily be centred on the United States, but they have paid far too little attention to the fact that, unlike Canada, whose interests are concentrated in one continent, the United States' economic and political influence is worldwide, and that this fact has implications for the kind of monetary arrangements that they might be willing to get themselves involved in. And some Canadians have had difficultly in deciding whether Mexico should or should not be involved in the new arrangements they have proposed – this despite the fact that Mexico is a fully-fledged member of the NAFTA and has made great strides in establishing its own domestic monetary stability in the 1990s. There has also been a reluctance to look beyond the NAFTA to possible futures for monetary arrangements in the Americas more generally, and systematically to study experience in the rest of the world, both developed and developing, to see what lessons it might yield to these questions. None of these criticisms can be levelled at this collection. It places questions about North American monetary integration firmly in the context, not only of the current state of affairs ruling in the international economy, but also of the way in which that state of affairs is likely to evolve. That is why this book amounts to more than a collection of independent essays. Taken together, they bring a coherent and anything but parochial perspective to bear on what is bound to be an ongoing discussion of the future of Canada's monetary order.

The conference at which these papers were first presented was one of the highlights of the Canadian academic year in 2001- 2002, and their publication confirms, if indeed confirmation were needed, that Ryerson University's economics department is already a place where important ideas about international economic affairs are discussed. Those of us who attended that first conference are better aware than most that the department has given itself a hard act to follow, but we are also looking forward to the next event, whenever that might be.

David Laidler
University of Western Ontario

Preface

The world economy continues to be buffeted by economic and financial shocks, whose consequences can be severe, but whose causes are not always fully understood. These shocks have given rise to skepticism about the viability of certain exchange-rate regimes and have stimulated a renewed search for alternative institutional and policy structures. The increasing integration of countries into the global economy is giving additional urgency to this quest. A better understanding of the nature of these developments is thus essential if the search for improved economic and financial stability is to succeed. This volume makes an important contribution to that effort.

It is the product of a major conference which took place at Ryerson University in 2002, co-organized by Professors Leo Michelis and Thomas Barbiero. The papers collected in this volume cover a broad range of the foremost issues on the contemporary research agenda in international trade and open-economy macroeconomics. The choice of exchange-rate regime and the suitability of regional currency unions are two important topics which receive particular attention. The apparent success of European Monetary Union and perceived failures of a number of exchange-rate arrangements continue to stimulate interest in alternative regimes, including monetary unification. Monetary integration with the United States is the subject of lively debate in Canada, for example, and the present volume offers a number of assessments of the possibilities.

The costs and benefits of economic integration are examined in several papers, with applications to a variety of countries and regions. The flow of foreign investment, the expanding network of financial-market linkages, and the increasing globalization of production are creating both challenges and opportunities for policy makers. The issues are explored at length and from a diversity of perspectives.

Together, the papers collected in this volume provide a rich array of treatments of the major open-economy policy issues of the day.

Sven Arndt
Claremont McKenna College

Introduction

This book is a collection of papers presented at an international conference on **Exchange Rates, Economic Integration and the International Economy**, that took place at Ryerson University, Toronto, May 17-19, 2002. At the conference, 47 papers were presented along with two roundtable sessions: (a) "*NAFTA, Borders and Trade*'' paneled by Werner Antweiler (University of British Columbia), John Helliwell (University of British Columbia), Lawrence Schembri (Bank of Canada) Michael Trebilcock (University of Toronto) and Paul Wonnacott (Unversity of Maryland), and (b) "*Prospects for a Common Currency in North America*'' paneled by John Crow (former Governor of the Bank of Canada), Herbert Grubel (Simon Fraser University and The Fraser Institute), David Laidler (University of Western Ontario) and Ronald I. McKinnon (Stanford University). The complete conference schedule and papers are available on the website: www.ryerson.ca/econ .

From the forty seven conference papers fourteen were selected for publication in the present volume. The selection criteria were shaped by the objective to balance analytical rigor and empirical techniques while giving the best possible coverage to four related themes: (i) globalization and monetary integration, (ii) monetary issues in North America, (iii) exchange rates, foreign direct investment and the domestic economy, and (iv) economic integration in emerging economies. The selected papers were then reviewed by the editors and two independent experts in the fields of international and monetary economics. Based on the referees' recommendations, the contributing authors revised and resubmitted their papers for the final inclusion in the volume.

This volume is divided into four parts, each presenting a subset of articles addressing one of the above themes. Part I is devoted to **Globalization and Monetary Integration** and includes four contributions. Ronald McKinnon discusses the important role of the US dollar as a vehicle currency in facilitating foreign exchange transactions and an invoice currency in facilitating international trade in all regions of the world except Europe. He looks at the problems this causes, both in terms of capital flight and devaluations in the dollar debtor developing countries, and in terms of currency appreciation and deflation in the dollar creditor countries such as Japan and China. He then proposes a new set of rules for the dollar standard in order to minimize the possibility of future foreign exchange crises in the developing world, and to reduce deflationary pressures in the creditor countries associated with U.S. trade deficits.

George von Furstenberg focuses on regional currency unions, and analyzes the well-known optimum currency area criterion that the more symmetric the shock exposure of countries, the more suited they are to form a monetary union (MU). Further, shock symmetry tends to increase endogenously due to the trade-enhancing effects of a monetary union. However, he points out that, in theory, shock symmetry is counteracted by the MU's single monetary policy, consistent with low inflation.

Such a policy cannot account for country-specific shocks and therefore it would tend to reduce shock symmetry. Examining recent data from the euro area, he concludes that these predictions are not consistent with the empirical evidence.

Herbert Grubel evaluates the benefits and costs of alternative forms of stringent fixed exchange rate systems or "hard currency fixes", such as currency boards, monetary unions and dollarization. Then, he reviews the empirical evidence and provides a detailed examination of Argentina's experience with its convertibility system. He concludes that Argentina's experience is far less damaging to the arguments in favour of hard currency fixes than is commonly recognized.

Massimo Di Matteo explores the applicability of two interpretations of the "subsidiarity principle" in the development of the EU: one "ascending" and the other "descending." He suggests that the first interpretation shaped the initial phase of policy-making in the EU, while the second has had a more recent policy impact. The reasons for this change are outlined, and the public sector ramifications of the change are evaluated. He contends that implementation of the subsidiarity principle has significantly reduced the scope for equity policies, especially when it is combined with the effects of the globalization process.

Part II consists of three articles dealing with **Monetary Issues in North America**. John Murray, Lawrence Schembri and Pierre St-Amant argue in favour of maintaining flexible exchange rates in North America. Concentrating on the macroeconomic effects of exchange rates, they cite quantitative and qualitative evidence to support the claim that flexible exchange rates have served the Canadian, Mexican and the US economies well, in the face of large asymmetric shocks and low cross-correlations in their business cycles. Further, exchange rates in Canada and Mexico are driven primarily by macroeconomic fundamentals, such as commodity price shocks, and flexible exchange rates accommodate adjustments to such shocks.

Leo Michelis examines the prospects for monetary union in North America. He makes a distinction between the traditional optimum currency area criteria that are appropriate to sustain fixed exchange rates, and some additional long-run convergence criteria that are necessary for a monetary union to exist. Using recent data on several key macroeconomic variables, he proceeds to evaluate empirically the two sets of criteria based on correlation and cointegration analysis respectively. The empirical results show that while a monetary union might be feasible between Canada and the US, it is less likely, at present, to be achieved among Canada, Mexico and the US.

John Murray and James Powell concentrate on the possibilities of a currency union between Canada and the US by examining the extent to which the Canadian economy is already informally dollarized. They conclude that informal dollarization is less prevalent in Canada than often thought. The evidence they present suggests that the imminent dollarization of the Canadian economy is highly unlikely, and that, by some measures, Canada is less dollarized now than it was twenty or thirty years ago.

Part III of the book contains four articles concerned with **Exchange Rates, Foreign Direct Investment and the Domestic Economy**. Kathryn Niles Russ analyses the welfare effects of exchange rate uncertainty in countries with foreign direct investment (FDI). The analysis is carried out in the context of a general equilibrium pricing-to-market model with a fixed cost to FDI. In this framework, it is shown that the home economy is affected by foreign monetary shocks, and that the price of the foreign good in the home country will be higher under fixed exchange rates than under flexible rates. Hence, average consumption and welfare will be higher under flexible rates than under fixed rates. These results are also used to explain the tendency of multinational firms to increase production abroad in the face of exchange rate uncertainty, and the low rate of return on assets of foreign firms in the US.

Olivia Galgau and Khalid Sekkat analyze the impact of the single market and the single currency on intra-EU FDI and on FDI from non-member countries. The authors find that the single market has increased FDI among member countries, but it has not had a major impact on FDI from non-member countries into the EU. They conclude by suggesting that the euro may lead to a decrease in FDI among member countries through the elimination of exchange rate volatility, and that it may increase FDI from non-member countries.

Simon Neaime examines the impact of productivity shocks on the real exchange rate and domestic output adjustments, in the context of a dynamic macroeconomic model with habits and durability in consumption. It is shown that productivity improvements in the traded goods sector draw resources from the non-traded goods sector to the traded goods sector, thus decreasing the supply of non–traded goods. If the durability effects dominate in the short run and habits in the long run, then a productivity improvement in the traded goods sector causes a significant real appreciation of the domestic currency. In contrast, a productivity improvement in the non-traded goods sector has an ambiguous effect on the real exchange rate, but it increases the supply of non-traded goods.

Kamal Ahmed investigates empirically the links among the exchange rate, domestic output, the price level and money supply in the framework of a structural VAR model for Malaysia. Using a sample of quarterly data from 1973 to 1999 and multivariate cointegration techniques, he finds a long-run equilibrium relationship among these variables as predicted by most theoretical models in the literature. Further, he provides short-run results, based on Granger causality tests and variance decomposition techniques, that are not always consistent with the long-run empirical results.

Part IV contains three papers on **Economic Integration in Emerging Economies**. Ansgar Belke and Kai Geisslreither discuss regional currency issues in Latin America by examining the costs and benefits of exchange rate stability within the Mercosur region. Their empirical analysis highlights the limited trade integration within Mercosur, and shows that intra-area exchange rates are less important for the economies of the region than the exchange rates relative to the US dollar and the euro. Volatility in the latter exchange rates and interest rate volatility have an adverse effect on investment and labour markets in the region.

Mustapha Sadni-Jallab and Enrique Blanco de Armas explore the effects of Mexico's export processing zones on foreign exchange earnings potential, foreign direct investment, technology transfer, and employment in both Mexico's local and national economies. They examine changes in these variables over the past 10 to 15 years in relation to the influence of the maquila sector. They find that the maquila sector has been successful in reducing unemployment of the low skill labour force, but it has had no significant impact either on foreign exchange earnings or the range of technology transfers to Mexico. They also suggest how their results can be applied more generally to assess the impact of export processing zones on world trade.

Lester Henry examines proposals for a monetary union among the small open economies of the English-speaking Caribbean region. First, he describes past attempts at economic cooperation and currency integration in the region, and then he interprets proposals for a Caribbean currency union using arguments for and against monetary integration for small economies. In particular, he evaluates arguments as to why monetary union will not succeed in the region and argues that many of these arguments are based on a misunderstanding of the economic reality in the region. He concludes by discussing the option of dollarization within the English-speaking Caribbean.

In summary the fourteen papers in this volume offer the reader a comprehensive treatment of the theory and practice of economic and monetary integration in Europe and other parts of the globe, with special emphasis on the prospects for monetary integration in North America. The volume provides a balance between analytic and applied work that can be useful to both academics and policy makers in understanding better the complexities of the real-world economy.

Leo Michelis
and
Mark Lovewell
Ryerson University

PART I

GLOBALIZATION AND MONETARY INTEGRATION

The World Dollar Standard and Globalization: New Rules for the Game?

Ronald I. McKinnon[1]
Stanford University

Abstract. In the absence of a purely international money, a strong central money (or key currency) becomes dominant – as the U.S. dollar now dominates on a worldwide scale outside of Europe. Today, the general use of the dollar as a vehicle currency in foreign exchange transacting, and as a dominant invoice currency in international trade, greatly facilitates international commerce. On the down side, however, it accentuates financial fragility on the periphery of the dollar standard – both in developing economies, which are dollar debtors and prone to capital flight and devaluations, and in (emerging) dollar creditors such as Japan and China, which are prone to currency appreciation and deflation. New rules for the dollar standard game are proposed for regulating capital flows so as to reduce the likelihood of foreign exchange crises in peripheral countries, to restrain mercantilist tendencies on the part of the United States, and to reduce American trade deficits with their deflationary threat to creditor countries.

1. Introduction

In the realm of economics, "globalization" refers to the growing interdependence among countries – the cross-border flows of goods, services, capital, and technical know-how. At first glance, the case for globalization seems to be just a more general version of the case for freer trade. And we have persuasive theorems showing that welfare generally (although not necessarily that of particular individuals or firms) increases as the ambit of trade expands. Indeed, the formal theory underlying the advocacy of free trade has it that small countries are the biggest gainers. Outside the United States, why then should globalization make so many people and their governments uneasy?

The enhanced hegemony of the U.S. is a prime source of international uneasiness in the new millennium – just as British military and financial hegemony made other countries uneasy with the spread of freer international trade in the 19th century. In today's military terms, there is just one superpower that sends gunboats – i.e., read aircraft carriers – to keep the peace in faraway places, at least where its vital interests are concerned. There is also the invasive crass commercialism of multinational firms, mainly American, that non-Americans see as threats to their traditional way of life – as when French farmers set fire to McDonald's hamburger stands. American pop culture can be pretty awful. Some countries, particularly regimes that force their people into subservience through a blinkered religion, see

American influences undermining their national cultures. However, I am not going to discuss any of these things.

Instead, I will approach the problem of American global hegemony from a monetary perspective: the world dollar standard. In the absence of a purely international money, the ever-widening ambit of international trade and finance today accentuates a natural asymmetry among national currencies. A strong central money (or key currency) becomes dominant – as the U.S. dollar now dominates on a worldwide scale outside of Europe, and as the old deutsche mark dominated within Europe before the 1999 advent of the euro. In the 19th century, Britain was resented as the world's dominant creditor country that kept the rest of the world in thrall to the London capital market with the pound sterling being the key currency. But because Britain was then on the international gold standard more or less on a par with other industrial countries, it had much less autonomy in monetary matters than does the U.S. in today's world of "fiat" national monies.

1.1. Definitive and Provisional Monies in International Exchange

Europe and the euro aside, international trade and capital flows in Asia, Africa, the Americas, and Australasia are mainly invoiced in dollars. Including Europe, governments hold their official foreign exchange reserves in dollars, and private foreign exchange markets are organized using the dollar as the vehicle currency for the inter-bank clearing of international payments. Developing countries and many industrial ones cannot borrow internationally in their own currencies – a phenomenon that has been dubbed *original sin* by Barry Eichengreen and Ricardo Hausmann (1999). In contrast, the United States has a virtually unlimited line of dollar credit with the rest of the world. The resulting currency asymmetry, a strong dollar as "definitive" money at the center and a fragile periphery, unbalances the world's monetary system.

On the crisis-prone periphery, developing countries which are (largely) dollar debtors live on sufferance: their domestic monies are only "provisional". Apart from debts to international agencies such as the IMF and World Bank, their foreign debts are very short term and largely dollar denominated outside of Europe. Any economic or political disturbance at home provokes the suspicion that these foreign-currency debts may not be repayable, and that the domestic currency will depreciate against the dollar – as in the East Asian crisis of 1997-98. The potential flight from the domestic currency into dollars then forces an increase in domestic interest rates: both on internal domestic-currency debt to slow the run, and, because of default risk, on dollar-denominated debt held both externally and internally. Then if any debtor economy is actually forced to depreciate against the dollar – as did Indonesia, Korea, Malaysia, Philippines, and Thailand in 1997-98 – massive internal bankruptcies ensue as bank and firms find that their domestic-currency earnings are no longer sufficient to service their dollar debts.

In Argentina before its currency crashed at the end of 2001, and in Brazil and other Latin American countries for the past several years, high domestic interest rates from this fear of devaluation against the dollar also throw the public finances into deficit. First, economic growth falls and so reduces current tax collections. Second, when interest rates rise, the cost of carrying public sector debt increases almost immediately because the debt is so short term. This fiscal double whammy further undermines confidence in the provisional domestic money: capital flight intensifies and normal bank lending to domestic industry dries up. In the worst case, as in Argentina, output falls sharply and the economy collapses.

Thus it is not surprising that developing countries the world over exhibit "fear of floating", as neatly shown by Calvo and Reinhart (2002). In noncrisis periods, they peg "softly" to the dollar. Even though most no longer have official dollar parities, most remain anxious to smooth fluctuations in their dollar exchange rates.

But what about the biggest international debtor of all? After running trade deficits for more than 25 years, the United States is a net debtor: its liabilities exceed its claims on the rest of the world by about $3 trillion in 2003. At about 25 percent of U.S. GNP, America's net international indebtedness is higher than that of any other industrialized country – and higher than, say, Brazil's which is only 20 percent of Brazilian GNP. Yet, unlike Latin American currencies today, and unlike East Asian currencies in the great crisis of 1997-98, the dollar is not threatened by a loss of confidence. As long as its purchasing power is seen to be stable, i.e., as long as the Federal Reserve Bank keeps ongoing price inflation very low, the dollar cannot be attacked in the usual sense. Why?

In the 21st century, the dollar is definitive money – much like gold was in the 19th century. When frightened by events at home, foreigners have no more fundamental monetary asset into which they want to fly. In this sense, the dollar standard now is stronger that it was during the Bretton Woods period of the 1950s and '60s with fixed exchange rates. While other countries had fixed dollar parities, the United States still had a residual commitment to convert dollars into gold at $35 per ounce. Although the foreign exchanges then as now were organized around the dollar as the vehicle currency, gold was the more fundamental asset. The dollar could be attacked (and was on occasion) as foreigners, speculating that the dollar price of gold might increase, rushed to convert their official dollar holdings into gold. However, this gold convertibility commitment has long since lapsed, and the dollar today is not only the world's vehicle and reserve currency but also its most fundamental monetary asset.

Consequently, the US *alone* can go deeply into debt to the rest of the world in its *own currency*. Private foreigners happily build up their dollar deposits in American banks – Latin Americans particularly like Florida banks! – and purchase dollar-denominated industrial bonds and equities. Foreign central banks have accumulated, and continue to acquire, huge stocks of U.S. Treasury bonds. Indeed, almost half of those outstanding outside of U.S. government agencies are in official foreign exchange reserves. If the dollar depreciates, say 10 to 20 percent against the euro or the yen, the creditworthiness of American banks is not impaired because their assets and liabilities are both denominated in the same currency, i.e., dollars. And the US Treasury's capability of servicing its foreign dollar debts remains unchanged. Thus the dollar can fluctuate more or less randomly against the currencies of other industrial economies – as it has since 1971 – without provoking a banking or currency crisis in the United States itself.

But this virtual invulnerability of the center country as debtor to foreign exchange risk means that this risk is shifted to creditor countries that, Europe aside, cannot lend to the US in their own currencies. After 25 years of large American current-account deficits, willy nilly other countries taken collectively are becoming increasingly exposed "dollar" creditors.

Take Japan, with its long history of current-account surpluses paralleling – albeit somewhat smaller than – the current account deficits of the United States. The cumulative effect of these surpluses has made Japan the world's largest international net creditor. Under the dollar standard, however, Japan finds it difficult to lend internationally in yen – except for officially sponsored development assistance or subsidized commercial credits. Instead, dollar claims on foreigners pile up within Japanese financial institutions such as insurance companies and banks, whose own domestic liabilities to Japanese households are in yen. Should a run into yen out of dollars force the yen to *appreciate*, these institutions could go bankrupt as the yen value of their dollar assets falls. And the appreciation itself would force Japan into further deflation.

Similarly, China, with borderline deflation, also now faces the uncomfortable problem of managing a huge build up of liquid dollar claims coupled with pressure from foreigners to allow the yuan to appreciate against the dollar. Even post-crisis Korea, after 5 years of trade surpluses, has worked off its dollar debts and is thus becoming a net international creditor – at least at the margin. Because, under the world dollar standard, these creditor countries cannot lend in their own currencies, they face the problem of (potential) currency appreciation and deflation – what has been dubbed *conflicted virtue* by McKinnon and Schnabl (2003b).

Conflicted virtue in creditor countries is the mirror image of original sin in debtor economies. So both creditor and debtor economies are now exposed to serious currency risk should their currencies fluctuate against the dollar. The big exception, of course, is the United States itself – whether being a large international creditor lending in dollars as in the 1950s and 1960s, or a huge net debtor borrowing in dollars today.

Paradoxically, Americans themselves have shown little appreciation of how the world dollar standard actually works and the currency risk, from which they are immune, that other countries face. Indeed, in the whole postwar academic literature since 1945, the dollar standard has been little analyzed. As a consequence, American policy makers have had little clear guidance in their interactions with other countries – and in their relationships with agencies such as the International Monetary Fund (IMF) or the World Bank – or international conclaves such as those taking place under the auspices of the Group of Seven (G-7). In this intellectual vacuum, how to reform the "International Financial Architecture," so as to make the world a financially safer place, remains in limbo.

The many facets of the international dollar standard can be understood only in historical perspective. Thus, Part I analyzes how the world dollar standard has evolved since World War II through strong and weak phases – with special concern for developing countries and emerging markets on its periphery which are dollar debtors. Then Part II suggests possible new rules for the dollar standard game, including regional exchange rate arrangements in East Asia, but focusing on the deflationary threat in increasingly impacted dollar creditors.

2. The World Dollar Standard in Historical Perspective

How did this asymmetrical position of the dollar become established in the world economy? After World War II, the US had the world's only intact financial system. There were inflation, currency controls, and so on, in Europe, as well as in Japan and most developing countries. Thus, because of the open U.S. foreign exchange and financial markets, the dollar naturally became the world's vehicle currency for (private) interbank transacting and the intervention currency that governments used for stabilizing their exchange rates. Under the Bretton Woods agreement of 1945, every country pegged to the dollar, and the US did not have a formal exchange rate policy, except for the residual tie to gold.

This was quite natural given the history of the situation. The US had the only open capital market, so countries could easily build up their dollar reserves and have a liquid market in which to buy and sell them. Similarly, private corporations in other countries all built up dollar reserves as well because their own currencies had exchange controls. Because of this accident of history, the US dollar became the intermediary currency in international exchange between any pair of "peripheral" monies.

2.1. The Dollar as Facilitator of International Exchange

But why does the dollar continue with this facilitating function even when most other industrial countries – such as Japan and those in Europe – no longer have exchange controls? A little algebra helps explain continued dollar predominance. Suppose there are 150 national currencies in the world economy. To facilitate international exchange, the markets themselves would always pick just one as the central money. The reason is a big economy of foreign exchange markets.

If we think of a world of N countries with independent national monies, then just from basic probability theory, the total number of country pairs in the system is the combination of N things taken two at a time ($^{N}C_{2}$). If foreign exchange dealers tried to trade across each pair, say, Swedish crowns against Australian dollars, or Korean won against Japanese yen, it would turn out that there would be a huge number of different foreign exchange markets. With 150 national currencies in the world (N = 150), and you tried to trade each pair, there would be 11,175 foreign exchange markets!

It is expensive for any bank to set up a foreign exchange trading desk. Thus, rather than trading all pairs of currencies bilaterally, in practice just one currency, the Nth, is chosen as the central vehicle currency. Then all trading and exchange takes place first against the vehicle currency before going to the others. By having all currency trading against that one currency, you can reduce the number of markets in the system to N-1. Thus, with 150 countries, we need to have just 149 foreign exchange markets – instead of 11,175. Unlike the Bretton Woods system where all countries set official dollar parities, this result does not depend on any formal agreement among governments. In private markets today, choosing one currency like the dollar to be the intermediary currency is the most natural way of economizing on foreign exchange transacting.

But history is important. If one country starts off providing the central money, as the US in the late 1940s did, then it becomes a natural monopoly because of the economies of scale. The more countries that deal in dollars, the cheaper it is for everybody to deal in dollars. If you're a Japanese importer of Swedish Volvos and you want to pay for the Volvos, you first get your bank to convert your yen into dollars on the open market, then use the dollars to buy Swedish crowns. Volvo corporation receives the Swedish crowns and the importer gets the Volvos. However, the dollar is the intermediary currency.

Using the standard textbook classification of the roles of money, Box 1 summarizes our paradigm of the dollar's central role in facilitating international exchange. For both the private and government sectors, the dollar performs as medium of exchange, store of value, unit of account, and standard of deferred payment for international transacting on current and capital account – and has done so from 1945 into the new millennium.

Box 1: *The US Dollar's Facilitating Role as International Money (1945 to 2003)*

	Private	*Official*
Medium of exchange	Vehicle	Intervention
Store of value	Banking	Reserves
Unit of account	Invoice	Peg
Standard of deferred payment	Private bonds	Sovereign bonds

First, the dollar is a *medium of exchange*. Because the foreign exchange markets are mainly interbank, the dollar is the vehicle currency in interbank transactions serving customers in the private sector. Thus, when any government intervenes to influence its exchange rate, it also finds it cheaper and more convenient to use the dollar as the official intervention currency. (The major exception to this convention is a fringe of small European countries to the east of Euroland which mainly use the euro as their central money.) Following Peter Kenen (2002), Tables 1 through 6 analyze the dollar's role in international finance. Table 1 shows that the dollar is on one side or the other of 90 percent of foreign exchange transactions worldwide.

Table 1: *Currencies Involved in Foreign Currency Trading (per cent of global trading with each trade counting twice)*

Currency	**1998**	**2001**
Dollar	87.3	90.4
EMS currencies and Euro*	52.5	37.6
Yen	20.2	22.7
Pound	11	13.2
Swiss franc	7.1	6.1
Canadian and Australian dollar	6.7	8.7
All other currencies	15.2	21.3
Memorandum: Total turnover in $ billion	1430	1173

Notes: As each trade involves two currencies, each trade is counted twice, so percentages should add up to 200, but detail may not sum due to rounding. * EMS currencies include the ECU and Danish Krone.
Source: Bank for International Settlements, *Central Bank Survey of Foreign Exchange and Derivative Market Activity in April 2001: Preliminary Global Data* (9 October 2001).

Perhaps counter-intuitively, Table 2 shows that dollar-based foreign exchange transacting is not centred geographically in the US. Although the dollar is the predominant money in foreign currency trading, London has the biggest foreign exchange markets using the dollar as the clearing currency. The UK actually has the bigger proportion of foreign exchange trading. And then you have the offshore markets in Singapore and Hong Kong.

Second, the dollar is an international *store of value*. Corporations and some individuals hold dollar bank accounts in London, Singapore, and other "offshore" banking centers – as well as in the US itself. But it is virtually impossible to obtain the distribution of foreign exchange holdings by currency of denomination for the private sector the world over. It is estimated that more than half the stock of the stock of coin and currency issued by the United States government circulates abroad in Latin America, Russia, Africa and in other financially distressed areas. So too does the euro circulate as hand-to-hand currency outside of Euroland, but more in the smaller countries of Eastern Europe. However, the Bank for International Settlements does compile information on the cross border liabilities of reporting banks identifiable by currency, and this is reported in Table 3.

Table 2: *Geographic Distribution of Foreign Exchange Trading (per cent of global trading)*

Country	1998	2001
United Kingdom	32.5	31.1
United States	17.9	15.7
Euro-zone countries	17.4	14.7
Germany	4.8	5.4
France	3.7	3.0
All other*	8.9	6.3
Japan	6.9	9.1
Singapore	7.1	6.2
Switzerland	4.2	4.4
Hong Kong	4.0	4.1
All other reporting countries	10.0	14.7

Note: Detail may not sum to total due to rounding. Every country in this group experienced a fall in its share of global trading.
Source: Bank for International Settlements, *Central Bank Survey of Foreign Exchange and Derivative Market Activity in April 2001: Preliminary Global Data* (9 October 2001).

Table 3: *Cross-border Liabilities of Banks (per cent of global total identifiable by currency)*

Currency	1998	2000
Dollar	47.6	51.7
Euro-zone currencies and Euro	26.3	25.6
Yen	8.4	7.4
Pound	6.5	6.6
Swiss franc	3.2	2.7
Other	8.1	6.0
Memorandum:		
Total liabilities in $ billion	8399	9307

Note: Detail may not sum to total because of rounding.
Source: Bank for International Settlements, *BIS Quarterly Review* (March and September 2001).

As the store of value of governments, international exchange reserves are mainly in dollars – as shown in Table 4. Before the advent of the euro, in 1999, many economists were speculating that foreign central banks were going to start diversifying their reserve portfolios into euros. Thus the dollar standard would not be as strong. Table 4 shows that the degree of this diversification has been minor. In the developing countries, about 70 per cent of their exchange reserves are in dollars if you allocate their unspecified exchange reserves in Table 4 in the same way that the specified reserves are distributed. The developing countries used to hold some deutsche marks, francs, and pound sterling. The euro is held more or less in the same balance as were the old European national currencies, but it is not really encroaching on the dollar-based system. This could change, but the dollar still predominates.

Table 4: *Currency Composition of Official Foreign-Exchange Reserves (per cent of global total)*

Country Group and Currency	1998	2000	2001
Industrial Countries			
Dollar	66.7	73.3	74.5
Euro-zone currencies and Euro*	16.8	10.2	10.1
Yen	6.6	6.5	5.5
Pound	2.2	2.0	1.8
Other and unspecified	7.6	7.8	8.1
Developing Countries			
Dollar	65.3	64.3	64.1
Euro-zone currencies and Euro*	13.3	14.6	16.2
Yen	4.5	4.4	4.5
Pound	5.2	5.2	5.5
Other and unspecified	11.8	11.5	9.6

Notes: Detail may not sum to total because of rounding. Euro-zone currencies include the Deutschemark, French Franc, and Dutch Guilder, as well as ECU held by industrial countries.
Source: International Monetary Fund, *Annual Report 2001.*

Third, the dollar serves as a *unit of account* for much of international trade. Trade in primary commodities shows a strong pattern of using the dollar as the main currency of invoice. Exports of homogeneous primary products such as oil, wheat, and copper all tend to be invoiced in dollars, with worldwide price formation in a centralized exchange. Spot trading, but particularly forward contracting, is concentrated at these centralized exchanges – which are usually in American cities such as Chicago and New York, although dollar-denominated commodity exchanges do exist in London and elsewhere.

Invoicing patterns for exports of manufactured goods are more complex. Major industrial countries with strong currencies tend to invoice their exports in their home currencies. Before the European Monetary Union (EMU), more than 75% of German exports had been invoiced in marks, more than 50% of French exports invoiced in francs, and so on. But these illustrative ratios were dominated by intra-European trade. With the advent of EMU, how much continental European countries will invoice their exports outside of Europe in euros remains unknown – but for manufactured goods, the proportion probably corresponds to the degree that Germany used to invoice in marks.

Within Asia, however, foreign trade is invoiced mainly in dollars. Table 5 displays Korea's invoicing practices. In the 1990s, the percentage of imports invoiced in US dollars was about 80%, while the proportion of dollar invoicing of Korean exports was even higher. Because the other smaller economies are less industrialized than Korea, their currencies are even less likely to be used in foreign trade, with the proportion of dollar invoicing being correspondingly greater.

Table 5: *Invoice Currencies in Korean Trade, 1980-2000 (percent)*

	Exports (receipts)					**Imports (payments)**				
	$	¥	DM	£	other	$	¥	DM	£	other
1980	96.1	1.2	2.0	0.4	0.3	93.2	3.7	1.7	0.5	0.9
1985	94.7	3.7	0.6	0.3	0.7	82.4	12.3	2.0	0.5	2.8
1990	88.0	7.8	2.1	0.5	1.7	79.1	12.7	4.1	0.9	3.4
1995	88.1	6.5	2.4	0.8	2.2	79.4	12.7	3.8	0.7	3.4
2000	84.8	5.4	1.8	0.7	7.3	80.4	12.4	1.9	0.8	4.4

Note: Trade in services is not included.
Source: Bank of Korea, *Monthly Statistical Bulletin.*

In striking contrast, yen invoicing in Korean trade is surprisingly small. In 2000, Table 5 shows that only 5.4% percent of Korean exports were invoiced in yen – and only 12 to 13% of Korean imports. This is "surprising" because Japan is at least as important a trading partner with Korea as is the United States – and direct investment by Japan in Korea has been much higher. Table 5 also shows that the use of European currencies is negligible.

For smaller East Asian countries not trading with Japan but with each other – as when Thailand trades with Malaysia – everything is typically invoiced in dollars. Even Japanese trade with other East Asian countries is invoiced more in dollars than in yen. Outside of Europe, the prevalence of dollar invoicing is also true in other parts of the world. For example, in Latin America, exports are largely dollar invoiced, and intra-regional trade is entirely dollar invoiced.

For pricing manufactures, more than pure invoicing is involved. Exporters everywhere outside of Europe typically opt to quote selling prices for their products in dollars, and then keep these dollar prices fairly constant in industrial catalogs and other published price lists. In effect, they price to the world market – and not just to the American one – in dollar terms. Thus national central banks aiming to stabilize the international purchasing power of their currencies, often opt – either formally or informally – to peg against the dollar, and thus against the huge sticky-priced mass of internationally traded goods that it represents.

Fourth, if we think of a *standard of deferred payment* – which is also a traditional role of money – private and sovereign bonds in international markets are heavily denominated in US dollars, though the euro seems to be as important. Table 6 is difficult to interpret because ‘international” also refers to intraEuropean issues of euro denominated bonds. But this ambiguity aside, the growth of a broadly based bond market within Europe denominated in euros has made it much more attractive for foreigners to borrow by issuing euro bonds. So Euroland is unusual. It is a net creditor in the world economy that can lend in its own currency. Other net creditors are more or less confined to lending in dollars.

Table 6: *Net International Issues of Debt Instruments (per cent of global trade)*

Currency or Nationality	**1998**	**1999**	**2000**	**2001**	**2002**
By Currency of Issue					
Dollar	60.3	44.4	50.1	48.4	41.5
Euro-zone currencies and Euro*	33.0	47.7	37.8	44.3	51.5
Pound	8.4	7.1	8.4	NA	NA
All other currencies	-1.8	0.8	3.7	7.3	6.97
By Nationality of Issuer					
United States	41.1	39.2	37.7	45.7	34.4
Euro-zone countries	31.4	41.3	45.0	47.9	59.6
United Kingdom	7.7	9.4	9.7	NA	NA
Other industrial countries	4.0	3.9	0.9	NA	NA
Developing countries and offshore centres	7.6	4.2	4.9	6.3	6.01
International Institutions	8.2	2.2	108	NA	NA
Memorandum:					
Net issues in $ billion	681	1230	1234	1347	1016

Notes: Detail may not sum to total because of rounding. Euro-zone currencies include ECU.
Source: Bank for International Settlements, *International Banking and Financial Market Developments and BIS Quarterly Review* (June 2003).

Despite the increasing importance of the euro in international bond markets, US Treasuries are still taken as the bench-mark or “risk-free” asset in international bond markets. That is, dollar-denominated sovereign bonds issued by emerging markets the world over have their credit ratings (by Moody’s, Standard and Poor’s, or Fitch) measured relative to US Treasuries. Thus, risk premia in interest rates on these bonds are typically quoted as so many percentage points over US Treasuries.

2.2. The Dollar as Nominal Anchor

Beyond facilitating international exchange, the dollar has a second and complementary international function. Foreign monetary authorities may better anchor their own domestic price levels by choosing to peg, officially or unofficially, to the dollar. By opting to keep their dollar exchange rates stable, foreign governments are essentially opting to harmonize – without always succeeding – their monetary policies with that of the US. This monetary harmonization has two avenues: (i) international commodity arbitrage – the *arbitrage avenue*, and (ii) the *signaling avenue* where other central banks take their cue from actions of the US Federal Reserve Bank.

The arbitrage avenue arises naturally out of the dollar's facilitating role in international finance. Because international trade in goods and services is largely dollar invoiced (including trade between countries outside of the US), international arbitrage in the markets for goods and services through a fixed dollar exchange rate can be a powerful device to anchor any one country's domestic price level. Putting the matter more negatively, if other countries fail to prevent their dollar exchange rates from fluctuating, the degree of pass-through of these exchange rate fluctuations into their domestic prices is (ultimately) very high. (The one big exception would be countries in the large euro area – whose domestic price levels are fairly well insulated from fluctuations in the euro's exchange rate against the dollar.)

Asymmetrically, because both American imports and exports are invoiced in dollars, America's own domestic price level is relatively insulated from fluctuations in the dollar's exchange rate. More generally in the world at large, the dollar prices of internationally traded commodities are relatively invariant to fluctuations in the dollar's value against other currencies. So, as the Nth country in the system, the US alone can carry out an independent monetary policy to target its own domestic price level without being much disturbed by exchange rate fluctuations. For the other N–1 countries, however, direct international commodity arbitrage through a fixed exchange rate can help stabilize their own internal price levels.

In securing monetary harmonization with the US, the signaling avenue can also be important. If any one national government resists upward pressure on its currency in the foreign exchanges, the resulting increase in its official dollar reserves signals the need for domestic monetary expansion – and vice versa. The national central bank can even take its cue directly from what the US Federal Reserve Board is doing. For example, the Bank of Canada typically changes its own discount rate (interbank lending rate) relatively quickly in response to changes in the US Federal funds rate.

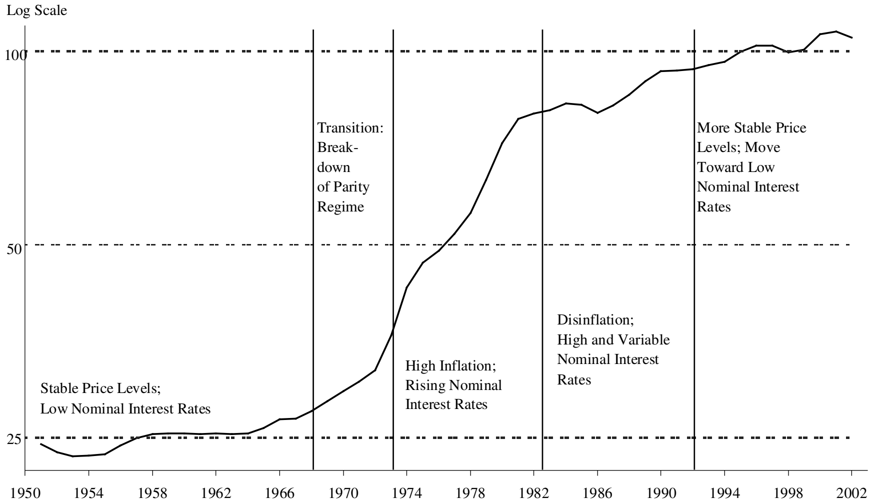
However, for the dollar to function successfully as nominal anchor, two important conditions must be satisfied:

(i) The American price level, as measured by a broad index of tradable goods prices, is stable and expected to remain so; and

(ii) Most countries, and certainly neighboring ones, are on the same international standard, i.e., they also fix their exchange rates to the dollar.

In the history of the postwar dollar standard, these two conditions were satisfied in some periods – but not so in others. Indeed, in contrast to the dollar's ongoing robustness as the facilitator of international exchange under either fixed or floating exchange rates, its function as nominal anchor has continually metamorphosed – as shown by the evolution of the American producer price index (PPI) in Figure 1.

Figure 1: *The World's Nominal Anchor: US Wholesale Prices (1951-2002)*



Source: International Monetary Fund, *International Financial Statistics*

2.3. High Bretton Woods, 1950 to 1968

The period of "high" Bretton Woods, as defined here for 1950 to 1968, is when the major industrial countries all had officially committed themselves to fixed dollar parities with little change. From the 1950s through 1968, the first panel of the figure below shows that the US price level for tradable goods prices – as measured by the US wholesale price index – was stable. Also interest rates on dollar assets were low and stable because of the absence of expected inflation. So, under the old Bretton Woods par value system, all other countries willingly declared dollar parities – and kept their market exchange rates within a narrow band of 2% around these central parities, which were seldom changed. During this period of "high" Bretton Woods, IMF member countries could use price stability in the center country as an anchor for their own domestic price levels.

But more than just the behavior of the center country was involved in this anchoring process. Because virtually all the major industrial countries were on the same fixed exchange rate regime, the "world" price level was more secure. Precipitate devaluations (or appreciations) of any one country, which could impart deflationary pressure to a neighboring one, were avoided. In addition, potentially inflationary national macroeconomic shocks were dampened. The inertia or "stickiness" in each country's price level was greater because all the countries were committed to, and bound together under, a common monetary standard – albeit one ultimately dollar based.

During this high Bretton Woods regime, even the American price level itself was more stable because of the generally fixed exchange rates. In the short and medium terms, the center country could benefit from commodity arbitrage with neighboring countries across the fixed exchange rates to dampen potentially inflationary shocks originating at home. In the end, however, the system could not survive persistent inflationary pressure in the center country – as we shall see.

Finally, as the initial panel of the figure indicates, nominal interest rates in the industrial countries were low and remarkably stable in the 1950s and 1960s. Until the very late 1960s, the common rate of price inflation was so low that ordinary Fisher effects in interest rates were largely absent. In these immediate postwar decades, the perceived continued stability in exchange rates meant that cross-country interest differentials remained modest – despite the presence of capital controls in most of the industrial countries. This commitment to fixed dollar parities by the industrial countries finally collapsed in early 1973. However, the common monetary anchor undergirded that era's famously high real economic growth – not matched in the industrial world in any sustained way before or since. For the less developed countries with immature domestic financial markets, having price and interest rate stability in the core industrial economies was particularly advantageous. They would have had great trouble controlling domestic inflation independently of stabilizing their dollar exchange rates. Instead, most simply opted to lock into the high Bretton Woods dollar standard. Of course, some in Latin America and elsewhere had too much domestic inflationary pressure to be able to keep their dollar exchange rates fixed. But even when any one less developed country experienced a currency crisis with devaluation, the authorities usually avowed to return to the fixed rate dollar standard when able – thus dampening expectations of further inflation.

2.4. Losing the Anchor 1968–1973: The Advent of Floating Exchange Rates

With hindsight, the old fixed rate dollar standard began to unravel in the late 1960s as wholesale price index (WPI) inflation in the US – the center country – began to escalate toward 3% per year (second panel of the figure). Other countries – particularly Germany – became unwilling to maintain their old dollar parity and import even moderate inflationary pressure. The deutsche mark was revalued upward in 1969. More importantly, the US was then hampered by the Keynesian belief (as encapsulated in the so-called Phillips curve) that disinflation would permanently increase domestic unemployment. So largely for doctrinal reasons, the center country refused to embark on a serious program of disinflation. But the ongoing inflation reduced America's industrial competitiveness. Worried about America's declining foreign trade position, President Nixon in August 1971 closed the vestigial "gold window": America's formal commitment under the old Bretton Woods articles to formally fix the dollar's value in terms of gold. Simultaneously, Nixon imposed an across-the-board tariff of 10% on American imports of manufactures, and insisted that the tariff would not be removed until all the other industrial countries appreciated their currencies against the dollar. They all appreciated between 10% and 20% before reestablishing their new "Smithsonian" dollar parities in December 1971. However, because the center country continued to inflate, the Smithsonian dollar parities were destined to fail. In February 1973, the industrial countries gave up on their dollar parities and moved to no-par floating.

In the 1970s into the 1980s in the US, high and variable price inflation coupled with high and volatile nominal interest rates – see the third panel in the figure – largely eroded the dollar's usefulness as nominal anchor. In most developing countries as well as many industrial ones, inflation also increased sharply. Many industrial countries were now quite willing to have their currencies *appreciate* against the dollar to better insulate themselves from what had become a maelstrom of variable inflation rates worldwide. (Europeans were induced to look for a new center currency as anchor – and tried to rebuild monetary stability around the deutsche mark. This effort culminated with the successful advent of the euro in the late 1990s.)

The collective effect of this worldwide monetary instability on world productivity growth was catastrophic. Without a common anchor for domestic price levels and exchange rates, productivity in the industrial world and its periphery – except for the East Asian "tigers" – slowed dramatically after 1973 through to the early 1990s.

2.5. Paradise Regained in the 1990s

But from the early 1990s into the new millenium, the last panel in the figure shows a return to price stability in the US – with US interest rates becoming moderate to low once more. Thus, the dollar has again become attractive as an international anchor currency, and as the predominant reserve asset worldwide. After the dollar's decline as a reserve asset in the inflationary 1970s and 1980s, the dollar's share in official foreign exchange reserves greatly increased over the last decade. The dollar rose from 51.3% of official holdings of foreign exchange (of members of the IMF) in 1991 to 68.3% in 2001. And if one assumes a pro rata share of "unspecified currencies" to be dollars, the dollar's current share in international reserves seems well over 70% (Table 4).

Surprisingly, the advent of the euro has not reduced the dollar's predominance in international reserve holdings. The table also shows that the share of euros in official foreign exchange reserves in 1999 and 2000 was no greater than was the sum of the old legacy currencies – marks, francs, and guilders – before the advent of the euro on 1 January 1999. Although the euro has been very successful for securing regional monetary integration in Europe, the dollar remains king in international finance worldwide.

However, in the new millennium, this stronger form of the international dollar standard differs from high Bretton Woods of the 1950s and 1960s in at least two important respects:

(i) In noncrisis periods, most governments in developing economies stabilize their exchange rates against the dollar but without declaring official dollar parities. And such informal pegging is also "soft" in the sense that many exchange rates drift.

(ii) Most countries on the periphery of the dollar standard are no longer willing or able to use capital controls. Thus dollar encroachment on the natural domestic domains of their national monies has become acute.

2.6. Soft Pegging

In their landmark study of 155 country exchange rate regimes using monthly data, Guillermo Calvo and Carmen Reinhart (2002) showed that the only "truly" floating exchange rates against the dollar were the euro, yen, and possibly the pound sterling and Swiss franc. Month-to-month variance in these industrial countries' exchange rates is high – and variance in short-term interest rates is low: short-run shifts in cross-currency portfolio preferences are mainly absorbed by exchange rate changes – while their central banks target short-term interest rates as an instrument of domestic monetary policy. (However, in 2002 and 2003, the Bank of Japan intervened massively to keep the yen/dollar rate close to 120.)

In contrast, in developing or emerging-market economies, Calvo and Reinhart show that their monetary policies are arranged so that monthly variance in their exchange rates against some key currency – either the dollar or the euro – is low, but that monthly variance in their interest rates is much higher than in the core industrial countries. Except for an Eastern European fringe of countries keying on the euro, the others key on the dollar. The main shock absorber for cross-currency shifts in international asset preferences is changes in their domestic interest rates – except for those developing countries with effective capital controls.

This surprising difference between the core industrial economies at the "center" and emerging-market economies on the "periphery" is even more pronounced at higher frequencies of observation. By accepting higher volatility in domestic short-term interest rates, monetary authorities in emerging markets generally succeed in keeping their dollar exchange rates relatively constant on a day-to-day or week-to-week basis. McKinnon and Schnabl (2003a) show that this high frequency pegging is a rational response to incomplete domestic bond and forward exchange markets in developing countries. However, at low frequencies, e.g., quarter-to-quarter, these soft pegs sometimes drift; and, in major crises, even short-term exchange rate stabilization may be impossible.

This new regime of informal, i.e., undeclared, dollar pegs for countries on the periphery of the US differs from high Bretton Woods with its officially fixed dollar parities. In East Asia, for example, all the countries are dollar peggers to a greater or lesser degree. But only Hong Kong with its currency board admits to an official dollar parity of HK$7.8 for one American dollar. The others all claim to be "independently floating," or a "managed float," or pegged to a "currency basket." Although the PRC calls its regime a "managed float", the renminbi's exchange rate of 8.3 yuan to the dollar has hardly moved since 1994. The others' dollar pegs may drift a bit more when measured at low frequencies, but the variance in their dollar exchange rates is an order of magnitude less than that in the euro/dollar exchange rate.

Why this reticence of governments in emerging markets in East Asia and elsewhere to admit to keying on the dollar – or to go further and declare official dollar parities? The reasons are both political and economic.

On the political side, the asymmetry among national monies – with a center and a periphery – is simply too impolitic to admit. Nationalists in any peripheral country would get restless if their government admitted, by declaring an official dollar parity, that it was in thrall to the U.S. De jure, the original Bretton Woods Agreement, appeared to treat all its member countries symmetrically. Under Article IV of the 1945 Agreement, all members were obligated to declare an official parity for their exchange rate against gold or any currency tied to gold. In the event, only the US adopted a very limited form of a gold peg – whereas all the others chose to peg to the dollar as the Nth currency (as described above). Nevertheless, in the 1950s and 1960s, the Bretton Woods articles provided an acceptable political fig leaf for disguising what was really a dollar standard. But now the IMF's exchange rate parity obligation for membership exists no more; it was blown apart by the American inflation of the 1970s.

On the economic side, the reluctance of any one government to declare an official dollar parity now appears too risky precisely because neighboring countries have not done so. If Country A (Argentina) declared a dollar parity, and then its close neighbor country B (Brazil) allowed its currency to depreciate against the dollar, country A could lose competitiveness and be badly hurt. Better for country A not to commit itself formally to a particular dollar exchange rate to begin with in case it might want to depreciate in response to a surprise depreciation by country B. Hence, A dare not commit if B, C, D,… have not committed – and vice versa.

As in 1945, collective action is necessary to prevent beggar-thy-neighbor devaluations. But the old collective agreement under high Bretton Woods was undermined by the American inflation of the 1970s and 1980s. With no stable anchor currency, maintenance of the old regime of exchange parities became impossible. Now the American price level has been quite stable for almost a decade (Figure 1). However, the IMF has not attempted to orchestrate a collective return to a parity regime. Whence the prevalence of soft dollar pegging where governments, forced to act individually, are unwilling to commit themselves to anything harder.

3. New Rules for the Dollar Standard Game

Suppose that the American government finally recognizes its central position in the world monetary system and the "unfair" asymmetry in current financial arrangements. It also agrees to reduce financial fragility on the American periphery, looking at the periphery as being a *collectivity* of debtor and creditor countries whose regional fortunes interact. The IMF as lender of first resort would stay as crisis manager, but the US itself would formally agree to be the residual source of finance – the lender of last resort. The combined IMF-U.S. entity would have sufficient resources to act sooner and more assuredly to limit financial crises on the periphery.

Box 2: *New Rules for the Dollar Standard Game*

Peripheral Countries

Rule 1. Recognize that the greater fragility of financial systems requires prudential regulations more stringent than those prevailing within the United States. Restrain foreign exchange exposure by banks and other financial institutions, if necessary by capital controls.
1A: Debtor economies: Limit build up of short-term dollar liabilities.
1B: Creditor economies: Limit liquidity of "overhang" of dollar assets.

Rule 2. Recognize that pegging to the dollar may reduce risk in countries that are either dollar debtors or dollar creditors, and is necessary under capital controls or tight limits on foreign exchange exposure by banks.

Rule 3. Aim for mutual exchange rate stability within natural economic regions such or East Asia. Set long-term dollar exchange-rate objectives for the group.

Rule 4. Use collective action clauses to defer repayment of private and sovereign debts should a debtor country be declared in crisis.

United States

Rule 5. Conduct an independent monetary policy to limit inflation and stabilize the purchasing power of the dollar. Provide a stable potential nominal anchor for the price levels of other countries.

Rule 6. In noncrisis periods, remain passive in the foreign exchanges without targeting the dollar's exchange rate. Allow foreigners to transact freely in dollars. No capital controls for the center country.

Rule 7. Supplement the resources of the IMF in major crises and, if necessary, act as lender of last resort with the aim of maintaining or restoring exchange stability.

Rule 8. Do not force developing countries to open their financial markets internationally – and cease pushing the entry of American banks and other financial institutions into their domestic economies.

Rule 9. Limit or reverse current account deficits by increasing domestic saving, government and private.

To see how our present international monetary order should be modified, new rules for the dollar standard game are set out in Box 2. Reflecting the inherent asymmetry in the world's money machine, the first set of four rules applies to countries on the dollar's periphery and the second set of five rules applies to the United States. The nine rules are hardly all encompassing – and the European bloc, with the euro as the central currency, really does not fit comfortably into this analytical framework. Yet these nine rules address the philosophical impasse on what should be America's relationship to both debtor and creditor countries in the rest of the world.

Using similar rule boxes, I previously described how the actual rules of the international money game evolved from the 19th century classical gold standard through the various phases of the post World War II dollar standard (McKinnon 1993, and 1996). As summarized in Box 2 for the new millennium, however, my analysis is both descriptive in describing how the dollar standard now works but also more prescriptive in suggesting major improvements. Let us discuss each rule in turn.

3.1. Rule 1

The greater financial fragility of peripheral countries, whether they be dollar debtors or creditors, might require international capital flows to be directly regulated to prevent undue turbulence in the foreign exchanges. But the regulatory problems would differ between debtor and creditors.

For developing debtor economies, the incentives of banks and other financial institutions to finance themselves by borrowing more cheaply in foreign currencies to make domestic loans needs to be curbed either by direct controls or by very high capital requirements on net foreign exchange exposure. The international Basel Accord recommends uniform bank capital requirements for all classes of countries making no distinction between the center and the periphery. Remarkably, the Accord fails to deal satisfactorily with foreign exchange exposure: the most pressing regulatory problem faced by developing countries, but not one seen to be all that important by American or European banking authorities who dominated the decision making leading up the Basel Accords. In a generally more fragile financial environment, governments in developing countries need to be much more stringent in regulating against foreign exchange risk, but also against interest rate and default risks, than the Basel Accords suggest.

For dollar creditor economies, the regulatory problem is more subtle: how to prevent the build up of privately held dollar claims by domestic households, firms, and financial institutions that are so liquid that they become a dollar "overhang". Continual conversions of dollars into the domestic currency could force repeated appreciations of the domestic currency followed by deflation – as in Japan in the past (Goyal and McKinnon 1993) and threatens to be the case in China in the future (McKinnon and Schnabl 1993b).

One illustrative, but very draconian, way of avoiding a dollar overhang is that followed by Singapore – which, on a per capita basis, may well be the world's largest dollar creditor. The Singapore government essentially nationalizes most of domestic private saving through compulsory forced contributions to its Provident

Fund, which is a defined-contribution retirement plan where each individual household is kept fully informed of the Singapore dollar value of its accumulated assets. However, in investing the proceeds from this Fund, government entities act as agents in domestic real estate, business ventures, *and* in huge overseas investments.

But the (mainly) dollar assets held by Singapore's overseas investment agency on behalf of households are in "safe hands", i.e., there is no threat to have them suddenly converted back into Singapore dollars. From a household's point of view, these dollar claims are essentially illiquid, and cannot even be separated from the domestic assets in its share of the Provident Fund. Thus, there is no U.S. dollar overhang, and no danger of forced appreciation(s) of the Singapore dollar. The Singapore government has no trouble in keeping the exchange rate more or less stable.

3.2. Rule 2

Rule 2 addresses the pressing need to achieve exchange rate security on the periphery. It codifies the existing practice of both debtor and creditor countries that informally peg to the dollar to reduce foreign exchange risk. One aim is to dissuade the IMF from dissuading peripheral countries from stabilizing their exchange rates.

3.3. Rule 3

Rule 3 complements Rule 2 in two respects. First, it identifies the need for concerted action to stabilize exchange rates when countries are closely integrated in trade and capital flows – as in East Asia. In effect, exchange rate stabilization by any one country is a "public good" for its neighbors, and thus any changes in exchange rates should be by mutual agreement.

Second, Rule 3 identifies the need to lengthen the maturity of credible exchange rate commitments to the dominant central money if currency risk is to be minimized: specifically, to reduce positive risk premia in the interest rates of debtor economies (McKinnon 2001) and negative risk premia interest rates of creditor economies (Goyal and McKinnon 2003).

The need for concerted action among countries that are closely integrated in trade to stabilize their exchange rates over the long term suggests the need for official exchange rate parities. In East Asia, China has kept its exchange rate stable at 8.28 yuan/dollar since 1994 – and this seems like a natural fixed point around which to stabilize the exchange rates of other countries in the region.

3.4. Rule 4

"Collective Action Clauses" (CACs) in debt contracts allow for a moratorium on debt servicing should the debtor country (as distinct from the individual borrower) be declared, by some impartial arbiter, to be in crisis. CACs would reduce the moral hazard in international banks and other short-term creditors to *overlend* to emerging market economies. Should there be a general attack on the domestic money, they would suddenly become long-term lenders. CACs have been mooted by the IMF for sovereign borrowing, but Rule 4 would cover private foreign debts as well. Rules 1, 3, and 4 together could nudge developing countries away from short-term borrowing in favor of longer-term sources of finance.

Consider now the behavior of the United States itself as encapsulated in Rules 5 to 9. Macroeconomic policies of the American government have typically been implemented with little or no thought to what is going on in the rest of the world. And, up to a point, this has served the rest of the world quite well – as per Rules 5 and 6.

3.5. Rule 5

The U.S. Federal Reserve orients domestic monetary policy towards stabilizing the U.S. price level, i.e., the purchasing power of the dollar in terms of a broad basket of goods and services. For the Nth or center country in the system without any exchange rate objectives or commitments of its own, American monetary independence is best utilized by using the Fed's domestic open market operations to target the U.S. price level. This then can provide an independent nominal anchor for the price levels of the other N-1 countries that are targeting their dollar exchange rates to greater or lesser degrees.

3.6. Rule 6

Similarly, the United States normally keeps its financial markets open and lets foreign citizens and governments buy and sell dollar assets freely. Indeed, the Federal Reserve Bank of New York often acts as the agent of foreign central banks in acquiring and holding U.S. Treasury bonds, and increasingly U.S. government agency securities, on their behalf. About 200 foreign official institutions own so-called Fed Custodial accounts, and more than half of official exchange reserves throughout the world are in this form. Clearly, the imposition of capital controls by the United States would undermine a central feature of how the world dollar standard works. The U.S. government should normally be quite passive in the foreign exchange markets.

3.7. Rule 7

Because the dollar is definitive money in the world system, in major crises the U.S. government is the natural lender of last resort to other governments. Because its ability to issue Treasury bonds – many of which are purchased by foreign entities anyway – is virtually unlimited, the U.S. government has great credibility in any financial rescue operation. However, the International Monetary Fund's has the technical expertise, and better political cover from being an international agency with a wide voting membership, for crisis management. To alleviate minor crises, the IMF (with the tacit consent of the U.S. Treasury) has sufficient resources on its own to act as lender of first resort. But in great crises, the U.S. Treasury must eventually be drawn upon.

Rules 5, 6, and 7 described benign behavior followed more or less unconsciously by the United States, and arise naturally from the inherent currency asymmetry in the world system. However, the unbalanced world monetary regime turns more malign when the center country tends to act – either consciously or unconsciously – in an exploitive fashion. Rules 8 and 9 are designed to identify, and then curb, these unfortunate tendencies.

3.8. Rule 8

Every government faces pressure from specific domestic mercantile interests, which are highly focused politically, to intervene for their benefit – even though such interventions may be against the general welfare at home or abroad. Domestic lobbying for protection against foreign imports is a well known example. Beyond this "normal" petitioning by special interests, however, the central position of the U.S government gives it unusual leverage to influence policies in other countries.

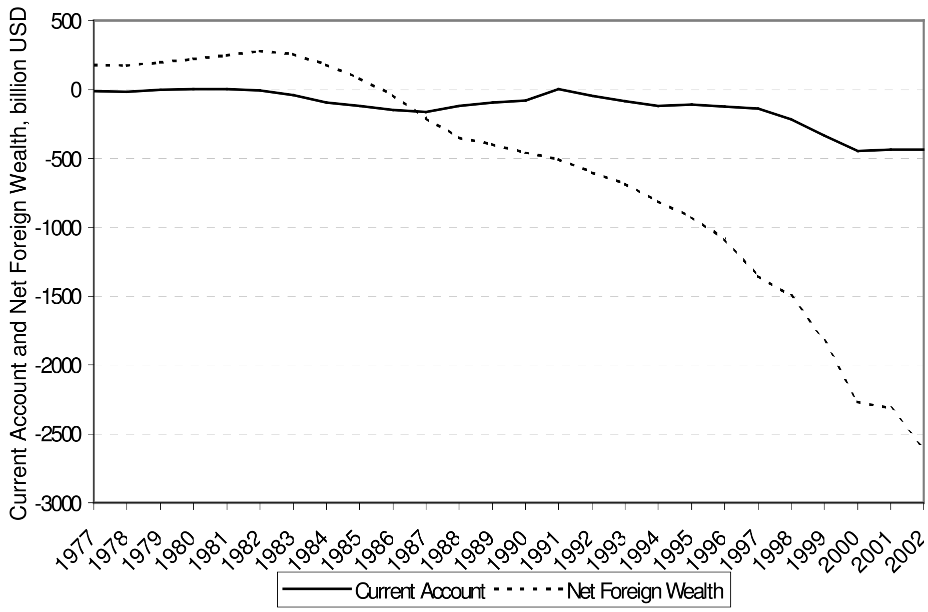
For example, the U.S. Treasury has pressured developing countries to (prematurely) jettison capital controls and open their domestic financial markets in the interests of American banks, insurance companies, stock brokerages, and so on. China is the most recent case in point where its application to WTO was held up until the U.S. government secured a separate agreement (not part of the normal WTO articles) from the Chinese to liberalize capital controls and admit foreign financial firms into China's domestic markets. For many developing countries, this pressure contravenes the good financial practices embodied in Rules 1 and 2.

3.9. Rule 9

The same unlimited line of credit with the rest of the world that makes the United States the international natural lender of last resort (Rule 7) can be exploited, consciously or unconsciously, to borrow indefinitely for domestic purposes. Since the early 1980s, the U.S. government, corporations, and increasingly households, have borrowed heavily – and almost invisibly through financial intermediaries and banks – from foreigners. Figure 2 shows the resulting current account deficits (about 3-5 percent of GNP in the 1980s into 2003) and the decline in America's net asset position from being positive in the 1950s and 60s to being highly negative (about 25%) of GNP today.

This huge inflow of capital into the world's richest and most mature capitalist economy is perverse in the sense of draining capital from poor Third World countries. India, in 2003, is now running a current account surplus, building up official exchange reserves in dollars, and lending to the United States! American households can borrow too easily on their consumer credit cards because banks issuing the cards have no trouble attracting capital from foreigners. America's budget constraints, both of the Federal Government and of households, are unduly (artificially?) soft because of an accident of history: the position of the United States at the center of the world dollar standard. Thus, from a long run perspective, Rule 9 enjoins the United States to reduce its current account deficits by increasing government saving, i.e. run government budgetary surpluses rather than deficits, and increase the incentives of American households to save via pension plans and fully funded social security arrangements.

Figure 2: *The US Current Account and Net Foreign Wealth Position, 1977-2002*



Source: US Department of Commerce, *Survey of Current Business* (June 2003).

However desirable to put in train these long-run reforms in American saving practices, the immediate pressure is slack in the world economy and potential deflation – which militates in the opposite direction of running fiscal deficits for Keynesian reasons. I now turn to this "short-run" counter cyclical problem.

4. Conclusion: U.S. Current Account Deficits and the Threat of Deflation

The current macroeconomic threat to the world economy is generalized deflation. The American economy, at the center of the world dollar standard, is still suffering the deflationary aftermath of the collapse of the high-tech bubble economy that lasted from 1995 through 2000. Ultra low American interest rates and large fiscal deficits may or may not provide enough domestic stimulus for the American economy to resume growing. However, because of the fundamental asymmetry in the world's money machine where the dollar is the central money in international trade and finance, coping with deflation in other economies is much more difficult.

In a deflationary world, each foreign government on America's periphery is paranoid about having its currency appreciate against the dollar with a consequent loss of mercantile competitiveness against its neighbors. In East Asia in particular, the currencies of Japan, China, and now most recently Korea, are facing strong upward pressure in the foreign exchanges. So, the Bank of Japan, the People's Bank of China, and the Bank of Korea, are all intervening heavily to buy dollars with their domestic monies to forestall appreciation.

For example, the Bank of Japan has intervened quite massively in 2003 and earlier to sell yen for dollars in a desperate attempt to prevent the yen from appreciating – buying US$34.4 billion in May 2003 alone. Japan's official foreign exchange reserves now total more than half a trillion dollars. The People's Bank of China has been selling yuan for dollars so that the recent run up in its exchange reserves, which are now more than $370 billion, has been proportionately faster. The run up of exchange reserves in Korea over the last two years has been proportionately much slower, but seems to be intensifying as of mid-2003. And each central bank is more or less forced to cut domestic interest rates to stem the conversion of privately-held dollar assets into domestic-currency assets. The Bank of Japan has cut the short-term interest rate in Japan's money market to virtually zero. However, if these intervention efforts were to break down, with a sharp appreciation, the deflationary domestic impacts could be traumatic.

Right now, China seems to be the flash point for such speculative pressure. Clamoring from foreign industrialists and politicians – particularly in Japan – that China's economy is too competitive and that the yuan should be appreciated, compounds the problem. China's exchange rate of 8.28 yuan to the dollar has been constant since 1994 and its internal price level is now quite stable at that rate. China has had a trade surplus since 1995, except for the first few months of this year when its trade happens to be roughly balanced multilaterally. However, many economists believe that China's trade surplus could be reduced, and even become negative, if an appreciated yuan made Chinese exports more expensive in dollar terms so that fewer are sold abroad.

But this conventional wisdom is misplaced. China's trade surpluses reflect its surplus saving, just as America's huge ongoing trade deficit reflects the extraordinarily low net saving within the American economy – zero net personal saving and now large government dissaving from extraordinary fiscal deficits. Changing an exchange rate does not change these net savings propensities in any obvious way. However, in a deflationary world, if one country is forced to appreciate its currency against all its neighbors, the fall in its domestic-currency prices of tradable goods and services could create a downward deflationary spiral in prices and output with a consequent fall in imports. Thus, there would be no predictable effect on China's net trade surplus from appreciating the yuan.

Among the emerging creditor economies of East Asia (Korea has now had five years of trade surpluses), this tension in the foreign exchanges could well provoke a new currency crisis which is the mirror image of the forced depreciations of 1997-98 . If any one East Asian currency is "attacked" with a run *into* it and so is forced into a substantial appreciation against the dollar, then the contagious pressure on the remaining creditor economies will intensify and possibly force appreciations there as well.

The best defense against these runs from dollars into East Asian currencies is a collective one. Building on China's very strong decade-long effort to sustain the yuan at close to 8.28 to the dollar, Japan (120 yen to the dollar?) and Korea (1200 won to the dollar?) could well jointly announce more specific goals for stabilizing their exchange rates. A collective agreement among the major players makes it easier for any one central bank to defend its position, and also easier for smaller economies like Malaysia and Hong Kong to keep their exchange rates fixed against the dollar.

The other major player, Western Europe with its new euro, is a huge economy somewhat better – but not completely – insulated from the world dollar standard. Its foreign trade and international lending is denominated in its home currency euros. Traditionally, the European Central Bank (ECB) does not intervene to keep the euro stable against the dollar and has been more sanguine, and probably too willing to ignore, the deflationary impact of the rise in the euro over the past two years from about US$.85 to US$1.13. True, partly in response to the euro's rise, the ECB cut its interbank rate sharply down to 2 percent in early June 2003. But, given the weak state of the German and French economies, that might be too little and too late.

My guess is that further significant ratcheting up of the euro will eventually elicit official intervention in the foreign exchanges by European governments, and more interest rate cuts by the ECB, to prevent further appreciation. But, of course, once interest rates approach zero, this avenue will no longer work, Then, Western Europe will be in the same financial trap as its neighbors in East Asia: massively intervening to keep their domestic currency from appreciating while not being able to do much to stimulate their internal economies.

So everybody will be waiting for the huge US economy to recover and once again start attracting private capital from the rest of the world. Only then may foreign governments withdraw from intervening to keep their currencies from rising, and make use of a more buoyant world economy to expand their exports and recover.

Notice that in neither of these scenarios has the United States any problem in covering its own massive current-account deficits. If the American economy recovers, it will again attract private capital inflows. But if the American economy continues to languish, then official capital inflows – the result of foreign governments intervening to prevent their currencies from appreciating – provide the finance for America's external trade deficits.

And there is a final irony. More and more countries on the American periphery are being induced to run trade surpluses as the inevitable counterpart of America's high trade deficits and unlimited line of credit from the rest of the world. Although the US is the calm at the center of the world's financial storm, its profligate trade deficits are at the root of the strong deflationary pressure – from the threat of exchange appreciation – now faced by many other countries that have become dollar creditors.

Notes

1. William D. Eberle Professor of Economics, Stanford University. E-mail: mckinnon@stanford.edu

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The Case for Monetary Union Reexamined with the Benefit of the Single Monetary Policy

George M. von Furstenberg[1]
Indiana University

Abstract. A traditional OCA criterion holds that the more symmetric the shock exposure of countries, the more suited they are for currency union. According to Frankel and Rose (1998, 2002), growing correlation of the ex post income fluctuations of members also can provide endogenous justification for regional monetary union (MU) after its creation. Trade-enhancing effects of MU increase symmetry of shock exposure. But the single monetary policy of a multilateral MU in theory counteracts net disturbances to the union as a whole to the extent consistent with low inflation. This would leave mostly idiosyncratic disturbances and hence less symmetry among the national disturbance effects that remain. But recent evidence from the euro area yields results contrary to those expected.

1. Introduction

Optimum Currency Area (OCA) criteria were formulated in the 1960s, notably by Mundell (1961) and Kenen (1969), by focusing on the costs and benefits of having a common money, and not on the benefits of having a common discretionary monetary policy. Part of the reason was that multilateral monetary union (MU), as opposed to currency union (CU), had not yet been invented. MU is co-managed by its members through a mutually agreed process while CU is achieved by unilateral adoption of another country's money and its policy. Then the more alike the shock exposure of dependent countries to that of their anchor country, the better they may be served by its policy. From this stems the interest in symmetry of disturbances among candidates for CU.

Even after a prototype for multilateral monetary union had been developed in the 1991 Maastricht Treaty, the output stabilization potential of its single monetary policy has tended to be disregarded in establishing (i) the suitability of countries for MU and (ii) the signs by which the success of MU is to be recognized. This paper aims to remedy the common oversight and to show that an endogenous symmetry-enhancing effect in the remaining output fluctuations of member countries is the opposite of what one would expect from a successful monetary stabilization policy by such a union. It then goes on to test whether there are any indications in the data already that the transition from unilateral ("German dominance") to multilateral (European Monetary Union, EMU) monetary union has in fact affected the underlying variances and covariances of percentage output gaps, and their common and idiosyncratic components, in the way theory would suggest. The model of "German dominance" continues to be of interest to the extent that its main features are equivalent both to formal dollarization that has occurred elsewhere in the world and to euroization and future euro-pegging beyond the borders of EMU.

Regional monetary union often is described as hazardous to the economic stability of individual member countries. The claim is that (a) due to the assumed loss of floating exchange rates and hence of an independent national monetary policy, (b) MU may be harmful to national economic stability, unless the process of regional economic integration is intensified by MU and (c) this MU-driven process leads to sufficiently greater symmetry of shock exposure for member countries.

Assertion (a), that countries in an economically integrating region without prospect of monetary union would prefer to float their exchange rates freely against each other, may well be counterfactual (Calvo and Reinhart 2002; McKinnon 2000) or unsafe for deep economic integration among them (Fernández-Arias, Panizza, and Stein 2004). With the exception most notably of NAFTA countries Canada and Mexico, all or most of the smaller members of an economic group have preferred to tie their currencies to an internal (e.g., DM) or external (U.S. dollar) anchor instead. Hence, as Kenen (2000: 7-9) has indicated, the assumption that every country is equally capable of conducting a stabilizing monetary policy regardless of size, openness, and of its neighbors and main trading partners may not be an apt starting point; we will not proceed as if an independent monetary policy were a relevant option for all or most countries in each group.

At least since the crisis of the Exchange Rate Mechanism (ERM) in the fall of 1992, the national choices of euro-area countries have centered on different forms of monetary union as the most relevant alternatives. Unilateral monetary union, as incompletely represented by “German dominance” in the European Monetary System, became the default solution that turned into a precursor to the multilateral European Monetary Union (EMU) outlined in 1991. In order to obtain crisp predictions about the relative stabilization success of these two regimes that can then be checked against recent evidence, the first part of this paper ends with a bare-bones model. It calibrates the degree to which these two types of monetary union could offset idiosyncratic and common shocks if they were completely successful in meeting their objectives.

The first part thus starts by asking what the decisions of the anchor country would imply for the economic stability of the other countries in the group compared with having a multilateral monetary union among all, including the region’s original currency leader. Here the weakness of the logical link between (b) and (c) is exposed in Section 2 by showing that the common monetary policy by itself tends to reduce symmetry in the ex post income fluctuations among members because it aims to reduce the output fluctuations which they have in common on weighted average. Except for the anchor country, the monetary policy of a multilateral MU is also superior in theory to the unilateral form represented by “German dominance” in Section 3. Section 4 presents a bare-bones model driving home these points, while Section 5 draws theoretical implications from this model about what happens to the relative size and correlation of ex post income fluctuations as economies pass from being unable to stabilize actively to getting some stabilization under German dominance but even more with MU.

The second part supplements the list of expected outcome properties with three particular data-based hypotheses in Section 6. These are then confronted with the evidence for euro-area countries, 1992-2002, in Section 7. The data do not support the theoretical expectation that multilateral monetary union is more effective in lowering the variance of the common component of the output gap for the euro area than unilateral monetary union and hence more stabilizing for all but the previous anchor country. Section 8 concludes by commenting on the failure of this and related hypotheses to find support in the evidence available so far.

2. In Theory, the Single Monetary Policy Lowers Symmetry Observed Ex Post

With regard to the link between (b) and (c), in the euro area, the symmetry-enhancing effects arising from a combination of industrial-structure integration, trade expansion and irrevocable exchange-rate stabilization among members may have won out narrowly during the stages leading up to European Monetary Union (EMU). Certainly the correlations of output gaps among the core countries of EMU in the sub-period 1991-2000 presented in Table 1 have been markedly higher between Germany and France and slightly higher between Italy and each of the other two core countries than in the post Bretton-Woods period, 1974-2000, as a whole. Kenen (2000: 12) has cautioned that such evidence may be inconclusive because the co-variation of output gaps is endogenous, being shaped not only by (i) truly exogenous shocks but also by (ii) policy-induced responses to those shocks and (iii) the strength of transmission links among the countries of the region. It is not clear how the development of the observed correlation of output gaps would differ from that of the exogenous shocks because the additional factors, taken together, can cut either way. Stronger transmission links, for instance of aggregate demand impulses, through increased trade (see Frankel and Rose 1998; Calderon, Chong and Stein 2002) raise the pairwise correlations of the GDP disturbances of member countries while policy-induced impulses could reduce them. Still there is no reason to think that the net effect of factors other than (i) is negligible and constant over time.

Table 1: *Cross-Correlations of Output Gaps of Euro Core Countries and U.S., 1991-2000 Compared with 1974-2000 (in parentheses)*

	France	**Italy**	**United States**
Germany	0.72 (0.61)	0.75 (0.74)	-0.57 (0.47)
France		0.74 (0.70)	-0.10 (0.35)
Italy			-0.28 (0.46)

Source: International Monetary Fund, *World Economic Outlook*, October 2001, 66.

As shown in Table 1, for the period since Maastricht, residual income growth correlations of up to 0.75 between what are now EMU member countries have been observed. Such correlations often have been interpreted as if they directly revealed the average cross-country correlations of the underlying structural demand and supply disturbances without any intervention by policy. Since the objective function and spatial application (domain) of monetary policy are both affected by monetary union, particularly if it is of the multilateral kind like EMU, monetary policy must be brought into the picture. As Alesina and Wacziarg (1999: 22) have noted, this has been done, if at all, by assuming that monetary policy is largely responsible for aggregate fluctuations. In that case, centralizing the policy can be expected to result in greater synchronization of business cycles within Europe based on the perception that a common monetary policy, rather than being stabilizing, means common monetary and hence economic disturbances. Alternatively, if the common monetary policy has little systematic effect on the real economy but the several national monetary policies it replaces were dysfunctional and destabilizing, country-specific monetary policy shocks that were previously responsible for most of the idiosyncratic component in output fluctuations would disappear, leaving a relatively larger common component in the income fluctuations remaining for members. Kenen (2000: 19-20) has considered this possibility.

This paper hypothesizes instead that the single monetary policy devised for the benefit of all members of a monetary union and not just of a single leading country offsets the net aggregate disturbance afflicting the region as a whole to at least some degree. But if all except the member country that served as anchor previously chose not to attempt an independent monetary policy, as was generally true since 1992 for countries now in the euro area, multilateral monetary union and its single monetary policy would have no appreciable effect on the idiosyncratic disturbances which they continue to experience. Reducing the common component then would make the remaining country-specific disturbances relatively more important in the total growth deviations or percentage output gaps of member countries. Hence no automatic inferences can be drawn about an OCA by simply determining from the data what happened to the symmetry of business cycles among members from before to after MU.

The ECB (2001: 38-39), like some other central banks for their country, has defined its goal of price stability as year-on-year price increases for the euro area averaging, over the medium term, below 2 percent but sufficiently above 0 to avoid any negative rates of "true" inflation after adjusting for any putative upward bias in measuring inflation with the Harmonized Index of Consumer Prices (HICP). Thus there can be room for experimenting with an actively countercyclical monetary policy, as the U.S. Federal Reserve has done with some success for at least the last 15 years, if achievement of the inflation target appears reasonably secure. Flexible inflation targeting that allows some intertemporal averaging then provides scope for the monetary authorities to react to other considerations as well. Smaller and more open countries do not tend to have this luxury. In developing countries, in particular, monetary policy tends to be tight and intermediation impaired when they are in crisis and easier in the opposite case, often making their monetary policy in effect procyclical (Hausmann 2000).

In well-governed countries with reliably low inflation, however, one would expect real income deviations from trend and real interest rates to correlate positively, as under the Taylor rule, so that when business is down, so are real interest rates. As Taylor (2001: 513) has pointed out, an interest rate rule with real output merely mimics what the interest rate would do when output fluctuates under a money supply rule. In Europe, those countries that accepted "German dominance" in the decades leading up to EMU would then find that their exposure to the automatic interest-rate effects that are helpful for Germany would be less helpful, or even destabilizing for them, depending on the correlation of their individual business cycles with Germany's. The ECB's monetary policy, by contrast, could become constructive for all countries that cluster around the cycle-average condition of the entire euro area at any one time. Even if the Bundesbank formerly gave some normative weight to the stabilization requirements of surrounding countries (Laopodis 2001), EMU inevitably reduced the weight of German concerns in the decision process of the ECB compared with those of the Bundesbank before. Hence the transition from "German dominance" to "collective responsibility" in the euro area could well involve a reduction in the severity of the common disturbance, or in the size of the output gap percentage which remains for the area as a whole – at least in theory.

The Taylor rule has two arguments in its reaction function: deviations of the inflation rate from its low desired level and percentage deviations of output from its dynamic "natural" trajectory or trend level. Now if inflation is staying close to its desired level, almost all the action in monetary policy is induced by changes in the output gap percentage without implying any rule change. However, estimating the output gap percentage in real time for policy applications is tricky. According to a systematic audit by Orphanides and van Norden (2002), the size of data revisions tends to be about as high as the originally reported gaps, with estimates of the most recent trends in filtered or natural output particularly uncertain. So when we subsequently assume a monetary policy that is correct in its assessment of what the output gap percentage would be if no action were taken and capable to take prompt and effective action to forestall the development of any such gap, we are greatly exaggerating what is feasible under realistic conditions.

3. Modeling the Limit Effects of the Single Monetary Policy

Before turning to data analysis, it may be insightful to stretch unilateral and multilateral monetary unions' capabilities for common-shock elimination to the extreme just identified to get clear-cut predictions of differences in their maximum conceivable stabilization effects. To set these theoretical benchmarks, assume that countries, like future members of EMU, have opted for ever harder parities that implied an ever more complete sacrifice of a functionally independent monetary policy for all but the anchor country in the group. Lacking an economically stabilizing national policy, there is both (i) a general net business cycle affecting all countries in the region in proportion to their GDP and (ii) an idiosyncratic fluctuation for each country. With regard to the latter, fiscal and financial intra-union insurance, which may be enabled and made more complete through monetary union (Kenen 1969), could have cushioned the country-specific and hence diversifiable fluctuations, but we do not here claim this extra credit for MU. In any event, by definition, the net contribution of the idiosyncratic parts of the business cycle to the cycle for the region as a whole is zero. Indeed, as in Goodfriend (1992) and as modeled in the next section, the common part is identified by this condition period by period. Then an optimal and completely successful single monetary stabilization policy for the entire region tends to eliminate the region-wide co-movement, thereby leaving only members' idiosyncratic fluctuation components. As in the monetary-policy model presented by Kenen (2000: 21), the ex post income changes for the regional monetary policy domain of a supranational monetary union add up to zero.

For a simple example, if two equal-sized countries are expected to grow by 1 and 3 percentage points less than desired in the coming year, completely offsetting the inferred common component of –2 percentage points through successful monetary policy would leave deviations of +1 percentage point for the first and –1 percentage point for the second of the two countries, if the effectiveness of monetary policy is perfectly symmetric. Of course responsiveness to the single monetary policy may vary due to differences in indexation, nominal contract duration and rigidity, and in financing practices that cause the monetary transmission mechanism to differ by channel, size, and speed in each country (Mihov 2001). For instance, if monetary policy were completely ineffective in one of the two countries, say the second, perhaps on account of differences in wage and price contracting as in the heterogeneous "archipelago" economy analyzed by Blinder and Mankiw (1984), the optimal monetary policy should aim to offset the 1 percent growth shortfall in the first country completely but not try to do more. In this case there would be no case for multilateral orientation of the single monetary policy since the effect of monetary policy would remain strictly confined to a single country. To avoid such complications, the simplifying assumption applied in the first part of this paper is that the effectiveness of monetary policy is the same in all countries.

The capacity of the single monetary policy to stabilize the economies of member countries is limited by its need to focus on the net output disturbance for the membership as a whole. If there is no such net disturbance because demand is switching from the output of one or more member countries to that of the others – as when there are preference shifts over Armington-type goods – the single monetary policy remains inactive. By contrast, in Corsetti and Pesenti (2002), the single monetary policy can stabilize each member country perfectly even if the aggregate demand shocks experienced by them are asymmetric. This happens when each country is assumed to be perfectly specialized in production but perfectly diversified, just like all other member countries, in consumption that is limited to a fixed basket of tradables. Then what matters for each country's production is the same unionwide level of aggregate demand that can be managed by the single monetary policy. Obstfeld (2001: 33) earlier put forward a symmetric production structure, based on two-countries' equal reliance on each others' intermediate-goods inputs, that would make one-sided hard pegging, or unilateral monetary union, produce the exact same welfare results as an optimal cooperative (perfectly) fixed exchange-rate regime, such as multilateral (in the two-country case, bilateral) monetary union.

Without going so far as to collectivize the consequences of country-specific shocks to aggregate demand or supply to make the single monetary policy equally perfectly suited to all members, such a policy can be expected at least to lower the residual co-movement of members' output gaps by leaning against any shared deviations of output from its natural level. This fall in the measured degree of correlation of the national output residuals is the opposite of what the endogenous-justification literature looks for by focusing only on production-structure and trade-network integration effects of monetary union. A rigorous demonstration of the best policy case for monetary union and of its theoretical ability to subvert endogenous OCA criteria follows.

4. A Bare-Bones Model

A model amenable to calibration is needed to deduce how the monetary policy of a unilateral or multilateral monetary union can contribute to the stability of output growth in the anchor country and the other countries in the group. The rate of growth of an individual member country i=1,N at time t, i.e., the change in the logarithm of income, $d\ln(y_{it})$, is decomposed in equation (1) into the expected (E) rate of growth of the income of the entire monetary union, $E_{t-1}d\ln(Y_t)$, and the residual growth-rate deviation, u_{it}. The latter, in turn, consists of the aggregate deviation, $\bar{u}_t$, and the idiosyncratic deviation relative to that aggregate, ε_{it}, as specified in equation (2).

$$d\ln(y_{it}) \equiv E_{t-1}d\ln(Y_t) + u_{it}, \tag{1}$$

$$u_{it} = \bar{u}_t + \varepsilon_{it},\ \bar{u}_t = \textstyle\sum_{i=1,N}(w_{it}u_{it}). \tag{2}$$

Taking the sum of the weighted individual income growth rates in equation (1) defines the common unexpected growth deviation component, $\bar{u}_t$, given that the sum of the member-country weights (w) is unity:

$$\textstyle\sum_{i=1,N}[w_i d\ln(y_{it})] = E_{t-1}d\ln(Y_t) + \bar{u}_t,\ \ \bar{u} \sim N(0, \sigma_{\bar{u}}^2). \tag{3}$$

Here any i country's average income share, $w_i = y_i/Y$, is constant over the medium run. Taking $\bar{u}_t$ as serially independent for expository convenience in equation (3), $E_{t-1}d\ln(Y_t)$ is the natural rate of growth of the aggregate income of the monetary union as a whole. Equation (2) implies that the sum of the weighted idiosyncratic deviations must always be zero by construction as:

$$\textstyle\sum_{i=1,N}[w_i(u_{it} - \bar{u}_t)] = \textstyle\sum_{i=1,N}(w_i\varepsilon_{it}) = 0. \tag{4}$$

This forcing condition, $\sum_{i=1,N}(w_i\varepsilon_{it}) = 0$, in equation (4) has important implications. It means that the realization of any country's weighted idiosyncratic residual income deviation, ε_{it}, equals the negative of the sum of the weighted realizations of all the other such deviations, ε_{jt}, $j \neq i$. N-1 values of $w\varepsilon$ then determine the N'th country's $w\varepsilon$. Individual ε_i values do not normally have expected values of 0 as some member countries may consistently grow faster or slower than the average. Here again only the sum of all such weighted expected values must be zero by construction.

If there were only two countries with weights w_i and $w_j = (1 - w_i)$, the construction implies that $w_i\varepsilon_{it} = -w_j\varepsilon_{jt}$. Hence, for the weighted idiosyncratic deviations to add to zero, $var(\varepsilon_{it})/var(\varepsilon_{jt}) = w_j^2/w_i^2$. This result shows that the variance of one country's idiosyncratic logarithmic disturbance vis-à-vis the other's must be lower the greater its relative weight. Hence, large countries tend to appear more stable than small countries after successful application of the single monetary policy. This results from the growth rate deviation, u_{it}, of country i contributing less to ε_{it} and more to the common aggregate component, $\bar{u}_t$, – and hence to the orientation of the single monetary policy – the greater the country's weight.

Furthermore, in the two-country setting, the covariance between the idiosyncratic deviation components, $covar(w_i\varepsilon_{it}, w_j\varepsilon_{jt}) = - w_i^2[var(\varepsilon_{it})] = - w_j^2[var(\varepsilon_{jt})]$, is necessarily negative on account of the forcing condition that can be used to substitute for either $w_i\varepsilon_{it}$ or $w_j\varepsilon_{jt}$. Again however, the tendency for negative covariance between the idiosyncratic deviations is diluted in a multi-country setting: It may not govern the correlation between each and every pair of countries in such a setting. Equation (5) below shows that $covar(w_i\varepsilon_{it}, w_j\varepsilon_{jt})$ could even be positive without violating the forcing condition, $\sum_{i=1,N}(w_i\varepsilon_{it}) = 0$. This possibility arises when a sufficient number of countries in addition to i and j are included in the union, as in the euro area, and the covariance of their idiosyncratic deviations with those of country i is sufficiently negative. For using the forcing condition to substitute for $w_j\varepsilon_{jt}$ in the first covariance below and solving yields:

$$covar(w_i\varepsilon_{it}, w_j\varepsilon_{jt})_{j\neq i} = - w_i^2[var(\varepsilon_{it})] - \sum_{k\neq i\neq j}[covar(w_i\varepsilon_{it}, w_k\varepsilon_{kt})]. \quad (5)$$

Because $\bar{u}_t$ and ε_{it} are not structural disturbances but growth rate fluctuations left after the structural disturbances have been processed through the economic and policy system, they are highly regime-dependent. Variance-covariance patterns observed under a national-currency regime may not carry over to another regime that has adopted a hard international money, particularly if currency and financial crises were a major source of output fluctuations under the former regime. The discussion that remains focuses on how the size and symmetry of deviations seen in the output growth data, or percentage output gaps, may change when monetary policy effects of monetary union are considered first in theory and then in practice.

Assuming as in Obstfeld (2001: 32) that deviations in the growth rate of aggregate income, $\bar{u}_t$, from the expected (natural) rate of growth are independent of the dispersion, indicated by ε, of individual country growth rates around this aggregate deviation yields:

$$\text{covar}(w_i u_{it},\ w_j u_{jt})_{j\neq i} = \ w_i w_j \sigma_{\bar{u}}^2 + \ \text{covar}(w_i\varepsilon_{it},\ w_j\varepsilon_{jt})_{j\neq i}. \qquad (6)$$

Now if the union's single monetary policy is completely successful in counteracting the aggregate growth-rate deviation from its natural level, its variance, $\sigma_{\bar{u}}^2$, measured ex post, falls to zero. In the simple special case where the N member countries, perhaps combined in appropriate groups, have the same economic size so that $w_i = w_j = 1/N$, $\text{var}(\varepsilon_i) = \sigma_\varepsilon^2$ can consistently be assumed for all i as in Goodfriend (1992). In that case $\text{std}(w_i u_{it}) = \text{std}(w_j u_{jt})$ and the product of the two standard deviations (std) is $w_i^2\text{var}(u_{it}) = w_j^2\text{var}(u_{jt}) = (\sigma_{\bar{u}}^2 + \sigma_\varepsilon^2)/N^2$. With this result and using equation (6), the correlation coefficient ρ_{ij}, between the growth rates of any two countries i and j (see equations (1) and (2)) can be obtained from the ratio of $\text{covar}(w_i u_{it},\ w_j u_{jt})$ to $\text{var}(w_i u_{it})$. After canceling N^2 it equals:

$$\rho(\text{dln}(y_{it}),\text{dln}(y_{jt})) = \rho(u_{it},u_{jt}) \equiv \ \rho_{ij} \ = \ [\sigma_{\bar{u}}^2 + \text{covar}(\varepsilon_{it},\ \varepsilon_{jt})]/[\sigma_{\bar{u}}^2 + \sigma_\varepsilon^2]\ . \qquad (7)$$

As already explained by reference to the forcing condition, $\text{covar}(\varepsilon_{it},\ \varepsilon_{jt})$ is normally negative and below $-\sigma_\varepsilon^2$ in absolute value. In the multi-country setting we will assume a value of $-0.25\sigma_\varepsilon^2$ in the conjectures immediately below. They are used to show how policy alternatives and their implications for correlation and variance of growth-rate deviations can be evaluated numerically. Hence equation (7) implies that ρ_{ij} tends to become negative when $\sigma_{\bar{u}}^2 \to 0$. A reduction in $\sigma_{\bar{u}}^2$, with no change in σ_ε^2, would be expected if a single monetary policy is instituted in the monetary union that targets the natural rate of growth of the union with some success by reducing deviations from it.

To elaborate, if this model held and $\rho(u_{it},u_{jt}) \equiv \rho_{ij} = \ (\sigma_{\bar{u}}^2 - 0.25\sigma_\varepsilon^2)/(\sigma_{\bar{u}}^2 + \sigma_\varepsilon^2)$ was about 0.75 prior to monetary union as Table 1 allows, $\sigma_\varepsilon^2/\sigma_{\bar{u}}^2 = 0.25$. Hence the idiosyncratic component is one-fourth as large as the common component in the absence of a growth-stabilizing monetary policy. Then if the monetary union's single monetary policy, having already achieved approximate price stability, could be employed with complete success against the common component of the income deviations, the variance of member countries' ex post income deviations, $\sigma_{\bar{u}}^2 + \sigma_\varepsilon^2 = 5\sigma_\varepsilon^2$ would fall by four-fifths when $\sigma_{\bar{u}}^2 \to 0$. The reason is that, in this best case for monetary union, only the zero-sum relative growth rate deviations between member countries and not the region-wide absolute growth rate shocks remain. In this example the ex post income correlation between any pair of member countries would fall from 0.75 to -0.25.

The conclusion, that monetary union could reduce ρ_{ij}, can be reinforced by considering the transition from presumed functional and political German dominance (gd) to the ECB regime. Interpreted more broadly, this also allows a comparison between unilateral monetary union, frequently called dollarization, and multilateral monetary union of the kind pioneered in the euro area. A self-centered German monetary policy that is completely successful in stabilizing German (g) income after factoring in all its transmission and repercussion effects, foreign and domestic, will provide a disturbance-offsetting impulse to aggregate demand, c_t, such that $\bar{u}_t + \varepsilon_{gt} + c_t = 0$. Because a common shock equal to $c_t = -(\bar{u}_t + \varepsilon_{gt})$ now is added to the growth-rate deviations, $u_{it} = \bar{u}_t + \varepsilon_{it}$, of all other countries, the total shock affecting any one of them is $\varepsilon_{it} - \varepsilon_{gt}$. Hence the sum of all countries' weighted growth-rate shocks, $w_i u_{it}$, that was equal to $\bar{u}_t$ in the absence of any growth-rate stabilizing monetary policy, would be $-\varepsilon_{gt}$ for the countries in the euro area combined: As a group they experience the flip side, equal to $-(1-w_g)\varepsilon_{gt}$, of Germany's self-centered stabilization plus their own idiosyncratic instability. Since the latter amounts to $-w_g\varepsilon_{gt}$ under the previous forcing condition, the total effect is $-\varepsilon_{gt}$. For each country that accepts Germany's "dominance" in monetary policy, the common disturbance element, $\bar{u}_t$, to which it otherwise would be exposed, thus is replaced with $-\varepsilon_{gt}$, the obverse of the country-specific part of the German shock.

Now the correlation in the weighted growth-rate deviations, $w_i(\varepsilon_{it} - \varepsilon_{gt})$ and $w_j(\varepsilon j_t - \varepsilon_{gt})$, between any two countries, i and j, not including Germany (g) expressed as the ratio of covariance to variance is:

$$\rho_{ij}{}^{gd}{}_{i,j\neq g} = \{[w_i w_j \text{var}(\varepsilon_{gt}) + \text{covar}(w_i\varepsilon_{it}, w_j\varepsilon_{jt}) - \text{covar}(w_i\varepsilon_{it}, w_j\varepsilon_{gt}) - \text{covar}(w_i\varepsilon_{gt}, w_j\varepsilon_{jt})] / \\ [w_i^2 \text{var}(\varepsilon_i) + w_i^2 \text{var}(\varepsilon_g) - 2\text{covar}(w_i\varepsilon_{it}, w_i\varepsilon_{gt})]\}. \quad (8)$$

In the denominator, the equal-size assumption ($w_i = w_j$) and the isovariance assumption – $\text{std}(\varepsilon_i - \varepsilon_g) = \text{std}(\varepsilon_j - \varepsilon_g)$ so that their product equals $\text{var}(\varepsilon_i - \varepsilon_g) = \text{var}(\varepsilon_i) + \text{var}(\varepsilon_g) - 2\text{covar}(\varepsilon_{it}, \varepsilon_{gt})$ – have already been applied. Setting all the covariances in equation (8) equal to $-0.25\sigma_\varepsilon^2/N^2$, as before, then yields:

$$\rho_{ij}{}^{gd} = [1.25\sigma_\varepsilon^2/N^2]/[2.50\sigma_\varepsilon^2/N^2] = 0.5. \quad (9)$$

Hence by eliminating the aggregate growth rate deviation that is common to all countries including Germany but also introducing a common disturbance, equal to the obverse of Germany's idiosyncratic income deviation, for all the other countries in the set yields only a moderate reduction of the income correlations among pairs of these other countries from 0.75 to 0.50. At the same time for countries other than Germany the variance of growth-rate deviations would fall from $(\sigma_{\bar{u}}^2 + \sigma_\varepsilon^2) = 5\sigma_\varepsilon^2$ to $2.5\sigma_\varepsilon^2$, or by 50 percent. In the best case for multilateral monetary union with $\sigma_{\bar{u}}^2=0$, this variance would fall further to σ_ε^2. Thus if "German dominance," rather than no monetary policy for growth-rate-stabilization policy at all, is taken as the relevant starting point, the single monetary policy can still bring ρ_{ij} and $\text{var}(u_{it})$ down further.

5. Theoretical Policy Comparisons

To summarize the limit case just examined, the transition, from the state-of-nature starting point with no effective national monetary income stabilization policy anywhere, to German dominance in what has become the euro area, changes the variance of member countries' income disturbances, $\sigma_{d\ln(y)}^2$, from $(\sigma_{\bar{u}}^2 + \sigma_{\varepsilon}^2)$ to $2.5\sigma_{\varepsilon}^2$. Hence German dominance is better for other members than having no countercyclical monetary policy at all if, prior to this form of unilateral monetary union, $\sigma_{\bar{u}}^2 > 1.5\sigma_{\varepsilon}^2$, and hence $\rho_{ij} > 0.5$ from equation (7).

However, multilateral monetary union, such as EMU, in theory can do far better still. For instance, if the idiosyncratic component σ_{ε}^2 for the representative country is only one-fourth as large as the common component $\sigma_{\bar{u}}^2$ as previously inferred, German dominance reduces the variance of other member countries' ex post income fluctuations by half while monetary union reduces it by four-fifths. Because the theoretically expected maximum degree of output stability for the area as a whole except Germany is growing with each step, the correlation coefficient of the ex post income correlations between pairs of affected countries declines from 0.75 without a monetary stabilization policy to 0.50 with German dominance and then to -0.25 with monetary union. Table 2 summarizes these results. Hence contrary to claim (b) mentioned at the outset, for all except the previous anchor country the single monetary policy of MU is helpful, not harmful, to national economic stability. Furthermore, contrary to claim (c), the success of such a policy is recognized by a reduction in the residual income correlation among members at least in theory.

Table 2: *Bilateral Correlation Coefficients and Variances of Ex Post Growth-Rate Fluctuations under Controlled Conditions*

Policy	ρ_{ij}	$\sigma_{d\ln(y)}^2$
(1) No Monetary Income Stabilization Policy	0.75	100 (base)
(2) Unilateral Monetary Union: German Dominance	0.50	50
(3) Multilateral Monetary Union	-0.25	20

Note: Pairwise correlations, ρ_{ij}, are between equal-sized (groupings of) countries in the euro area that include Germany except under policy (2), where $\rho_{ij} = 0$ if Germany is a party to the correlation. The variance of ex post growth-rate fluctuations refers to any of these countries except that, if that country is Germany, $\sigma_{d\ln(y)}^2 = 0$ under policy (2) assuming its policy is purely self-centered and completely successful in stabilizing its growth rate. Making this extreme assumption is compatible with making the equally extreme assumption that the single monetary policy of a multilateral monetary union is completely successful in eliminating the aggregate deviation of the growth rate from its natural level, $\bar{u}$, for the entire union.

6. Technical Implications

After pointing to statistical implications of the decomposition technique used for countries' output gaps and developing some further data-based hypotheses, theory-based predictions are confronted with evidence for euro-area countries 1992-2002 in the second part of this paper. The identification technique used to distinguish the common component of growth rate fluctuations from country-specific or idiosyncratic components of national output fluctuations or gaps has important statistical implications. By forcing the weighted sum of the latter deviations to be zero by construction, it sets up negative covariances between a preponderance of the individual idiosyncratic disturbances.

Furthermore, unless all N countries are of equal size with weight 1/N each, the variance of the idiosyncratic component of low-weight countries will tend to exceed that of high-weight countries by construction, with the variance ratio in the two-country case being $var(\varepsilon_{it})/var(\varepsilon_{jt}) = w_j^2/w_i^2$. Furthermore, because ε_i is defined as the deviation of country i's growth rate not from its own mean but from the mean growth rate for the aggregate of member countries, it should not be assumed that the mean of ε_i is zero for any or all i. Rather, only the sum of the weighted means of $w_i\varepsilon_i$ must be zero.

It is important to recognize the statistical properties imparted by construction so as not to mistake them for noteworthy economic results. Nevertheless, the deduction of statistical properties from controlled, albeit unrealistic, conditions, can prepare one for assessing the single monetary policy under more realistic conditions when some of the inferred properties carry over while others do not in the reality check that follows.

Symmetry of national disturbances often is deemed sufficient for making common cause on stabilization policy with other countries. Yet if such symmetry is represented simply by correlation coefficients on percentage deviations from national trend levels of output, as is the common practice, even a perfect correlation can establish agreement only on the direction which a stabilizing policy impulse should take, but not on its strength. For instance, if one country's percentage output gap is always exactly one-hundredth of that of a second country, the correlation between their output gaps is perfect but the first country would have no interest in an appreciably more active stabilization policy since it is quite stable already.

To reveal these differences in national interests in a single monetary policy, one needs to go beyond measures of ex post correlations and how they are affected by a change in the monetary regime. For this purpose it is useful first to construct a common (C) cyclical disturbance factor as the weighted average of the output gaps of member countries. In the euro area, weights could be set equal, for instance, to member countries' share in the capital subscription to the European Central Bank or just in euro-area real GDP which is one of the two factors used in the subscription key. Each country i's percentage output gap (G_i) then can be represented as the sum of the common component (C) and the idiosyncratic, residual component (I_i), so that $G_i = C + I_i$. This allows the following variance (var) and covariance (covar) decompositions for countries i and j:

$$var(G_i) = covar(G_i,C) + covar(G_i,I_i) = var(C) + 2covar(C,I_i) + var(I_i) \qquad (10)$$

$$covar(G_i,C) = var(C) + covar(C,I_i) \qquad (11)$$

$$covar(G_i,I_i) = var(I_i) + covar(C,I_i) \qquad (12)$$

$$\text{covar}(G_i,G_j) = \text{var}(C) + \text{covar}(C,I_i) + \text{covar}(C,I_j) + \text{covar}(I_i,I_j) \quad (13)$$

Returning for the moment to the case of two countries, 1 and 2, with equal weights and with perfectly correlated percentage output gaps whose size is always higher by a factor of 100 for the second country may show why it is important to go beyond measures of correlation. Since country 1 is practically stable compared with country 2 and both have a weight of one half, the variance of the constructed common component, var(C), is approximately equal to the variance of half the output gap percentage of country 2 and hence also equal to the variance of its residual "idiosyncratic" output variation, var(I_2). For country 1, I_1 = - I_2 implies that var(I_1) = var(I_2) = var(I), covar(I_1,I_2) = -var(I), and covar(C,I_1) = - covar(C,I_2) = -var(I). Given that var(I) = var(C) in this example, it follows from equations (10) and (13) that var(G_1) and covar(G_1,G_2) are approximately zero while var(G_2) is approximately 4var(C) = 4var(I). Clearly only the second country has an interest in active stabilization in this example while the first would be hurt by any strong action. Hence not only the extent of comovement between two time series, established by correlation, but also the strength of the comovement, established by comparing the size of the respective covariances, are critical to assessing countries' interest in the joint pursuit of policies of any particular strength.

Since the single monetary policy is not constrained by the requirement to make each member country better off at each turn, one may ask what it could maximally accomplish in this example to reduce income instability. In the unlikely event that monetary policy is omnipotent and equally effective in each country, it could be deployed to eliminate the weighted-average common disturbance C. This would leave only I_1 = -I_2 as the irreducible disturbances affecting the two countries so that covar(G_i,G_j) = covar(I_i,I_j) = -var(I). Now the sum of var(G_1) and var(G_2), previously equal to 4var(I), would fall to half that amount, or 2var(I), as a result of a single monetary policy that is assumed to be maximally effective. Comparing this situation to a caricature of "German dominance" wherein one of the two countries sets monetary policy for the group as a whole but only to suit itself, would show that if Germany is country 1, country 2 would suffer var(G_2) = 4var(I) as before, because Germany has (next to) nothing to stabilize and hence to contribute to country 2's stabilization. If Germany is country 2, its partner country, now country 1, would suffer the damage. German stabilization policy now would actively eliminate its own disturbances thereby disturbing the previously practically stable country 1. Hence in this case var(G_2) = 0 and var(G_1) = 4 var(I) if the single monetary policy can change percentage output gaps by equal amounts in the two countries regardless of the initial levels of that gap. Hence our first hypothesis is:

(H.1) On account of the transition from German dominance – which is logically equivalent to dollarization or other forms of unilateral monetary union – to multilateral monetary union, the variance of the weighted average percentage output gap of the member countries should decline.

Because the reducibility of the unemployment rate is less the lower its level, the weighted average unemployment rate for a group of countries that are subject to a single monetary policy would commonly be above the weighted average of their natural unemployment rates. Under these conditions it would not be feasible to push some countries to very low unemployment rates to compensate for the high unemployment rates of others. Rather, the optimal monetary policy for the group as a whole would aim to keep the weighted percentage output gap constant at a low, but positive, level that takes account of the underlying nonlinearities. If the single monetary policy were capable at all times of keeping the common component of the measured output gap constant at this desired level, the variance of a country's percentage output gap,var(G_i), would be attributable entirely to the variance of its idiosyncratic component var(I_i). So our second hypothesis relating to the composition, rather than the size, of var(G), is:

H.2 Compared with German dominance, the relative contribution of the idiosyncratic component to the variance of the percentage output gap of countries would be expected to rise so that the variance ratios var(I)/var(G) and var(I)/var(C) would be expected to increase for all member countries with the institution of EMU.

If, compared with German dominance, the single monetary policy reduces var(C), it is unlikely to increase, though it may not reduce, the coefficient of correlation, $\rho(C,I_i)$. However, given $\rho(C,I_i)$, a fall in var(C), unless offset by an equal percentage increase in var(I_i) for which there is no obvious cause except for the previous anchor country, would lower covar(C,I_i) = $\rho(C,I_i)[\text{var}(C)\text{var}(I_i)]^{1/2}$. Hence our third consistent hypothesis is:

H.3 The transition from German dominance to multilateral monetary union does not raise $\rho(C,I_i)$ or, except for Germany, var(I), but it lowers covar(C,I_i) because of its effect on var(C).

7. Empirical Evidence for the Countries of the Euro Area, 1992-2002

The empirical analysis relates to three periods of 13 quarters each: (1) the post-EMR-crisis period 1992:III-1995:III, (2) the run-up-to-EMU period 1995:IV-1998:IV, and (3) the EMU period starting in 1999:I with data through 2002:I. Over these three periods, the mean of the GDP-weighted average output gap for the euro area minus Ireland and Luxembourg fell from 4.23 percent to 3.81 percent, and then to 1.31 percent. Because output gaps were again widening in 2002 after the end of the most recent observation period, this result should not be taken to suggest that the single monetary policy has already proved itself to be more effective since 1999 than its unilateral predecessor. Table 3 explains how the percentage output gaps were constructed.

Because the three largest countries in the euro area, Germany, France and Italy, together have a weight of over 70 percent and similar gap experiences except in the first period, the common gap percentage tends to coincide more closely with their respective output gaps than with those of other countries. Table 4 confirms that for each of these three countries the ratio of the variance of the idiosyncratic component of their output gap var(I_i) to the variance of the common component var(C) is always less than 1 and, in fact, less than one quarter during the most recent period. The bare-bones model had already alerted us to the inverse relation between the relative size of countries and their var(I_i) that is imposed by construction of the weighted average common component, C, as a weighted average of countries' output gaps, G_i. Hence the greater the weight of a country, the more its G_i contributes to C and the less is left for its I_i.

Table 3: *Data Used in the Construction of Output Gap Percentages 100(Q_N – Q)/Q_N (billions of 1995 ECU/euro, or percent)*

	1991:I u% (u_N%)	**1991:I Q (Q_N)**	**2002:I u% (u_N%)**	**2002:I Q (Q_N)**	**Av. 91-02 Weights (1997 w.)**	**Quarterly % Growth Rate of Q_N**
Belgium	6.3	49.15	6.7	61.44	3.95	0.5176630
	(6.4)	(49.05)	(6.6)	(61.56)	(4.01)	
Germany	5.6	449.04	8.0	517.42	34.60	0.3771834
	(6.0)	(445.45)	(7.2)	(525.70)	(34.98)	
France	9.2	283.21	8.9	348.16	22.58	0.4614760
	(7.7)	(291.71)	(7.6)	(357.21)	(22.19)	
Italy	8.6	198.71	9.0	234.21	15.51	0.3876251
	(7.5)	(203.08)	(7.6)	(240.77)	(15.62)	
Netherlands	5.7	72.60	2.5	96.32	6.02	0.5933076
	(6.1)	(72.02)	(4.0)	(93.43)	(6.12)	
Austria	4.3	41.37	4.0	51.77	3.33	0.5063046
	(5.3)	(40.54)	(5.1)	(50.63)	(3.36)	
Portugal	4.0	18.58	4.3	25.64	1.57	0.7393353
	(5.1)	(18.17)	(5.3)	(25.13)	(1.61)	
Finland	6.6	24.58	9.2	31.77	2.01	0.6478854
	(6.5)	(24.63)	(7.7)	(32.72)	(1.94)	
Spain	16.4	103.42	11.2	137.22	8.57	0.5018614
	(10.3)	(116.04)	(8.5)	(144.63)	(8.44)	
Greece	16.4	21.87	11.2	28.49	1.80	0.4599569
	(10.3)	(24.54)	(8.5)	(30.03)	(1.73)	
Sum		1262.53		1532.44	100	
		(1285.23)		(1561.81)	(100)	
Weighted Average	7.94		8.01			0.4439664
	(7.04)		(7.07)			

Note: Ireland is omitted for lack of quarterly data for real GDP (Q) prior to 1997 and Luxembourg is excluded. The most recent quarterly unemployment (u) data for Greece, not yet available at time of computation in 2002, were assumed to be the same as for Spain since their most recent annual unemployment rates were close. Standardized unemployment rates for 1991, for all countries except Greece (assumed same as Spain), were obtained from the OECD via Deutsche Bundesbank, *Monthly Report*, October 1999, p. 49. The corresponding standardized rates for all countries for 2002:I were obtained as the average of monthly data published in its *Monthly Report*, July 2002, p. 7*. Seasonally adjusted quarterly (not annualized) real GDP data in ECU/euro are from Datastream, (Country Code) GDP (ESA 95) CONA. The natural unemployment rates (u_N) in the first (1991:I) and last quarters (2002:I) shown – the two quarters had comparably low aggregate unemployment – were obtained for each country as the geometric average of its actual unemployment rate and 6.5 percent. The natural level of output (Q_N) for the respective quarter was then estimated with an Okun's Law coefficient of 0.5 on the percentage output gap which translates into a coefficient of 2 on (u – u_N) when solving for the output gap and hence Q_N = [1+ 0.02(u-u_n)]Q, when u and u_N are in percent.

The most important stabilization question that remains for the collective, or GDP-weighted aggregate, of member countries is whether the weighted average of var(G_i) has in fact declined over the decade 1992-2002 that contains the transition from unilateral to multilateral monetary union among the ten countries of Europe examined in this paper. If monetary policy has become effectively more stabilizing for the group as a whole, one would expect this weighted average to decline over the three periods as hypothesis H.1 suggests. The evidence highlighted in Table 4 suggests the opposite, with the weighted average of var(G_i) climbing steadily from 0.60 to 0.88, and then to 1.03 percent of natural output. The second, distinct hypothesis, H.2, was that the single monetary policy should have increased the ratio of var(I_i) to var(C) on a weighted average basis compared with German dominance, since the single monetary policy is likely to be most effective in reducing var(C). It turns out, however, that at least from the middle to the latest period distinguished, this ratio moved quite the other way: it fell from 1.41 in 1995:IV-1998:IV to 0.443 in 1999:I-2002:I because var(I_i) declined and var(C) doubled. Even for Germany, var(I_g) declined strongly even though it could no longer just suit itself.

Hence, judging by the surprising behavior of these component variances, the single monetary policy did not appear to leave countries more exposed to fluctuations in their idiosyncratic disturbances. Instead it left them more exposed to fluctuations in the common component of the percentage output gap. This is precisely the component which the single monetary policy is supposed to be motivated and able to stabilize to a greater degree, and presumably at a lower level, than the preceding regime of "German dominance."

The last hypothesis, H.3, was to check further into the supporting infrastructure of correlations should H.1 and H.2 be accepted. Because the data lent no support to H.1 and H.2, H.3 essentially fails also. Both $\rho(C,I_i)$ and covar(I_i,C) remain close to zero on weighted average so that it is not possible to spot a trend. What is interesting, however, is that Germany is the only country for which these two measures are negative in all three periods so that it is somewhat more stable than the weighted average. And indeed its var(G_i) is the lowest for the 10 countries in the first two periods shown in Table 4 and the second lowest (after Italy) in the third period that starts with the introduction of the euro.

8. Concluding Comments

Because the euro era is young and its sample short and because there may be many special factors other than changes in the monetary policy regime contributing to differences in results with earlier periods, our indications are weak and not yet even usefully tested for statistical significance. Nevertheless, the discipline of having to formulate statistical models of what exactly one would expect to see in the data, and why, provides a useful caution against relying on theoretical inference from models alone as if they were so compelling as to make verification unnecessary. The impression conveyed by this paper is that such verification could well fail. Finding increasing correlations among residual output gap percentages among member coun-

Table 4: *Mean, Variance, and Variance Decomposition of Percentage Output Gaps (three-year intervals, 1992:3 – 2002:1)*

1992:3-1995:3	**Mean**	**Variance**	**--I$_i$**	**--C**	**Covar(C,I$_i$)**	**Rho(C,I$_i$)**
Belgium	-2.375	0.858	0.275	0.424	0.08	0.233
Germany	-2.731	0.418	0.052	"	-0.029	-0.193
France	1.361	0.712	0.201	"	0.044	0.15
Italy	0.258	0.687	0.215	"	0.024	0.08
Netherlands	-3.153	0.196	0.148	"	-0.188	-0.749
Austria	-5.858	0.505	0.409	"	-0.164	-0.394
Portugal	-3.011	2.388	1.277	"	0.344	0.467
Finland	6.978	1.28	0.513	"	0.171	0.367
Spain	9.678	0.501	0.042	"	0.018	0.132
Greece	11.288	1.267	0.847	"	-0.002	-0.004
Weighted Sum	0	0.601	0.177	0.424	0	0.045
1995:4-1998:4	**Mean**	**Variance**	**--I$_i$**	**--C**	**Covar(C,I$_i$)**	**Rho(C,I$_i$)**
Belgium	-2.515	0.832	0.396	0.365	0.035	0.093
Germany	-1.989	0.191	0.362	"	-0.268	-0.737
France	2.442	0.613	0.152	"	0.048	0.202
Italy	-0.24	0.293	0.211	"	-0.142	-0.511
Netherlands	-5.212	2.127	0.816	"	0.473	0.866
Austria	-5.44	0.712	0.335	"	0.006	0.018
Portugal	-5.289	1.279	0.472	"	0.22	0.531
Finland	2.688	7.993	5.384	"	1.122	0.8
Spain	7.783	2.656	1.213	"	0.539	0.809
Greece	9.868	2.469	1.633	"	0.235	0.305
Weighted Sum	0	0.879	0.513	0.365	0	-0.138
1999:1-2002:1	**Mean**	**Variance**	**--I$_i$**	**--C**	**Covar(C,I$_i$)**	**Rho(C,I$_i$)**
Belgium	-2.329	1.341	0.254	0.709	0.189	0.446
Germany	-0.632	0.698	0.117	"	-0.064	-0.222
France	1.251	1.254	0.169	"	0.188	0.543
Italy	1.05	0.555	0.082	"	-0.118	-0.489
Netherlands	-6.308	0.804	0.545	"	-0.225	-0.362
Austria	-4.781	0.855	0.365	"	-0.109	-0.215
Portugal	-4.973	0.83	1.156	"	-0.517	-0.571
Finland	-0.719	2.817	1.115	"	0.497	0.559
Spain	4.708	1.407	0.591	"	0.054	0.083
Greece	7.219	4.903	3.843	"	0.176	0.106
Weighted Sum	0	1.028	0.314	0.709	0.003	-0.026

Note: The weighted sum of ratios var(I$_i$)/Var(C) is 0.417, 1.406, and 0.443, for the 3 periods using 1991:I, 1997:I and 2002:1 real GDP weights, respectively. Column 1 shows the means of the idiosyncratic components of each country's output gap. They are obtained by subtracting the weighted average gap for the group of countries as a whole, of 4.23% in 1992:3-1995:3, 3.81% in 95:4-98:4, and 1.31% in 1999:1-2002:1, from each country's mean output gap percentage. The variance of each country's total output gap, shown in column 2, is decomposed into the sum of the variances of its idiosyncratic (I$_i$) and common (C) components and their covariance. The entries in column (2) thus are equal to the sum of those in columns (3) and (4) plus two times the covariance in column (5). The correlation coefficient shown in parentheses in column 5, in turn, is equal to the covariance in column (5) divided by the geometric mean of the component variances in columns (3) and (4). The covariance of a country's total output gap with the common element in that gap, E[(C+I$_i$),C] (not shown), is equal to the sum of the variance of the common element, C, in column 4 and the covariance between the common and idiosyncratic components in column 5. The geometric mean of two variances is the same as the product of the respective standard deviations.

tries, in particular, need not imply, either logically or empirically, that they have become more suitable for the single monetary policy or vice versa. Indeed, if that policy is associated with a pronounced increase in the variance (and still uncertain decline in the mean) of the estimated EMU-wide common component of the output gap as here found, the application of existing criteria for multilateral monetary union to be stabilizing could be seriously misleading.

For instance, because the variance of the common component, var(C), is by far the largest part of the covariance between national output disturbances, covar(G_i,G_j), an increase in var(C) is highly likely to raise this covariance and most likely the coefficients of correlation between G_i and G_j for most pairs of member countries. However, instead of indicating that growing "symmetry" has increased the suitability of countries for the single monetary policy conducted in their name, it would show that the policy has been ineffective in stabilizing against euro-area wide real net disturbances since 1999.

If the only contribution to real output stability and economic growth which monetary policy has been able to make in Europe is due only to maintaining low inflation and not to trying directly to stabilize the euro-area output gap at a low desired level through judicious timing of policy initiatives, then there may not be much difference in what unilateral and monetary union can deliver in that regard. Although a multilateral monetary union involves deeper financial system and market integration and more highly developed common institutions than a unilateral monetary union, the distinction between the two types of MU would be macroeconomically unimportant if low inflation is the only appropriable policy product in either case. Then ignoring the specifics of whether the single monetary policy is governed by a single country or co-managed would be entirely excusable in the derivation of OCA criteria.

The experience of the United States over the past two dozen years on the one hand, and that of Japan both before and after the bursting of the asset price bubble in 1989, shows that approximate stability of the general price-level can be achieved with varying degree of benefit in different countries. Much depends on the credibility and management skills of the authorities involved. If policies are firmly believed to always reassert their anti-inflationary resolve effectively over the medium term, they can activate additional output stabilization through flexible inflation targeting along the way. Perhaps because its anti-inflationary credentials first needed to be firmly established by building a track record over a period of years, any such additional output stabilization through judicious preventive policy measures appears to have eluded the ECB under its first President (1999-2003) thus far. Hence one might ask whether monetary output stabilization was even tried. If not, then once the ECB's investment in a reputation for stable prices is fully credited, its capability for stabilizing the euro-area output gap at a low level should rise. One should then expect more of the ECB in that regard. If, on the other hand, the endogenous forces of integration documented by Frankel and Rose (1998, 2002), or other factors, caused the symmetry of shock experience to rise faster inside the EMU than the single monetary policy could reduce the common shocks, then the finding, that the residual shared real-economic disturbances of members have become larger under monetary union, and their idiosyncratic disturbances smaller, may not prove so transitory.

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Notes
1. During the time this paper was written and subsequently revised, George von Furstenberg was Robert Bendheim Chair in Economic and Financial Policy, Fordham University, and J.H. Rudy Professor of Economics, Indiana University. E-mail: vonfurst@indiana.edu

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The Merit of Hard Currency Fixes and Argentina's Experience with a Currency Board

Herbert G. Grubel[1]

Simon Fraser University and The Fraser Institute

Abstract. In recent years some countries have adopted hard currency fixes through currency boards, monetary union or the replacement of a domestic with a foreign currency, also known generically as dollarization. These hard currency fixes have been undertaken in the expectation that they would bring more benefits than costs. Many critics are skeptical and argue that the costs of hard fixes far exceeded the benefits. This paper evaluates the theoretical arguments for and against hard fixes, reviews relevant empirical evidence and presents a detailed analysis of Argentina's experience with what is widely alleged to have been a currency board.

1. Introduction

In recent years some countries have adopted hard currency fixes through currency boards, monetary union or the replacement of a domestic with a foreign currency, also known generically as dollarization. These hard currency fixes have been undertaken in the expectation that they would bring more benefits than costs. Many critics are skeptical and argue that the costs of hard fixes far exceeded the benefits.

The core of the argument against hard currency fixes is that they rob countries of their national monetary sovereignty and therefore the ability to deal efficiently with external economic shocks through the use of monetary, fiscal and exchange rate policies as prescribed in macro-economic models based on Keynesian concepts. Many of these critics predict that countries will abandon hard fixes when future economic shocks cause high unemployment and severe economic crises.

Economists holding these views see Argentina's economic crisis in 2001-02 and its abandonment of its hard fix through a currency board as evidence for their case. The main question to be addressed in this paper is the extent to which Argentina's experience supports the general case that hard currency fixes result in more costs than benefits. I do so by first describing the economic and social benefits brought by hard fixes generally. Secondly, I describe some of the countries that have had positive experiences with such fixes. Thirdly, I argue that Argentina did not really adopt a hard fix of the sort required to obtain its full potential benefits; that indeed, Argentina does not need a shock absorber through flexible exchange rates, but that it needs a completely new car.

I conclude more generally and in principle that one of the benefits of hard currency fixes is that they increase pressures on governments to make their internal markets more flexible, their fiscal policies more responsible and to engage in other needed reforms to strengthen markets. In the case of Argentina these pressures were insufficient to bring changes that were needed and have to be undertaken to restore economic prosperity in the new international economic environment. It is difficult to know whether hard currency fixes in other countries will bring about needed changes. On the other hand, countries that have flexible markets and responsible fiscal policies do not need exchange rate adjustment to deal with economic shocks and reap only benefits from hard currency fixes.

2. The Nature and Benefits of Hard Currency Fixes

Exchange rates fixed through the unilateral commitments of governments were popular and recommended by the IMF during the last 20 years. They have suffered from the fact that sooner or later the exchange rate becomes misaligned and speculation forces a revaluation. As a result, risk premia remain in place for domestic assets, transactions costs remain high and politicians continue to face the temptation to use exchange rate changes to manage the domestic economy or to deal with wrong policies.

Hard currency fixes, on the other hand, involve institutional and international arrangements that go beyond the unilateral commitment to the maintenance of a certain rate. These arrangements make it much more difficult to abandon a given exchange rate so that its fix is more credible and brings economic benefits not arising in the case of rates that are fixed by the simple commitment of the government.

In the case of a *currency board*, the credibility of a government's commitment to a fixed rate is enhanced because it requires the government to end the ability of the central bank to set interest rates, determine monetary policy and lend money to finance the government's spending deficits. In addition, the currency board legislation guarantees citizens the convertibility of the domestic currency into dollars or similar currencies with a strong record of stability and value. The dissolution of a currency board involves much higher political and economic costs than does the simple commitment to a fixed exchange rate. However, as the case of Argentina shows, it is possible to do dissolve currency boards if domestic pressures become strong enough.

Dollarization involves an even harder commitment to a fixed exchange rate than a currency board system since the national currency disappears completely and the central bank is virtually eliminated. Nevertheless, it is possible in principle to reintroduce a national currency, central bank and floating exchange rate. Since only Panama and Ecuador have dollarized their economies and neither has reversed the process, no case studies are available to understand the full cost of reintroducing a domestic currency and central bank.

Monetary unions lead to the most credible type of hard currency fix since the elaborate international treaties involved are difficult to revoke. On the other hand, escape clauses do exist in the treaty establishing the Euro zone and abandonment of the hard fix is possible, if highly unlikely.

Why do countries adopt hard currency fixes? They do so in the expectation that domestic interest rate structures will be lowered in response to the elimination of the exchange risk on the foreign holding of domestic assets. They also expect to save on the cost of international transactions, which results in increased trade, capital market integration and ultimately productivity and higher living standards. These benefits are a decreasing function of the size of countries. Canada and Mexico will gain more from a North American Monetary Union than does the United States.

In my own writings on the benefits from hard currency fixes (Grubel 1999, 2000) I have also pointed to payoffs that involve restraints on politicians and special interest groups. For example, Italy during the postwar years up to the 1980s had suffered from repeated cycles of inflation and devaluation of the lira, which were caused by attempts of the large unionized sector to gain wage increases and a larger share in national income. Most of these wage increases were in excess of productivity gains. The higher wages therefore inevitably led to inflation, trade deficits and devaluation. This process was made possible by the Bank of Italy, which increased the money supply so that the higher wages and prices would not lead to unemployment.

Since Italy joined the European Monetary Agreement the Bank of Italy has been unable to print the money needed to sustain these cycles of inflation and devaluation. Unions eliminated their traditional, excessive demands for higher wages, knowing that they would result in reduced international competitiveness and ultimately unemployment for their members.

Similarly, hard currency fixes limit the ability of governments to run spending deficits. Under flexible rates, inflation and a depreciating currency can be used to impose an inflation tax on the public without explicit legislation and the cost of higher unemployment. Under a hard currency fix, deficits have to be financed through borrowing, which may cause credit ratings to decrease and cause borrowing costs to rise correspondingly. As a result, the effects of deficit spending are much more transparent and public opinion as well as political forces come into play to eliminate or curtail deficit spending.

These two examples show that in principle the benefits from hard fixes involve not only economic gains but also incentives to make labor markets more efficient and constrain politicians' ability to manipulate the economy for their own benefits.

3. The Spread of Hard Currency Fixes

Hanke (2002a) provides Table 1, which lists the currently existing currency boards in the world.[2] In his paper he also notes that there have been a number of other currency boards, primarily associated with membership in the British Empire, which were abandoned after the Second World War.

Several points are worth noting about Table 1. The oldest board is that of the Falklands, which was created in 1899 while that of Bermuda stems from 1915. Several new boards have been created during the 1990s; the most important was that of Argentina, which involved 37 million people and a national income of $374 billion. Most boards are linked to the US dollar, but Bosnia, Bulgaria and Estonia are linked to the DM and since 2002 automatically to the euro. Gibraltar and the Falklands are linked to the British pound.

Table 1: *Currency Boards and Currency Board–like Systems*

Country	System Began	Exchange Rate	Population	GDP (in U.S.$)*
Argentina **	1991	1 peso = U.S.$1	37 million	$374 billion
Bermuda	1915	Bermuda$1 = U.S.$1	62,000	$1.9 billion
Brunei **	1952	Brunei$1 = Singapore$1	320,000	$5.4 billion
Bosnia **	1997	1 convertible mark = DM 1	3.5 million	$5.8 billion
Bulgaria **	1997	1 lev = DM 1	8.2 million	$34 billion
Cayman Islands	1972	Cayman$1 = U.S.$1.20	39,000	$930 million
Djibouti **	1949	177.72 Djibouti francs = U.S.$1	450,000	$530 million
Estonia **	1992	8 kroons = DM 1	1.4 million	$7.8 billion
Falkland Islands	1899	Falklands£1 = U.K.£1	2,800	unavailable
Faroe Islands	1940	1 Faroese krone = 1 Danish krone	41,000	$700 million
Gibraltar	1927	£1 = U.K.£1	29,000	$500 million
Hong Kong**	1983	Hong Kong$7.80 = U.S.$1	6.8 million	$168 billion
Lithuania **	1994	4 litai = U.S.$1	3.6 million	$18 billion

Notes: * Expressed in terms of purchasing power parity, not at current exchange rates. ** Currency board–like system
Source: Schuler (2002a)

Hanke has classified the boards into those that adhere to classical rules and those that do not and therefore are considered only to have currency-like boards. The latter are shown in the table with asterisks. Hanke attributes the failure of the Argentine currency board to the fact that it was not set up and operated as a classical board. This point will be considered below in some more detail.

3.1. Dollarization

In most economies of the world private agents hold dollar, DM or other leading currencies in their portfolios for transactions and diversification purposes. This phenomenon is known generically as private dollarization and tends to develop spontaneously in response to market incentives. In contrast, official dollarization involves the complete replacement of a domestic currency by US dollars (or another major currency) as a matter of government policy. The dollars used for this purpose can be borrowed in private markets or bought with gold and dollar reserves held by the central bank, which no longer needs them. The Joint Economic Committee of the US Congress has recommended that the US government provide circulating notes free to countries wanting to dollarize since it costs little to produce them and they do not become a claim on US assets as long a the system remains in place. Additional notes that are needed as a result of economic growth can be acquired through surpluses on trade and capital accounts. Dollarization involves the exchange of national currencies at a rate that in principle leaves real private income and wealth unchanged and does not affect the country's international competitiveness.

3.2. Monetary Union

The creation of a monetary union requires agreement among member countries to adopt a new, common currency. The creation of the union is likely to involve a lengthy period during which specific policies cause inflation in member countries to converge to a common level. The exchange rate for the domestic into the new common currency in each country is set to preserve international competitiveness.

One of the most important institutions required for the proper function of a monetary union is one new central bank, which sets monetary policy in place of the national central banks it replaces. Under its constitution, the new central bank is designed to be politically independent and is required to pursue only the maintenance of price stability, not full employment or a strong or weak currency.

The creation of monetary unions is under discussion by academics for North America involving Canada, Mexico and the United States and for South America involving potentially Brazil, Paraguay, Argentina and Chile. Similar discussions have been taking place involving Australia and New Zealand as well as some countries around the Arabian Gulf.

The technical issues around the introduction of a common currency are complex but the European experience can readily serve as a blueprint and a background for the discussion of alternative policy approaches.

Politicians have reacted very cautiously in response to these plans for regional monetary union. They cannot afford to cause speculation in currency markets by taking strong stands in favor of unions. Their economic advisers are likely to argue against unions, especially if their self-interest is involved through their employment at central banks. Politicians also fear public backlash from nationalists who view the currency as a symbol of nationhood and sovereignty. Perhaps most important, politicians are concerned about the economic costs and risks associated with the loss of the exchange rate as a shock absorber mentioned above.

4. The Experiences with Hard Fixes

A thorough analysis of the economic performance of countries that have adopted hard currency fixes exceeds the scope of this study. However, Hanke (2002) has compared the rates of real economic growth, inflation and fiscal deficits of countries with currency boards and those with central banks for different time periods and samples of countries. He found that for 98 developing countries between 1950 and

1993 those with currency boards performed much better in all three respects: GDP growth rates 2.6 vs. 1.7 percent; inflation rates 7.0 vs. 33.6 percent; fiscal deficits as percent of GDP 2.2 vs. 3.7. Even stronger are the results for members of the IMF for the years 1970 – 1996: GDP growth 3.2 vs. 1.6 percent; inflation 5.6 vs. 48.3 percent; and fiscal deficits 2.6 vs. 4.4 percent of GDP.

Comparisons of this sort may be misleading since most of the countries with currency boards are quite small and often started the periods at low levels, so that the data may simply reflect convergence through time. Be that as it may, perhaps most impressive are the experiences of some countries before and after the recent introduction of currency boards. Hanke (2002a) provides detailed tables of relevant economic performance data for Argentina, Estonia, Lithuania, Bulgaria and Bosnia and Herzegovina.

These data leave little doubt that the introduction of a currency board improves economic performance very quickly

4.1 Dollarization

It is widely believed that Panama's dollarized economy in general has been more stable than that of its Central American neighbors. Certainly, the country has never been in the financial headlines for its inflation, falling currency values and bank failures. As one observer once told me, Panama had bad presidents just like its neighbors, but it never suffered as much as they did. The reason is that the Presidents of Panama never had the power to make inflationary monetary policy and force the central bank to finance their spending deficits. (The observer concluded that for this reason, several of the Central American republics are studying the merit of dollarization for their countries.)

While this story makes sense as far as it goes, Sebastian Edwards (2001) considered the economic performance of Central American countries in greater detail. He found that Panama's real economic performance has not been significantly better than that of its neighbors during the postwar period.

Ecuador dollarized its economy in a bold experience on January 9, 2000. That country's economy has stabilized and there are encouraging signs that it is reaping the benefits that have been promised by the advocates of dollarization. However, Ecuador's economy has been burdened by regulations, corruption, protection, inflation and many other ailments for decades. It will take a long time to eliminate these obstacles to economic prosperity and it remains an open question whether dollarization brings enough incentives to bring about the needed reforms.

5. A Case Study of Argentina's Currency Board[3]

Argentina during the 1940s had one of the highest per capita incomes in the world. This prosperity was based on the fact that the production and export of beef and grains could be accomplished through the application of relatively little labor to a large supply of land with rich soil and minerals. A skilled labor force of immigrants from Europe was very productive. The world had a great demand for Argentina's exports.

Under such conditions, the owners of land and traders tend to earn large incomes and as a result of the original unequal ownership of land, the distribution of income and wealth also became very unequal. Partly as a result of the boom and these inequalities, a political movement developed that had as its main platform the provision of general social programs and the equalization of income and wealth. Juan Peron was the founder of this political movement. After his death, his wife Evita, her legend strengthened by the Peronist Movement, became the darling of leftist politicians around the world. The legend culminated in a popular musical about her life.

A military coup in 1955 ended the power of the Peronist Movement. But in 1973 it returned to power, only to be removed again three years later by another military coup. Up to the present, Peronist Populism has continued to be the prevalent ideology of most Argentinean leaders, whether they called themselves Peronists, Radicals or Militaries. This ideology still aims for the redistribution of income and wealth through massive state intervention. It has retained much of its popular base in Argentina and remains a potent political force.

5.1. The Costs of Peronist Populism

The social programs and redistribution policies adopted by Peron and his successors dulled incentives to work, invest and take risks. When the world economy returned to normal after the Second World War, Argentina's main exports languished. At the same time, the social and redistribution policies required increasing government expenditures and resulted in growing government deficits.

These deficits were aggravated by some special characteristics of the Argentine political system. The federal government was required by the constitution to pay for a substantial part of spending programs initiated by provincial governments. The taxation system, like that in most other countries in Latin America, allowed many citizens to escape taxation altogether, either legally or through lax enforcement of existing laws. Legislation favored unions. Labor markets have been very rigid and caused much inefficiency in the allocation of resources.[4]

As a result of this political climate and the left-wing economic institutions and policies, Argentina after the Second World War was unable to close the gap between government spending and tax revenues. The government could pay for the deficit only by forcing its central bank to buy its bonds. In paying for these bonds, the central bank used money that it had created for this purpose. Inevitably, the resultant increases in the nation's money supply caused inflation, balance of payments deficits and currency devaluations.

Under these inflationary conditions economic growth stagnated. In 1976 a military junta took over the country in an attempt to restore stability. Like all such military juntas, Argentina's made conditions worse and to top it off, the regime engaged in an expensive and fruitless war with Britain over the Falkland Islands.

Stripped of many of the details, the basics of Argentina's experience amount to the following. During the economic boom of the 1940s and before the enactment of the populist economic policies of Peron, the country had developed well and its population enjoyed a high standard of living. Excellent urban and rural infrastructures were developed and made Buenos Aires a modern, vibrant capital that was known as the Paris of Latin America. Drawing down this capital investment paid for part of Peron's costly policies. Repairs of the public infrastructure were neglected. Private buildings decayed as regulations deterred owners from making necessary repairs. By the late 1980s Buenos Aires in many ways had the drabness of cities in the former Soviet Union.

Argentina's problems are best summarized by some salient statistics. Since the central bank of Argentina was created in 1935, the peso has depreciated against the dollar by a factor of about 1/6,000,000,000,000 (the number of zeroes is not a misprint!). In 1989 alone the consumer price level rose by 4,927 percent. National income that year dropped by 6.9 percent. At the end of that year the money market interest rate was 1.3 million percent.

Importantly, the public had used US dollars in place of pesos for all the services provided by money: the unit of account and denomination of many prices of goods, services and assets; and as a store of value for transactions balances and financial wealth. The practice of using dollars for this purpose increased the efficiency of the economy and protected wealthholders from losses due to the inflation in terms of pesos. But there was much inefficiency associated with a parallel monetary system that used pesos falling rapidly in value with inflation and dollars that maintained their value but did not serve as legal tender and were not widely used by the poor.

5.2. The Convertibility System of 1991

On April 1, 1991 Argentina under the leadership of Minister of Economics Domingo Cavallo created a multicurrency Convertibility System. It had several important provisions. First, contracts were made to be legally enforceable whatever the currency that had been used by the signing parties. Second, the use of the US dollar in all transactions was legalized. Third, a new local currency – the new peso - was introduced and made equal to one US dollar. Fourth, the new peso was made convertible into US dollars through a guarantee by a board operated by the Central Bank of Argentina. This guarantee was made credible by the key provision that all outstanding peso obligations of the board had legally to be backed by assets denominated in US dollars.

The government of Argentina officially never called the system a currency board in the traditional sense. It insisted that the board was only a temporary ingredient of the convertibility system just described. However, for a number of reasons, the system has become known outside Argentina as the "Argentinean Currency Board" and thus became subject to much critical analysis.

The Convertibility System had an immediate, strong positive impact on economic performance. The public regained confidence in the country's economy and monetary system. The inflation rate dropped to 17.5 percent in 1992, and to 7.4, 3.9 and 1.6 in the following 3 years. Interest rates fell to a little over 6 percent and remained steady. Foreign investment and trade soared. Between 1991 and 1998 Argentina had the highest growth rates in its postwar history and one of the highest in the Western world, averaging 4.7 percent annually in real terms.

5.3. The Challenges to the Convertibility System

However, Argentina's fortunes took a turn for the worse in 1998. That year Argentina's economy went into a recession as a result of economic difficulties experienced and devaluations undertaken by several of its major trading partners. The recession caused large government deficits, which were financed by the increased issuance of Argentine government bonds denominated in US dollars and in euros. Upon the recommendations of the International Monetary Fund, taxes were raised but for a variety of reasons, revenues fell.

The causes of Argentina's recession at the end of the century were partly foreign and partly domestic. First, consider the foreign influences. During the years 1997-99 the entire international financial system of the world was in turmoil. Mexico suffered from what became known as the Tequila crisis, the Asian Tiger countries' stellar economic growth collapsed and currency speculation forced the abandonment of their fixed exchange rates. Russia and Brazil were also caught up in the maelstrom and had to let their currencies float or lowered the peg on their exchange rates. The devaluation of the Brazilian real in 1999 was of special importance for Argentina since its large neighbor to the north was its main trading partner. In addition, the value of the euro against the dollar fell so that the peso fixed against the dollar implicitly appreciated against the European currency.

Second, there were damaging domestic developments. By 1999 it had become increasingly obvious that the country's banking system was near insolvency as a result of the massive borrowing by Argentina's provinces, which the banks were forced to accommodate. The provincial and federal governments had failed to get their deficits under control except for a short period during the initial boom and questions arose about the future ability of these governments to serve these debts held by the banks.

The public reacted to these financial and economic problems in the same way it had during preceding decades. It sold pesos, bought dollars and sent them abroad. The capital flight became massive in 2001 and forced the abandonment of the Convertibility System on January 6, 2002. Dollar contracts, which accounted for more than 90 percent of the financial and capital market transactions, were by law transformed into peso contracts at parity, but the peso was no longer convertible into dollars at the promised rate. The peso exchange rate was allowed to float and promptly depreciated by one third.

The 2002 laws involved a large redistribution of wealth. The owners of dollar assets were faced with an expropriation equal to the percent by which the peso exchange rate had fallen. On the other hand, the issuers of these same dollar obligations were able to repay their original dollar debt with the depreciated pesos. This redistribution of wealth was popular with the majority of Argentina's citizens who did not own dollar assets but enjoyed lower tax burdens due to the reduced cost of servicing the obligations.

The fall of the peso that took place after the link with the dollar had been severed did not revive the economy. Whatever positive effect the depreciation may have had on foreign trade, the uncertainties and capital flight that took place in its wake caused the economy to shrink in real terms. There were massive price increases. There was a rapid succession of Presidents and Ministers of Economics. In 2003 a national election brought Nestor Kirschner into power. He is a politician who professes his love for Peronist economic policies.

5.4. Currency Board Principles and Argentina's Policies

It will take some time to sort out what went wrong with Argentina's economic policies, what role the so-called currency board played in the crisis and how the country will solve its problems in the future. Advocates and critics of currency boards have brought intensive scrutiny to the experience of Argentina. The critics of boards blame it for the bulk of the crisis since the link to the dollar prevented a prompt adjustment of its exchange rate when other countries' rates were altered during the global currency crisis. The advocates of currency boards argue that the design of the board was so flawed that its failure was not a real test. Moreover, they argue that Argentina's basic structural problems were so severe that even a genuine currency board could not have solved them.

Perhaps most fundamental for the advocates of currency boards is the view that Argentina never had a board worthy of that description. Both Cavallo and Hanke argue that the Argentinean authorities had never decided to create a currency board as the monetary and exchange rate system of Argentina. The Convertibility Law had the purpose of giving Argentineans freedom to choose the currency for their contracts.

Hanke analyzed the operations of the board in some detail. He found that the board had engaged in policies that were totally inconsistent with the most basic characteristics of a genuine board. Thus, the board changed the backing of the peso 100 percent with dollars to 50 percent dollars and 50 percent euros. The Central Bank took a long list of "special measures" very different from the operating procedures of a genuine currency board.[5] The ratio of domestic and foreign assets held against peso obligations was varied. In Hanke's words:

> *The holding of domestic assets and the varying of the ratio of foreign reserves to monetary liabilities meant that the (board) engaged extensively in a discretionary policy of sterilized intervention.* Hanke (2002b), p. 3

Sterilized intervention was identified above as the main cause of the demise of traditional, unilateral national attempts of governments to fix their exchange rates. It is no surprise that such intervention should bring the same result to Argentina.

However, the practice of sterilization almost always has an ultimate cause, which is typically related to politics and other misguided domestic policies. In Argentina's case the ultimate cause has been the lack of control over the finances of the federal and provincial governments. As mentioned above, the constitution allowed the former increased spending without consent by the federal government, which was forced to pay for the bills. In addition, Argentina's political culture has for decades now been based on perceived rights to social benefits, low tax compliance, high tax rates, the periodic creation of new distortionary taxes and the redistribution of income and wealth. All of these policies have had the negative effects on growth one would expect.

No simple innovation like the legal enforceability of contract denominated in foreign currencies and convertibility of the domestic currency into dollars can take the place of fundamental economic reforms needed to fix these problems. The introduction of the Convertibility System in 1991 had highly beneficial effects on confidence, which resulted in rapid economic growth in output and tax revenues, but only temporarily.

5.5. The Critics' Case

Critics of the Convertibility System argue that the recession after 1998 was caused primarily by the inability of Argentina's monetary authority to devalue the peso and remain competitive in the face of devaluation of the country's trading partner's currencies. Hanke noted that the data do not support this analysis and conclusion. Argentina did not have inflation. The statistics show that in 1999 and 2000 consumer prices fell. The peso was not overvalued since exports remained a virtually constant percent of national income. Brazil's devaluation created only a small competitive advantage since primarily it corrected for Brazil's inflation in preceding years.

Cavallo, the creator of the Convertibility System and again the Economic Minister during the last nine months of its existence, agrees with Hanke that Argentinean exports were not suffering from extreme currency overvaluation. However, he notes that nevertheless the markets had perceived that the peso was overvalued due to the large real depreciation of the Brazilian currency and the euro since these two regions for Argentina are more important commercial partners than the United Sates.

Cavallo also argues that the recession started in 1998 with a permanent decline of investment. This decline was due to the crowding out effect on domestic credit, which in turn was caused by the large borrowing of the provinces from the local banking system. He argues that the crisis could have been avoided if in January 1999 upon the introduction of the euro, the peg for the peso had been changed from one to one to the dollar to a basket of the dollar, euro and the Brazilian real. He also insists strongly that Argentina should never have abandoned the legal enforcement of contracts denominated in foreign currencies, which was the essence of the Convertibility System.

5.6. Lessons from the Experience

The experience of Argentina with its currency system contains some important lessons for all countries. First, legally guaranteed convertibility of a domestic currency, be it under a genuine currency board or the Argentine Convertibility System, has the strong potential to increase confidence in a country that has a history of inflation, devaluation and poor economic performance. The increased confidence can lead to many of the benefits discussed in preceding chapters concerning credibly fixed exchange rate systems.

Second, the system can put pressures on the body politic to fix fundamental flaws in the country's fiscal arrangements, labor markets and other policies inimical to growth and stability. But if these flaws are severe and embedded enough, politicians will resist having them changed and instead force the currency arrangements to be abandoned.

Third, the amount of pressures that a currency board system can put onto the body politic depends on its design as well as a country's culture, which determines its commitment to uphold the constitution. Argentina's Convertibility System had many rules that made it different from the classical ideal of a currency board, as Hanke has shown. In addition, some of Argentina's politicians showed an unfortunate willingness to break constitutional guarantees and other commercial agreements. This behavior allowed politicians to avoid policies that would have fixed the fundamental problems but that would have imposed great costs on some powerful domestic interest groups.

The following quote from a respected economist and expert on South American economies, the late Rudiger Dornbusch (2002), summarizes the issue succinctly:

> *Can we really say that leaving the dollar has been a great strategy for Argentina? It has put people on the streets and devastated the country's banks. Would it really have been more painful to stick to the dollar and do the hard reforms – the deregulation and fiscal reforms – that were needed?*

5.7. Conclusion

In my view, Argentina's experiment with the credible fixing of its exchange rate through a constitutional guarantee of currency convertibility involved policies that captured the essence of the solution to the country's currency and basic economic problems. But the experiment was imperfect in many institutional and operational details. In addition, it faced the overwhelming problem of persistent populist policies that damage any economy, whatever its monetary and exchange rate system may be.

The experience of Argentina with its Convertibility System does not constitute a valid case against currency boards in general. In particular, it does not constitute a valid case against strong pegs to the currency of a commercial partner that represent the bulk of the foreign trade of the involved country, which is the case of Canada and Mexico against the dollar, most Central European nations against the euro, and several Southeast Asian nations against the yen.

Notes

1. Professor of Economics Emeritus at Simon Fraser University and Senior Fellow, The Fraser Institute. E-mail: herbert.grubel@shaw.ca
2. This section draws heavily on Hanke (2002a) and (2002b).
3. The discussion in this section has benefited from comments made by Domingo Cavallo, Minister of Economics in the Argentine government when the currency system was created and Steven Hanke, who consulted with Cavallo on the operating procedures of that system. I am grateful for the input of both Cavallo and Hanke. Remaining errors and ambiguities are my own.
4. The labor laws closely resemble those existing in Italy, from where many of Argentina's immigrants had come before and immediately after the Second World War. Not by coincidence, the wage-price push spiral that resulted in inflation and currency depreciation in Argentina had a striking resemblance to those spirals in postwar Italy.
5. See Hanke (2002b) (2002c) for a long list of other policies that genuine currency boards would not be allowed to initiate. This publication also contains graphs showing the extent to which the currency board sterilized the effects of payments imbalances on the domestic money supply, policies that genuine currency boards are expressly designed to prevent.

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Some Aspects of the Subsidiarity Principle in the EU*

Massimo Di Matteo[1]
University of Siena

Abstract. It is argued that there are two interpretations of the concept of subsidiarity: one "ascending" and the other "descending". These two concepts appear to have shaped the first phase of EU policy and the second, recent phase, respectively. The reasons for this change are outlined. The second part of the paper analyses the consequences that this interpretation has on achievement of the objectives of the public sector. It is stressed that, according to the received doctrine of public finance, the principle has a limited and well defined field of application. Implementation of the principle has the effect of severely reducing the scope for equity policies. The latter are already jeopardized by the globalisation process and will be further threatened by consistent application of the subsidiarity principle within the EU.

1. Introduction

The word subsidiarity was not mentioned in the Treaty of Rome (1957) when the European Common Market (ECM) was created. Indeed the word itself was then absent from the political discourse, let alone the agenda. It is not my intention to trace the history of the concept back to Althusius, a XVI century political writer and proponent of a communitarian perspective in the philosophy of politics.

Here I first argue that in the thirty years after the foundation of the ECM, an implicit concept of (vertical) subsidiarity was indeed behind the development of the processes of European integration: political, economic as well as military. I then give examples to show that this implicit concept is at variance with the explicit subsidiarity principle embodied in the Treaty of Maastricht. I finally offer a hypothesis on the reasons for this change in the concept of subsidiarity.

2. Before the Treaty of Maastricht

2.1. Let us recall the atmosphere prevailing in the western world and Europe in the late 1940s. The major aim of political leaders was to counter the threat of

Communist invasion. Then there was the problem of Germany which had been at the centre of all major wars on the continent (and in the world) in the previous 80 years.

There was a military response and an economic solution to the first problem. The former was the formation of NATO (from which Germany was initially excluded). The latter was the Marshall Plan. Both were proposed by the US and accepted by Europeans.

The second problem had various aspects. Should Germany be unified or stay divided? What was the best way to solve the controversy over the Ruhr and the Saar that had been at the core of recurring conflicts? On a more general level, how best could peace be secured?

Some Europeans thought that the very existence of nation states was a source of conflict because in the concept itself there was inevitably the seed of nationalism. It would therefore be sensible to work for elimination of the nation state altogether and build a (sort of) federal state of Europe. The US was not against this idea as it served the objective of building a big power against the Soviet Union: a divided Europe would be fragile in the face of the communist threat. The US was also favourable for economic reasons as a process of integration was expected to rejuvenate the European economy and speed its reconstruction and development. A prosperous economy was the best way to reduce the influence of communist parties on European nations.

However these objectives (that were shared by all European governments) called for some reduction in the decision making power of the states in favour of a new entity: national governments had to agree to give up some of their powers (and/or other aims).

This renunciation could take different forms. The most extreme was certainly the federal state, but others, such as a confederation of states or a council of ministries, though less radical, still implied that states have to abide by the decisions of another political body.

The real difference is evident when one compares unanimity with majority voting. Clearly unanimity preserves sovereignty better, as vetoing is always an option.

In spite of the dictum that majority voting leads to unanimity and unanimity to no decision, the history of the EU up to the Treaty of Maastricht (when majority voting on a number of matters was introduced) is a history of common policies decided and enacted. It is true that much less was actually realized than was hoped, but this is my point: the prevailing idea was that to achieve the aims of prosperity and peace, action at a level higher than that of the single state was required.

2.2. In other words some idea of subsidiarity was implicit in the discussions on the future of Europe. By “ascending” subsidiarity I mean that it was necessary to get together to achieve the goals of peace, growth and economic efficiency.

This meaning is first exemplified by the solution to the Ruhr controversy between France and Germany. The region had long been a source of dispute between the two countries. In 1951, at the instigation of Jean Monnet, who then advised Schuman, a (supranational) authority was created to manage, control and open France and Germany[2] coal and steel production to free trade. This institutional setup solved the political problem of controlling the rearmament of Germany (while putting Germany at the same level as the allied powers) and the economic problem of French and German reconstruction and growth (which depended on Ruhr resources for both countries). Finally it prevented steel industry cartels from forming again by establishing free trade among participants.

This exemplifies what I mean by an ascending concept of subsidiarity. It proved "impossible" to solve the coal controversy between France and Germany on a bilateral basis: a higher level of governance was called for. In this case it was also true that a supranational authority was created: this need not be the case. Countries can agree to perform a certain function together, according to certain rules, without necessarily forming a supranational entity.

The immediate post-war period was permeated by a favourable attitude towards greater cooperation: it was felt that agreement on a number of issues (political as well as economic) was needed to enhance the potential of each country. The costs (transaction as well as other costs) were considered to be worth the benefits.

The reason may have been that if the main underlying scope is political, costs and benefits are evaluated less rigorously and are a less important factor in the decision. I do not think this was true, but rather that the lack of importance assigned to costs and benefits had another reason. I will come to this later in the paper.

2.3. My example continues with the creation of the ECM (and EurAtom) and its development through the 1960s. The idea of a common market was certainly a way out of defeat of the proposed common defense policy (rejected by France in 1954). As Adam Smith taught, however, the division of labour (i.e. level of productivity) depends on the extent of the market, so why not pursue the building of a large, unified European market? Elimination of trade barriers (tariffs and quotas) would raise the efficiency of the European economies and the increased mobility of labour and capital would have a similar effect. It is debatable whether this affected solely the level of European income, or also its growth rate, as suggested by recent theories of endogenous growth.

What does this mean for subsidiarity? It means that member states were prepared to give up their power to fix quotas and/or tariffs (both bilaterally and multilaterally) and to restrict the movements of (financial and real) capital. Incidentally one of the more pervasive results of the process has been the creation and consolidation of community law over and above that of member states and in certain circumstances directly applicable to all citizens.

In my opinion, this would not have taken place in the absence of the ECM, as the activity of various lobbies opposing the free trade measures amply testify.

It was not necessary to invent (or resume) the concept of subsidiarity in its "ascending" meaning to formalize the behaviour of the six countries in implementing significant changes in their policies. Be that as it may, the creation of the ECM forced member economies to quickly adapt to a more competitive environment. This effect is not easily measured but is an important factor in the process of growth.

The competitive effect was reinforced by the provision of the Treaty of Rome regarding enforcement of a competitive environment across countries. "To restrict competition and to abuse a dominant position" was forbidden. The Commission was in charge of this aspect, in addition to and beyond the working of national antitrust authorities: if there was one market, there should be one antitrust authority as well. The action of the Commission has also been effective in various sectors (cement, steel, etc.).

In addition, the Treaty of Rome launched the EIB (European Investment Bank), a bank intended to help the realization of large projects financed on the capital market. Projects for special attention included those aimed at the development of less favoured regions (lagging behind in terms of income per capita or with severe industrial decline) and those which, for their very nature, could not be implemented with funds of a single member state. A community institution could provide funds at a low interest rate by virtue of its good rating on the market. The financing was meant mainly for infrastructure and productive enterprise investment.

Parallel to this we had the ERDF (European Regional Development Fund), the idea of which was launched at the end of the 1960s when the process of establishing a common market had been completed. It was felt that the working of the market alone could not swiftly abolish regional differences across Europe because of the well-known phenomena of economies of scale, external economies and agglomeration economies. The need for such a policy was recognized with more keenly after the world crisis of 1973-4: the slowing of the growth process was to negatively affect the closing of the gap. England asked for its immediate implementation as a quid pro quo upon its joining the ECM in 1975. The Common Agricultural Policy (CAP) would mean a net financial outflow for the UK to be balanced by the ERDF.

A major feature of the ERDF was that its financial resources should add to member state funds. Prior to the Single European Act (SEA), which boosted policies for cohesion, giving them more funds and importance, programmes financed within the ERDF were either Community programmes at the initiative of the Commission or national programmes promoted by member states.

2.4. Let us now move on to common policies introduced in the Treaty of Rome. The most notorious common policy enacted in parallel with the process of abolishing trade barriers, was agricultural policy. Its aims ranged from a fair standard of living for the agricultural population and reasonable prices for consumers to increased sectoral productivity. Its chief operating mechanism was the determination of prices for agricultural products by the Council of Ministries. To be effective this required several schemes involving tariffs, subsidies, stocking charges, etc.

The result over the years has been a tremendous increase in production and productivity. It has involved (and still does) a huge mobilization of funds with massive redistribution away from third country producers (especially agricultural) and EU consumers in favour of EU agricultural producers. It also includes redistribution across member states, with some receiving more than they contributed to CAP. According to recent findings (Tarditi-Zanias 2001) Germany, Italy and the UK are among the countries that receive less than their contribution to CAP.

I do not discuss its failures in terms of equity or efficiency issues, as they are well known and documented. To argue for consideration of equity issues in government action does not imply approval of implementation of a particular policy (see my criticism of CAP in Di Matteo 1999).

2.5. A low level of transport costs was deemed helpful to establish free trade. Transport activities were heavily regulated by member states to favour exports and deter imports.

In the Treaty of Rome it seemed appropriate to weaken national interest in the transport industry (road and rail, to be precise) and to move towards a liberalization of transport services. A common policy was therefore deemed necessary to enhance competition: entry should be favoured, although certain standards should be established to prevent reckless competition to the detriment of road safety. Not much was accomplished in practical terms until recently, but this is beside the point.[3]

The Common Market and EurAtom were established simultaneously with the aim of coordinating and developing the scientific, technical and commercial activities for the pacific use of atomic energy. For efficiency reasons, a supranational body was necessary, given the enormous expense of nuclear energy programmes.

As a conclusion to this part, I argue that the countries that founded the ECM in 1957 felt that equity, efficiency and growth could be best achieved through the implementation of the principle of subsidiarity in the ascending interpretation.

To put the conclusion in a more general form, one can think of the EU as an attempt to build a new political entity in a long, step by step, process on the ruins of the old nation states. The aim was to secure a political space adequate to the enlarged economic space (Milward 2000), akin to the US case.

3. The Treaty of Maastricht and Beyond

3.1. If we look at the Treaty of Maastricht (and of Amsterdam) we are immediately struck by the fact that the principle of subsidiarity is mentioned at the very beginning and that its meaning is not the implicit one I outlined in the first part. It was presumably mentioned to specify divergence from the prevailing (albeit implicit) meaning. In the Treaty of Maastricht, the general presumption is that all action within the EU is undertaken at the lowest level of government. Needless to say, exceptions are those fields where the EU has exclusive competence. It is remarkable that nowhere in the Treaty can a list of these areas of exclusive competence be found, although it is clear that monetary policy is one of them.

In other words there is no action that is prima facie the responsability of the EU, save those of exclusive competence: all others must be considered case by case.[4] This is a complete change in direction with respect to the presumption of the previous period.[5]

3.2. The question as to where this change comes from then naturally arises. The following episode is paradigmatic in that it illustrates a crucial element of my interpretation.

The year was 1989, the place Strasbourg and the stage the discussion about the Community Charter of Basic Social Rights for Workers. If there was to be one market by 1992, then one could well think of a EU Espace Sociale. The single market was certainly a move towards a more efficient situation, but what about equity? The SEA (1987) would in due course (by 1992) remove any controls on people, capital and commodities at the borders (indeed would abolish the border itself), promoting liberalization of many services (industrial as well as financial). Would the increase in GDP expected as a consequence of these choices be fairly distributed? Since capital is certainly more mobile than labour, a sort of social dumping could accompany the change, hence the idea of strengthening social policy (already established as a principle in 1957) to establish uniform basic principles across the Community.

The Charter was not conceived as law but as a form of solemn declaration. It included several rights of workers: the right to freedom of movement, employment and fair remuneration, freedom of association and collective bargaining, equal treatment for men and women, worker information, protection of children, safety in the workplace, and so forth.

The UK opposed the very idea of a Social Charter arguing, on the basis of the principle of subsidiarity, that social policy was typically an area where action is better left with member states. The reason is probably to be found in the competitive advantage enjoyed by UK firms not subject to the rules and provisions that regulate labour relations elsewhere. It is precisely this point that the French raised in favour of a uniform basic level in the social provision: otherwise there could be distorted competition engineered precisely by the preminence of member state legislation over EU legislation.[6]

3.3. The introduction of the principle of subsidiarity raises other questions: who assesses insufficiency of an action at a lower level and therefore calls for a higher level? It could be (and actually is) the Commission, but then conflict emerges, as the Commission itself would be in charge of implementing the action at the EU level, should it deem insufficient a particular action taken by a member state.

As well, a citizen, or firm, can clearly bring the Commission to the European Court of Justice to determine whether the principle of subsidiarity has been violated by the present working of the EU.

3.4. The Social Charter case has been raised to the level of "paradigm" as it illustrates what introduction of the subsidiarity principle entails. I think France had a point in arguing that different levels of social protection across countries lead to distorted competition and fair competition is a primary objective in EU policy.

When distortion comes from taxes, subsidies to specific industrial sectors, tariffs, and so forth, there is no disagreement that they must be eliminated by EU action; when it comes from a different social policy, some nations regard the problem as being a matter of domestic policy.

My conclusion is that there are two motivations to the inclusion of the principle of subsidiarity in the Treaty: the first is connected with the aim of preserving an advantage (in spite of the fact that in so doing, distortions are preserved), the second is connected with refusal to include equity standards.

Let us recall that in the early 1980s a change in the political environment started taking shape in the USA and UK: a revision of the then prevailing Keynesian policy was underway in favour of reinstatement of the classical doctrine that economic policy is a major factor of destabilization and distortion of the economy. This was true at both the micro and macro levels.

The rights mentioned and highlighted in the Social Charter are not necessarily in line with the efficiency principle, but it was thought, that application of the latter alone could induce a race to the bottom. Mention of fair remuneration for labour clearly indicates that the latter is not to be considered as a commodity like any other but a special one, regulated by standards that cannot be entirely reduced to those of marginal productivity and disutility.

3.5. The above situation can be interpreted in the light of the so-called Social Trilemma, clarified by Rodrik (2000): in the long run nation states, welfare states and full integration of economies cannot coexist. This mainly depends on three basic elements: tax mobility (that shifts the burden on low mobility factors and may reduce overall receipts), increase in risk (integration enhances the exposure to risk that the various welfare systems seek to mitigate), and race to the bottom (the tendency to reduce social benefits to enhance firm competitiveness).

One of the three elements has to go. In 1989 the UK preferred the welfare system to go, whereas others thought that the nation state ultimately had to go, granted that full integration of the economies was inevitable.[7]

A fact not well understood (in my opinion) is that in today's environment, a single European state cannot preserve its quality of life and income per capita while competing on its own. Would anyone be prepared to argue that if, say, Greece were outside the EU it would be enjoying a higher level of income per capita? The real problem of the EU and its difficulties lies in the fact that this perspective has not (yet) led European governments to act consequently, on both constitutional and policy levels. Both are necessary: not only good and bold policies (see the US response after the Twin Towers attack) but also a democratic Charter with which European citizens can identify themselves (for a perspective very different from Rodrik's, see Breton & Ursprung 2002).[8]

3.6. At this point let us recall two results of public finance theory: i) because of economies of scale and increasing returns, efficiency may require that actions be implemented not at the lowest possible level but at a higher level; ii) the lower the level of government, the less scope there is for redistributive policies. Further argument centred on the results of organizational theory was recently advanced to cast doubt on gains in efficiency as a result of strict application of the subsidiarity principle as codified in the Treaty of Maastricht (Fabel & Miconi 2000).[9]

To this effect, I will briefly review the arguments usually put forward justifying the current (i.e. descending) concept of subsidiarity on the grounds of efficiency: i) budget constraint effect; ii) diversity of preferences; iii) competition among different levels of governments.

The lower the level, the harder the budget constraint and this restrains the abuses and profligacy (genetically) connected with public expenditure. How money extracted from the citizens is utilized becomes more visible.

Secondly, citizens have different preferences across different territories and it would therefore be inefficient to supply them with identical amounts of public goods or services.

Finally, even if citizens share similar preferences, they can contribute to a more efficient working of the various levels of government by comparing their respective performances thereby bringing them into competition.

I think that these arguments are not conclusive: indeed a good deal of criticism has been levelled against them.

First, the argument under i) actually entails an "appropriate" level of government where there is a correspondence between those who bear the cost of the public good and those who benefit from its supply: there is no presumption in favour of the lowest level. This depends on the existence of economies of scale in the supply of services and spillover effects across territories. Oates' theorem applies only in the absence of these effects: in many cases they can be very large.

What is more relevant is that the process of integration on a world scale makes the nature of externalities such that they can be dealt with only through the operation of global institutions (global warming, AIDS, defence, etc.). The existence of the EU (instead of several nation states) could be a factor favouring larger scale agreement on such issues.

At the same time it is not clear whether operating at the lowest level helps prevent local pressure (and lobbying) groups characterized by low level of accountability because of the limited power of the free press at the local level.

With regard to ii) it is not obvious that preferences differ mainly on a regional basis and not due to income and social status. The two may be correlated but I suspect that two chemical workers (school teachers) with similar income have a rather similar demand pattern, although they belong to different territories and that, on the contrary, a worker has a different structure of preferences than a teacher living in the same neighbourhood.

Finally (as for iii), competition is certainly an excellent method of ensuring efficiency. However if competitors differ widely in size and/or (financial, economic) power, one should not necessarily expect results to be beneficial. Again, in particular circumstances, such as those existing in tax competition among local authorities, recent empirical findings have shown that this does not lead to a general increase in investment but simply to its redistribution across counties.

The conclusion of my discussion is simple: the descending interpretation of the principle of subsidiarity is a constitutional rule with the primary scope of reducing the possibility of redistributive action, as it cannot be taken for granted that it is justified by efficiency.

I do not wish to venture into the discussion of whether the approach of restraining equity policies is justified: I am content to persuade the reader that this is actually the case and leave her to decide whether the EU has gone too far in its redistributive policy and needs to redress it (for a positive answer to this question see Alesina-Wacziarg 1999).[10]

To be fair, another interpretation of the subsidiarity principle can be advanced.[11] According to this line of thought, the principle serves the objective of ensuring swift unification of European legislation through competition among member states. If the end point were unsatisfactory, the Commission would enact appropriate directives. This interpretation, however, is not inconsistent with my own: indeed, it can be expected that in this competitive process equity considerations are not taken into account.

Unified legislation is certainly a great achievement and subsidiarity could help in reaching it efficiently and without the intervention of EU bureaucrats, but the quality of legislation should also be of concern.

3.7. My conclusions are in line with the traditional three objectives of the public sector: efficiency, equity, and stabilization. In recent years, however, it has been argued that the role of government in pursuing these ends should be scaled down. Stabilization policies are either useless (fluctuations are needed to keep the system innovative) or harmful (policies themselves create additional instability); efficiency reached via the market may be superior to the results obtained through the public hand, because of government failures; and equity seems to be completely eradicated from the list of objectives (see the analysis in Inman & Rubinfeld 1998).

I do not agree with these conclusions as most are derived from models based on assumptions far removed from reality (e.g. in the presence of rigid prices, economic systems can be made more stable via economic policy), or do not pay enough attention to the complex reality of the market with its transactions costs, fixed costs, and so forth. In some cases regulation policies or public provision of goods are the most satisfactory options.

With regard to stabilization, it is a basic result of Mundell's approach that a centralized budget is needed when labour mobility is not very high in a currency area: and this is exactly the case for Europe. One of the implications of the subsidiarity principle is certainly to shrink the EU budget even more, thus making it totally unsuitable for dealing with asymmetric shocks.[12] It should be remembered that in the 50s and 60s automatic fiscal stabilizers were successful in dealing with macroeconomic stability. Indeed today, much credit is granted to built-in stabilizers within the Growth and Stability Pact, but the effect could be more powerful if the EU budget were a little bigger (for a contrary view based on the "fiscal inefficiences" of the present US budget procedures, see Inman & Rosenfeld 1998).

3.8. A final point needs reflection. It has been argued (Alesina & Wacziarg 1999) that increasing integration among countries (towards a generalized free trade situation) reduces the incentive to build larger states: the latter do no longer provide an economic space large enough to increase the division of labour (and hence income per capita) necessary in the presence of trade restrictions.

Leaving aside external security problems, there are, however, other reasons why people form states, in addition to efficiency. I think that to be a part of a community that can provide some form of help (not necessarily state- run) in case of need (unemployment, illness, old age) is also a good reason for belonging to a particular state, e.g. Canada, rather than the US.

A political model that sweeps these elements aside seems to me to be founded, again, on limiting hypotheses (Alesina & Wacziarg 1999 confine the interest of "voters" in redistributive policies to a footnote and in discussing reasons for political integration, never mention welfare policy). In these models there is a trade off in the provision of a public good, between the gain resulting from economies of scale that call for a large state (region) and the losses arising from greater heterogeneity that call for a small state (region). The optimal size that results clearly involves redistributive gains and losses, which however are not given attention or importance by these scholars.[13]

I find this way of treating redistributive effects of efficiency gains (such as those emerging when discussing the virtues of free trade) extremely unsatisfactory and worrying. Indeed, they are introduced but not taken into account and are treated as if they do not matter to "consumers": is this not a form of implicit theorizing? It is also worrying because it restricts discussion of efficiency to a narrow field unable to account for the resistance to efficiency gains from those who are actual losers. To the latter it is little consolation that the cake is larger if their share shrinks and no redistributive policy is actually implemented: a potential gain cannot be considered to have the same value as an actual gain.

Acknowledgements

The paper is in memory of Franco Romani who died a few days after I discussed the topic with him. Although he would not have agreed with some of my conclusions, I would like to acknowledge my great debt to his teaching over thirty years.

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Notes

1. Professor of Economics, Dipartimento di Economia Politica, University of Siena. E-mail: dimatteo@unisi.it
2. And all other countries willing to participate.
3. Incidentally, the objectives of common policy did not take the environmental problems created by the increasing road transport into account.
4. To be fair, research by law scholars identifies a number of issues where competence is exclusive, but is not without interpretative problems that must be (and have partly been) solved by the Court of Justice.
5. I repeat that I am not going to discuss the concept and implications of the notion of horizontal subsidiarity, which calls for a different argument.
6. The same argument is reflected in the preoccupation now present in Less Developed Countries with labour conditions changes (in terms of safety, child exploitation, etc.) induced by the increased level of competition on a world scale.
7. Someone has argued that the existence of big free trade areas could slow down the integration process (Romani 2001).
8. In my opinion their analysis is not convincing as it is too optimistic with regard to the effects of competition in the government sphere. It is not clear in practice how vertical competition can be implemented in the presence of imperfect information (and hence difficulty in preference revealing) and political agreement (if not collusion) among leaders of the same or different parties (the existence of a political elite has been well documented since Mosca and Pareto). Furthermore, are we sure that the consumer will be able (and hence happier) to recognize that the same service is provided by different jurisdictions under different procedures? In response to the statement that in the presence of the Tiebout mechanism, redistribution programmes that command general acceptance will survive, it can be objected that the rich will move to jurisdictions that have no redistribution program at all.
9. Referring to the subsidiarity principle, Fabel & Miconi (2000, p. 104) argue that "... innovative European ruling or simply lengthning the decision chain may result in a better service for the clients in all member states and, at the same time, decrease the overall size of the administration."

10. The authors claim that "... the EU has already acquired a significant set of prerogatives to be much more than a simple area of free trade ..". This is correct but, as I tried to show at the beginning of the paper, the ECM and the other European institutions essentially arose by political intention: the free trade area (actually a customs union!) was conceived to be an intermediate step towards a political European state, not for its own sake! The economic has always preceded the political side of the EU construction process. Indeed, they claim that "the list of policies with little or no economic content has grown steadily over time." (Alesina & Wacziarg 1999, p. 25).
11. I owe this to V. Santoro.
12. The small size of the EU budget can lead to additional problems e.g. in the conduct of monetary policy (see Alesina & Wacziarg 1999, pp. 13-4). These authors hold that this problem is a further reason for building a political union.
13. To be fair, Alesina and Wacziarg (1999, p. 23) acknowledge that their results may be different "if one has some clear redistributive goal in mind".

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PART II

MONETARY ISSUES IN NORTH AMERICA

Revisiting the Case for Flexible Exchange Rates in North America*

John Murray[1]
Bank of Canada

Lawrence Schembri[2]
Bank of Canada

Pierre St-Amant[3]
Bank of Canada

Abstract. This paper provides econometric and qualitative evidence that flexible exchange rate regimes have played important roles in stabilizing the Canadian and Mexican economies in the face of asymmetric shocks, nominal rigidities, and limited international labor and capital mobility. Empirical evidence from Canada and from the more recent period in Mexico is organized around three propositions: one, the economies of Canada, Mexico, and the United States often experience large asymmetric shocks and the correlation between their business cycles is relatively low; two, exchange rates in Canada and Mexico are primarily driven by macroeconomic fundamentals and adjust appropriately to large asymmetric shocks, which are often caused by commodity price movements; and, three, flexible exchange rates facilitate adjustment to shocks in the underlying fundamentals.

1. Introduction

Canada has had a flexible exchange rate for all but eight of the last fifty years. Mexico adopted a flexible rate in 1995, in the wake of the 1994 peso crisis. The authorities in both countries argue that flexible exchange rates combined with explicit inflation targets have served their economies well[4]. Nonetheless, opponents maintain that some form of fixed exchange rate with the U.S. dollar would be a better alternative. In Canada, the proposed alternatives range from an adjustable peg to North American Monetary Union (NAMU), while in Mexico the main alternatives are unilateral dollarization or NAMU[5]. Among the reasons for replacing the flexible

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exchange rate regimes are introduction of the euro and dissatisfaction with sharp exchange rate depreciations caused by financial crises in other parts of the world.

This paper argues that flexible exchange rates have played a useful role in stabilizing the Canadian and Mexican economies in the face of asymmetric shocks, nominal rigidities and limited international labor mobility. We do not consider the important issue of transaction costs, nor do we assess other criteria developed in the optimum currency area literature. Instead, we focus on the macro-stability benefits of a flexible rate.

The next three sections are devoted to (i) shock asymmetries, (ii) macro fundamentals and (iii) adjustment processes. The concluding section briefly addresses the trade-off between the macro-stability benefits provided by a flexible exchange rate and the associated transaction costs.

2. Asymmetric Shocks

Proposition I: Canada, Mexico, and the United States often experience large asymmetric shocks and the correlations among their business cycles are low.

In this section, we consider the existence, magnitude and sources of asymmetric shocks among the three countries[6]. We present evidence that the trade sectors of Canada, the United States and Mexico are different and that the three countries experience asymmetric terms of trade shocks.

2.1. Differences in Economic Structures and Terms of Trade Shocks

Table 1 shows the share of various types of exports in total exports and GDP in Canada, Mexico, and the United States. Canada and, to a lesser extent, Mexico, are more dependent on commodity exports than the United States. While total commodities (oil plus non-oil) account for more than a third of Canada's goods exports, they account for 19 percent of Mexico's goods exports and 17 percent of U.S. goods exports. The counterpart of this is that manufacturing and machinery exports represent a larger portion of total exports in Mexico and the United States than in Canada.

While non-oil commodity exports account for most of the commodity exports in Canada and the United States, in Mexico oil exports account for more than half of commodity exports. Differences in the role played by commodity exports become even more striking when exports are expressed as a percentage of nominal GDP. While total commodity exports account for 12 percent of Canada's GDP, in Mexico and the United States they represent 6 percent and 1 percent, respectively.

Although total commodity exports have declined as a percentage of total exports in all three countries (particularly in Mexico), they have been more stable as a share of nominal GDP. In fact, in the case of Canada, exports of commodities have increased in the 1990s as a share of nominal GDP. Again, the increased openness of the three economies accounts for this fact. Of the three countries, Canada is the most dependent on commodity exports. Mexico stands in between Canada and the United States. Mexico's dependence on oil exports, however, implies that it has been affected by large asymmetric shocks since the price of oil has been very volatile over the last 30 years.

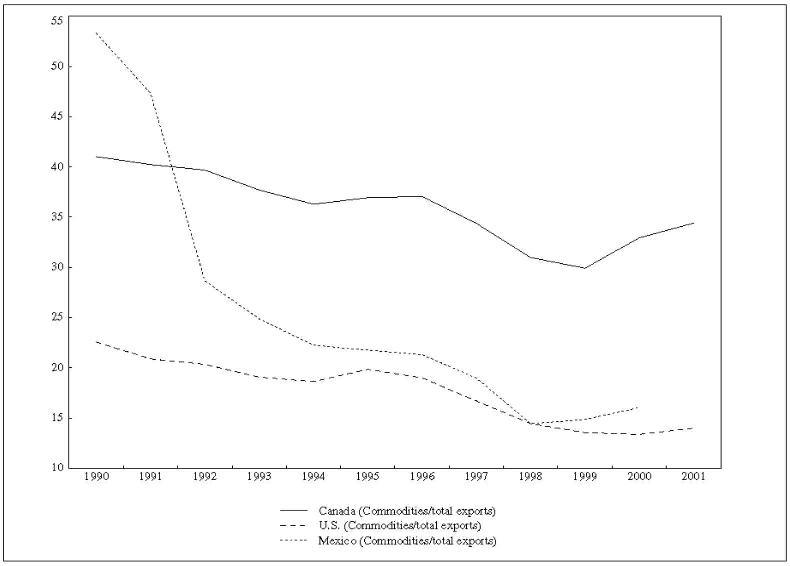
Table 1: *Goods exports as a percentage of total goods exports and of nominal GDP (in parentheses) in 1997*

	Canada	**United States**	**Mexico**
Non-oil commodities[1]	31 (10)	16 (1)	9 (3)
Oil[2]	5 (2)	1 (0)	10 (3)
Chemicals	6 (2)	11 (1)	4 (1)
Manufacturing	16 (5)	19 (2)	23 (6)
Machinery	39 (5)	50 (4)	54 (15)
Others	3 (1)	4 (0)	0(0)

Source: OECD.

Notes: 1. Includes food and live animals, beverages and tobacco, non-fuel crude materials, animal and vegetable oils, coal, natural gas, electric current, leather and dressed fur skins, and wood and paper manufactures. 2. Petroleum, petroleum products, and related materials.

Figure 1: *Commodity exports as a percentage of total goods exports.*



Another way to look at the differences in the structures of the three economies is to consider their terms of trade. Table 2 presents correlations between the terms of trade for Canada, the United States and Mexico; it shows that while the terms of trade of the United States and those of the other two countries are negatively correlated, the terms of trade of Mexico and Canada are positively correlated. Table 3 illustrates the fact that the negative correlations presented in Table 2 reflect, to a large extent, differences in the impact of commodity prices movements on the terms of trade of the three countries. While the correlation between the terms of trade of both Canada and Mexico and commodity prices is both high and positive, the terms of trade of the United States are negatively correlated with commodity prices. Again, there is a distinction to be made between Canada and Mexico: while the terms of trade of Canada are more correlated with non-oil commodity prices, those of Mexico are much more correlated with the price of oil.

Table 2: *Correlations between the terms of trade of Canada, the United States, and Mexico (1982 to 1998)*[1]

	Canada	**United States**	**Mexico**
Canada	1	-0.36 (-0.54)	0.37 (0.35)
United States		1	-.077 (-.073)
Mexico			1

Note: 1. Annual data in first differences and filtered with an Hodrick-Precott filter (in brackets), obtained from Statistics Canada, the IMF's International Financial Statistics (IFS), and the Banco de Mexico. Unit root tests (available on request) indicate that these series are non-stationary in levels.

Table 3: *Correlations of terms of trade with oil and non-oil commodity prices (1982 to 1998)*[1]

	Oil	**Non-oil**
Canada	0.39 (0.48)	0.67 (0.50)
United States	-0.75 (0.83)	0.13 (-0.21)
Mexico	0.83 (0.75)	0.15 (0.19)

Note: 1. Annual data in first difference or HP-filtered (in brackets). The data on oil and non-oil commodity prices are taken from the IFS.

2.2. Measuring the Symmetry of Shocks with Structural VARs

To assess the symmetry of the exogenous shocks hitting Canada, Mexico and the United States, we use an extension of the methodology proposed by Bayoumi and Eichengreen (1993, 1994). Their analysis is based on a traditional aggregate supply-aggregate demand model. Following Blanchard and Quah (1989), they assume that aggregate supply shocks have a permanent impact on output, while aggregate demand shocks are transitory. The econometric approach developed by Blanchard and Quah is then applied to the price and output series of various regions and countries in order to identify and estimate demand and supply shocks, after which the correlations between the various shocks are compared. Bayoumi and Eichengreen give greater emphasis to correlations of supply shocks, because demand shocks include monetary policy shocks, which are a source of asymmetry that would not be present in a monetary union.

We extend Bayoumi and Eichengreen's analyses by separately identifying monetary policy shocks, so that the correlations between both real demand and supply shocks can be considered. We use three-variable structural VARs which include the first differences of output, inflation, and interest rates, to identify supply (ε^s), monetary (ε^m), and real demand (ε^d) shocks. Supply shocks are distinguished from demand shocks (both monetary and real) as in Bayoumi and Eichengreen (1993); i.e., demand shocks are assumed to have no long-term effect on output. Monetary shocks are distinguished from real demand shocks in that, of the two, only monetary shocks can alter the trend of inflation. This is consistent with the view that demand shocks are neutral in the long run in terms of their impact on real output and the fact that only the monetary authorities can affect the long-run value of inflation.

Using Wold's theorem, the structural model can be written as follows:[7]

$$x_t = A_0\varepsilon_t + A_1\varepsilon_{t-1} + \ldots = \sum_{i=0}^{\infty} A_i\varepsilon_{t-i} = A(L)\varepsilon_t, \tag{1}$$

where

$$\varepsilon_t = \begin{bmatrix} \varepsilon_t^s \\ \varepsilon_t^m \\ \varepsilon_t^d \end{bmatrix}, x_t = \begin{bmatrix} \Delta\pi \\ \Delta y \\ \Delta r \end{bmatrix} \tag{2}$$

and the variance of the structural shocks is normalized so that $E(\varepsilon_t\varepsilon_t') = I$, the identity matrix. The variables are defined as: y the logarithm of industrial production, π the rate of inflation, and r a nominal interest rate.[8]

The data are quarterly, seasonally adjusted, and cover the period 1975Q1 to 1999Q2. Note that consistent interest rate data for Mexico are not available prior to 1975. The interest rate series for Canada, the United States, and Mexico are, respectively, the overnight rate, the Federal Funds rate and the average cost of funds (the only interest rate series available over a reasonably long period for Mexico). Inflation is measured with country and regional consumer price data. The interest rate used for the regions of the United States is the Federal Funds rate. The regional data are obtained from Data Resources Incorporated (DRI) and the country data from the OECD and the IMF. The U.S. regions are: Eastern North Central (ENC), Eastern South Central (ESC), Middle Atlantic (MATL), New England (NENG), Pacific North West (PNW), Pacific South West (PSW), South Atlantic (SATL) West North Central (WNC), and West South Central (WSC). Appendix 1 identifies the states that are included in each of these regions.

The series are first-differenced since augmented Dickey-Fuller tests were unable to reject the null hypothesis of a unit root for each variable[9]. The cointegration tests produced mixed results, so that we proceed by assuming that there is no cointegrating relationship.[10] We estimate three-variable VARs for each of the three countries and the nine regions of the United States. The number of lags is determined on the basis of sequential likelihood ratio tests applied in a general-to-specific approach with a maximum of 8 lags[11]. The estimated VAR models have the following moving average representation:

$$x_t = e_t + C_1 e_{t-1} + \ldots = \sum_{i=0}^{\infty} C_i e_{t-i} = C(L)e_t \tag{3}$$

In all cases, the reduced-form residuals are related to the structural residuals through the following equation:

$$e_t = A_0 \varepsilon_t \tag{4}$$

$$A(1) = C(1)A_0 \tag{5}$$

To identify the model, we impose three a priori restrictions on $A(1)$. First, we assume that real demand shocks have no effect on inflation in the long run. Identification is completed with the assumption that both real demand shocks and monetary policy shocks have no effect on output in the long run.[12]

Figs. A2.1 to A2.9 in Appendix 2 present the responses of output, prices and the real interest rates to the three types of shocks in Canada, Mexico, and the United States.[13] The shocks have characteristics broadly consistent with standard macroeconomic theory. For instance, monetary shocks are associated with a short-run decline in real interest rates, and temporary increases in output and inflation. Supply shocks cause a short-run decline in inflation and a long-run increase in output. It is important to remember that only the long-run impact of the shocks on output and inflation is constrained ex ante.

Figs. A2.1 to A2.9 also indicate that the shocks have a sizable impact on the output series. This is important because asymmetry of shocks is only relevant to the extent that these shocks have a significant economic impact. Notice, however, that the demand shocks hitting the Mexican economy dissipate quickly. Indeed, Mexico is characterized by the predominance of supply shocks and relatively fast adjustment to all types of shocks. This result, which is consistent with the one obtained by Lalonde and St-Amant (1995), suggests that Mexico has fewer nominal rigidities than Canada and the United States.

Tables 4 and 5 show the estimated correlations between the supply and real demand shocks of Canada, Mexico, and the nine regions of the United States.

Tables 4 and 5 indicate that the shocks hitting the nine regions of the United States are more highly correlated than those hitting Canada, Mexico, and the United States. They also suggest that, from the point of view of the symmetry of shocks, the Mexican economy is the part of North America that is least suited for NAMU. These results are broadly consistent with those obtained by Bayoumi and Eichengreen (1993) and Lalonde and St-Amant (1995), who employed different sample periods and identification strategies.

Table 4: *Correlations between supply shocks (1976Q4 to 1999Q2)*

	CAN	MEX	ENC	ESC	MATL	NENG	PNW	PSW	SATL	WNC	WSC
CAN	1.000	0.173	0.234	0.104	0.288	0.201	0.240	0.119	0.262	0.269	0.328
MEX		1.000	-0.148	-0.244	-0.053	0.026	-0.134	0.078	-0.138	0.106	0.248
ENC			1.000	0.661	0.615	0.266	0.552	0.476	0.613	0.095	0.365
ESC				1.000	0.642	0.327	0.739	0.541	0.734	0.047	0.204
MATL					1.000	0.658	0.629	0.578	0.669	0.426	0.561
NENG						1.000	0.400	0.403	0.467	0.494	0.560
PNW							1.000	0.533	0.659	0.203	0.291
PSW								1.000	0.611	0.344	0.483
SATL									1.000	0.203	0.364
WNC										1.000	0.750
WSC											1.000

Average correlation between regions of the United States: 0.48
Average correlation between Canada and the regions of the United States: 0.23
Average correlation between Mexico and the regions of the United States: -0.03

Table 5: *Correlation between real demand shocks*

	CAN	MEX	ENC	ESC	MATL	NENG	PNW	PSW	SATL	WNC	WSC
CAN	1.000	0.134	0.297	0.340	0.319	0.200	0.190	0.119	0.237	0.109	0.171
MEX		1.000	0.198	0.111	0.153	0.201	0.104	0.052	0.182	0.120	0.083
ENC			1.000	0.726	0.796	0.606	0.618	0.578	0.707	0.580	0.596
ESC				1.000	0.680	0.480	0.603	0.515	0.711	0.384	0.418
MATL					1.000	0.833	0.642	0.752	0.855	0.697	0.759
NENG						1.000	0.595	0.674	0.754	0.720	0.774
PNW							1.000	0.631	0.770	0.598	0.644
PSW								1.000	0.819	0.745	0.817
SATL									1.000	0.677	0.815
WNC										1.000	0.826
WSC											1.000

Average correlation between regions of the United States: 0.68
Average correlation between Canada and the regions of the United States: 0.22
Average correlation between Mexico and the regions of the United States: -0.13

2.3. Symmetry of Business Cycles

Table 6 presents correlations between the growth rates of industrial production in Canada, Mexico, and the nine regions of the United States. These correlations are a measure of similarities in the business cycles of the various regions and countries. The business-cycle correlation coefficients between Canada and the United States are higher than correlations for the corresponding shocks. Further, business-cycle correlations among regions of the United States are still higher than correlations between Canada and Mexico, on the one hand, and U.S. regions, on the other hand.[14]

Table 6: *Correlation between the growth rates of industrial production series of Canada, Mexico, and the regions of the United States (1975Q1 to 1999Q2)*

	Canada	**Mexico**	**ENC**	**ESC**	**MATL**	**NENG**	**PNW**	**PSW**	**SATL**	**WNC**	**WSC**
Canada	1.00	0.24	0.64	0.58	061	0.53	0.46	0.59	0.52	0.61	0.62
Mexico		1.00	0.09	0.09	0.15	0.17	0.14	0.24	0.09	0.09	0.31
ENC			1.00	0.86	0.93	0.74	0.63	0.82	0.74	0.93	0.79
ESC				1.00	0.91	0.82	0.67	0.75	0.92	0.84	0.81
MATL					1.00	0.86	0.62	0.89	0.84	0.93	0.87
NENG						1.00	0.55	0.82	0.86	0.78	0.80
PNW							1.00	0.63	0.72	0.63	0.53
PSW								1.00	0.77	0.85	0.79
SATL									1.00	0.76	0.74
WNC										1.00	0.83
WSC											1.00

Average correlation between regions of the United States: 0.78
Average correlation between Canada and the regions of the United States: 0.57
Average correlation between Mexico and the regions of the United States: -0.15

A limitation of the correlations presented in Table 6 is that they do not distinguish various types of shocks; in particular, they do not control for the influence of monetary policy shocks on output. This is important because in a monetary union, independent monetary policies could not be a source of asymmetric shocks.

To take into account the dynamics of shocks, the SVAR methodology described in Section 2.2, was used to generate the following historical decomposition of industrial production:

$$\Delta y_t = A_s(1)\varepsilon_t^s + A_s(L)\varepsilon_t^s + A_m(L)\varepsilon_t^m + A_d(L)\varepsilon_t^d , \tag{6}$$

where

$$A(1) = \sum_{i=0}^{\infty} A_i \text{ and } A(L) = A(L) - A(1).$$

The right-hand side of equation (6) corresponds to the moving-average components of different types of structural shocks affecting industrial production. The expressions $A(L)$ and the $A(1)$ correspond to transitory and permanent components of the shocks, respectively. The first two terms on the right-hand side of equation (6) represent the permanent and transitory components of aggregate supply.

The other two terms correspond to the monetary and real demand components of output. The sum of these last two components can be viewed as a measure of the business cycle defined as the gap between actual output and the level of output consistent with aggregate supply[15]. The term $A_d(L)\varepsilon_t^d$ can then be seen as a measure of the contribution of real demand shocks to this gap.

Table 7 shows the correlations between the real demand components of industrial production in Canada, Mexico and regions of the United States. They are not very different from those presented in Table 6, although correlations between Canada and the United States tend to be lower. Business cycles would appear to be much more correlated among regions of the United States than between these regions and either Canada or Mexico.

Table 7: *Correlation between the real demand components of industrial production of Canada, Mexico, and the regions of the United States (1976Q4 to 1999Q2)*

	Canada	Mexico	ENC	ESC	MATL	NENG	PNW	PSW	SATL	WNC	WSC
Canada	1.000	0.149	0.241	0.140	0.382	0.318	0.172	0.395	0.321	0.387	0.458
Mexico		1.000	0.116	0.090	0.203	0.107	0.221	0.146	0.307	0.152	0.217
ENC			1.000	0.770	0.793	0.648	0.707	0.608	0.743	0.590	0.667
ESC				1.000	0.683	0.623	0.712	0.506	0.711	0.521	0.520
MATL					1.000	0.901	0.748	0.834	0.883	0.767	0.832
NENG						1.000	0.673	0.830	0.831	0.748	0.806
PNW							1.000	0.633	0.837	0.630	0.669
PSW								1.000	0.769	0.756	0.868
SATL									1.000	0.740	0.850
WNC										1.000	0.787
WSC											1.000

Average correlation between regions of the United States: 0.73
Average correlation between Canada and the regions of the United States: 0.31
Average correlation between Mexico and the regions of the United States: -0.17

3. Flexible Exchange Rates: Is There Anything But Noise?

Proposition II: Mexican and Canadian flexible exchange rates are primarily driven by macroeconomic fundamentals and adjust appropriately to large asymmetric shocks.

Recent evidence for Canada and Mexico suggests that most of the broad movements in their real exchange rates are driven by macroeconomic fundamentals. Moreover, exchange rates move in a manner consistent with dampening the asymmetric shocks. Although flexible exchange rates are often seen as a source of macroeconomic instability rather than a potential solution, closer scrutiny of the data for Canada and Mexico indicates that trend movements in their exchange rates tend to mitigate the effects of external shocks on domestic prices and output.

In this section, we show that bilateral exchange rates for Canada and Mexico vis-à-vis the United States can be modeled with simple econometric specifications which include commodity prices as key explanatory variables. Large movements in these prices, representing important asymmetric shocks for the Canadian and Mexican economies, are found to have a significant and predictable effect on exchange rates.

3.1. An Equation for the Canadian Dollar

The equation used by the Bank of Canada is based on a simple error-correction model that was first developed in 1991.[16] The dependent variable is the nominal Can-U.S. exchange rate deflated by the GDP price indices for Canada and the United States. Its long-run equilibrium value is determined by two commodity prices: the world price of energy (proxied by oil) relative to the U.S. GDP deflator, and the world price of non-energy commodities (a weighted average of the world price for grain, livestock, forest products and metals and deflated by the U.S. GDP price index). The interest-rate spread on Canadian and U.S. commercial paper is also added to the equation, but is not allowed to affect the long-run value of the exchange rate. Unlike the two commodity price terms, the interest-rate differential is not cointegrated with the real exchange rate, and is therefore placed outside the error-correction term, helping to explain the short-run dynamics of the Canadian dollar.

The basic equation for the real Can-U.S. exchange rate can be written as follows:

$$\Delta \ln(rfx) = \alpha (\ln(rfx)_{t-1} - \beta_0 - \beta_c \ln(comtot_{t-1}) - \beta_e \ln(enetot_{t-1})) + \Upsilon \, intdif_{t-1} + \varepsilon_t \qquad (7)$$

where:

rfx = real Can-US exchange rate
$comtot$ = non-energy commodity terms of trade
$enetot$ = energy terms of trade
intdif= Can-US interest rate differential

Representative results for equation (1) estimated over four different sample periods are shown in Table 8. Most of the parameters have their expected signs and are statistically significant. An increase in the dependent variable rfx represents a real depreciation, so that increases in $comtot$ and *intdif* cause the exchange rate to strengthen, while increases in $enetot$ cause it to weaken. Although the last result may be surprising, given that Canada is a (modest) net exporter of energy products, it is remarkably robust. The effect of $enetot$ on the exchange rate is explained by the fact that many of Canada's industries are very energy intensive, so that benefits from higher-priced energy exports are more than offset by higher costs in energy-using industries and the resulting decline in their international competitiveness.

Table 8: *Results for the Canadian exchange rate equation*

Variable	**1973Q1 – 1986Q1**	**1973Q1 – 1991Q3**	**1973Q1-1996Q1**	**1973Q1-1998Q4**
Speed of adjustment	-0.198 (-3.251)[1]	-0.167 (-3.917)	-0.141 (-4.149)	-0.125 (-3.752)
Constant	2.419	1.807	2.728	3.04
	(-4.585)	(-5.306)	(-7.566)	(-7.672)
COMTOT	-0.454	-0.368	-0.524	-0.58
	(-4.794)	(-5.713)	(-6.558)	(-6.328)
ENETOT	0.059	0.119	0.07	0.057
	(-1.442)	(-2.916)	(-1.769)	(-1.298)
INTDIF	-0.54	-0.519	-0.604	-0.576
	(-2.442)	(-3.105)	(-3.682)	(-4.040)
$\overline{R}^2$	0.218	0.227	0.204	0.194
Durbin-Watson	1.197	1.159	1.265	1.311

Note: 1. *t*-statistic

Overall, the performance of equation (1) is surprisingly good. It is able to explain roughly 20 per cent of the quarterly variation in rfx; its parameters are for the most part sensibly signed and significant; and the relationship is remarkably robust.

Two dynamic simulations are shown in Fig. 2, using parameter estimates drawn from the periods 1973Q1 to 1996Q1 and 1973Q1 to 1998Q4. In order to facilitate comparisons between the actual and predicted values of the exchange rate, the series were converted into nominal values by adjusting them for changes in the Canadian and U.S. GDP price deflators. The general correspondence between the two simulated series and the actual exchange rate is very close and remains essentially unchanged when the estimation period is lengthened. It is important to remember that the equation was first estimated in 1991 and that the predicted values shown in Fig. 2 are based on a true dynamic simulation which starts in 1973Q1 (i.e., they are not updated with lagged values of the actual exchange rate as the simulation moves towards 1998Q4).

Table 9 provides a decomposition of one of the simulations shown in Fig. 2 and indicates the relative contribution of each variable to changes in the actual Can-U.S. exchange rate.

Figure 2: *Equation for the Canadian dollar. Dynamic simulation – basic model.*

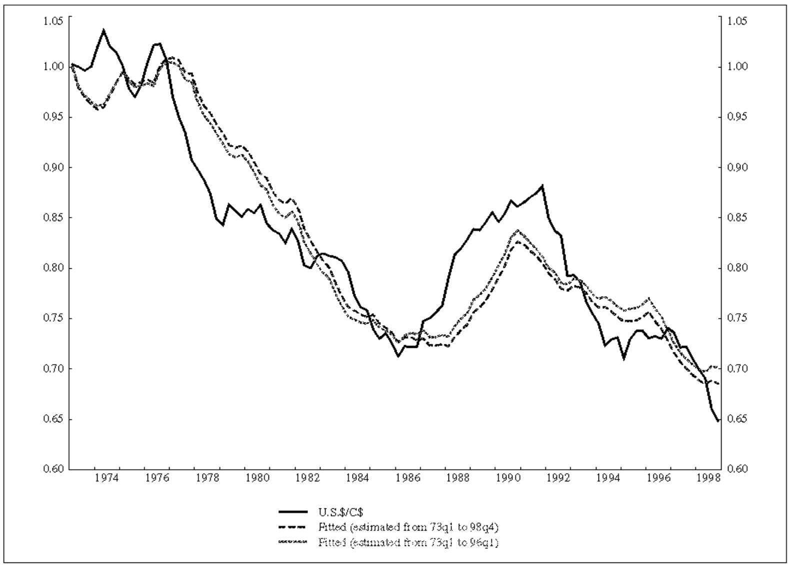


Table 9: *Relative importance of the explanatory variables 1973Q1 - 1998Q4*

Variable	Percentage Share
COMTOT	56.20
ENETOT	1.85
INTDIFF	-6.52
Inflation	23.00
Lags	11.51
Other[1]	13.76
Total	100.00

Note: 1. Includes error term.

Over the 1973Q1 to 1998Q4 period, the nominal Can-U.S. exchange rate depreciated by roughly 44 cents (Canadian). More than 56 per cent was due to a trend decline in the relative price of non-energy commodities; 23 per cent was caused by higher inflation rates in Canada than the United States (purchasing power parity); 1.85 per cent came from higher energy prices; and 25 per cent was related to other unidentified factors (including the lagged adjustment term and the residual error). Short-term interest-rate differentials provided some offset to the depreciation and raised the value of the Canadian dollar by roughly 6.5 per cent.

3.2. An Equation for the Mexican Peso

The Bank of Canada has also developed an equation for the Mexican peso. The three main differences between the Canadian and Mexican equations are (i) exclusion of non-energy commodity prices, (ii) use of the real short-term Mexican-US interest rate differential in lieu of the nominal one, and (iii) inclusion of a dummy variable for financial crises.

We exclude non-energy commodity prices from the equation as non-energy commodities comprise only 9% of Mexico's good exports as opposed to 31% of Canada's. This decision is supported by tests for a cointegrating relationship between these two variables.[17] The cointegration tests were significant at the 5% level, providing support for the idea of a long-run equilibrium relationship between the real peso exchange rate and oil prices.

Theoretically, it makes more sense that the lagged real interest rate differential be included in an equation for the real exchange rate. In the case of the Canadian dollar real exchange rate, the difference in explanatory power between using the nominal rate differential and the real differential is small because monetary policies in Canada and the United States have produced similar rates of inflation over the sample period. For some unknown reason, the equation performs slightly better with the nominal differential. Mexican and U.S. monetary policies, however, have been very different since 1980, thus it is not surprising that the real differential has greater statistical significance.

Finally, the sudden and uncertain nature of financial crises, and the well-documented tendency for the exchange rate to overshoot during crises, make it unlikely that an exchange rate equation based solely on fundamentals could explain them fully. Thus, the CRISIS variable takes a value of one during quarters in which the Mexican pegged exchange rate regimes collapse: 1982:1, 1985:3&4, 1987:4 and 1995:1.[18]

The Mexican Peso equation can then be written as follows:

$$\Delta \ln(rpeso) = \alpha\,(\ln(rpeso)_{t-1} - \beta_0 - \beta_1 \ln(oil_{t-1})) + \Upsilon_1\, rintdif_{t-1} + \Upsilon_2\, CRISIS \tag{8}$$

where:

rpeso = real Mex-US exchange rate

oil = real US$ oil price

intdif = Mex-US real short-term interest rate differential

CRISIS = dummy variable= 1 if t=82:1, 85:3, 85:4, 87:4, or 95:1

= 0 otherwise.

In Table 10, all of the parameters have their expected sign and are significant below the 5% level. An increase in the price of oil and a relative increase in the Mexican interest rate both appreciate the peso, while the peso depreciates in the quarters commonly associated with currency crises. The fit is relatively good, as illustrated by the dynamic simulation shown in Fig. 3. Of course, a valid criticism is that the good fit is partly due to the ex-post inclusion of the CRISIS dummy variable. Although our framework ignores the sources of currency crises, it is not our intention to try to explain the complex causes of the currency crises in Mexico. Instead, our model simply illustrates the sensitivity of the Mexican exchange rate to its major commodity export, oil, and to interest-rate differentials.

Table 10: *Results for the Mexican peso exchange rate equation*

Variable	**1980:1 – 1998:4**
Speed of adjustment	-0.022
	(-2.222)
Constant	-3.83
	(-0.790)
OIL	-6.834
	(-2.975)
RINTDIF	-0.286
	(-2.393)
CRISIS	0.286
	(-4.486)
$\overline{R}^2$	0.314
Durbin-Watson	1.139

Note: 1. *t*-statistic

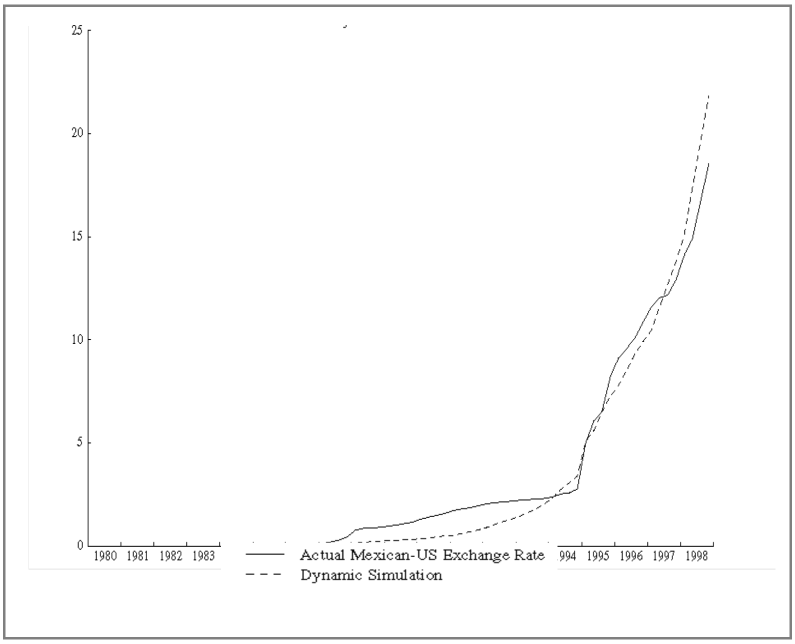
The dynamic simulations for the peso and the Canadian dollar are comparable, trend movements in the exchange rate are usually consistent with the underlying fundamentals and the large gaps that regularly appear between the actual and predicted values are all eventually closed. The fact that Mexico operated under a fixed exchange rate for most of the sample period does not prevent the equilibrium real exchange rate from asserting itself; it simply delays the process and makes the adjustment of output and employment in the real economy that much more difficult.

4. Flexible Exchange Rates: Do They Help or Hinder Adjustment?

Proposition III: By responding to shocks to the underlying fundamentals, flexible exchange rates facilitate economic adjustment.

We have argued that Canada and Mexico experience substantial asymmetric shocks relative to the United States, driven, in part, by movements in world commodity prices, and that their flexible rates generally move in a direction consistent with these perturbations. The final step in our argument is the proposition that these exchange rate movements significantly mitigate the macroeconomic impact of these shocks.

Figure 3: *Equation for the Mexican peso. Dynamic simulation of real Mexican-US exchange rate.*



Adjustments in the exchange rate are widely believed to help stabilize the domestic economy by accommodating nominal rigidity in prices and/or wages. A flexible rate either facilitates the required movement in the real exchange rate or it shelters the domestic economy from price shocks, leaving the domestic real exchange rate unchanged. An adverse real shock causes domestic output and interest rates to decline and exchange rates (real and nominal) to depreciate. However, if the economy is hit by domestic monetary or foreign portfolio balance shocks, then a flexible rate will not offer much protection. The evidence we have marshalled so far implies that most of the shocks that the Canadian and Mexican economies have faced were real. While monetary shocks have been more prevalent in Mexico, real shocks, especially oil price shocks and U.S. policy shocks have also been very important.[19]

4.1. Adjustment to Large Shocks: A Canada-Mexico Comparison

To illustrate the role of the exchange rate regime in adjustment, we compare the economic histories of Mexico and Canada over the postwar period. The two countries often faced similar macroeconomic shocks, either commodity shocks or shifts in U.S. macroeconomic policies, yet the two countries had very different exchange rate regimes in place over the period. While Canada has been on a flexible exchange rate regime for all but 8 of the past 50 years, almost exactly the opposite is true for Mexico, which has been on some form of fixed or controlled exchange rate regime for all but 5 years.[20]

We consider a small set of large exogenous shocks that both countries experienced, albeit to different degrees, over the postwar period. Analyzing the adjustment of the respective economies to these large shocks should provide additional insights into the macroeconomic implications of alternative exchange rate regimes and help in assessing the advantages of a flexible exchange rate.

Consider first the two instances in which Canada left a fixed exchange rate to float: September 30, 1950 and May 31, 1970. These periods are highlighted in Figs. 4 to 6. In both cases, the fixed exchange rate was under upward pressure from inflationary expansions originating in the United States. In 1950, the inflationary pressures were fuelled by the Korean War, which started in June of 1950, and in 1970, by the Vietnam War, which had been ongoing for some time. Commodity prices were moving upward in both periods, but more sharply in 1970, and spurred direct investment inflows. In both cases, the Canadian dollar appreciated after floating, thereby moderating demand pressures. The inflation rates in Canada were 5.3% and 2.5% in 1950-51 and 1970-71, respectively. Mexico, in contrast, remained on a fixed exchange rate during both periods and experienced much higher inflation (16.7% during 1950-51 and 4.9% during 1970-71). Moreover, when the shock reversed in 1953-54 and the U.S. economy slowed, Mexico was left with an overvalued and uncompetitive real exchange rate and was forced to devalue by 44.5 per cent from 8.65 to 12.5 pesos per U.S. dollar.

The next episode is the commodity price boom of 1972-74, which included a tripling of the world price of oil. (See Figs. 7-9). The Canadian dollar appreciated by more than 5 per cent over this period in response to the shock. The Mexican peso once again remained fixed and inflation rose sharply from 2.2 per cent in 1972 to 22.5 per cent in 1974. Eventually, as commodity prices retreated from historic highs, Mexico found itself with a seriously overvalued pegged rate that collapsed in 1976 (from 12.5 to 20.0 pesos per U.S. dollar) and output growth fell to 3.4% in 1977, its lowest level in almost 20 years. The Canadian dollar, in contrast, depreciated in orderly fashion as commodity prices declined and output growth was maintained.

In the 1980s, Canada and Mexico experienced two major shocks: the first, which occurred in the first half of the 1980s, was the Reagan fiscal expansion in conjunction with the Volcker tightening of U.S. monetary policy; the second was the sharp fall in the price of oil in 1986, followed by a strong recovery in commodity prices in 1988-89. The Reagan-Volcker shock had the effect of sharply raising real and nominal interest rates in the United States. In Canada, domestic interest rates also increased as a similar monetary policy was adopted. Nevertheless, the exchange rate depreciated from Cdn$1.15 at the beginning of 1980 to a low of Cdn$1.45 in 1985. While Canada experienced a recession in 1981-82 due to higher interest rates and reduced U.S. demand, it eventually recovered with a healthy expansion, fuelled in part by the depreciated real exchange rate.

Figure 4: *Real commodity prices and the real exchange rate for Canada (1949-71).*

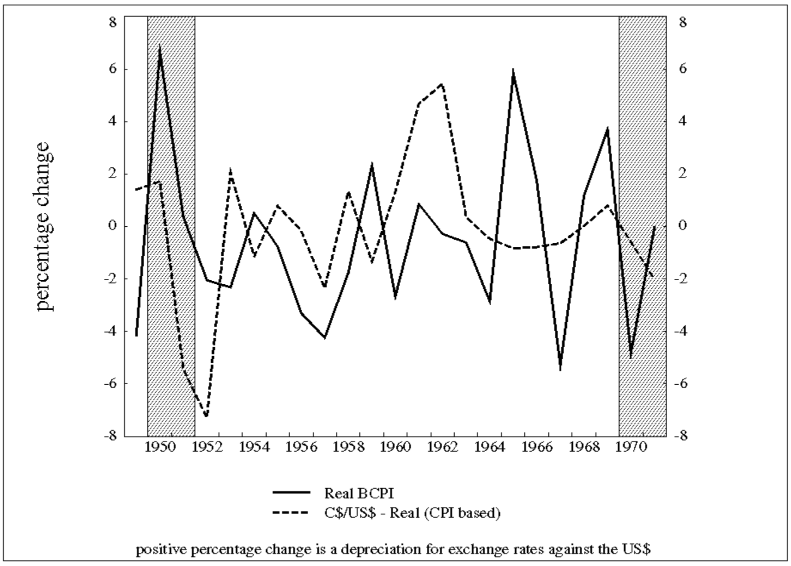
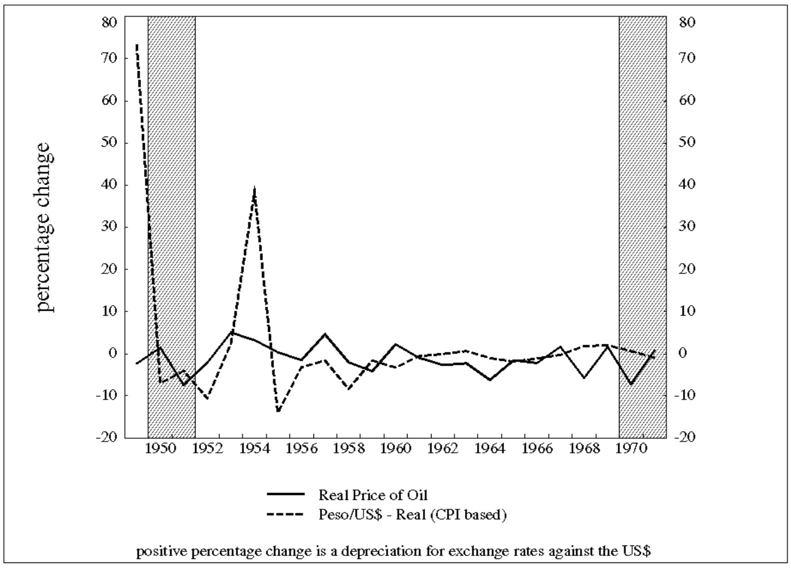


Figure 5: *The real price of oil and the real exchange rate for Mexico (1949-71).*



Note: Shaded areas represent the time periods of the large exogenous shocks examined in this section.

Figure 6: *Consumer prices in Canada, Mexico, and the United States (1949-71).*

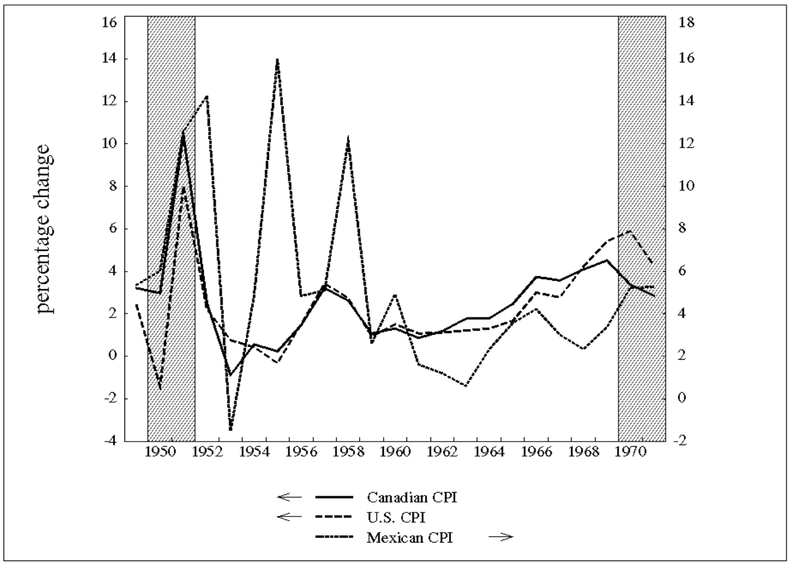
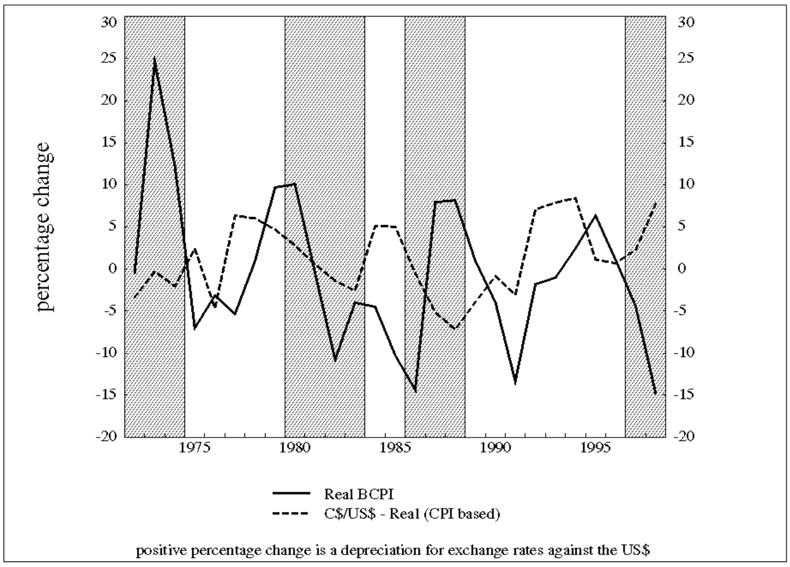


Figure 7: *Real commodity prices and real exchange rate for Canada (1972-98).*



Note: Shaded areas represent the time periods of the large exogenous shocks examined in this section.

Figure 8: *The real price of oil and the real exchange rate for Mexico (1972-98).*

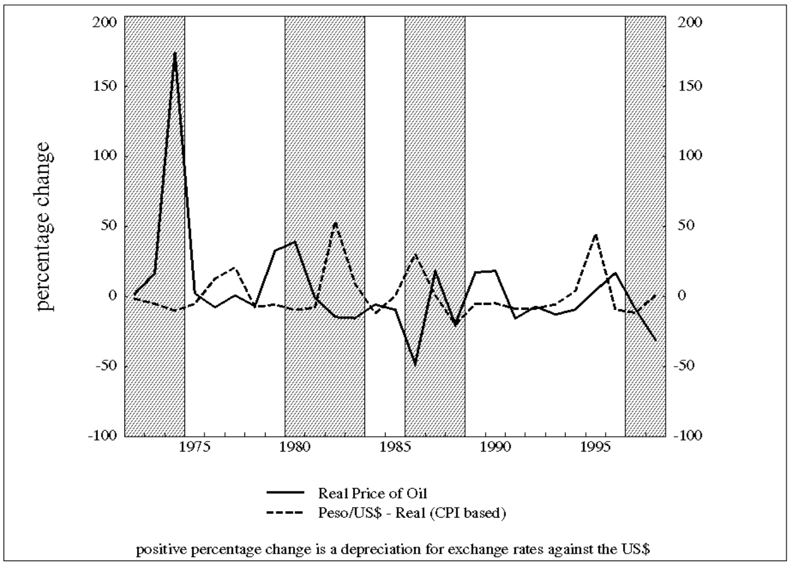
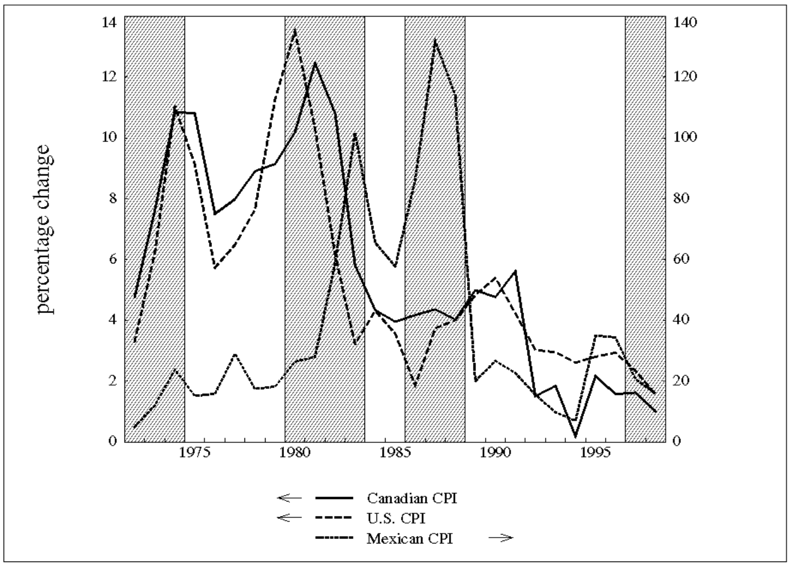


Figure 9: *Consumer prices in Canada, Mexico and the United States (1972-98).*



Note: Shaded areas represent the time periods of the large exogenous shocks examined in this section.

Once again, the Mexican economy fared much worse. In 1982, the pegged rate regime collapsed and the official peso depreciated by almost 300 per cent, which caused the domestic financial sector to implode. Output in Mexico fell by 2% on average over 1982-83 – its worst two-year performance in the entire postwar period. The proximate cause was the Mexican debt crisis. During the latter half of the 1970s, when the price of oil was high and rising, Mexico had borrowed heavily in U.S. dollars to finance the expansion of its domestic oil industry. However, as U.S. interest rates rose and the world economy slipped into recession, these debts could no longer be serviced or rolled over. Although Mexico's adjustable peg was not the root source of the problem, it served to amplify rather than mitigate the impact of the shock. As Osakwe and Schembri (1999) show, the peso should have been allowed to appreciate in the late 1970s, rather than remaining almost unchanged. An appreciating exchange rate would have reduced the incentives to borrow in foreign currency. The peso should have been devalued earlier, when U.S. policies shifted in 1980-81, rather than waiting and allowing it to collapse in 1982.

After peaking in 1980, the prices of oil and other commodities declined until 1986; the Canadian commodity price index fell by 37%, while the price of oil fell by 68% over this period. Non-energy commodity prices fell more sharply at the beginning of the period, whereas the price of oil declined more dramatically towards the end. After 1986, non-energy commodity prices experienced a stronger recovery than oil prices. As noted earlier, the Canadian dollar has a close positive relationship with non-energy prices and this generally held over the 1980s, as the currency depreciated sharply to Cdn$1.44 per U.S. dollar in 1986 and then appreciated to Cdn$1.15 in 1989. By adjusting in this manner, the Canadian dollar served to stabilize the economy over the 1980s, depreciating when the economy was weak early in the period and then appreciating as the economy strengthened towards the end of the decade.

Following the 1982 exchange rate crisis, there were two mini-collapses in Mexico in 1985 and in 1987. Although the peso was officially on a crawling peg during the period 1982-87, it was not depreciating fast enough to accommodate movements in the equilibrium real rate caused by the falling price of oil. As a result a series of exchange rate collapses occurred, which reduced economic activity in Mexico as banking operations and financial markets were disrupted.

The final major exogenous shock to affect both Canada and Mexico was the fall in commodity prices during the recent Asian crisis. From 1993 to 1996, commodity and oil prices increased moderately, but then plummeted by 25% until the end of 1998, due primarily to the fall in demand by the afflicted East Asian countries. Both Canada and Mexico were on a flexible exchange rate at the time and both were able to continue to grow strongly despite the magnitude of the negative shock. Their currencies depreciated and thereby mitigated the impact of the shock on aggregate demand. In Canada, resource-dependent areas were hard hit by the commodity price decline; the damage, however, would have been far worse had the Canadian dollar not been allowed to adjust.

These examples suggest that over the postwar period Canada has been well-served by its flexible exchange rate regime. The flexible exchange rate has adjusted appropriately to large exogenous shocks, thereby helping to accommodate the necessary real exchange rate movement to stabilize the real economy. In contrast, Mexico's predominantly fixed exchange rate regime has consistently retarded the necessary adjustment to exogenous real shocks, thereby sowing the seeds of its many collapses and crises. Rather than mitigating the impact of shocks, Mexico's fixed exchange rate regime has greatly amplified and propagated their effect, primarily by hollowing out and decapitalizing the financial sector, thereby causing disintermediation and disrupting economic activity. Moreover, by hindering real exchange rate adjustment, the fixed exchange rate eventually transformed even positive shocks into negative outcomes (e.g., the oil price increases of the 1970s and the capital inflows resulting in part from the reform process of the early 1990s - both resulted in crises).[21]

4.2. A Simple Test: Provinces Versus States

This section examines data on Canadian provinces and U.S. states in order to assess the stabilizing role of Canada's flexible exchange rate.[22] Unlike U.S. states, all Canadian provinces are heavily dependent on commodity-based products - lumber, pulp and paper, oil and natural gas, metals and minerals, agriculture, fishing, and electricity[23]. In addition, the prices of these products are highly correlated. Thus, it would stand to reason that if the Canadian exchange rate adjusts in a stabilizing manner to commodity price movements, then the output of Canadian provinces should be less variable than comparable commodity-dependent U.S. states, because the latter lack the stabilizing benefit of a flexible exchange rate and are tied to other U.S. states via a common currency.

To test this hypothesis, we first compare the output and export profiles of seven Canadian provinces (we aggregated the Atlantic provinces into one province) and all the continental U.S. states plus Alaska, and for each province select the four most similar U.S. states. We also take into account geographic similarities in our choices[24]. (The province-state concordance is given in Appendix 3). For each of the provinces and states, as well as for the aggregate Canadian and U.S. economies, we then calculate the mean and the standard deviation of output growth over the sample period, 1982-97, as well as the coefficient of variation (i.e., the standard deviation divided by the mean). At the aggregate level, the ratio of the Canadian and U.S. coefficients of variation is 1.30, implying that Canadian output has generally been more variable than U.S. output, which is not unexpected given Canada's dependence on commodity-based products and the relatively high volatility of commodity prices.

Our hypothesis is that if Canada's flexible rate adjusts appropriately in response to commodity price movements, and has a stabilizing macroeconomic effect, then the ratio of coefficients of variation for output of Canadian provinces to comparable U.S. states should be less than the national ratio of 1.30. Table 11A shows that for 23 out of 28 pairings, the ratio of the coefficient of variation of the seven Canadian provinces to comparable U.S. states is less than the national ratio. Indeed, in 19 out of 28 pairings the ratio is less than one. Thus for all provinces, except Manitoba, their output variability is generally much less than for comparable U.S. states.

We can test this outcome against the null hypothesis that the ratios of the province-state pairings are randomly distributed around the national ratio using a normal approximation to the binomial distribution. Under the null hypothesis of a random distribution, the p-value of the outcome that the output of 23 out of 28 provinces is less variable than the output of comparable U.S. states is 0.00046, less than one twentieth of one percent[25]. Thus, the null assumption is strongly rejected by the data.

Table 11A: *Ratios of coefficients of variation (provinces/states)*

	Ontario	Quebec	BC	Alberta	Manitoba	Saskatchewan	Atlantic
Michigan	**0.88**						
New York	**0.88**	**0.76**					**0.72**
Ohio	**1.19**						
Pennsylvania	1.6						
Maine		**0.74**					
Massachusetts		**0.79**					**0.75**
Vermont		**0.96**					**0.91**
Alaska			**-0.03**	**-0.04**			
California			**0.87**				
Oregon			**1.12**				
Washington			**1.29**				
Montana				**0.61**		**0.93**	
Oklahoma				**0.27**			
Texas				**0.98**			
Illinois					1.85		
Iowa					**1**		
Minnesota					1.66		
Wisconsin					2.29		
North Dakota						**0.35**	
South Dakota						1.49	
Wyoming						**0.5**	
New Hampshire							**0.93**
Aggregate Ratio	1.3						

Note: Bold data represent ratios that are less than the aggregate (Can/US) ratio.

Although this rejection is consistent with our hypothesis that Canada's flexible exchange rate mitigates the macroeconomic impact of commodity price shocks, two alternative explanations can be made. The interprovinical tax and transfer system of the Canadian federal government and provincial government borrowing in Canada could also serve as stabilizing mechanisms.[26] Because Canadian federal government transfers are sizable and often designed to mitigate regional inequities, the analysis was repeated by adjusting provincial output data for the effect of net transfers from the federal government. The results are shown in

Table 11B. After this adjustment, the ratios do increase marginally for provinces that are the principal recipients of these transfers (e.g., the Atlantic provinces and Quebec) and they decrease for the remaining provinces that are net payers into the system. Nonetheless, this adjustment does not alter the essential findings in Table 11A: for 23 out of 28 province/state pairings, the ratio of the coefficient of variation is less than the national ratio.

Table 11B: *Adjusted ratios of coefficients of variation (provinces/states)*[1]

	Ontario	Quebec	BC	Alberta	Manitoba	Saskatchewan	Atlantic
Michigan	**0.87**						
New York	**0.87**	**0.80**					**0.73**
Ohio	**1.17**						
Pennsylvania	1.57						
Maine		**0.77**					
Massachusetts		**0.84**					**0.76**
Vermont		**1.01**					**0.92**
Alaska			**(0.03)**	**(0.03)**			
California			**0.86**				
Oregon			**1.11**				
Washington			**1.27**				
Montana				**0.49**		**0.83**	
Oklahoma				**0.21**			
Texas				**0.78**			
Illinois					1.68		
Iowa					**0.91**		
Minnesota					1.51		
Wisconsin					2.08		
North Dakota						**0.31**	
South Dakota						1.34	
Wyoming						**0.45**	
New Hampshire							**0.94**
Aggregate Ratio	1.30						

Notes: Bold data represent ratios that are less than the aggregate (Can/US).
1. Provincial output data are adjusted for federal government transfers, and taxes.

4.3. Response of the Exchange Rate to Various Types of Shocks

Djoudad, Gauthier and St-Amant (2001) study the response of the real exchange rate to various types of shocks affecting Canada and the United States, two countries that have shared a flexible exchange rate since the early 1970s. Their models include the following variables: the price of energy, the price of non-energy commodities, the Canada-U.S. real GDP differential, the Canada-U.S. real exchange rate, the Canada-U.S. consumer prices differential, and the Canada-U.S. short-run interest-rate differential. Their cointegration tests provide uncertain results. Accordingly, they follow two approaches, one of which assumes that there is no cointegration among the variables, and the other incorporating the cointegration relationship between commodity prices and the real exchange rate discussed in Section 3.

To identify types of shocks in the model without cointegration, Djoudad et al. extend the approach put forward by Clarida and Gali (1994). Clarida and Gali estimate VAR models made of the following series for pairs of countries (including Canada and the United States): the real GDP differential, the real exchange rate, and the consumer prices differential. To identify supply, real demand and monetary shocks with their empirical models, they use a small two-country "Mundell-Fleming-Dornbush" model, predicting that only supply shocks can affect the output differential in the long-run and that monetary shocks cannot affect the real exchange rate in the long-run. Djoudad et al. add energy price shocks and non-energy commodity price shocks, which they identify by assuming that the other variables in the model do not affect commodity prices in the long run.

To obtain estimates in the model with cointegration, Djoudad et al. use a variant of the methodology developed by King et al. (1991). This involves the use of a mix of cointegration and a priori long-run restrictions to identify a reduced-form Vector Error Correction Model (VECM). With this methodology, they identify energy price shocks, non-energy commodity price shocks, supply shocks, and demand shocks (the cointegration vector implies that real demand and monetary shocks cannot be distinguished in this case since only commodity price shocks can affect the real exchange rate in the long run).

In the model without cointegration, real demand shocks account for most of the variance of the real exchange rate at all time horizons. When cointegration is included, commodity price shocks account for most of the variance of the exchange rate in the long run, but other shocks, such as demand shocks, remain important in the short run. In this paper, we focus on the results corresponding to these two shocks.

Of particular interest in the context of our paper are the impulse responses of the real exchange rate, the nominal exchange rate, and the Canada-U.S. price differential (shocks are one-standard deviation in size). The responses to a real demand shock (case with no cointegration) and a non-energy commodity price shock (case with cointegration), are shown in Figs. 10 and 11. The vertical axis shows the percentage change in the various series (0.015 is 1.5 percent) and the horizontal axis shows the number of quarters.

Adjustment of the real exchange rate appears to come mainly from movements in the nominal exchange rate. Following a commodity price shock, the Canadian dollar appreciates relative to the U.S. currency, which is consistent with the fact that Canada is a net exporter of commodities. A real demand shock favorable to Canada also causes an appreciation of the Canadian dollar, reflecting the traditional crowding-out effect. In both cases, the differential of price indices between the two countries is left almost unchanged by the shocks. Adjustment of the real exchange rate to the nominal exchange rate indicates that the flexible exchange rate has contributed to macroeconomic adjustment in Canada.

Figure 10: *Response of the real exchange rate, the nominal exchange rate and the price differential to a one-standard-deviation real demand shock (case with no cointegration).*

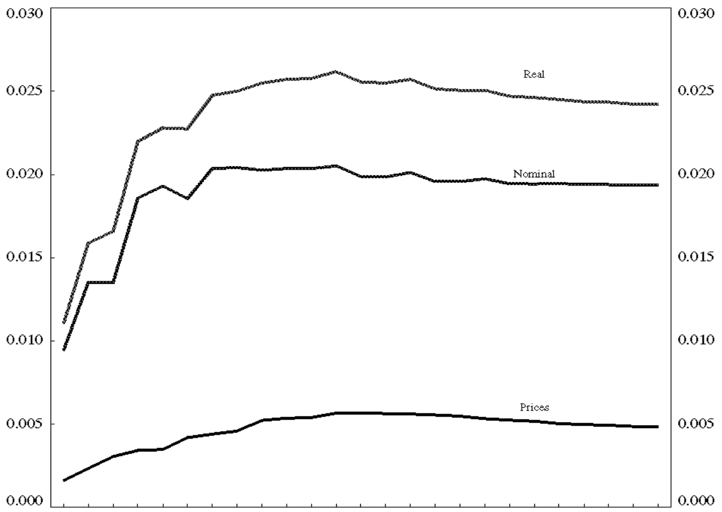
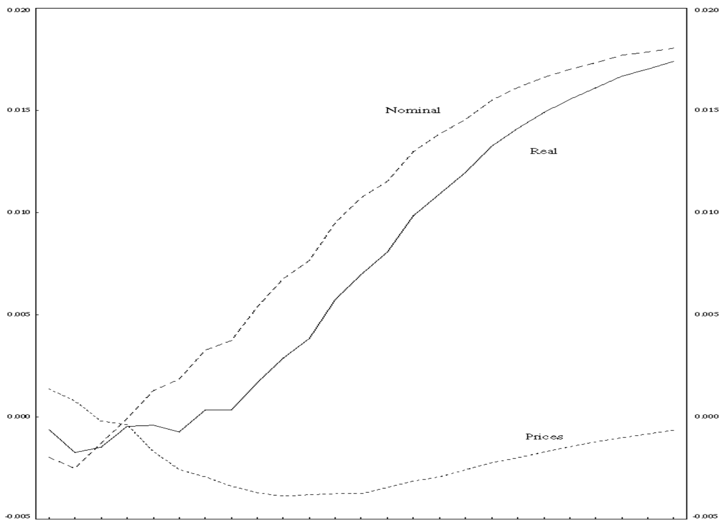


Figure 11: *Impulse responses of the real exchange, the nominal exchange rate and the price differential to a one-standard-deviation commodity price shock (case with cointegration).*



5. Summary and Concluding Remarks

In making the case for flexible exchange rates for North America, we have argued that the Canadian, Mexican and U.S. economies normally experience significant and asymmetric economic shocks, which require real exchange rate adjustment. We then demonstrate that flexible nominal rates generally respond in the appropriate manner, thereby facilitating the necessary real exchange rate adjustment. Finally, we provide evidence to indicate that by facilitating this adjustment, flexible exchange rates mitigate the effect of these shocks on the real economy by reducing output and employment volatility in Canada and Mexico.

The outstanding question, however, is whether this line of reasoning in favor of a flexible exchange rate is sufficient, given the other arguments proffered by the huge literature on optimum currency areas spawned by Mundell's original paper? Clearly, the most obvious omissions from our analysis are the issues of monetary sovereignty/governance and transactions costs.

Both Mexico and Canada have relatively independent central banks that are responsible for implementing monetary policy. Both central banks have also adopted some form of inflation targeting as a nominal anchor in conjunction with their flexible exchange rates. This combination provides a coherent monetary order that is sustainable, transparent and publicly accountable. Thus, there are additional benefits from this monetary order that we have not considered.[27]

Broadly defined, the transaction costs associated with national currencies and flexible exchange rates can take many forms: currency translation, hedging, impediments to trade and investment, risk premia in Mexican and Canadian interest rates and inefficiencies due to lack of comparability of prices across borders. Moreover, these costs are probably not as small as many believe. Although estimates are normally in the range of 0.2 to 0.5 per cent of GDP per annum, recent work by Helliwell (1996), McCallum (1995), Rose (1999) and others finds unexpectedly large border/currency effects on trade flows. There is less tangible evidence for investment flows, yet many, including Courchene and Harris (1999), believe they are significant.

At this juncture, we believe that these transactions costs are not large enough to outweigh the substantial macroeconomic stability benefits of a flexible exchange rate. However, if the Canadian and Mexican economies became even more integrated into the U.S. economy and with each other, North American trade and investment flows may grow larger and the potential costs of having separate currencies could increase. Moreover, as the Canadian and Mexican economies evolve through the accumulation of human and physical capital, their economies may become more diversified and similar to that of the United States. Indeed, Mexico's dependence on oil has fallen substantially over the last 10 years. Hence, shocks may become less asymmetric and the benefits from having a floating rate could decline.

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Appendix 1. Composition of the Nine Regions of the Unites States

Table A1.1: *Composition of the nine regions of the United States*

Regions	Composition
New England	Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut
Middle Atlantic	New York, New Jersey, and Pennsylvania
East North Central	Ohio, Indiana, Illinois, Michigan, and Wisconsin
West North Central	Minnesota, Iowa, Missouri, South Dakota, North Dakota, Nebraska, and Kansas
Southern Atlantic	Delaware, Maryland and Colombia District, Virginia, West Virginia, North Carolina, South Carolina, Georgia and Florida
East South Central	Kentucky, Tennessee, Alabama, and Mississippi
West South Central	Arkansas, Louisiana, Oklahoma, and Texas
Pacific North West	Alaska, Idaho, Montana, Oregon, Washington and Wyoming
Pacific South West	Arizona, California, Colorado, Hawaii, New Mexico, Nevada and Utah

Note: The groupings are by DRI.

Appendix 2. Impulse Responses - North American VAR Model

Figure A2.1: *Response of output to the various types of shocks in Canada*

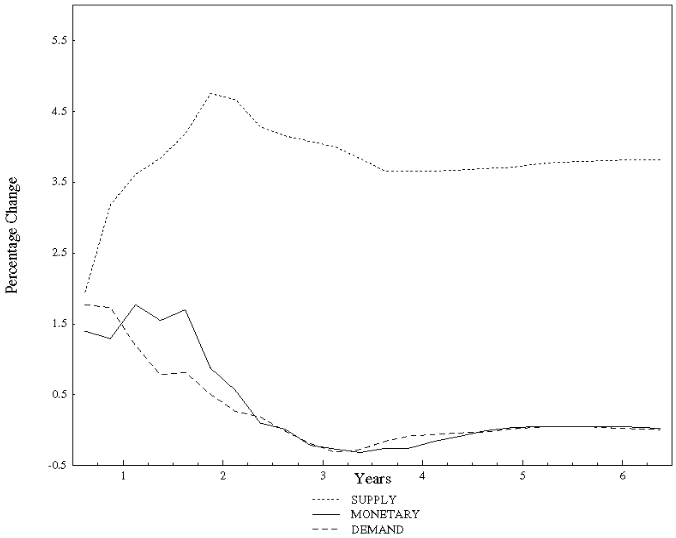


Figure A2.2: *Response of output to the various types of shocks in the United States.*

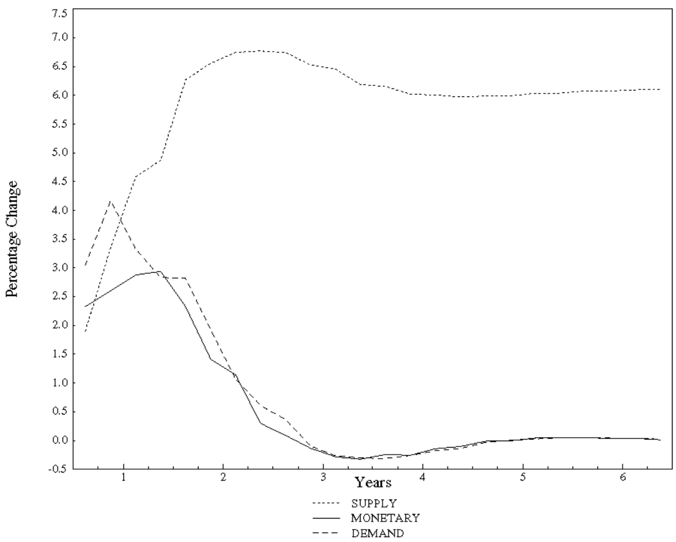


Figure A2.3: *Response of output to the various types of shocks in Mexico.*

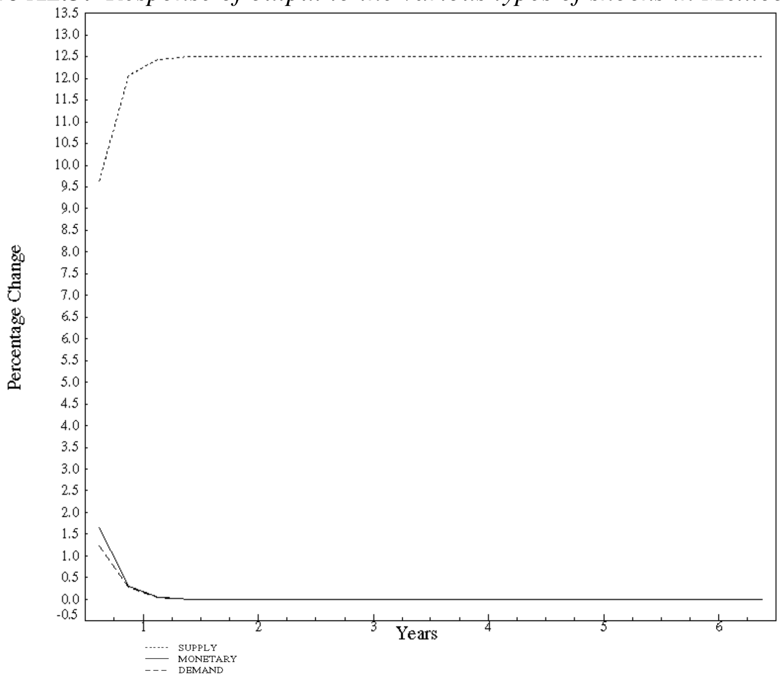


Figure A2.4: *Response of inflation to the various types of shocks in Canada.*

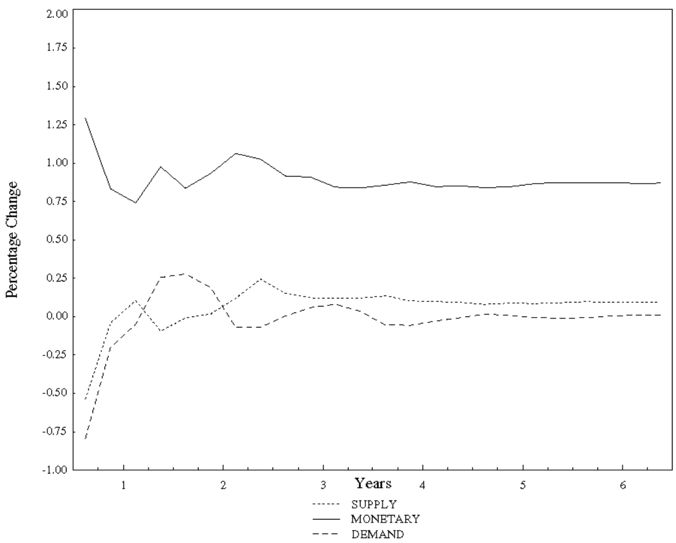


Figure A2.5: *Response of inflation to the various types of shocks in the United States.*

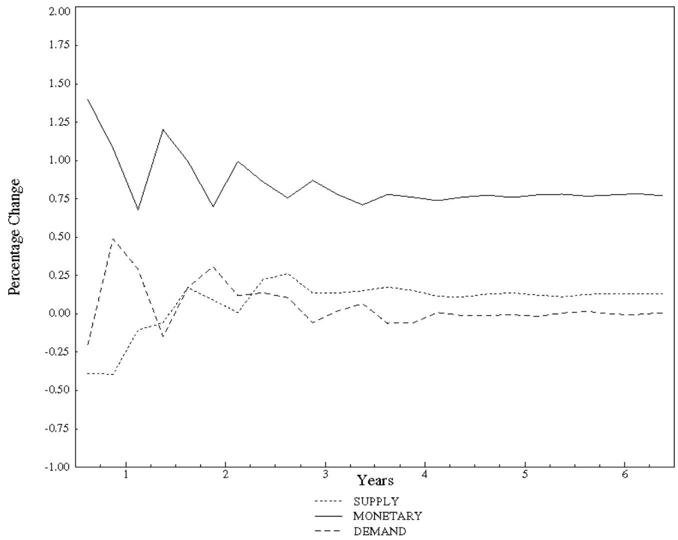


Figure A2.6: Response of inflation to various types of shocks in Mexico.

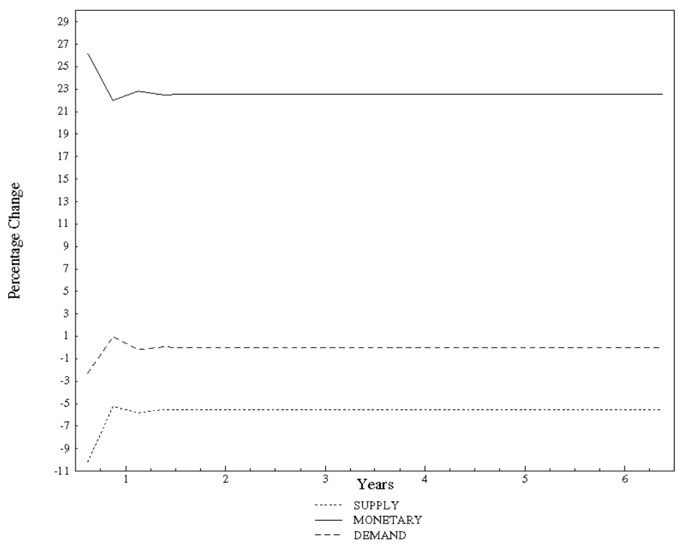


Figure A2.7: *Response of real interest rates to the various types of shocks in Canada.*

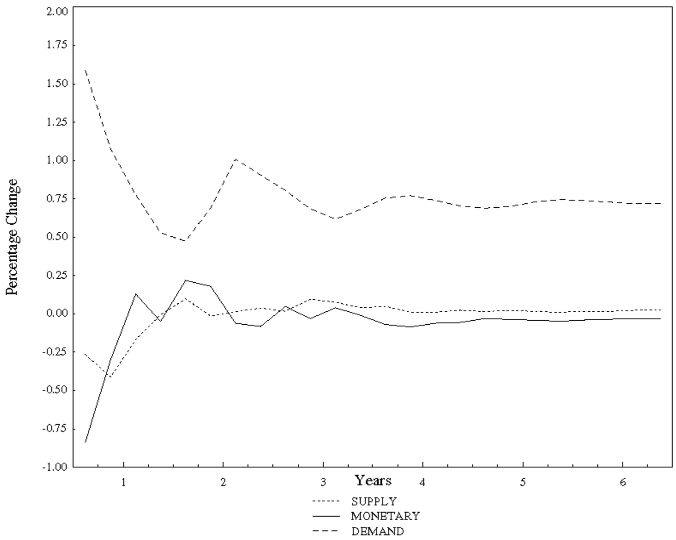


Figure A2.8: *Response of real interest rates to the various types of shocks in the United States.*

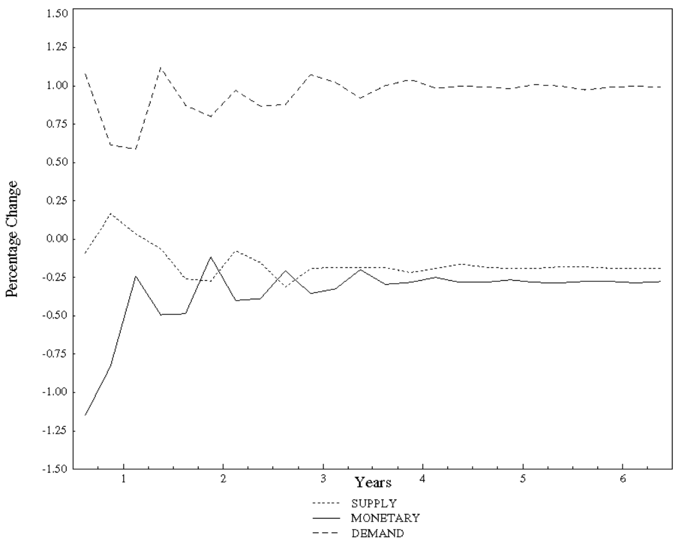
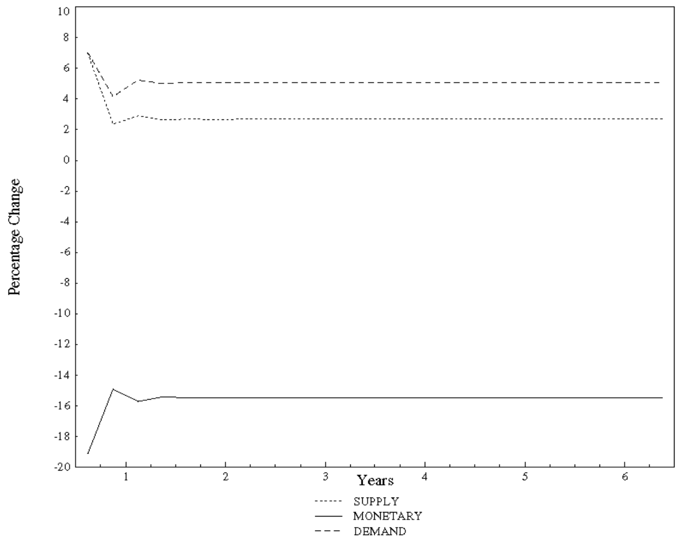


Figure A2.9: *Response of real interest rates to the various types of shocks in Mexico.*



Appendix 3. Provincial-State Concordance

Table A3.1: *Provincial – state concordance*

Province	Main Exports	Comparable U.S. States
Atlantic Provinces	Agricultural, forestry, energy	Maine, New Hampshire, New York, Massachusetts (Vermont)
Québec	Machinery and equipment, industrial, forestry	New York, Vermont, Maine, Massachusetts (New Hampshire)
Ontario	Automotive, machinery and equipment, industrial	New York, Ohio, Michigan, Pennsylvania (Kentucky)
Manitoba	Agricultural, machinery and equipment, industrial	Minnesota, Wisconsin, Iowa, Illinois (Kansas)
Saskatchewan	Agricultural, industrial	Montana, North Dakota, South Dakota, Wyoming (Minnesota)
Alberta	Energy, industrial and agricultural	Oklahoma, Texas, Alaska, Montana (Idaho)
British Columbia	Forestry, energy, industrial	Washington, Oregon, California, Alaska (Maine)

Notes

1. Executive, Bank of Canada. E-mail: jmurray@bankofcanada.ca
2. International Department, Bank of Canada. E-mail: Lschembri@bankofcanada.ca
3. Department of Monetary and Financial Analysis, Bank of Canada. E-mail: pstamant@bankofcanada.ca
4. Canada began formal inflation targeting in February 1991, when the government and the Bank of Canada announced a target path for reducing inflation to the 1 to 3 per cent range by the end of 1995. This target range has been extended three times since then, most recently until the end of 2006. In 1998, the Banco de Mexico adopted an informal target of 12 per cent (actual inflation in 1998 was 18 per cent) and the target for 1999 was 13 per cent. By 2003, the inflation target will be a band similar to those of its major trading partners, roughly 0 to 3 per cent.
5. For Canada, recent contributions to the debate include: Courchene and Harris (2000) and Grubel (2000) in favor of fixed rates; and Crow (1999), McCallum (1999), Murray (2000) and Lafrance and Schembri (2003) in favor of flexible rates. For a recent debate on Mexico's exchange rate policy, refer to the *Journal of Money, Credit and Banking*, May 2001.
6. In this paper, we define asymmetric shocks as shocks having negative or small positive correlations.
7. We make the usual assumption that (1) is invertible. For a discussion of the cases where (1) is not invertible, see Lippi and Reichlin (1993).
8. Industrial production data are used because they are more readily available on a quarterly basis than GDP data for Mexico and the regions of the United States.
9. The only exception is that the unit root in Mexican inflation could be rejected. However, for the sake of consistency across models, Mexican inflation is assumed to be nonstationary. The rejection of the unit root in Mexican inflation might be due to the bias in the test induced by the presence of a large negative moving-average component in the process (Schwert, 1987).
10. Unit root and cointegration tests are available upon request.
11. Simulations performed by DeSerres and Guay (1995) indicate that this approach is to be preferred to other approaches such as Akaike or Schwarz information criteria for the specification of structural VARs with long-run restrictions.
12. For more discussion on related methodologies see Dupasquier, Lalonde, and St-Amant (1997), Bayoumi and Eichengreen (1993), and Blanchard and Quah (1989).
13. We consider the response of aggregate data for the United States instead of regional data in order to economize on space. We verified that regional responses are similar to aggregate responses.
14. Results similar to those presented in Table 6 were obtained using data filtered with an Hodrick-Prescott (HP) filter (the smoothing parameter was set at 1600).
15. Dupasquier, Guay, and St-Amant (1999) discuss this component as a measure of the business cycle and compare it with other measures.

16. The original specification was developed by Amano and van Norden (1993). The specification described above differs from the original equation in three respects. First, the energy and non-energy terms of trade variables are deflated by the U.S. GDP price index rather than the price of manufactured goods. Second, oil prices are used as a proxy for all energy prices. Third, the interest-rate differential is simply the spread between 90-day commercial paper rates in Canada and the United States rather than the difference between long-term and short-term interest rates in the two countries. These changes do not affect the performance of the equation in any significant way and were introduced mainly to simplify it and reduce the number of data series required to use it. See Djoudad et al. (2001) for a recent update.
17. We tested for cointegration between oil, non-oil commodities and the exchange rate. The tests did not show clear evidence of a cointegrating vector among these variables.
18. See Otker and Pazarbasioglu (1995) for more details.
19. A structural VAR analysis by Guay and St-Amant (1995) indicates that oil prices fluctuations can account for a large portion of output fluctuations in Mexico over the 1970s and the 1980s.
20. Canada was on a fixed rate from 1945-50 and again from 1962-70 while Mexico was on a flexible rate for brief periods immediately after crises in the 1970s and 1980s and also from 1995-99. Powell (1999) provides a useful overview of the history of the Canadian dollar.
21. In a Wall Street Journal article, Bank of Mexico Governor Ortiz (1999) praised the recent performance of Mexico's flexible exchange rate, stating "the flexible exchange rate allowed the Mexican economy to weather the real and financial shocks of 1998."
22. McCallum (1999) first raised the issue and performed an analysis with a limited number of Canadian provinces and U.S. states. He reached the tentative conclusion that the Canadian flexible rate is a useful shock absorber for these provinces, because they seem to perform better than comparable U.S. states.
23. Although Ontario is the Canadian province that is the least dependent on primary commodities, in 1997 approximately 22 percent of its exports were primary-commodity based. For the Canada, Mexico and the United States, comparable figures are 37, 20 and 18 per cent.
24. The rationale for choosing four states per province is to obtain a sample of reasonable size and to insure that the matched provinces and states are not too dissimilar. Note that the results do not change significantly if five states are chosen instead of four.
25. Although the current experiment does not exactly match the conditions necessary for application of the binomial distribution, (i.e., the Bernouilli trials are not identical nor completely independent), they are close enough, especially given the overwhelming strength of the rejection of the null hypothesis.

26. The U.S. federal government also engages in interstate transfers, in part motivated by a desire to redistribute income across states (e.g. military expenditures). Such intentions are often implicit, however. No formal program exists in the United States that is comparable to the interprovincial transfer program in Canada.
27. See Laidler (1999) for further details.

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Prospects of a Monetary Union in North America: An Empirical Investigation

Leo Michelis[1]
Ryerson University

Abstract. This paper examines the issue of a regional currency union among the NAFTA members Canada, Mexico and the US. Drawing from the theory of optimum currency areas, (OCAs) and the long-run convergence properties of some key macroeconomic variables, we assess the conditions for both the existence of an OCA and a successful monetary union within NAFTA. The data set includes trade flows, indices for economic openness, growth rates of industrial production, foreign direct investment, regional GDP growth rates between Canada and the US, short term and long term interest rates, exchange rates and inflation rates. Using correlation and cointegration analysis, the empirical results indicate that while a common currency may be feasible between Canada and the US, it is less likely to be achieved among the three countries.

1. Introduction

Following Mundell's (1961) classic contribution on the theory of optimum currency areas (OCAs), interest on this topic intensified in the 1990s with a lag of almost 30 years. Mundell demonstrated that a fixed exchange rate system is the optimal monetary arrangement among a group of countries or regions that are subject to similar and symmetric economic shocks. On the other hand, if the shocks are asymmetric or idiosyncratic, factor mobility among the regions, wage-price flexibility and fiscal transfers are required to sustain fixed exchange rates.

McKinnon (1963) extended the theory by suggesting openness of an economy as a criterion for choosing an OCA. Kenen (1969) added the criterion of economic diversification, in the sense that diversified economies are more likely to have correlated economic shocks and thus require a common policy response.

Since the early 1990s the literature on OCAs has been large and growing. Applied researchers have studied the conditions under which certain groups of countries or regions are OCAs. Eichengreen (1992), among others, examined the question of whether the EU is an OCA by computing the volatility of bilateral real exchange rates and comparing it to the volatility of relative prices within different regions of the US. The basic idea is that regions with more highly correlated shocks will have less volatile real exchange rates. He found that EU real exchange rates were more volatile than the relative prices of the US regions. The implication of this finding is that the EU was further away than the US from being an OCA.

Decressin and Fatas (1995) examined regional labour dynamics in Europe and compared their findings to those obtained by Blanchard and Katz (1992) for the

US. They found that shocks to labour markets in Europe are 80 per cent region specific, while in the US the same shocks are only 40 per cent state specific. Also, in Europe labour market shocks are absorbed in changes in the participation rates, while in the US they induce labour migration. Based on Mundell's OCA criteria these results suggested that the EU would form a less suitable monetary union than the US.

Bayoumi and Eichengreen (1997) related movements in actual European exchange rates to variables suggested by the OCA theory: asymmetric output disturbances, trade links and country size. They found empirical support for the theory of OCAs. Frankel and Rose (1997) pointed out that both international trade patterns and business cycle correlations are endogenous, in the sense that countries that trade more tend to have more highly correlated business cycles. Thus economic integration may help a country to satisfy the conditions for entry into a currency union.

Following the ratification of NAFTA, the debate on economic and monetary integration has gained considerable momentum in North America. Closer trade links through NAFTA imply greater economic links among the US, Canada and Mexico and greater prospects for monetary unification in the future among the three countries. In Canada the debate has centered on monetary arrangements within NAFTA and the advantages and disadvantages of fixed versus flexible exchange rates. The emerging literature has reached diverging conclusions.

White (1994) evaluated the economic and monetary conditions in Canada and Mexico and concluded that a flexible exchange rate regime would suit the needs of both countries better – more so for Canada than Mexico. He argued that the benefits of monetary unification in the form of elimination of currency conversion costs and exchange rate uncertainty would be small compared to the costs of adopting a common currency. He pointed out that both Canada and Mexico have relatively large primary goods sectors and as such are subject to asymmetric shocks. NAFTA itself does not provide for labour mobility within the three countries or for fiscal cross-border transfers in order to smooth out these shocks. Further the Bank of Canada has a good track record of maintaining price stability, and a flexible exchange rate allows Canada to pursue its own independent monetary policy. On this issue, the case for Mexico may not be as clear-cut. A policy that ties the Mexican peso closely to the US dollar is instrumental in borrowing monetary credibility from the US Fed and thus reducing the Mexican inflation rate and interest rates.

Murray (1999) compared the Canadian economy and the US economy and concluded that a flexible exchange rate regime is better for Canada given the structural differences between the two countries and the desire for monetary policy independence. Courchene and Harris (1999) reached different conclusions. They indicated that Canada's experience with flexible rates has been disappointing given the high volatility of real exchange rates and the prolonged misalignment of the Canadian dollar from its equilibrium value. A weak Canadian dollar contributes to the low productivity of the Canadian firms competing in the foreign sector and it biases investment in physical and human capital toward the US. Since NAFTA implies greater trade links with the US, these authors favour greater exchange rate fixity vis-à-vis the US dollar. Examining all the different types of fixed exchange rates, they recommended a North American Monetary Union (NAMU) within NAFTA.

Grubel (1999) made similar arguments by pointing out that flexible exchange rates have not delivered the expected results in Canada. Unemployment has remained high and labour market flexibility has been lower because of flexible rates. Also the high volatility of the Canadian dollar has increased the exchange rate risk premium and resulted in higher Canadian interest rates. A common currency, the *amero*, would improve Canada's position within NAFTA by eliminating currency conversions costs and exchange rate risk premia, as well as by reducing interest rates and the volatility of the general price level.

Bayoumi and Eichengreen (1994) have given a comprehensive empirical assessment of monetary and exchange rate arrangements for NAFTA. Using data of various time spans from 1963 to 1989 and the Blanchard and Quah (1989) methodology of computing demand and supply shocks, they studied the nature and transmission of economic shocks in Eastern and Western Canada, eight regions of the US and Mexico. They found that economic shocks are more asymmetrically distributed within NAFTA than in the EU, and consequently the costs of giving up the exchange rate and forming a NAMU are likely to be larger.

In this paper I examine empirically the prospects of a North American monetary union. The present analysis differs from the existing literature in two important respects. First, I use a more recent data set that ranges, depending on data availability, from 1950 to 1999. Second, to guide my empirical analysis, I make a useful distinction between the conditions that characterize an OCA and the conditions that are necessary for a successful monetary union. I consider the OCA conditions empirically as in Bayoumi and Eichengreen (1994) by analyzing trade data and correlations of real GDP growth rates in four Canadian regions, eight US regions and Mexico. Next, I evaluate the prospects of a NAMU using cointegration analysis on some key macroeconomic variables. In particular, I examine long-run co-movements in regional GDPs, short term and long term interest rates, exchange rates and inflation rates.

The rest of the paper is as follows. Section 2 states the conditions for OCAs and currency unions. Section 3 describes the data and discusses the empirical results. Section 4 concludes the paper.

2. OCAs and Currency Unions

This section draws a clear distinction between an OCA and a currency union, and states the conditions that must be satisfied for either a successful OCA or monetary union to exist.

2.1. Optimum Currency Areas

A currency area is basically a collection of countries or regions that operate under some tight form of fixed exchange rates. Kenen (1997) gives a useful definition of a currency area.

Definition 1: *Currency Area*
"A currency area is a group of countries that undertake to contain their bilateral exchange rates within narrow bands defined in respect of agreed central rates which they cannot change unilaterally."

The Exchange Rate Mechanism (ERM) of the EMS is an example of a currency area. Based Mundell's pioneering contribution, economists have basically agreed on the following criteria that make a currency area optimal; that is, criteria for an OCA to exist:
(a) Regions are exposed to common economic shocks
(b) The shocks are similar or symmetric
(c) The regions should have similar responses to common shocks
(d) If regions are subject to asymmetric or region specific shocks, they need to be capable of quick adjustment.
McKinnon (1963) suggested a fifth OCA criterion:
(e) The more open an economy is the more ready it will be to join an OCA.

McKinnon showed that for a small open economy wishing to achieve simultaneously internal balance, external balance and price stability the optimal policy is to adopt fixed exchange rates. In this setting, flexible exchange rates contribute to greater variability of the domestic price level and the negative effects of exchange rate variability are likely to be larger the more open is the economy.

2.2. Currency Union

A currency or monetary union exists if the members of the union adopt a common currency and there is one monetary policy for the whole union. Here again we state a definition given by Kenen (1997).

Definition 2: *Monetary Union*
"In a monetary union there is one money, one central bank and one monetary policy."

Clearly, a currency union is an extreme option within an OCA system of fixed exchange rates, whereby the fixed exchange rates have been eliminated and a new currency has been introduced.

Along with the OCA criteria, some additional conditions must be satisfied for a successful monetary union to exist and be maintained. These conditions include credible policy actions by the member states so as to make their economic policies converge to a common trend that is consistent with achieving and maintaining a currency union.[2] Further, there should be a tendency for convergence in some key real variables for a monetary union to be viable in the long-run. For these reasons, in this paper, we study the long-run co-movements of regional real GDPs, short term and long-term interest rates, exchange rates and inflation rates among the three countries.

The statistical concept of cointegration is a useful device to formalize nominal convergence and evaluate empirically the prospects of a successful currency union within NAFTA. If there exist stationary linear combinations of a set of *n* nonstationary variables, then we say that these variables are cointegrated. These linear combinations or cointegrating relations describe stable long run equilibria among these variables that are driven by a number of "common stochastic trends". If the number of cointegrating relations is *r* then the number of common stochastic trends is *n-r*. For a concrete example, consider the inflation rates of Canada, the US and Mexico and assume that each is a nonstationary variable. If the three inflation rates are cointegrarted once, then they are bound together by a stable long-run equilibrium relation, which in turn implies that the monetary policies of the three countries have converged to two stochastic common trends that determine the stable equilibrium relation.

To evaluate the likelihood of a currency union within NAFTA, we test for the long-run co-movements of the following variables among the three member countries:
(a) Co-movement of regional GDP growth rates
(b) Co-movement of short term and long term interest rates
(c) Co-movement of nominal exchange rates
(d) Co-movement of inflation rates

3. Data and Empirical Results

This section first describes the data used in the empirical analysis including their sources and the necessary currency conversions for the purpose of international comparisons. Next, the empirical findings are presented and analyzed both with respect to the OCA criteria and the nominal convergence criteria for a currency union.

3.1. Data

The data set used for the empirical analysis ranges over the time period 1948-2000 with shorter time spans for certain time series at annual or quarterly frequencies. More specifically, the exports, imports and total trade data are given at annual frequencies over the period 1994-1999. They are measured in millions of US dollars and were obtained either from Industry Canada (Canada/US, Canada/Mexico) or the IFS-Directory of Trade Statistics, 1999, IMF (Mexico/US). The data on foreign direct investment were obtained for the period 1994-1999 from two sources: the US Bureau of Economic Analysis (BEA) (for Canada/US and Mexico/US data) and from the Canadian Ministry of Foreign Affairs and International Trade (for

Canada/Mexico data). The growth rates of industrial production for the three countries range over the period 1994-1998 and were constructed from index numbers of industrial production found in the Monthly Bulletin of Statistics, September 1999, UN, at base period (1990=100). The correlations of GDP growth rates for the three counties were computed from annual observations over the period 1981-1999 and were obtained from the CANSIM data base for Canada and from the IFS-CD, 2000 IMF for the US and Mexico. To make the data from the three countries comparable internationally the three time series were converted to constant 1993 US dollars using exchange rates implied by purchasing power parity theory. For example, if Y is real Canadian GDP in constant 1993 Canadian dollars and E=P/P*, where P and P* are the Canadian and US GDP deflators at base period 1993, then y=Y/E will give the value of the Canadian GDP expressed in 1993 US dollars. The same procedure was followed whenever conversions of this type were required for other series, such as regional GDP values for Canada and the US. The Canadian regional GDP data span the period 1981-1999 and were obtained from the CANSIM tape for four regions: Atlantic, Central, Prairies and BC-Territories. The data for the eight US regions were obtained from the website of the Bureau of Economic Analysis (BEA), US-Department of Commerce. The eight US regions are: New England, Mid East, South East, Great Lakes, Plains, Rocky Mountains, South West and Far West. The detailed breakdown for the Canadian and US regions are given in the Appendix. The data for short-term interest rates for the three countries are given in quarterly frequencies over the time period 1978:1–2000:3 and were obtained from the IFS-CD, 2000-IMF. The data for long-term interest rates were obtained from the same source and are given at annual frequencies over the time period 1985-1999. The data for the nominal exchange rates were also obtained from the IFS tape at annual frequencies over the time span 1948-1999. Finally, the inflation data for the three countries come from the same source and span the time period 1949-1999, at annual frequencies.

3.2. Is the NAFTA Region an OCA?

It should be clear from the discussion above that if a group of economies is subject to symmetric economic shocks, the economies are flexible enough to handle asymmetric shocks, and they are also open economies with high trade links, then it is highly likely that they will have synchronized business cycles and will require a common policy response; that is the group of economies will be an OCA.

To check this hypothesis empirically we first look at trade links among the three countries since the ratification of the NAFTA treaty in 1994. Table 1 shows trade flows in NAFTA over the period 1994-1999 in millions of US dollars. As seen from the table, total exports, imports and total trade have increased uniformly among the US, Canada and Mexico. Table 2 shows the indices of economic openness in terms of the ratios exports/GDP, imports/GDP and total-trade/GDP. As shown in the table, all three economies have become more open to each other since the beginning of the NAFTA period. Canada´s total trade shares with the US and Mexico have increased from 41.6 per cent and 0.73 per cent, respectively, in 1994 to 53.4 per cent and 1.14 per cent respectively in 1999. Similarly, Mexico´s total trade shares with both Canada and the US have gone up, especially with the US where the total trade shares has almost doubled in five years since the signing of NAFTA. Further, as seen from the last panel of Table 2, the US total trade shares with Canada and Mexico have risen marginally. Table 3 shows foreign direct investment for the three countries in millions of US dollars. As seen from the table, the foreign direct investment between Canada and the US has increased uniformly in both directions between 1994 and 1999. The same is true for foreign direct investment between the US and Mexico, except for Mexican direct investment into the US for the years 1995 and 1996, where, in fact, FDI is negative. This most likely is due to the aftermath of the 1994 peso financial crisis. On the other hand, foreign direct investment between Canada and Mexico has been relatively small, fluctuating around an upward trend. By and large, all three countries show fluctuating but increasing volumes of investment in both directions. This will tend to strengthen the economic links and integration among the three countries.

Table 1: *Trade Flows in NAFTA (millions of $US)*

	Canada/ U.S.			Canada/ Mexico			Mexico/ U.S.		
	Cdn. Exports	**Cdn. Imports**	**Total Trade**	**Cdn. Exports**	**Cdn. Imports**	**Total Trade**	**Mex. Exports**	**Mex. Imports**	**Total Trade**
1994	134196	100550	234746	793	3313	4106	49494	50843	100337
1995	151348	109772	261120	846	3899	4745	62101	46311	108412
1996	163678	115109	278787	923	4426	5349	74297	56972	131269
1997	176160	133202	309362	923	5072	5995	85938	71388	157326
1998	181999	137273	319272	989	5180	6169	94629	78772	173401
1999	207335	145054	352389	1085	6422	7507	109721	86909	196630

Source: Industry Canada

Table 2: *Indices of Country Openness*

	Canada		Mexico		U.S.	
	Total Mex. Trade/GDP	**Total U.S. Trade/GDP**	**Total Cdn. Trade/GDP**	**Total U.S. Trade/GDP**	**Total Cdn. Trade/GDP**	**Total Mex. Trade/GDP**
1994	0.73%	41.59%	0.97%	23.66%	3.33%	1.42%
1995	0.80%	44.22%	1.64%	37.40%	3.53%	1.46%
1996	0.87%	45.42%	1.61%	39.40%	3.57%	1.68%
1997	0.94%	48.52%	1.49%	39.18%	3.72%	1.89%
1998	1.00%	51.77%	1.46%	41.07%	3.64%	1.97%
1999	1.14%	53.39%	1.56%	40.84%	3.80%	2.12%

Sources: Trade Data: Industry Canada. Exchange Rates: Bank of Canada. Canadian GDP: CANSIM, Statistics Canada. Mexican GDP: Organization for Economic Cooperation and Development. U.S. GDP: U.S. Bureau of Economic Analysis.

Table 3: *Direct Investment in NAFTA (millions of $US)*

	Canada/U.S.		**Canada/Mexico**		**Mexico/U.S.**	
	Cdn. DI in U.S.	**Cdn. DI from U.S.**	**Cdn. DI in Mex.**	**Cdn. Di from Mex.**	**Mex. DI in U.S.**	**Mex. DI from U.S.**
1994	4583	6047	389	23	1058	4457
1995	4824	8602	-91	-16	-263	2983
1996	8590	7181	719	112	-47	2405
1997	8380	7642	161	44	331	5596
1998	15958	7831	458	147	871	4593
1999	21241	15947	320	NA	1269	5084

Source: Canada and U.S.: IFS-2000, International Monetary Fund. Mexico: Economic Outlook-2001, OECD.

Table 4 reports the growth rates of four categories of industrial production for the period 1994-1998: general, mining, manufacturing and electricity, gas and water. All growth rates are volatile around their mean values. For the years 1996, 1997, and 1998 the growth rates for Mexican manufacturing have been higher than in the other two countries. The reason for this is the increase in manufacturing activity following NAFTA in the Mexican states bordering the US (maquiladoras).

Table 4: *Growth Rates for Industrial Production*

Canada	**1994**	**1995**	**1996**	**1997**	**1998**
General	6.5	4.72	1.33	5.23	2.4
Mining	4.67	5.06	1.96	4.09	-0.23
Manufacturing	7.71	4.9	1.26	6.57	3.83
Electricity, Gas and Water	2.87	2.98	1.27	0.36	-0.02
U.S.	**1994**	**1995**	**1996**	**1997**	**1998**
General	5.45	4.89	4.41	6.13	3.59
Mining	2.52	-0.49	1.75	2.02	-1.78
Manufacturing	5.98	5.47	4.67	6.9	4.18
Electricity and Gas	1.32	3.55	3.25	0.44	0.96
Mexico	**1994**	**1995**	**1996**	**1997**	**1998**
General	4.97	-7.9	10.18	9.15	6.61
Mining	2.91	-3.11	8.17	4.41	3.45
Manufacturing	4.07	-4.91	10.8	10.01	7.37
Electricity, Gas and Water	4.99	1.9	4.58	5.28	4.47

Note: Constructed from index numbers of industrial production (1990=100).
Source: Monthly Bulletin of Statistics, September 1999, United Nations.

Table 4A gives the correlations of GDP growth rates for the US, Canada and Mexico. These correlations are based on data converted to constant 1993 US prices as described in the section 3.1 above. As shown in this table, the correlation coefficient between the Canadian and US GDP growth rates is quite high at 80.1 per cent. By contrast, the corresponding correlations for the pairs US-Mexico and Canada-Mexico are much smaller in magnitude at -6.6 per cent and 15.7 per cent respectively. This evidence provides a strong support to the claim that the Canadian and US economies are highly integrated and their business cycles are highly synchronized. By contrast, neither the US-Mexican economies nor the Canadian-Mexican economies are at pace with each other. In fact the evidence in Table 4A shows that the US and Mexican economies are largely independent of each other, and if anything they tend to move in opposite directions. The fact that the correlation coefficient for Canada and Mexico is positive and larger that the correlation coefficient between the US and Mexico may be due to the fact that the two former economies have relatively larger primary goods sectors that are likely to follow the same international business cycle.

Table 4A: *Correlations of Annual GDP Growth: US, Canada, Mexico, 1981-1999*

CORR(US, CAN) =	0.801
CORR(US, MEX) =	-0.066
CORR(CAN, MEX) =	0.157

Note: Data are measured in constant 1993 US dollars.
Sources: Canadian GDP: CANSIM, Statistics Canada. US, Mexican GDPs: IFS-2000, International Monetary Fund.

In order to gain more insight into these issues, we look at more disaggregated data for Canada ad the US.[3] Table 5 shows the correlation coefficients of regional GDP growth rates for Canada and the US. As seen from the table, every Canadian province and territory is highly correlated with Canada itself, with Quebec, Manitoba, Ontario and BC leading the way. This is also true for the four Canadian regions, with the Central (Ontario and Quebec) region having a 92.2 per cent correlation coefficient with Canada. This number shows the importance of these two provinces for the Canadian economy. Clearly, based on this evidence one can argue that Canada itself is an OCA that can adjust rather easily to economic shocks.

The same claim can be made also for the US. The eight US regions are highly correlated with the US itself. The highest correlation coefficient is attained with the South East region followed by the Far West, the Plains and the Mid East. Based on this evidence, it is clear that the US, like Canada, is an OCA.

Table 5: *Correlations of Annual Regional GDP Growth Rates: Canada, U.S., 1981-1999*

Canada	Corr. With CAN	U.S.	Corr. with U.S.
Alberta	0.654	New England	0.795
B.C.	0.830	Mid East	0.823
Manitoba	0.913	Great Lakes	0.780
New Brunswick	0.538	Plains	0.881
Newfoundland	0.793	South East	0.981
Nova Scotia	0.654	South West	0.717
Ontario	0.889	Rocky Mountains	0.736
Quebec	0.933	Far West	0.909
P.E.I.	0.732		
Saskatchewan	0.717		
Yukon-NWT	0.731		
Atlantic	0.699		
Central	0.922		
Prairies	0.727		
B.C.-Territories	0.843		

Sources: Canada: CANSIM, Statistics Canada. U.S.: BEA, Department of Commerce.

What about Canada and the US taken together? Do they form an OCA? Table 6 reports the cross-correlation coefficients of regional and national GDP growth rates between Canada and the US. As shown in this table, every US region, other than the South West, has a cross correlation coefficient with Canada, which is around 60 per cent or higher. As expected the Great Lakes is the most highly correlated US region with Canada. This is due to geographic proximity and the trade and manufacturing links between the two geographic regions (eg, Auto Pact Agreement). Also every Canadian region, other than the Prairies, has a cross correlation coefficient of 50 percent or higher. As expected the Central (Ontario and Quebec) region of Canada is most highly correlated with the US, with a correlation coefficient of about 87 per cent. Again, this can be explained by the high integration of the two regions in terms of manufacturing services and trade. Further, as, reported earlier, the two national economies have a correlation coefficient of about 80 per cent. Based on this cross-correlation evidence, we can say that Canada and the US form an OCA.

Overall the evidence so far would seem to suggest that each country taken individually is an OCA. Each of the two economies has a well integrated and flexible economy to deal with economic shocks, and each has a common national business cycle that can be handled with a common national policy. Further, the cross-correlations indicate that the Canadian and the US business cycles have a common component that can be accommodated with a common transnational policy.

Table 6: *Cross-Correlations of Annual Regional and National GDP Growth Rates: Canada, U.S., 1981-1999*

	Atlantic	Central	Prairies	B.C.-Territories	Canada
New England	0.612	0.771	-0.053	0.127	0.591
Mid East	0.587	0.800	0.009	0.268	0.612
Great Lakes	0.524	0.869	0.429	0.669	0.828
Plains	0.263	0.694	0.502	0.544	0.704
South East	0.534	0.854	0.372	0.519	0.815
South West	-0.117	0.236	0.905	0.432	0.457
Rocky Mountains	0.064	0.321	0.877	0.530	0.595
Far West	0.452	0.726	0.227	0.234	0.576
U.S.	0.502	0.871	0.389	0.550	0.801

Note: Data are measured in constant 1993 U.S. dollars.
Sources: Canada: CANSIM, Statistics Canada. U.S.: BEA, Department of Commerce.

As far as Mexico is concerned, the evidence is rather weak, due to its weak GDP growth correlation structure with both the US and Canada. As seen in the trade data though, the trade links among the three countries are growing and in the future Mexico is expected to increase its economic co-movements with the other two North American economies. The NATFA provisions for the quick development of Mexico's financial sector is likely to increase its integration with the US and Canadian economies faster that anticipated. Based on our evidence so far though, it is safe to claim that the NAFTA region as a whole is not an OCA at the present time.

3.3. Can the NAFTA Region Form a Currency Union?

The discussion in Section 2 suggests some additional criteria for a given set of countries to form a successful monetary or currency union. Here, we look at four criteria to evaluate the prospects of a successful NAMU. These are co-movements of regional GDP growth rates, short-term and long-term interest rates, nominal exchange rates and inflation rates. Even though the earlier analysis showed that Mexico cannot be a part of a North American OCA, for completeness, we keep Mexico in the analysis when data availability is not a problem.

The co-movement of these variables is examined empirically using cointegration analysis. For the interpretation of the empirical results, there will be "complete" convergence of government policies among a set of n countries if there exist $r = n\text{-}1$ cointegrating relations and a single common stochastic trend among them. Otherwise if r is in the interval $0 < r < n\text{-}1$, there will be only "partial" convergence of policies. Convergence in this context means that government policies have been coordinated so that the variables of interest move to a long run equilibrium and do not drift too far apart over time. For instance, if there exist two common stochastic trends in some policy measure within NAFTA, then it must be the case that two countries in the group set their policies independently, at least in the long run. Hence the circumstances of forming and maintaining a monetary union will be quite difficult. On the other hand, if we find only one common stochastic trend it shows that policies have converged to a common long run path, dominated perhaps by the policy preferences of a single country in the union.

Before testing for cointegration, we first tested each series for a unit root using the ADF test. As shown in Table 7, the ADF test detects a unit root in the level (but not the first difference) of all regional GDPs for Canada and the US. Thus, we proceed to test for cointegration or long run co-movements of these variables. The empirical results of Tables 8 to 10 were based on estimating a vector error correction model (VECM) with a constant term and not a deterministic trend.[4] The lag order of the VECM was selected using the Akaike information criterion (AIC).

Table 8 shows, the four Canadian regions are bound together by three long-run equilibrium relations that are driven by a single stochastic trend. Table 9 reports the cointegration results for the eight US regions. In this case the trace test finds four cointegrating relations and four stochastic trends at the 1 per cent level of significance.

Table 10 shows the cointegration results for various cross-country combinations of regional GDP data between Canada and the US. In the first two panels we show the results for Eastern and Western Canada combined with the Eastern US. Based on the results of the trace test, both Canadian regions are cointegrated with the Eastern US with four cointegrating vectors and two stochastic trends at the 1 percent level of significance. The same is true when Western Canada is combined with the Western US in the third panel of Table 10. Unexpectedly, in the fourth panel of Table 10, the trace statistic indicates five cointegrating vectors and a single stochastic trend between Eastern Canada and Western US. The implication is that Eastern Canada is more integrated economically with the Western US than is integrated with the Eastern US, something contrary to what Mundell had argued for in his original paper.

Table 11 shows the unit root and cointegration results for the short term interest rates for Canada, Mexico and the US. Clearly, the ADF test indicates that each time series is nonstationary of order one, and thereore, one can proceed with testing for cointegration.[5] As Table 11 shows, the trace test detects one cointegrating relation when the three interest rates are considered jointly. Further, the Canadian and US rates are bound together by one cointegrating relation which is driven by a common trend. On the other hand the US and Mexican short-term interest rates do not cointegrate.

In summary, the evidence in Table 11 is what one would expect to find. The existence of one equilibrium relation between the Canadian and the US short rates is due to the high financial integration and depth of financial markets in the two economies. On the other hand, the Mexican short term interest rates behave quite differently from either the US or Canadian short term interest rates. This is also shown very clearly in Figure 1, where the Mexican interest rate is much more volatile than the other two. The lack of a well developed financial sector in Mexico and its lack of integration with the other two North American economies is the most likely cause of this evidence.

Table 7: *Unit Root Tests: Annual U.S.-Canadian Regional GDP Data, 1981-1999*

	U.S. Unit Root-ADF Tests		**Canada Unit Root-ADF Tests**
Level		**Level**	
NE	0.401318 [4]	ATL	-1.450736 [1]
ME	0.776073 [1]	CNT	-1.426561 [1]
SE	-0.046473 [1]	PRA	-1.2101 [2]
GL	2.481393 [1]	BCT	-0.707538 [2]
PL	1.105579 [2]		
RM	1.784786 [1]		
SW	1.556271 [3]		
FW	0.997755 [2]		
First Difference		**First Difference**	
ΔNE	-3.6058160** [5]	ΔATL	-3.40860*** [2]
ΔME	-2.954130*** [5]	ΔCNT	-3.164403** [2]
ΔSE	-3.8620680** [2]	ΔPRA	-3.885604** [3]
ΔGL	-3.650434*** [2]	ΔBCT	-3.411672** [2]
ΔPL	-4.0416110** [2]		
ΔRM	-3.506153*** [5]		
ΔSW	-2.61354100* [2]		
ΔFW	-2.792786*** [5]		

Notes: *** indicates significance at the 10% level. ** indicates significance at the 5% level. * indicates significance at the 1% level. The figures in brackets [ ] denote the number of lags which made the error term in the ADF test regression white noise.

Sources: Canada: CANSIM, Statistics Canada. U.S.: BEA, Department of Commerce.

Table 8: *Cointegration Results of Canadian Regional GDP Data, 1981-1999*

H_0: Rank = r	Trace Test	1% C.V.
r = 0	82.49*	60.16
r <= 1	52.18*	41.07
r <= 2	28.51*	24.60
r <= 3	12.64	12.97

Note: * indicates rejection of H_0 at the 1% level of significance.

Table 9: *Cointegration Results of U.S. Regional GDP Data, 1981-1999*

H_0: Rank = r	Trace Test	1% C.V.
r = 0	313.47*	168.36
r <= 1	202.39*	133.57
r <= 2	125.01*	103.18
r <= 3	77.18*	76.07
r <= 4	50.61	54.46
r <= 5	28.24	35.65
r <= 6	10.36	20.04
r <= 7	0.07	6.65

Note: * indicates rejection of H_0 at the 1% level of significance

Table 10: *Cointegration Results of Cross-Country GDP Data, 1981-1999*

Atlantic, Central, Northeast, Southeast, Mideast, Great Lakes			Prairies, B.C.-Territories, Southwest, Far West, Rocky Mountains, Plains		
H_0: Rank = r	**Trace Test**	**1% C.V.**	**H_0: Rank = r**	**Trace Test**	**1% C.V.**
r = 0	200.97*	111.01	r = 0	198.02*	111.01
r <= 1	124.76*	54.45	r <= 1	110.18*	54.45
r <= 2	76.53*	60.16	r <= 2	62.71*	60.16
r <= 3	35.06	41.07	r <= 3	35.73	41.07
r <= 4	16.4	24.6	r <= 4	17.96	24.6
r <= 5	4.1	12.97	r <= 5	7.2	12.97
Prairies, B.C.-Territories, Northeast, Southeast, Mideast, Great Lakes			**Atlantic, Central, Southwest, Far West, Rocky Mountains, Plains**		
H_0: Rank = r	**Trace Test**	**1% C.V.**	**H_0: Rank = r**	**Trace Test**	**1% C.V.**
r = 0	183.00*	111.01	r = 0	227.82*	111.01
r <= 1	104.66*	54.45	r <= 1	121.18*	54.45
r <= 2	64.75*	60.16	r <= 2	70.17*	60.16
r <= 3	40.85	41.07	r <= 3	43.54*	41.07
r <= 4	23.19	24.6	r <= 4	18.49	24.6
r <= 5	7.51	12.97	r <= 5	6.88	12.97

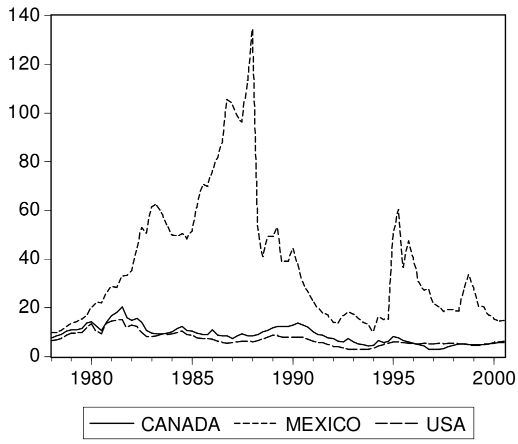
Note: * indicates rejection of H_0 at the 1% level of significance.

Table 11: *Unit Root and Cointegration Tests: Quarterly Short Term Interest Rates: Canada, U.S., Mexico, 1978:1-2000:3*

Level	**Unit Root-ADF Tests**	**First Difference**	**Unit Root-ADF Tests**
STICAN	-1.757783 [5]	ΔSTICAN	-3.860272* [4]
STIUS	-1.797946 [3]	ΔSTIUS	-5.703226* [2]
STIMEX	-1.785999 [3]	ΔSTIMEX	-3.477012** [5]
Cointegration Results: U.S., Canada, Mexico (Model 2, Lag 10)			
H_0: Rank = r	**Trace Test**	**5% C.V.**	**1% C.V.**
r = 0	36.48113**	34.91	41.07
r <= 1	10.417450	19.96	24.60
r <= 2	2.177355	9.24	12.97
Cointegration Results: U.S., Canada (Model 1, Lag 11)			
H_0: Rank = r	**Trace Test**	**5% C.V.**	**1% C.V.**
r = 0	12.54176**	12.53	16.31
r <= 1	2.863403	3.84	6.51
Cointegration Results: U.S., Mexico (Model 2, Lag 10)			
H_0: Rank = r	**Trace Test**	**5% C.V.**	**1% C.V.**
r = 0	10.578190	19.96	24.6
r <= 1	3.605126	9.24	12.97

Notes: ** indicates significance at the 5% level. * indicates significance at the 1% level. The figures in brackets [ ] denote the number of lags which made the error term in the ADF test regression white noise.
Source: IFS-2001, International Monetary Fund.

Figure 1: *Quarterly Short Term Interest Rates: US, Canada, Mexico, 1978:1-2000:3*



Source: IFS-2001, International Monetary Fund.

Table 12 presents the unit root tests and cointegration tests for long-term interest rates. The ADF test shows that the long rates are also first order nonstationary. The cointgration tests provide empirical results consistent with our expectations. The three long rates do not cointegrate according to the trace test. The same is true for the US-Mexico pair of long-term interest rates. On the other hand, the trace statistic detects one cointegrating relation between the Canada-US long term interest rates. The same sort of conclusion emerges from the evidence provided by Figure 2. Again, the explanation of these results lies with the high degree of financial integration between Canada and the US, but not the Mexican financial markets. This evidence also implies that Canada and the US follow very similar monetary policies, but this is not the case for the Mexican monetary policy.

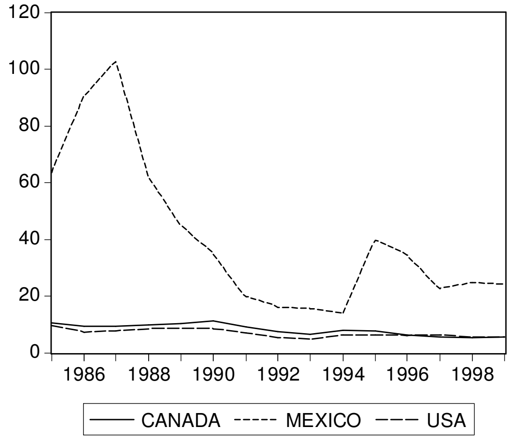
Table 12: *Unit Root and Cointegration Tests: Annual Long Term Interest Rates: Canada, U.S., Mexico, 1985-1999*

Level	**Unit Root-ADF Tests**	**First Difference**	**Unit Root-ADF Tests**
LTICAN	0.049011 [4]	ΔLTICAN	-3.326192** [2]
LTIUS	-1.463876 [2]	ΔLTIUS	-2.739886*** [2]
LTIMEX	-2.522886 [2]†	ΔLTIMEX	-3.301789** [0]
Cointegration Results: U.S., Canada, Mexico (Model 2, Lag 1)			
H_0: Rank = r	**Trace Test**	**5% C.V.**	**1% C.V.**
r = 0	27.523800	34.91	41.07
r <= 1	10.771610	19.96	24.60
r <= 2	3.542422	9.24	12.97
Cointegration Results: U.S., Canada (Model 1, Lag 3)			
H_0: Rank = r	**Trace Test**	**5% C.V.**	**1% C.V.**
r = 0	25.36752*	19.96	24.6
r <= 1	6.329193	9.24	12.97
Cointegration Results: U.S., Mexico (Model 2, Lag 1)			
H_0: Rank = r	**Trace Test**	**5% C.V.**	**1% C.V.**
r = 0	18.240910	19.96	24.6
r <= 1	5.010771	9.24	12.97

Notes: † includes trend. *** indicates significance at the 10% level. ** indicates significance at the 5% level. * indicates significance at the 1% level. The figures in brackets [ ] denote the number of lags which made the error term in the ADF test regression white noise.

Source: Canada and U.S.: IFS-2000, International Monetary Fund. Mexico: Economic Outlook-20001, OECD.

Figure 2: *Annual Long Term Interest Rates: US, Canada, Mexico, 1985-1999*



Source: IFS-2000, International Monetary Fund.

Table 13 reports the unit root and cointegration tests for the nominal exchange rates of Canada and Mexico relative to the US dollar. Both exchange rates are nonstationary and not cointegrating according to the trace test. This result is not surprising given that the two exchange rates have behaved quite differently over time, especially during the recent floating exchange rates period, with the recurrent crises of the Mexican peso.

Table 13: *Unit Root and Cointegration Tests: Annual Nominal Exchange Rates: Canada, Mexico, 1948-1999*

Level	Unit Root-ADF Tests	First Difference	Unit Root-ADF Tests
EXCANUS	-0.702378 [4]	ΔEXCANUS	-4.270865* [1]
EXMEXUS	-1.861116 [3]	ΔEXMEXUS	-4.674588* [1]
Cointegration Results: U.S., Mexico (Model 2, Lag 1)			
H_0: Rank = r	**Trace Test**	**5% C.V.**	**1% C.V.**
r = 0	13.36623	19.96	24.6
r <= 1	0.910311	9.24	12.97

Notes: * indicates significance at the 1% level. The figures in brackets [ ] denote the number of lags which made the error term in the ADF test regression white noise.
Source: IFS-2000, International Monetary Fund.

Table 14 shows the unit root and cointegration tests for the inflation rates in the three countries. According to the ADF test the three inflation rates are nonstationary. The trace test finds only one cointegrating relation among the three inflation rates, which, as the rest of the evidence in the table indicates, comes from the US-Canada co-movement of inflation rates. The empirical results with respect to inflation are consistent with expectations. Clearly, the monetary policy stance of the Bank of Canada and the US Fed for price stability over the last 15 years or so explains what we actually observe empirically. Further, low and stable inflation rates in Canada and the US have caused both short term and long term interest rates in the two countries to converge to single common stochastic trend as was shown above. In contrast, Mexico´s inflation experience has been markedly different from that of Canada and the US. As shown in Figure 3, since the early 1970s Mexico´s inflation rate is much higher than in the other two countries. Nonetheless, since the early 1990s, Mexico's monetary authorities have reduced inflation dramatically and brought it much closer to the Canada and the US levels. If this trend continues, Mexico's inflation will be even closer to the Canada and US inflation in the near future, thus preparing the ground for greater monetary convergence.

Table 14: *Unit Root and Cointegration Tests: Annual Inflation Rates: Canada, U.S., Mexico, 1949-1999*

Level	**Unit Root-ADF Tests**	**First Difference**	**Unit Root-ADF Tests**
INFLCAN	-1.314113 [4]	ΔINFLCAN	-4.867949* [4]
INFLIUS	-1.233563 [2]	ΔINFLUS	-3.5044017** [2]
INFLMEX	-2.677935 [1]	ΔINFLMEX	-7.360454* [2]

Cointegration Results: U.S., Canada, Mexico (Model 2, Lag 6)

H_0: Rank = r	**Trace Test**	**1% C.V.**
r = 0	44.98022*	41.07
r <= 1	13.11231	24.60
r <= 2	4.6754	12.97

Cointegration Results: U.S., Canada (Model 1, Lag 3)

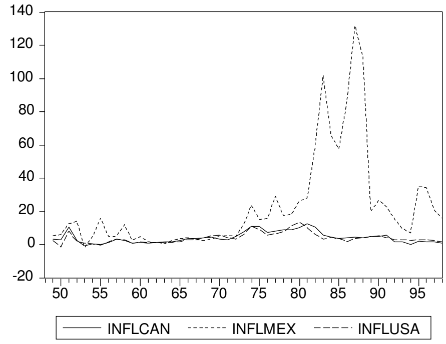
H_0: Rank = r	**Trace Test**	**1% C.V.**
r = 0	36.69583*	24.60
r <= 1	5.1687	12.97

Cointegration Results: U.S., Mexico (Model 2, Lag 6)

H_0: Rank = r	**Trace Test**	**1% C.V.**
r = 0	16.65	24.60
r <= 1	5.97	12.97

Notes: *** indicates significance at the 10% level. ** indicates significance at the 5% level. * indicates significance at the 1% level. The figures in brackets [ ] denote the number of lags which made the error term in the ADF test regression white noise.
Source: IFS-1998, International Monetary Fund.

Figure 3: *Annual Inflation Rates: US, Canada, Mexico, 1949-1998*



Source: IFS-2000, International Monetary Fund.

4. Conclusion

In this paper, we have attempted to empirically evaluate the conditions under which the NAFTA region is an OCA and the prospects on forming a monetary union in North America. To do so, we used the conceptual distinction between criteria that are suitable for an OCA to exist and conditions that must be met for a successful currency union. The former criteria are based on the theory of optimum currency areas. To evaluate the conditions for a prospective NAMU, we examined the co-movements of regional real GDPs between Canada and the US, and co-movements of interest rates, exchange rates and inflation rates among the three countries.

The empirical results of the paper support the claim that the NAFTA region as a whole in not an OCA. However, the empirical evidence shows that Canada and the US satisfy the conditions for an OCA. Further, the cointegration analysis indicated that there is a good deal of real and monetary convergence between Canada and the US to form a successful monetary union, even at the present.

The NAFTA region itself is far from forming a monetary union. But since NAFTA will accelerate the trade and financial links among the three countries, the real time frame whereby all three countries can be an OCA and form a successful NAMU will be shortened considerably. This is due to the endogeneity of the OCA and monetary union criteria.

Acknowledgements

I would like to thank Brennan Thompson for superb research assistance, and the participants of the conference ´´Exchange Rates, Economic Integration and the International Economy´´, Ryerson University, Toronto, May 17-19, 2002, for valuable comments and suggestions. I would also like to acknowledge financial support from a SSHRC Canada grant. All remaining errors are my own.

Appendix:

Regional Composition

US Regions

New England Region
Connecticut
Maine
Massachusetts
New Hampshire
Rhode Island
Vermont

Mideast Region
Delaware
District of Columbia
Maryland
New Jersey
New York
Pennsylvania

Great Lakes Region
Illinois
Indiana
Michigan
Ohio
Wisconsin

Plains Region
Iowa
Kansas
Minnesota
Missouri
Nebraska
North Dakota
South Dakota

Southeast Region
Alabama
Arkansas
Florida
Georgia
Kentucky
Louisiana
Mississippi
North Carolina
South Carolina
Tennessee
Virginia
West Virginia

Southwest Region
Arizona
New Mexico
Oklahoma
Texas

Rocky Mountain Region
Colorado
Idaho
Montana
Utah
Wyoming

Far West Region
Alaska
California
Hawaii
Nevada
Oregon
Washington

Canadian Regions

Atlantic Region
Newfoundland
Prince Edward Island
Nova Scotia
New Brunswick

Central Region
Ontario
Quebec

Prairies
Saskatchewan
Manitoba
Alberta

BC and Territories
British Columbia
Northwest Territories
Nunavut
Yukon

Notes:

1. Associate Professor, Department of Economics, Ryerson University. Email: michelis@ryerson.ca

2. The nominal convergence criteria laid down by the Maastricht Treaty in the context of the European Monetary Union (EMU) is a good example of such a set of conditions. Based on these criteria, a given EU country had to satisfy specific target with respect to their bilateral exchange rates, inflation rate, long-term interest rates and government deficits and debts in order to qualify for participation in the EMU.

3. Regional data for Mexico are not available at a significant length of time to carry out a reliable analysis of the data. I could find regional data for Mexico at an annual frequency only for the period 1993-1999 from the Mexican National Institute of Statistics, Geography and Information. For this reason, in this section I present regional results for Canada and the US only.

4. See Johansen (1995), for example, for the 5 possible VECMs that can be estimated depending on restrictions that one can impose on the deterministic component of the model.

5. The cointegration results in Tables 11 to 14 are based on estimation of a VECM with no deterministic components (Model 1), or a VECM with a restricted constant term (Model 2). These models were chosen by the likelihood ratio test given in Johansen (1995). Also the lag order of he VECM in each case was determined by the AIC criterion.

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Dollarization in Canada: Where Does the Buck Stop?*

John Murray[1]
Bank of Canada

James Powell[2]
Bank of Canada

Abstract. The sharp depreciation of the Canadian dollar and the successful launch of the euro have spawned an animated debate in Canada concerning the potential benefits of formally adopting the U.S. dollar as our national currency. Some observers have suggested that this debate is largely irrelevant, since the Canadian economy is already highly "dollarized." Canadian businesses and households, they assert, often use the U.S. dollar to perform standard money functions in preference to their own currency. Very little evidence has been advanced, however, to support these claims.

The authors of this paper examine the available data in an effort to overcome this informational deficiency and to draw some tentative conclusions about the extent to which Canada has already been informally dollarized. The evidence that they present suggests that many of the concerns that have been expressed about the imminent dollarization of the Canadian economy are misplaced. The Canadian dollar continues to be used as the principal unit of account, medium of exchange, and store of value within Canada's borders, and there is no indication that dollarization is likely to take hold in the foreseeable future.

1. Introduction

The sharp depreciation of the Canadian dollar and the successful launch of the euro have spawned an animated debate among academics and policy-makers in Canada concerning the potential benefits of "dollarization"—generally defined as the widespread use of another country's currency to perform standard monetary functions. Several proposals, ranging from unilateral adoption of the U.S. dollar to a full-blown monetary union, have been put forward and received varying degrees of support from Canadian politicians and the general public.

Some observers have suggested that any decision made at an official level,

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either for or against such an initiative, will be largely irrelevant, since dollarization is already proceeding through less formal channels. They argue that the highly integrated Canadian and U.S. economies, coupled with Canada's growing dependence on its southern neighbor, have set in train a process whereby Canadians are being inexorably drawn towards the U.S. dollar. With or without the agreement of policy-makers, therefore, market forces will eventually ensure that the U.S. dollar becomes the preferred unit of account, medium of exchange, and store of value.

The purpose of this paper is *not* to review the advantages or disadvantages of adopting the U.S. dollar as the national currency, but rather to examine the available data and determine the extent to which Canada has already been informally dollarized. Section 2 discusses the various forms that dollarization can take and the alternative ways it has been defined in the literature. Section 3 reviews some of the factors that might either encourage or discourage dollarization in Canada. Sections 4 to 6 take each money function in turn (unit of account, medium of exchange, and store of value) and document the degree to which dollarization has taken hold in Canada. Section 7 summarizes the results and assesses the policy challenges that dollarization might pose in the future.

Although the evidence is fragmentary, existing data suggest that informal dollarization is proceeding at a very slow (to non-existent) pace. Indeed, by many measures, Canada is less dollarized now than it was 20 years ago and bears little resemblance to those economies that are typically regarded as truly dollarized. Some Canadian companies maintain their financial statements in both Canadian and U.S. dollars, and roughly 9 per cent of the deposits held at Canadian banks are now denominated in U.S. dollars. Canadians also appear to be holding an increasing proportion of their financial wealth in U.S.-dollar assets. It would be a mistake to interpret this as evidence of dollarization, however, in the sense of domestic economic activity being conducted increasingly in U.S. dollars. The assets that Canadians hold in foreign currencies are used, for the most part, to support business activities abroad and to achieve a more efficient allocation of wealth. In other words, globalization and diversification should not be confused with dollarization.

Most, if not all, domestic transactions in Canada are still conducted with the Canadian dollar. While globalization may eventually push Canada to a point where the benefits of operating under a common currency outweigh the advantages of a separate national currency, this "tipping point" does not appear to be imminent. Some observers like to assert that the end is near, but the changes we have witnessed so far are less revolutionary than these would-be visionaries suggest. To paraphrase Mark Twain: reports of the impending death of the Canadian dollar are greatly exaggerated.

2. Forms of Dollarization

Dollarization is a generic term used to characterize any currency that effectively serves as a replacement for the national currency—the substitute currency need not be the U.S. dollar. It is typically the currency of a major trading partner or an important industrial power with a reputation for sound monetary policy. In the case of Canada, of course, dollarization would mean the use of the U.S. dollar.

Dollarization can occur either officially or through a market-based process, in which individual consumers and businesses shift to another currency. Most countries that have opted for *official* dollarization are extremely small and open, relying on a single good or service (such as tourism) for much of their income and importing most of what they consume. In addition, they have often had a colonial connection with the country whose currency they use, or they exist as a dependency of a larger industrialized economy. Prior to the recent move by Ecuador to dollarize its economy, the largest country to officially use another country's currency was Panama, whose population is currently less than 3 million. The U.S. Congress Joint Economic Committee (2000) has identified 29 countries (or separate economic entities) that are currently members of an official common-currency regime.

For many of these "countries," the choice of currency was a matter of history and long-standing political affiliation. No explicit decision was made to adopt the mother country's money; they simply stayed with the currency that they had always used. The choice was not necessarily a bad one, and it may have represented the most efficient outcome from their perspective. Many of these countries are too small and open to effectively operate under a floating exchange rate or to establish the sort of institutional infrastructure necessary to issue their own money. So much of their output is concentrated in a single exported good or service that the money illusion necessary to sustain a floating exchange rate would not be present (McKinnon, 1963). Prices would invariably be quoted in the currency of their major trading partner, and it would not be efficient or feasible to maintain a separate national currency for most domestic transactions.[3]

Countries that have experienced *unofficial* or market-based dollarization are often larger than those that have officially dollarized, but the situation is not as common as some might assume. Baliño, Bennett, and Borensztein (1999) identify only 18 countries that fall into this category. Unofficial dollarization has usually been preceded by an extended period of high inflation and reckless macroeconomic policy. Failed currency reforms, onerous capital controls, the arbitrary confiscation of wealth, and the absence of defined property rights are also common in these countries. Years of fiscal and monetary policy mismanagement have typically eroded investor confidence and forced citizens to look for an alternative monetary instrument. What is surprising, in most instances, is how serious and protracted the economic mismanagement must be before a majority of citizens are prepared to abandon their domestic currency. It is unclear whether this is due to nationalism, habit, or significant network externalities. In any event, policy-makers must go to some lengths before they risk losing their national currencies. Unofficial dollarization, it seems, is not as easy as some suggest. But once it has happened, the process is almost impossible to reverse, except through involuntary means.

It is important not to confuse dollarization with globalization. The dramatic growth in world trade and investment in recent years has led to a sharp increase in the number of transactions that businesses and households have with foreigners. This, in turn, has led to a natural increase in the demand for foreign currency—even among the largest and most well-managed economies. One might argue that globalization is making countries much smaller and that they will soon resemble the microeconomies described above. It will be some time, however, before the level of foreign activity in most industrial countries reaches the point where they have little choice but to adopt a common currency. In the meantime, most domestic transactions will continue to be conducted in the national currency.

It is also important not to confuse dollarization with diversification. The fact that investors have started to hold a much larger share of their financial wealth in foreign assets is not necessarily a sign of dissatisfaction with their domestic currencies or a sign of capital flight. Market liberalization and a greater appreciation of the gains that can be realized through international diversification have resulted in a dramatic increase in gross capital flows into and out of countries. Investors in previous periods suffered from an evident home-country bias and are only now beginning to achieve a more efficient trade-off between risk and return. The excessive concentration in home-country assets in earlier periods has been highlighted in work by Tesar and Werner (1992). If foreign goods and services account for 25 to 30 per cent of what the typical household consumes, as is currently the case in Canada, a similar proportion of its wealth should probably be invested in foreign assets simply for hedging purposes. When one recognizes that most of an individual's wealth is held in the form of human capital and domestic real estate, the proportion of financial wealth that ought to be held in foreign assets could easily approach 100 per cent. In other words, the typical household in most industrial countries is still some distance from the efficient frontier suggested by a simple capital-asset pricing model.

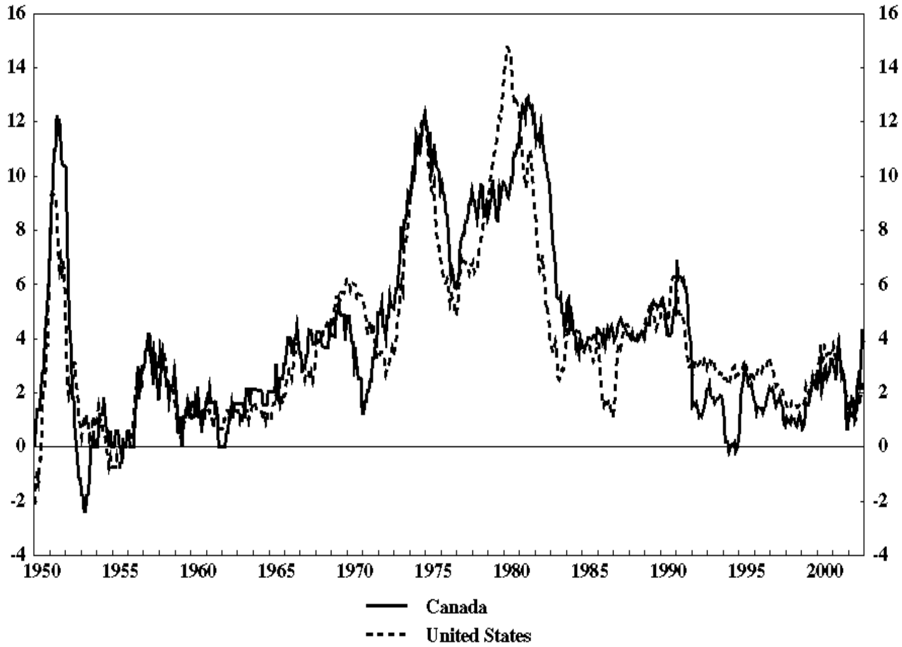
3. The Evidence for Canada

The International Monetary Fund (IMF) regards any country that has more than 30 per cent of its broad money aggregates denominated in a foreign currency as being dollarized (Baliño, Bennett, and Borensztein 1999). As subsequent figures will show, Canada is still some distance from this relatively modest hurdle.[4] Before examining the data, however, it is useful to review some of the factors that might have either encouraged or discouraged dollarization in Canada.

Canada has an inflation history that is broadly similar to that of most other industrial countries. While the 1970s and 1980s were marked by occasional episodes of inflation in the low double digits, this experience was shared by many other G-10 countries, including the United States. Indeed, over the past 50 years, the year-by-year movements in the Canadian and U.S. consumer price indexes (CPIs) have been strikingly similar—even though Canada has operated under a floating exchange rate for most of this period (Fig. 1). The cumulative difference in their price levels from 1950 to 2001 was less than 7 per cent. The desire to move to a more reliable monetary regime would not provide a very convincing reason, therefore, for

Canadians to shift to the U.S. dollar. An additional point worth noting is that Canada's inflation rate has been slightly lower than that of the United States in each of the past 10 years, and is now tied to a system of explicit inflation targets.

Figure 1: *CPI inflation rates (year-over-year percentage change).*



Unlike the microeconomies that have officially dollarized, Canada is a major industrial power. It has the eighth-largest GDP in the world (measured according to the purchasing-power-parity value of its exchange rate), and the 34th-largest population. Canadians are used to thinking of their economy as small and open, but judged on an international scale, it is neither small nor very open. While exports and imports account for close to 80 per cent of GDP, much of this represents transborder shipments of raw materials, automobile parts and intermediate products, which receive some additional processing in Canada and are then sent back to the original country. Government activities and other non-tradeable goods and services currently account for more than 65 per cent of Canada's final output.

Two factors that might favor dollarization, at least when compared with the situation in Europe prior to the introduction of Economic and Monetary Union, are (i) Canada's proximity to the wealthiest country in the world and (ii) the large percentage of Canada's trade that is conducted with this single trading partner. From this perspective, dollarization becomes a more legitimate subject of debate. If 12 relatively disparate and occasionally fractious countries in Europe can form a monetary union, why shouldn't Canada and the United States? The issue that we are addressing, however, is not whether Canada and United States *should* officially dollarize, but whether it is already happening by unofficial means.[5] Here there is reason to be more skeptical.

Sections 4 to 6 will examine the available evidence, with a view to determining whether this process is occurring. Although the data are not complete or comprehensive, the picture that emerges is one of globalization and diversification rather than dollarization. Canada's strong commercial ties with the United States have led to an increased demand for U.S. dollars and have encouraged a number of Canadian firms to keep their accounts in both Canadian and U.S. dollars. It is not obvious, however, that these practices reflect true dollarization. Nor are they significant enough to lead to the wholesale adoption of the U.S. dollar by the rest of the economy.

4. The U.S. Dollar as a Unit of Account

Very little information is available on the extent to which Canadian businesses and households use the U.S. dollar as a unit of account. While this may be a testament to how uncommon the practice is, there is reason to believe that some Canadian firms regularly price their products and keep their accounts in U.S. dollars. For the most part, however, one would expect this to be restricted to export sales and firms with extensive operations outside the country.

4.1. Consumer Products and Salaries

Casual observation suggests that goods and services purchased by Canadian households from firms operating within Canada are seldom, if ever, priced in U.S. dollars. The only exceptions that we are aware of involve tourist services, such as hotels, amusement parks, and other entertainment activities, where a large share of the customer base comes from outside the country. In these cases, both Canadian and U.S. prices are often quoted.

Similarly, few Canadians have their salaries and wages denominated in U.S. dollars, or in any other currency, except the Canadian dollar. Some professional athletes and business executives may be paid in U.S. dollars, but this, once again, is a reflection of the international market in which their services are sold and the time that they spend working outside the country. It is not dollarization in the sense that domestic salaries and many household purchases are regularly quoted in another country's currency.

4.2. Intra- and Interbusiness Pricing

It would not be surprising if most of the exports that Canadian firms sold to foreign customers, as well as the commodities that they purchased from foreign firms, were priced in U.S. dollars. The U.S. dollar is the dominant currency in world markets and is regularly used for invoicing products, even when neither party to the transaction is located in the United States.

Krugman (1984), Black (1990), and others observe the following patterns in international invoicing.[6] First, the currency of the exporting country is typically used *unless* the importing country is much larger than the exporting country. Second, sales involving homogeneous primary commodities, such as oil, minerals and forest products, are almost always priced in U.S. dollars. These practices, coupled with the dominant role that the U.S. dollar plays more generally, suggest that Canadian exports and imports would rarely be priced in Canadian dollars. This would not be evidence of any new trend towards dollarization, however, or a new-found preference for U.S. dollars, but simply the continuation of a practice that has existed since the U.S. dollar replaced the pound sterling as the principal international currency.

Information on the pricing practices used in business-to-business sales within Canada would be most relevant for our study. If there were signs that Canadian businesses were beginning to price in U.S. dollars for sales to other Canadian firms, this would clearly be evidence of creeping dollarization. Care must be exercised, however, in interpreting any anecdotal evidence that indicates this is happening. First, one might expect sales between branches of the same firm operating on both sides of the Canadian–U.S. border to be invoiced in U.S. dollars. Second, as noted earlier, sales involving primary products might also be priced in U.S. dollars, based on long-standing industry practices.

4.3. Survey Results

To better determine what is actually happening in Canada, a survey was recently conducted by the staff in the Bank of Canada's regional offices. In March and April 2002, 100 firms were surveyed on whether (and under what circumstances) they priced their products and kept financial records in a currency other than the Canadian dollar. Although the sample was relatively small, the staff tried to ensure that it reflected the industrial composition and regional distribution of firms within the economy. (Additional surveys will be run in coming months and will include 300 more firms.)[7] The results of this initial survey are reported below.

Q.1 Do you quote prices to Canadian customers in Canadian dollars, U.S. dollars, or both?

As expected, pricing in U.S. dollars for purely domestic sales is rare. Only 6 per cent of the reporting firms quoted prices exclusively in U.S. dollars (Table 1). An additional 17 per cent quoted prices in both Canadian and U.S. dollars. These firms, however, also tended to export a large part of their production or to produce raw materials, whose prices are set on U.S.-based markets (such as the New York Mercantile Exchange and Chicago Mercantile Exchange) and are traditionally priced in U.S. dollars. Some firms indicated that they priced in both currencies for convenience, using the same price list for domestic and foreign customers. Others noted that they did so in response to demands from other Canadian companies that are part of a U.S. supply chain or that have extensive international operations. In many instances, however, the Canadian-dollar price was still used as the base (or true unit of account) on which the U.S.-dollar price was calculated.

Table 1: *Denomination of Domestic Prices*

	Per cent of total responses (absolute number)		
	Can$	**US$**	**Both**
Canada	77 (76)	6 (6)	17 (17)
Atlantic Canada	94 (15)	0 (0)	6 (1)
Quebec	62 (13)	10 (2)	28 (6)
Ontario	84 (21)	8 (2)	8 (2)
Prairies	89 (17)	0 (0)	11 (2)
British Columbia	56 (10)	11 (2)	33 (6)

Q.2 Do you quote prices to foreign customers in Canadian dollars, U.S. dollars, the local currency, or some combination of currencies?
As Table 2 shows, 53 per cent of the firms surveyed indicated that they price their foreign sales in U.S. dollars, with another 7 per cent using a different local currency. These figures were somewhat smaller than had been expected, given the earlier empirical evidence cited by Krugman (1984) and the strong economic ties linking the Canadian and U.S. economies. Surprisingly, only 20 per cent of the foreign sales originating from firms in Ontario were priced in U.S. dollars.

Table 2: *Denomination of Foreign Prices*

	Per cent of total responses (absolute number)			
	Can$	**US$**	**Local**	**Combination**
Canada	23 (19)	53 (43)	7 (6)	17 (14)
Atlantic Canada	0 (0)	84 (10)	8 (1)	8 (1)
Quebec	20 (3)	70 (14)	0 (0)	10 (3)
Ontario	45 (9)	20 (4)	25 (5)	10 (2)
Prairies	15 (2)	62 (8)	0 (0)	23 (3)
British Columbia	29 (5)	42 (7)	0 (0)	29 (5)

Q.3 Are your financial statements quoted in Canadian dollars, U.S. dollars, or both currencies?
Over 80 per cent of the firms that were interviewed prepare their financial statements in Canadian dollars (Table 3). Some of them noted that, since they are obliged to use Canadian dollars for domestic taxes and/or regulators, this is the most efficient alternative. Firms that prepare their statements in both currencies or solely in U.S. dollars typically have extensive operations in the United States or want to tap U.S. capital markets to finance their operations. Most firms in this category still use Canadian dollars in their daily accounting operations, however, and base their U.S.-dollar statements on reports that are already completed in Canadian dollars.

4.4. Other Evidence

Multinational firms and companies whose shares are listed on U.S. exchanges are

Table 3: *Denomination of financial statements*

	Per cent of total responses (absolute number)		
	Can$	**US$**	**Both**
Canada	82 (81)	7 (7)	11 (11)
Atlantic Canada	94 (15)	0 (0)	6 (1)
Quebec	76 (16)	14 (3)	10 (2)
Ontario	76 (19)	8 (2)	16 (4)
Prairies	74 (14)	5 (1)	21 (4)
British Columbia	94 (17)	6 (1)	0 (0)

typically required to provide financial statements in U.S. dollars. Some Canadian stocks that are traded on the Toronto Stock Exchange (TSX) are also quoted in U.S. dollars.

The *Factbook* published by the NYSE suggests that 72 Canadian firms had stock listed on the NYSE in 2000, with a trading volume of over US$304 billion and a market capitalization of approximately US$116 billion. While these figures are impressive, and significantly higher than those reported in 1996, the numbers must be put into context.[8] The number of foreign firms listed on the NYSE grew by more than 42 per cent during this period, and Canada's share of all foreign stocks listed on the NYSE actually declined (from roughly 18 per cent to 16 per cent). Other industrial countries gained ground. The share of European stocks, for example, increased from roughly 45 per cent of the total market value to more than 53 per cent.

Fig. 2 shows the proportion of firms with stocks trading on the TSX that also have shares listed on a foreign exchange.[9] This proportion has increased from approximately 10 per cent in 1980 to 14 per cent at present. The proportion of total trading in these stocks that takes place on U.S. exchanges has remained relatively constant, however, at around 50 per cent, with a slight downward trend noticeable in the data.[10]

Additional insights into the degree of dollarization, measured in this manner, can be obtained from a report published by the TSX. The results of that report are summarized in Table 4. The data reported in column 2 indicate the number of firms that are listed on the TSX and that have at least one share issue quoted in U.S. dollars. Their relative importance, expressed as a percentage of all firms listed on the TSX, is shown in column 4. Both the absolute number of firms with shares trading in U.S. dollars and their relative importance have been declining over time.

While these results may provide some comfort to those who view diversification and globalization as a threat, rather than a natural market phenomenon, it is clear that use of the U.S. dollar as a unit of account can be expected to rise with the proportion of Canadian business conducted outside our borders. Although this might not qualify as dollarization in the true sense of the term, it will, on balance, increase the savings that firms could realize if all their activities were priced in one currency – thereby increasing the attraction of a common

Figure 2: *Canadian interlisted companies.*

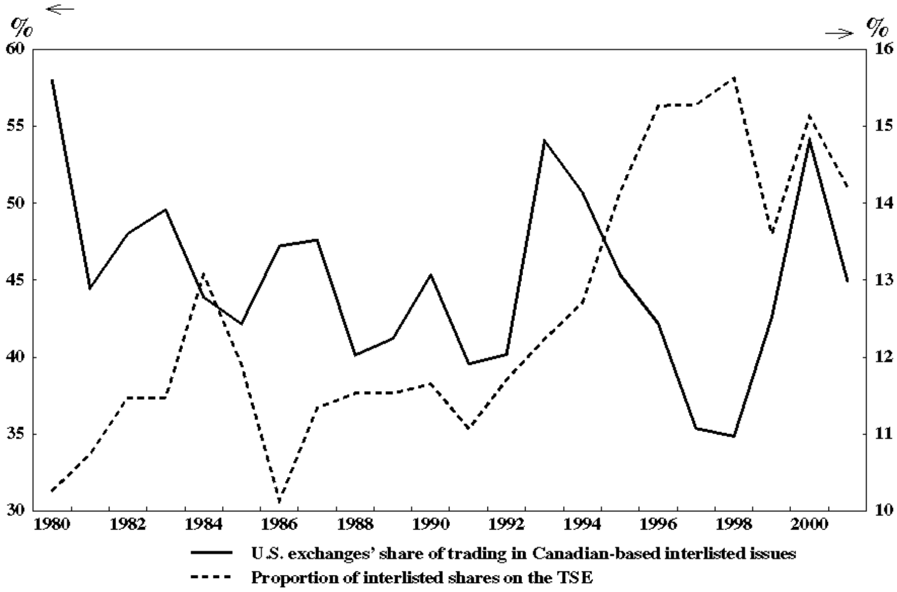


Table 4: *Companies trading in U.S. dollars on the Toronto Stock Exchange*

Years	No. of U.S.-dollar companies	Total no. of companies on the TSX	Percentage of U.S.-dollar companies
1980	56	799	7.0
1985	61	966	6.3
1990	53	1193	4.4
1995	51	1258	4.1
2002	52	1306	4.0

Source: TSX Review

currency. It is not obvious, however, that this point will be reached in the foreseeable future.

5. The U.S. Dollar as a Medium of Exchange

The second use of money is as a medium of exchange. Everyday experience would suggest that U.S. dollars are not typically used for transactions in Canada. Although U.S. currency is generally accepted in retail stores in Canada, usually close to market rates, and Canadian residents are free to hold foreign currency deposits in banks, examples of Canadians using U.S. dollars in transactions with other Canadians are rare.

Hard data on the extent to which U.S. dollars are used in Canada are limited. While statistics on U.S.-dollar deposits are available, no Canadian agency collects information on the amount of U.S. currency held by Canadians and the extent to which such currency is used for transactions in Canada.

We examine three methods of measuring the extent to which U.S. dollars are used for transactions in Canada. The first method, using data collected by the Bank of Canada, focuses on the ratio of U.S. deposits held by Canadians in Canadian banks to broad money (M3). The second method uses confidential data from the U.S. Customs Service on reported cross-border flows of U.S. currency. By summing these flows over time, one can estimate the amount of U.S. cash that is in circulation within Canada. The third method examines the holdings of U.S.-dollar currency by Canadian banks.

All of these measures provide biased views on the extent to which U.S. dollars are used as a transactions vehicle in Canada. None, however, suggests that Canadians use U.S. dollars in domestic transactions to any significant degree. Nor is there strong evidence of a rising trend in the use of U.S. currency in Canada.

Section 5.4 describes the results of stability tests on short-run demand equations for currency and broad money (M2++). These tests were used to ascertain whether there have been structural breaks or currency substitution effects, which might point to dollarization. The estimated equations are given in Appendix A.

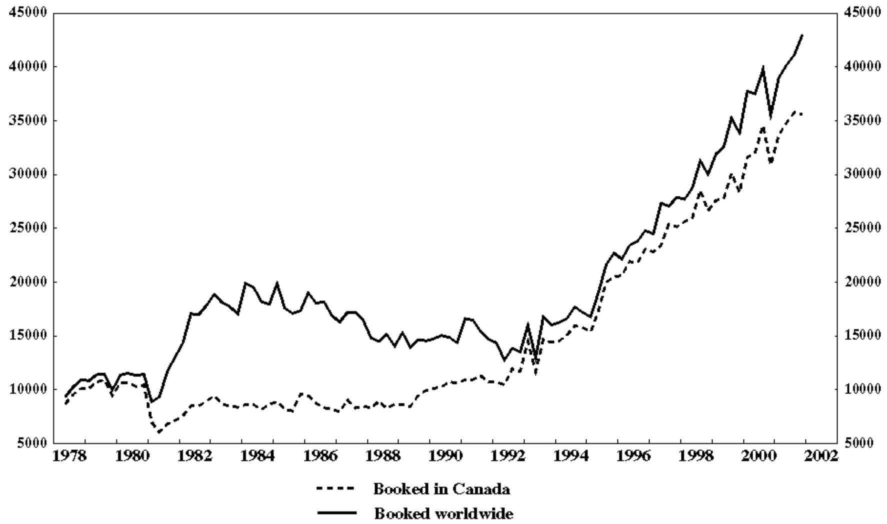
5.1. Ratio of Foreign Currency Deposits in Canada to Broad Money

The extent to which a foreign currency is used for transactions purposes is traditionally measured by examining the ratio of a country's foreign currency deposits to its money supply, broadly defined. This method is not a pure measure of the use of foreign currency as a transactions vehicle, since some foreign currency deposits are held for other purposes; for example, as a store of value. It can also be a biased indicator, since it assumes that foreign currency deposits and foreign currency are close substitutes and that movements in one bear a strong relationship with movements in the other (Feige et al. 2000).

Fig. 3 reports U.S.-dollar deposits of Canadian residents in Canadian banks.[11] Data are reported both on a booked-worldwide and booked-in-Canada basis. While the trends in the two series have been broadly similar in recent years, there was a sizable divergence during the 1980s.[12] After holding relatively steady through the 1980s, U.S.$ deposits booked worldwide rose sharply in absolute terms through the 1990s. U.S.-dollar deposits also rose sharply during that period.

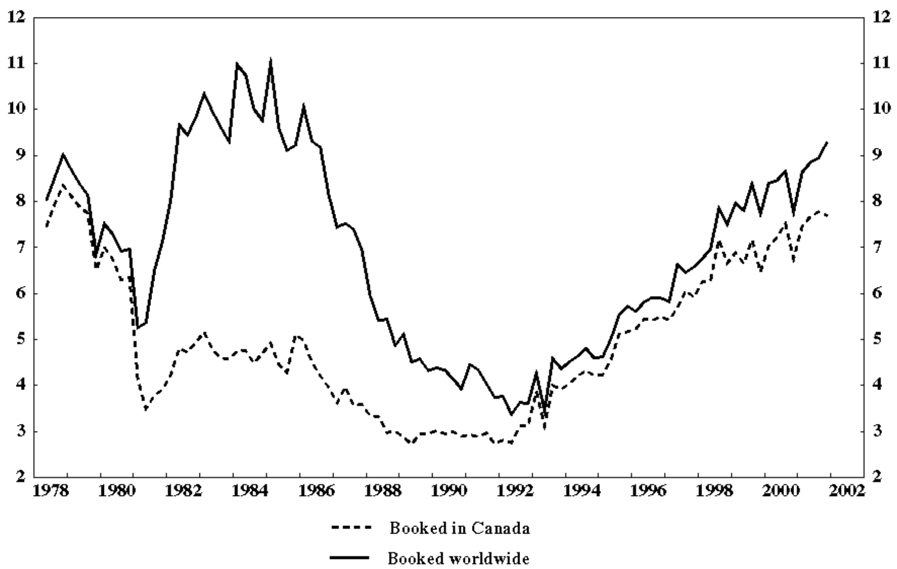
Fig. 4 shows the same data, converted into Canadian dollars and scaled as a proportion of broad money (M3). Again, there is a sharp pickup in the proportion of U.S. deposits through the 1990s in both categories. These ratios have fluctuated over a wide range during the past 25 years, so that the current levels are not exceptional. Part of the rise in the ratio of U.S.-dollar deposits to M3 simply reflects the appreciation of the U.S. dollar against its Canadian counterpart. Factors behind the large swings in the ratio of U.S.-dollar deposits to broad money are not immediately obvious. Currency substitution might provide one answer, with Canadians reducing their holdings of U.S. dollars as the Canadian dollar strengthened during the second

Figure 3: *U.S. dollar currency deposits of Canadian residents (US$ millions).*



Source: Bank of Canada, geographic assets and liabilities booked in Canada and outside Canada.

Figure 4: *U.S. dollar currency deposits of Canadian residents as a percentage of M3 (expressed in Canadian dollars).*

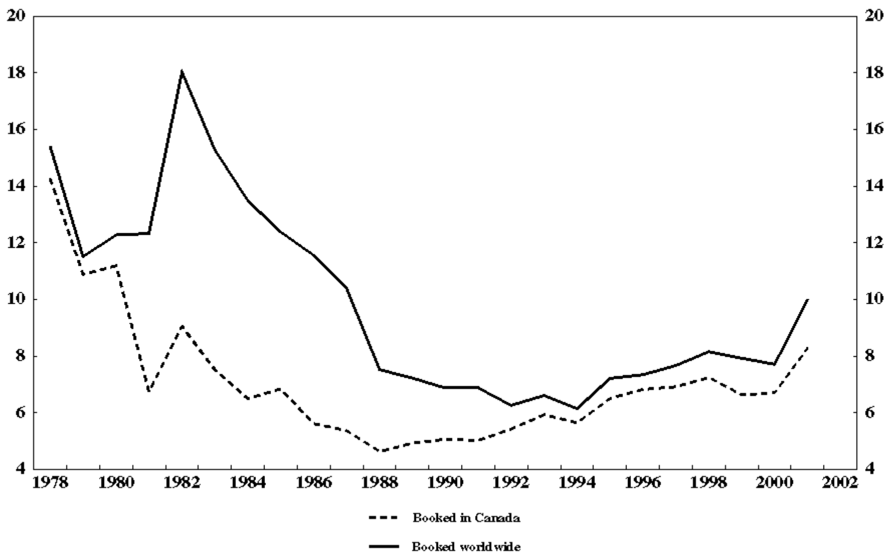


Source: Bank of Canada, Geographic Assets and Liabilities Booked in Canada and outside Canada.

half of the 1980s, and increasing such holdings as the Canadian dollar subsequently weakened during the 1990s.

The steady rise in U.S.-dollar deposits since the beginning of the 1990s could also reflect growing Canada–U.S. economic integration following the signing of the Free Trade Agreement (FTA) in 1988. Growing two-way trade with the United States may have increased the demand for U.S.-dollar balances by Canadian firms, which account for more than two-thirds of foreign currency deposits held in Canadian banks. Despite the rapid growth of continental trade, U.S.-dollar deposits, as a percentage of trade (exports and imports of goods and services) with the United States, have increased only modestly since the late 1980s (Fig. 5).

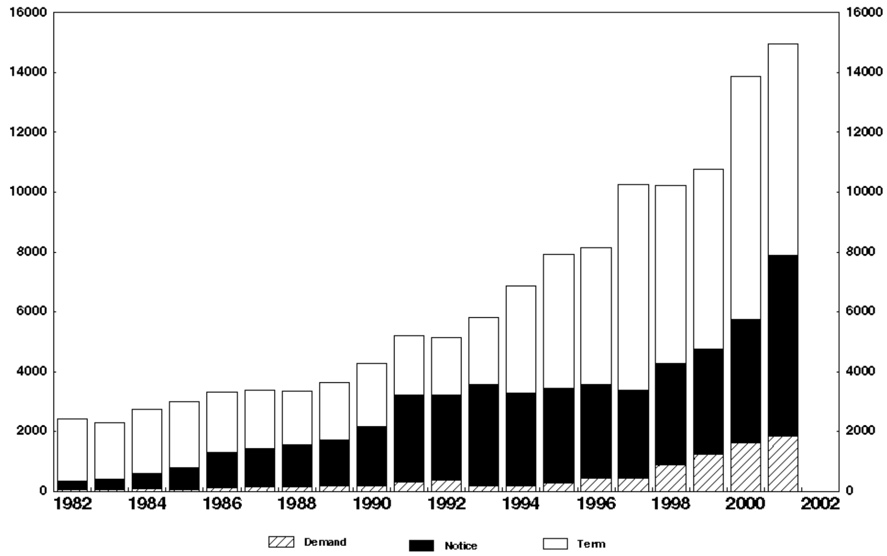
Figure 5: *U.S. dollar currency deposits of Canadian residents as a percentage of trade with the United States (expressed in Canadian dollars).*



Source: Bank of Canada, Geographic Assets and Liabilities Booked in Canada and outside Canada.

As stated earlier, people hold foreign currency for purposes other than domestic transactions. A decomposition of the data on the foreign currency deposits of Canadian individuals (Fig. 6) indicates that the amount of U.S. dollars held in demand accounts—the type of account usually used for transactions—is relatively small, despite some recent growth. This suggests that the reason Canadians are holding foreign currency deposits is probably not related to the transactions demand for money.

Figure 6: *Total U.S. dollar deposits payable to Canadian residents (Individuals) (US$ millions).*



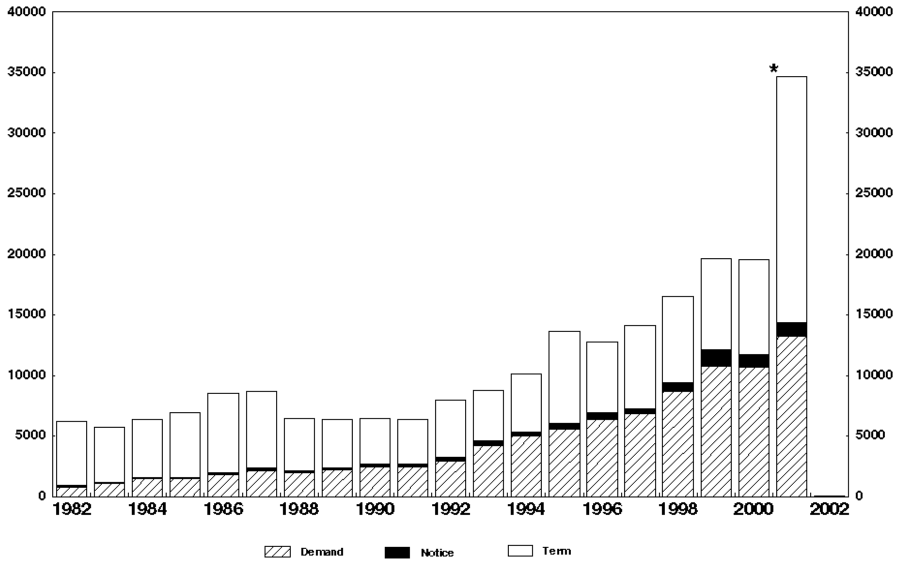
The U.S.-dollar deposits of Canadian firms have, however, increased steadily over the past decade (Fig. 7). This trend is consistent with growth in trade with the United States since the signing of the FTA.[13]

5.2. Currency and Monetary Instruments Reports

Since 1980, the U.S. Customs Service has required individuals and companies shipping US$10,000 or more in cash across the border to complete a confidential currency and monetary instruments report (CMIR), indicating the size, origin, and destination of the shipment.[14] While, theoretically, CMIRs should be a good source of information regarding the extent to which countries are dollarized, there are many reasons to believe that they are biased. As noted by Porter and Judson (1996), CMIR data are distorted by at least four factors. First, only travellers entering the United States are required to pass through customs. Consequently, outflows of U.S. currency are likely to be underreported. Second, shipments of currency of less than US$10,000 are not captured by the CMIR data system. This could be particularly significant for Canada, given its proximity to the United States and the number of cross-border visits that occur annually. Third, it is likely that some shipments of greater than $10,000 are misreported and unreported: some individuals, particularly those engaged in illegal activities, would seek to avoid reporting. Fourth, the CMIRs were designed to track individual transactions, rather than to provide aggregate data on currency movements. Consequently, errors, including double counting, can arise when the data are aggregated.

Despite these caveats, CMIR data provide an interesting perspective on U.S.-

Figure 7: *Total foreign currency deposits payable to Canadian residents (Firms) (US$ millions).*



* Break in series in 2001.

dollar flows and can shed some light on the extent to which there is net demand for U.S. currency outside the United States. Large, persistent net outflows of U.S. cash to a country would be evidence that U.S. dollars are being used for transactions (and possibly other purposes) by individuals and companies resident in that country.

Fig. 8 plots the cumulative inflow of U.S. dollars, based on the CMIR data, as a proportion of Canadian notes and coins in circulation. Two alternative series are plotted. One values the U.S. dollars at the going exchange rate, while the other uses a constant exchange rate to see through movements in the ratio caused purely by exchange rate movements.

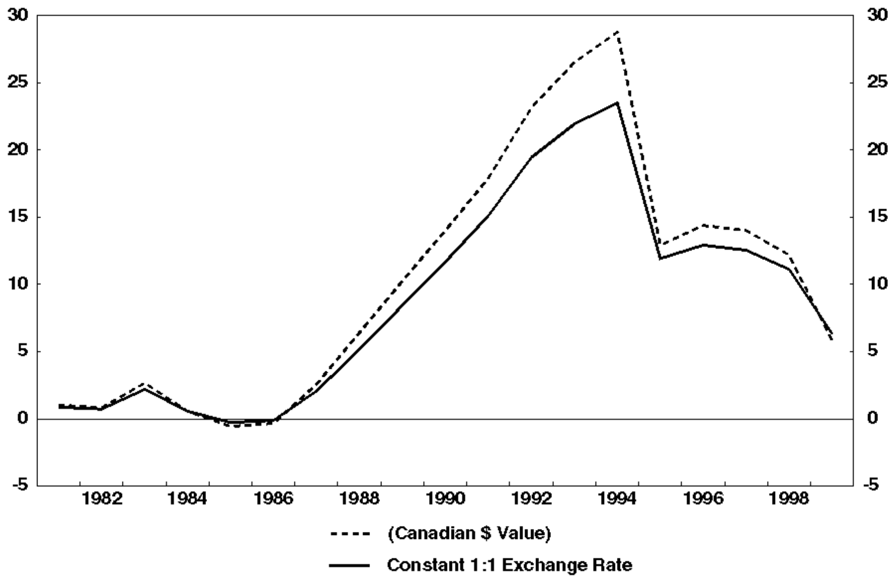
After fluctuating close to zero until the mid-1980s, both ratios rose steadily through the second half of the 1980s and the early 1990s. At prevailing exchange rates, the CMIR data suggest that the amount of U.S. dollars in circulation at their peak in 1994 was more than 30 per cent of the outstanding stock of Canadian notes and coins in circulation. This is a surprisingly high figure. By 1999, however-the last year for which data are available-this ratio had fallen to about 9 per cent.

There may be a variety of explanations for the temporary increase in demand for U.S. cash by Canadians during the late 1980s and early 1990s, but the fallback is not consistent with increasing dollarization.[15]

5.3. Holdings of U.S. Dollars by Canadian Banks

Another way of measuring the trend in U.S.-dollar holdings in Canada is to examine

Figure 8: *Cumulative Net U.S.-Dollar Inflows of US$ (CMIR data) as a Percentage of Canadian Notes and Coins in Circulation*



Notes: Currency and Monetary Instrument Reports were collected by the U.S. Customs Service. Prior to 1981, data on notes only were collected.
Sources: U.S. Federal Reserve Board of Governors; Bank of Canada - b251 (Notes); Royal Canadian Mint, Memorandum of Subsidiary Canadian Coin in Circulation (Coins).

the stock of U.S. currency held by Canadian banks. Rising demand for U.S. currency should be reflected in growing stocks of U.S. currency in banks. Unfortunately, holdings of U.S. cash are not routinely reported by Canadian banks. The Canadian Bankers Association conducted a special survey for the Bank of Canada, in which three of the six major banks were able to provide consistent data for the 1985–2000 period and two other banks were able to give partial information. There was little net change in the amount of U.S. bank notes held by Canadian banks over the 1990s. Over the fifteen-year period, however, their holdings of U.S. currency more than doubled. Holdings of Canadian-dollar cash rose by slightly more than one-third over the same period.[16]

5.4. Stability of Currency and Money Equations

In Appendix A, short-run demand equations for currency and broad money (M2++) are estimated using single-equation, error-correction models. The stability properties of the estimated functions are then examined for structural breaks. To test for currency substitution effects, the Canada/U.S. bilateral exchange rate is included in both equations. In the case of the currency-demand equation, the coefficient on the exchange rate term was consistent with currency substitution over the 1961-2001 sample period and was statistically significant. The significance of the exchange rate term, however, was the result of data from the first half of the sample period (1961-80). In the second half of the sample period, the exchange rate term was incorrectly signed and was not significant, suggesting no currency substitution. In the case of the M2++ equation, the coefficient was correctly signed but statistically insignificant.

6. The U.S. Dollar as a Store of Value

The third use of money is as a store of value. This section explores the extent to which Canadians invest their savings in U.S.-dollar assets and how this may have changed over time. We also look at the currency in which Canadians denominate their liabilities and how this too may have evolved.

6.1. Assets of Canadians

Table 5 lists estimates of the currency distribution of holdings in Canadian mutual funds, pension funds, and other pooled funds over the 1997–2000 period.[17] The share of assets denominated in Canadian dollars declined steadily from 75 per cent in 1997 to 67 per cent in 2000, with the share of foreign assets rising concomitantly from 25 per cent to 32 per cent. The share of identified U.S.-dollar assets rose from 13 per cent to 19 per cent over the period.

Table 5: *Holdings in equities and bonds of mutual, pension, and other pooled funds distribution of portfolio assets by currency of denomination (percent)*

Currency group	1997	1998 share	1999 share	2000 share
Canadian dollar	75	72	68	67
U.S. dollar	13	15	17	19
Other currency	6	7	7	9
Unidentified currency[1]	5	5	8	4
TOTAL	100	100	100	100

Source: Statistics Canada

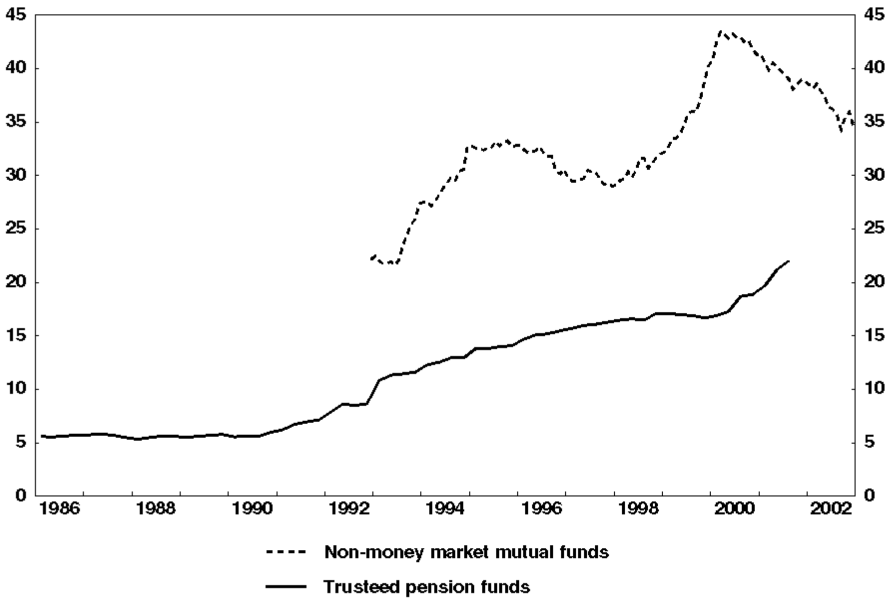
Note: Canadian stocks and bonds are considered to be 100 per cent Canadian dollars and U.S. stocks are considered to be 100 per cent U.S. dollars.

1. Contains foreign assets only.

Fig. 9 shows a longer, but less-detailed, time series for the foreign content of trusteed pension funds as well as for non-money-market mutual funds. There has been a consistent upward trend in the foreign-denominated assets of pension funds over the past decade.[18] The bulk of foreign currency assets is believed to be denominated in U.S. dollars.

This increase has at least been partly in response to changes in regulations governing the foreign content of tax-sheltered investment funds. While Canadians are free to invest in foreign assets without constraints, the federal government has

Figure 9: *Foreign content of trusteed pension funds and mutual funds.*



Note: The funds are non-money market.

limited the extent to which pension funds, as well as mutual funds eligible to be held in registered retirement plans, can invest in foreign assets.[19] This ceiling, which was set at 10 per cent prior to 1991, was raised in steps to 20 per cent in 1994 and to 30 per cent effective January 2001.[20]

Because not all mutual funds are eligible for inclusion in registered retirement plans, some are not subject to the foreign-content restrictions. It is therefore not surprising that the foreign content of mutual funds, as a group, is higher than that of trusteed pension funds. An additional explanation would be that the mutual funds data are on a market-value basis, while the pension funds data are on a book-value basis and therefore might not fully capture the current value of the assets, particularly if the assets were acquired a long time ago. In both cases (but especially for mutual funds, given their market valuation), the depreciation of the Canadian dollar would be another factor contributing to the rise in the value of the foreign component.

6.1.1. Comparison with Other Countries

The foreign currency component of Canadian pension and mutual funds has steadily increased over time. How does this experience compare with that of other countries? Is the fact that Canadians are holding an increasing portion of their wealth in U.S.-dollar-denominated assets a sign of dollarization, or of something else?

Table 6 lists the percentages of non-domestic assets held by pension funds in a range of OECD countries as well as an estimate of what the percentage is likely to be in 2005.[21] As the table shows, the Canadian experience is not exceptional. If anything, Canadian pension fund portfolios appear to be relatively underweight in foreign assets, reflecting at least in part government restrictions on foreign content. With the easing of such restrictions in 2001, the share of non-domestic assets is expected to rise significantly by 2005.

Table 6: *Non-domestic investment in OECD-country pension funds (percentage)*

	1995	**2000**	**2005 estimate**
Australia[1]	17	23	29
Belgium	36	63	65
Canada	18	17	29
Finland	2	31	38
France	7	14	17
Germany	3	16	17
Ireland[1]	38	61	65
Japan	13	21	24
Netherlands[1]	18	65	73
Spain	3	23	37
Sweden	0	11	26
Switzerland	11	27	31
United Kingdom[1]	25	27	30
United States[1]	10	11	14

1. Judged to have a low level of regulatory constraint on foreign investment (Reisen 2000).
Source: InterSec Research Corporation (2001).

Several factors explain the growing internationalization of pension fund portfolios: the easing of government restrictions on foreign content; better communications and information regarding foreign companies, which have reduced transactions and monitoring costs; demographic factors, which may have pushed pension managers to look for better returns; and, most importantly, diversification. International diversification can simultaneously raise returns and lower risk if pension funds invest in countries where returns are relatively uncorrelated with returns in the domestic country. The evidence thus suggests that while Canadians are indeed holding an increasing proportion of their assets in U.S.-dollar-denominated instruments, this trend has more to do with the easing of government restrictions and portfolio diversification than with dollarization.

6.2. Liabilities of Canadians

In this section, the extent to which Canadian individuals and firms borrow in foreign currency is examined. Generally, consumer lending of foreign currency by Canadian banks to Canadian individuals has been on a slow upward track in current dollar terms over the past 20 years. But as a share of total bank lending, foreign currency lending accounted for slightly less than 1 per cent in 2001, unchanged from its share in 1981.

The share of foreign-currency lending for purchasing securities as a proportion of total lending for such purposes has more than doubled over the past 20 years, to roughly 10 per cent. This type of lending to Canadian residents rose sharply during the late 1990s, peaking in 2000. This undoubtedly reflected the strong returns then available in foreign equity markets, particularly in the United States. Weakening equity markets led to a decline in such lending in 2001.

Foreign-currency lending to Canadian firms has also been on a slow upward track in current dollar terms over the past 20 years. As with consumer lending, however, the share of foreign lending as a proportion of total business lending has remained essentially constant, at roughly 18 per cent.

Important industrial sectors that experienced a large increase in their foreign-currency borrowing over the past 20 years include the manufacturing sector—where more than 30 per cent of that sector's total bank borrowing in 2001 was in foreign currency, up from 17.5 per cent in 1981—and the transportation, communications, and other utilities group, where borrowing rose from 13 per cent to 31 per cent over the same period. Increases in these sectors were offset by declines in foreign-currency borrowing by the construction and real estate sector, where the share of foreign-currency borrowing fell to 12.5 per cent in 2001 from 18.6 per cent in 1981, and by conglomerates, which fell to 5 per cent from 25 per cent.

In contrast with foreign-currency lending by banks, there has been strong growth in U.S.-dollar bond issues by Canadian firms over the past 25 years. Consequently, the share of Canadian-dollar issues (including euro-Canadian issues) as a proportion of total outstanding bonds issued by Canadian corporations has fallen from 80 per cent in 1975 to 46 per cent in 2001 (Table 7). Outstanding U.S.-dollar issues have risen from 19 per cent to 49 per cent over the same period.

Nevertheless, Canadian-dollar issues placed in Canada have been broadly stable since 1985. The share of U.S.-dollar-denominated bonds increased at the expense of issues denominated in third currencies, and euro-Canadian-dollar issues, which peaked at a 14 per cent share in 1990 and fell steadily to only 2 per cent in 2001. The decline of euro-Canadian issues was likely the result of waning overseas investor interest in Canadian-dollar bonds as the Canadian dollar depreciated and as interest differentials narrowed or shifted to favour U.S. instruments.

Table 8 reports on net equity issues of Canadian corporations. As the table shows, only 7 per cent of such issues were placed abroad, on average, in the 1996–2000 period. In other words, the vast proportion of equity raised by Canadian corporations was placed in Canada. The 7 per cent figure likely provides an upper limit on the amount of equity issued in foreign currency (i.e., U.S. dollars). Equity issues placed in Canada but denominated in foreign currency are rare.

Table 7: *Distribution of outstanding bonds issued by Canadian corporations (percent)*

	Can$	US$	EuroCan$[1]	EuroUS$[1]	Other
1975	79	19	1	0	0
1980	62	25	6	6	1
1985	47	23	7	16	7
1990	46	17	14	8	15
1995	43	35	8	6	8
2000	47	37	3	9	5
2001	44	42	2	7	5

Source: *Bank of Canada Review* Table K8.
1. EuroCan$ are Canadian-dollar issues placed outside of Canada; EuroUS$ are U.S.-dollar issues placed outside the United States.

Table 8: *Canadian corporate equity issues placed abroad: 1955–2000*

Period	Per cent of total net corporate stock issues placed abroad
1955-60	1
1961-65	3
1966-70	10
1971-75	3
1976-80	3
1981-85	3
1986-90	6
1991-95	12
1996-2000	7

Source: Bank of Canada

7. Main Messages and Policy Implications

The evidence presented in this paper suggests that many of the concerns that have been expressed about the imminent dollarization of the Canadian economy are misplaced. The Canadian dollar continues to be used as the principal unit of account, medium of exchange, and store of value, and there is no indication that dollarization is likely to take hold in the foreseeable future.

Use of the U.S. dollar is well below the normal benchmarks used to define dollarization. Relative to many other industrial economies, Canada is remarkably “undollarized.” Despite the close proximity of the U.S. economy and the evident importance of U.S. exports and imports to the Canadian economy, very little informal dollarization has taken place. The significance of the U.S. dollar as a unit of account, medium of exchange, and store of value is often greater in countries like Japan and the United Kingdom than it is in Canada.

Most goods and services are priced exclusively in Canadian dollars, unless they are destined for the U.S. market or involve the sale of a primary product. The same is true for the preparation of corporate financial statements, unless the company is a large multinational and conducts most of its business outside Canada. Firms with interlisted shares are often required to use the U.S. dollar for reporting purposes, but the relative importance of Canadian firms with stock listed on the NYSE and other U.S. exchanges has actually been declining over time— compared with other foreign firms and as a share of the firms listed on the TSX. In short, the U.S. dollar is seldom used as a unit of account for domestic transactions.

The same can be said of the U.S. dollar as a medium of exchange. The absolute value and percentage share of Canadian bank deposits denominated in U.S. dollars were on a rising trend through most of the 1990s. The relative importance of such deposits was actually higher, however, in the late 1970s and early 1980s. Currency holdings displayed a somewhat different pattern, increasing dramatically prior to 1994–95 and then falling back to the low levels observed 10 and 20 years earlier. Much of this movement appears to reflect activities related to cross-border shopping, however, of both a legal and illegal nature.

The one area where dollarization has become more prevalent is as a store of value. Canadian households seem to be directing an ever-larger share of their portfolios to U.S.-dollar assets. Again, however, the relative importance of foreign investment in Canadian portfolios is often much lower than it is in other industrial countries. Moreover, most of the foreign investment activity that we have seen in the recent past can be credited to looser government restrictions. Standard portfolio models indicate that, by most measures, Canadians are still seriously underdiversified, and that more outward investment can be expected in the future.

Canadian corporations are also borrowing more extensively in U.S. dollars and in U.S. markets, but much of this has been at the expense of other foreign borrowing. The share of financing raised in domestic markets has remained essentially unchanged during the past 15 years. The same can be said of Canadian equity financing, where domestic markets have also managed to preserve and even increase their relative share through the late 1990s and early 2000s.

Critics of the present exchange rate system acknowledge that the current state of the Canadian dollar is not as dire as some had suggested, but they note that its future is far from assured. The world is becoming more polarized, they suggest, dominated by two or three key currencies. Small regional currencies, such as the Canadian dollar, will find it increasingly difficult to survive and will eventually be displaced by the euro, the U.S. dollar, and the yen or yuan.

Even if this were true, it is not obvious that the process would unfold as easily or as quickly as the critics believe. Past experience indicates that there are only two ways that a country can become dollarized. Its government can make an explicit decision to adopt another country's currency – official dollarization – or it can so mismanage its own economy that citizens opt for another currency – unofficial dollarization. Unofficial dollarization has never been effected under a regime of sound macroeconomic management. In fact, the evidence tends to go in the other direction. Countries, it seems, must chronically mismanage their economies before households and firms show any indication of shifting to other currencies. The hysteretic effects associated with the use of a given currency are sizable. It is difficult to supplant the domestic currency; but, once replaced, it is difficult to resurrect.

Canada has a reputation for solid macroeconomic performance. While no one would claim that it has been perfect, it has been at least as good as that of most other industrial countries – including the United States – and it is getting better over time. Inflation in Canada has typically been quite similar or slightly lower than that of the United States since the early 1990s. And with explicit inflation targets now in place, there is every reason to expect even better performance in the future. Although low and stable inflation is obviously of benefit in its own right, it also reduces the likelihood of unofficial dollarization.

The counter to this argument, as well as to past experience, is that Canada is special, and that dollarization remains a strong possibility. Old rules, therefore, will not necessarily apply. Canada enjoys a unique relationship with the United States, and has an unprecedented amount of trade and investment with its southern neighbour. These factors, the critics suggest, increase the likelihood of dollarization and override the lessons learned in other countries. While such an outcome is always possible, nothing that we have uncovered in the data points in this direction. Many of the recent trends actually move in the opposite direction and indicate that dollarization is less likely now than it was in the past. The best contribution that the Bank of Canada can make to the performance of the Canadian economy *and* to the longevity of the Canadian dollar is to maintain low and stable inflation.

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Appendix. Short-Run Demand Equations for Currency and Broad Money

A.1. Introduction

This appendix describes empirical work that was undertaken using short-run money-demand equations to detect and measure the extent of dollarization in Canada.[22] The approach that was followed borrowed extensively from an earlier literature on currency substitution. The latter bears a close relationship to the present discussion of dollarization and was of considerable interest to monetary economists in the late 1970s and early 1980s.[23] For obvious reasons, it is now receiving renewed attention.

The first stage of the analysis involves estimating standard, closed-economy models for currency, together with a broad money measure, M2++, to test their stability over time. Evidence of structural instability in these standard equations would provide indirect support for the presence of dollarization, particularly if it was associated with a significant and unexplained decline in the demand for domestic money. The results would not be conclusive, of course, since other factors, such as financial innovation, might also have caused the instability.

The second stage of the analysis is designed to yield a more direct measure of dollarization. It involves adding variables to the original specification to capture the opportunity cost of investing in foreign currency and short-term money instruments. While problems of collinearity often make it difficult to obtain reliable estimates of the parameters on these extra variables, the existence of correctly signed and statistically significant coefficients would provide direct evidence of dollarization.

The rest of this appendix describes the specifications that were tested and the results that were obtained. Although some suggestion of currency substitution or dollarization was observed in the currency equation during the first half of the sample, the results, for the most part, were not very supportive of the dollarization hypothesis.

A.2. A Simple Error-Correction Model

The demand functions that we estimated are shown below. They are based on the simple, error-correction specification described in equation (1).

$$\Delta m_t = \alpha_0 + \sum_{i=1}^{n1} \alpha_{1i} \Delta m_{t-i} + \sum_{i=0}^{n2} \alpha_{2i} \Delta y_{t-i} + \sum_{i=0}^{n3} \alpha_{3i} \Delta r_{t-i} \quad (1)$$
$$+ \lambda (m_{t-1} - \beta_0 - \beta_1 p_{t-1} - \beta_2 y_{t-1} - \beta_3 r_{t-1}) + u_t,$$

where m is the natural logarithm of the monetary aggregate (currency or M2++) deflated by the CPI, y is the natural logarithm of real GDP, r is the domestic opportunity cost holding money (the 90-day commercial paper rate in the currency equation and the 10-year government bond rate in the M2++ equation), Δ is the first-difference operator, and λ is the error-correction coefficient.

The equations were estimated with quarterly data, spanning the sample period 1961Q1–2001Q4 in the case of currency and 1968Q1–2001Q4 for M2++. As long as the non-stationary variables appearing in the equation were cointegrated, equation (1) could be estimated using a consistent estimation procedure. The lag lengths on the first-difference variables that were used to capture short-run dynamics were determined by assigning four lags to each variable and then "testing down." In most cases, only the first lag was significant.

A.3. Parameter Estimates for the Standard Equations

The parameter estimates for the two standard equations are shown in column 2 of Tables A1 and A2. All the coefficients are statistically significant and correctly signed. The implied long-run demand for currency is:

$$curr_t = -4.07 + 0.76 y_t - 0.07 r90_t, \tag{2}$$

and the corresponding equation for M2++ is

$$m2{+}{+}_t = -10.41 + 1.45 y_t - 0.03 rl_t \tag{3}$$

As one would expect, the income elasticity in the currency equation is much smaller than that in the M2++ equation, while the semi-elasticity for the interest rate term is much larger. Both estimated equations are able to track the major movements in the actual data with reasonable accuracy (see Fig. A1), and there are no evident signs of structural instability.

Table A1: *Money-Demand Equation For Currency: Parameter Estimates Sample Period: 1961Q1–2001Q4*

	Excluding The Exchange Rate	Including The Exchange Rate
adjustment	-0.017 (-2.185)	-0.029 (-3.227)
constant	-4.066 (-3.887)	-6.220 (-7.027)
RGDP[t-1]	0.761 (9.899)	0.964 (11.103)
R90[t-1]	-0.070 (-2.488)	-0.057 (-4.099)
exchrate[t-1]	æ	-0.616 (-2.832)
Δcurr[t-1]	0.404 (5.600)	0.340 (4.515)
Δrgdp[t-1]	-0.044 (-0.684)	-0.036 (-0.565)
ΔR90[t-1]	-0.001 (-2.028)	-0.001 (-1.490)
Δexchrate[t-1]	æ	0.014 (0.484)

Note: *t*-statistics in parentheses. Dependent variable is the first difference of the real currency outside banks. Δ indicates first difference.

A.4. Testing for Structural Stability

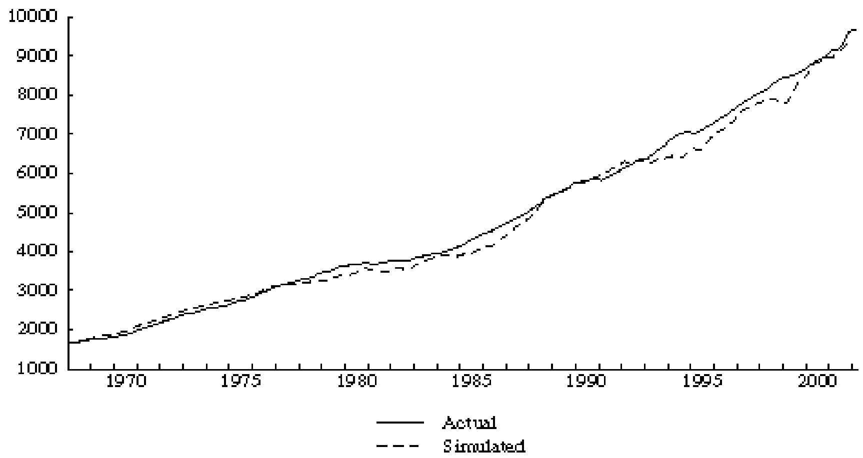
Although the equations appear to be well behaved, rolling Chow tests were also used as a more rigorous check for structural instability. The resulting *p*-values are plotted in Fig. A2. Although some movement is detected in the final estimates of the currency equation at either end of the sample, the *p*-values are typically higher than 0.1, indicating that the parameters are stable. Some variability is also observed in the plot for M2++, but the *p*-values are again greater than 0.1. In short, there is no reason to believe that the standard equations have undergone a major structural shift over the last 40 years because of dollarization or any other unsettling influence.

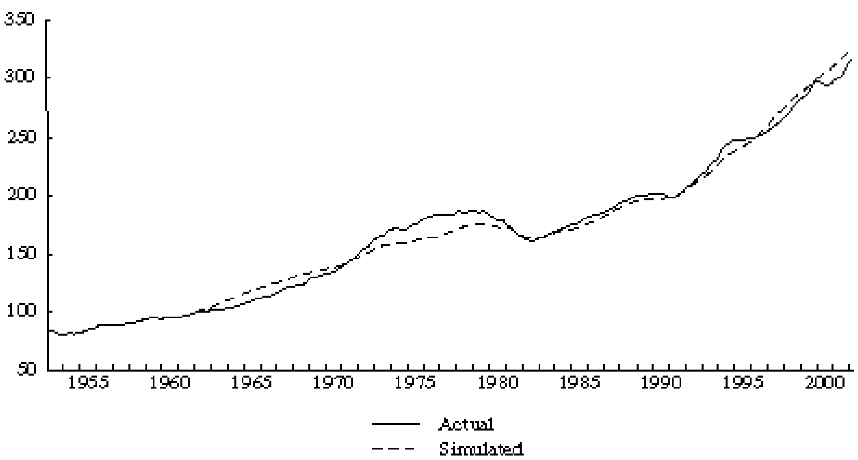
Table A2: *Money-demand equation for M2++: Parameter estimates sample period: 1968Q1–2001Q4*

	Excluding the exchange rate	**Including the exchange rate**
adjustment	-0.037 (-2.578)	-0.030 (-1.969)
constant	-10.406 (-6.511)	-8.938 (-2.374)
RGDP[t-1]	1.448 (13.481)	1.339 (4.691)
RL[t-1]	-0.031 (-2.638)	-0.038 (-2.039)
exchrate[t-1]	Æ	0.106 (0.336)
Δm2++[t-1]	0.204 (2.186)	0.195 (2.081)
Δrgdp[t-1]	-0.049 (-0.614)	-0.054 (-0.660)
ΔRL[t-1]	-0.002 (-2.444)	-0.002 (-2.110)
Δexchrate[t-1]	Æ	-0.049 (-1.518)

Note: *t*-statistics in parentheses. Dependent variable is the first difference of the real currency and real m2++. Δ indicates first difference.

Fig. A1: *In-sample fit (Can$ billions).*



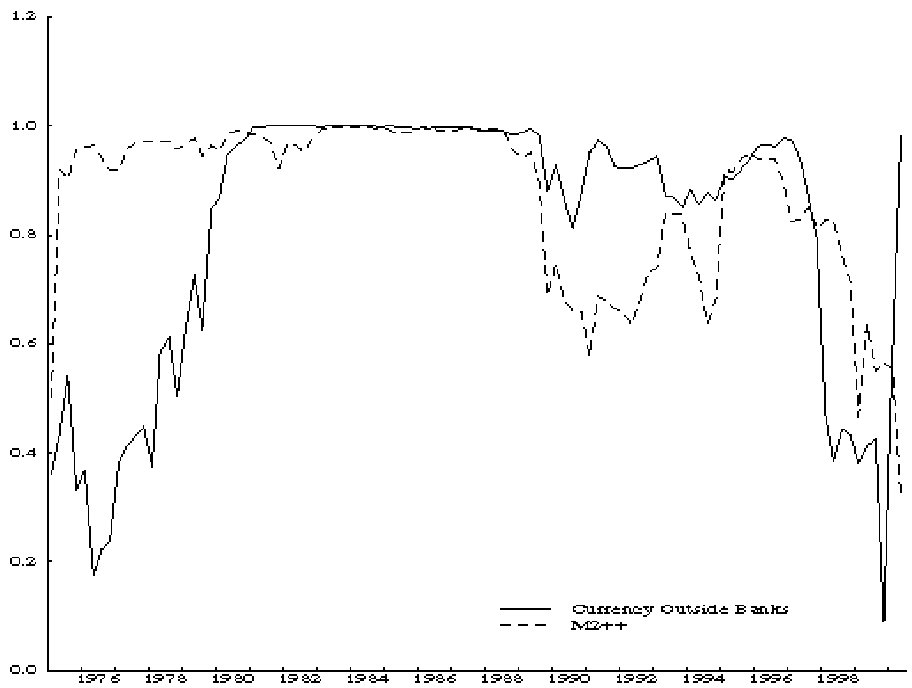


A.5. Testing for Currency Substitution

A more direct test of dollarization can be conducted by adding to each equation an extra variable that captures the opportunity cost of shifting funds out of the Canadian dollar and into U.S.-dollar assets. The best results, in terms of generating coefficients that were occasionally significant, were obtained by including the Can$/US$ exchange rate in both the cointegrating vector and as part of the short-run dynamics.

Trying to add foreign interest rates to the equations proved ineffective, owing to severe collinearity, and it typically made both the domestic and foreign interest rate terms insignificant.

Fig. A2: *Rolling Chow tests for the money-demand functions.*



The final estimates are shown in column 3 of Tables A1 and A2. No evidence of currency substitution or dollarization was found in the case of M2++, but the exchange rate term in the currency equation was significant and correctly signed. Further testing indicated that all the significance was drawn from the first half of the sample, however, and that the exchange rate term lost all of its explanatory power once the sample was split in 1980 (Table A3).

Table A3: *Money-demand equation for currency with exchange rate variable: Parameter estimate split sample*

	1961Q1-1980Q4	**1981Q1-2001Q4**
Adjustment	-0.098 (-2.848)	-0.064 (-3.447)
Constant	-6.319 (-9.128)	-4.680 (-2.484)
RGDP[t-1]	0.963 (16.581)	0.764 (5.653)
R90[t-1]	-0.024 (-2.475)	-0.034 (-3.373)
Exchrate[t-1]	-0.836 (-4.602)	0.059 (0.426)
Δcurr[t-1]	0.183 (1.633)	0.236 (2.205)
Δrgdp[t-1]	-0.079 (-0.992)	-0.076 (-0.734)
ΔR90[t-1]	0.001 (0.824)	-0.001 (-1.165)
Δexchrate[t-1]	-0.056 (-0.901)	0.059 (1.681)

Note: *t*-statistics in parentheses. Dependent variable is the first difference of the real currency outside banks. Δ indicates first difference.

A.6. Conclusion

The parameter estimates and stability tests reported above provide little support for the notion that dollarization was or is an important feature of the Canadian economy. Some evidence of currency substitution was detected in the currency equation over the 1960–80 sample period, but its significance seemed to disappear rather than grow as the sample was extended.

Notes

1. Executive, Bank of Canada. E-mail: jmurray@bankofcanada.ca.
2. International Department, Bank of Canada. E-mail: jpowell@bankofcanada.ca
3. Interestingly, many of these countries have a national currency that manages to coexist with the foreign currency. Its use, however, is limited to very small transactions, such as buying a newspaper or other convenience good.
4. Some researchers favor a higher benchmark, arguing that a country should not be regarded as being dollarized unless more than 50 per cent of its broad money stock is denominated in a foreign currency.
5. The advantages and disadvantages of moving to an alternative exchange rate system have been examined in other papers. See, for example, Murray (2000) and Murray, Schembri, and St-Amant (2003).
6. Several studies have shown that even large countries, such as Japan, have a tendency to invoice their exports in U.S. dollars, whether or not the foreign customer is American.
7. These additional surveys have now been completed. The results were published in Murray, Powell and Lafleur (2003).
8. The *Factbook* indicates that 55 Canadian companies had stock listed on the NYSE in 1996, and that their market capitalization was US$60 billion.

9. A further 35 Canadian companies are currently listed solely on U.S. exchanges, down from 53 in 1998.
10. These figures refer to the number of shares that are traded on U.S. exchanges as opposed to the TSX, and may understate the relative importance of U.S. trading activity, since the market value of interlisted firms is often greater than that of firms listed solely on the TSX.
11. Data on total foreign currency deposits are also available. Because U.S.-dollar deposits account for the vast proportion of such deposits, however, and because we are interested in examining the extent to which U.S. dollars are used in Canada, we have focused on U.S.-dollar information.
12. Reserve requirements levied on domestic deposits but not on deposits booked outside of Canada might offer at least a partial explanation for the divergence. Reserve requirements were phased out during the early 1990s.
13. Baliño, Bennett, and Borensztein (1999) identify several countries whose ratio of foreign currency deposits to total bank deposits exceeded 30 per cent in 1995. These included Argentina, with a ratio of foreign currency deposits to broad money of 44 per cent, Bolivia at 82 per cent, Turkey at 46 per cent, and Uruguay at 76 per cent. Similar ratios for selected industrial countries ranged from 4.4 per cent for the Netherlands to 21.6 per cent for Greece. The ratio for the United Kingdom was 15.4 per cent. On this basis, Canada, with only 10 per cent, cannot be considered a dollarized economy.
14. The U.S. Customs Service began collecting these reports in 1977. The threshold amount was increased from US$5,000 to US$10,000 in 1980.
15. See the conference version of the paper for possible explanations.
16. Prior to the phasing-out of reserve requirements during the early 1990s, banks could count their vault holdings of Canadian dollars towards meeting reserve requirements. The elimination of reserve requirements gave banks an incentive to economize on their holdings of Canadian currency that had not existed earlier.
17. No data prior to 1997 are available.
18. These data are on a book-value basis.
19. Some funds have circumvented the regulation through the use of derivative products.
20. Limits on the foreign content of private pension funds are quite common in OECD countries. Compared with other OECD countries, Canada was, as of 1994, considered as having a "medium" level of restrictions. Reasons that countries impose restrictions on foreign content include retaining domestic savings for investment, having a captive source of funds for government borrowing, and enabling governments to direct resources to particular industries (Reisen 2000).
21. See InterSec Research Corporation (2001).
22. We would like to thank Joseph Atta-Mensah, Andra Ghent, and Ramdane Djoudad for their assistance in completing this work.
23. See, for example, Boothe et al. (1985), Bordo and Choudri (1982), Cuddington (1983), and Feige et al. (2000). Currency substitution can be regarded as a modest or

less-threatening form of dollarization, in which agents shift between domestic and foreign money balances in response to their respective rates of return and opportunity costs.

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PART III

EXCHANGE RATES, FDI AND THE DOMESTIC ECONOMY

Exchange Rate Regimes and Foreign Direct Investment

Katheryn Niles Russ[1]

Johns Hopkins University

Abstract. This paper argues that exchange rate uncertainty can impact the welfare of countries hosting foreign direct investment ventures even in a pricing-to-market framework, which previous models argue insulates the home economy from the impact of foreign monetary shocks. The key engine generating this result is a fixed cost drawn from trade and industrial-organization theory of multinational firms, which drives a wedge between the price charged for the home and foreign good in the home market. The results explain observed tendencies of firms to expand production overseas in the face of exchange rate uncertainty, as well as the low rate of return on assets for foreign-owned firms in the United States.

1. Introduction

> *In the financial crises of 1997-98, the middle ground was weakened: pegged exchange rates crashed from Bangkok to Brasilia. Since, the extremes have been in vogue.*
>
> --The Economist *(29 January 2000, pp. 88)*

Foreign direct investment (FDI) constitutes the single largest source of capital inflows for developing countries, accounting for two-thirds of capital flows to LDCs in 1999 and 86 percent of inflows to Latin America (Williamson 2001). Sales by foreign branches of multinational enterprises (MNEs) owned by the U.S. are more than twice as large as U.S. exports and production by resident majority-U.S.-owned companies constitutes between 2.4 and 3.4 percent of the gross national product in Argentina, Brazil, Chile Mexico, and Venezuela (Mataloni 2000a). Nevertheless, the impact of exchange rate volatility on investment decisions by multinational firms is largely ignored in the debate over optimum currency regimes. Although empirical and partial-equilibrium analyses suggest that exchange rate uncertainty may be important in a firm's decision to engage in production activity overseas, the literature incorporating multinational firms into models of the global economy has remained largely separate from studies of exchange-rate policy.

One exception to this state of affairs is a study by Michael B. Devereux and Charles Engel (1999), who do consider the welfare impact of fixed and floating exchange rate regimes in the presence of a stylized form of FDI. This paper joins their conceptualization of the MNE with local host-country fixed costs prevalent in trade and industrial-organization models in a one-period monetary model of the international economy. It argues that exchange-rate uncertainty presents two risks for a foreign firm investing in the home country if the firm must pay a fixed cost to operate its home-country plant. First, it faces the direct risk that a depreciation of the home currency will cause a net loss if the fixed cost is paid before monetary shocks occur. Second, a downward movement in the home-country money supply might cause a negative demand shock to sales in the home market, also causing a net loss. In an imperfectly competitive environment, either factor can compel the foreign-owned firm to set a lower price in local currency for goods produced in its home-country plant than in the absence of exchange rate uncertainty. Hence, this paper provides micro-foundations for the link between foreign direct investment activity and exchange rate risk in a pricing-to-market (PTM) model. The fixed cost drives a wedge between the price charged for the home and foreign good within the home country, which in previous PTM models are equal.

The paper begins with a review of general equilibrium models incorporating multinational firms in Section 2. It examines the links between trade and industrial organization in the theoretical treatment of MNEs and identifies fixed costs as an important characteristic in the structure of markets where FDI exists. The welfare implications of FDI for the host country are also explored. Section 3 discusses the evolution of general equilibrium models of optimum currency area (OCA) theory and cross-border investment. Section 4 outlines a one-period representative agent model and derives reduced-form pricing rules. Section 5 presents implications of the model's results.

2. Foreign Direct Investment and Trade

> *Without the MNE, the orthodox theory of international trade and investment is seriously out of date and inadequate for policy-making.*
>
> --Asim Erdilek (1976, pp. 287)

While assessing what implications the existence of direct investment flows from abroad should have for a country's choice of currency regime, it is natural first to ask why a firm would choose to undertake multinational production, how these decisions will be affected by uncertainty, and whether the presence of MNEs is actually welfare-improving for the source and host nations. Until the 1980s, there was no place for the multinational firm at all in general equilibrium models of the international economy.[2] Within the linear models rooted in constant returns to scale technology that characterize traditional trade theory, it makes no difference where production takes place, as long as factor prices are allowed to equalize through the unhindered exchange of output in the world market. Factor mobility can be assumed away simply for convenience.

Robert Mundell (1957) pioneers in a departure from this convention and allows for factor mobility in order to confront the existence of cross-border capital flows.[3] In Mundell's modification of the Heckscher-Ohlin-Samuelson framework, differing factor endowments motivate not only trade, but also transnational flows of capital when trade is deterred by barriers such as tariffs or quotas. If the imposition of a trade barrier causes a disparity in the returns to capital across countries, capital will naturally flow across the border from the country where returns are low into the nation where returns are high until payments to capital inputs are again equalized. Mundell concludes that "World production is not changed, at constant prices, by a movement of capital from one country to another. In the world we are considering it makes no difference in which country a commodity is produced if commodity prices are equalized (1957, p. 327)." In his extension of the traditional trade model, the question of foreign direct investment remains a nonissue as long as factors are perfectly mobile.[4]

Theoretical trade models explicitly embracing the multinational firm emerged in the early 1980s as attempts to explain observed patterns of intra-industry and intra-firm trade conflict with standard classical and Heckscher-Ohlin paradigms. The existence of multinational firms in these models is based primarily on increasing returns to scale occurring at the firm level. Increasing returns to scale was certainly not a new idea in trade theory at the time. Negishi (1969) points out that "Ohlin [1933] himself already suggested economies of scale as an endogenous factor explaining international trade (p. 132)."[5] However, and Wilfred Ethier (1979) and Paul Krugman (1979 and 1983) brought new relevance to increasing returns in production to provide a theoretical explanation for the perplexing phenomenon of intra-industry trade. Krugman, in particular, explores the imperfectly competitive market structures accompanying increasing returns and enriches his model with differentiated products. Their work set the stage for multinational firms to emerge in modern models of international trade.

2.1. Dunning's OLI Theory, Increasing Returns to Scale, and Factor Endowments

The multinational firm grew as a natural extension to Krugman's modernized modeling framework, fortuitously converging with theories of direct investment emerging in the industrial organization literature. The new general equilibrium models incorporating MNEs draw heavily from premises exposited by Coase (1937), Hymer (1960), Kindleberger (1969), and Hirsch (1976) and which Dunning (1977) developed into a cohesive theory of the three forces governing multinationalization: "Ownership," "Location," and "Internalization" (OLI) (Dunning 1980, Ethier 1986, Markusen 1995, Caves 1996, Ethier and Markusen 1996). Coase (1937) inquires why firms should exist at all, rather than having production take place in a cloud of independently contracted owners of factor inputs all synchronized by the price system. Dunning effectively expands Coase's exploration by asking why multinational firms exist, rather than having production take place at "arms length," synchronized only by contracts with foreign licensees, or perhaps just exported to foreign markets.

Put simply, the OLI hypothesis argues that a multinational firm must possess some unique competitive edge in the production process to compensate for additional costs incurred surmounting political, cultural, and marketing barriers when undertaking direct investment. Such a production advantage can take the form of the ownership of a nonrival, intangible asset – such as managerial, marketing or technical know-how – that is specific to the firm, but can be applied to plants that are geographically separate from the home office.[6] The ownership advantage is the principal tenet from Dunning's theory that couples so well with Krugman's conceptualization of increasing returns. An asset providing an ownership advantage naturally implies the existence of economies of scale at the firm level. The second tenet, location, complements the focus in traditional trade models on relative factor endowments (Ethier 1986, Markusen 1995). Dunning (1980) argues that there must also be locational circumstances in the foreign country that favor a direct investment venture, such as import tariffs, proximity to a large market, local investment incentives, or low input costs. Thus, OLI theory brought together attractive theoretical elements for both "new" and traditional trade theorists seeking to model foreign direct investment.

2.2. Integrating OLI and Trade Theory in Models of FDI: The Pioneers

As Mundell pioneered in the general-equilibrium analytics of cross-border capital flows, Elhanan Helpman and James Markusen pioneered in undertaking a formal general equilibrium analysis of multinational firms. Helpman (1984) does not explicitly mention ownership and locational advantages within the context of Dunning's work. However, he constructs an intangible, immobile capital asset that can remain in the home country while still being used in production abroad, to play the role of firm-specific marketing or management know-how, or product-specific research and development (R&D). Thus, his intangible asset that can be applied to production in multiple plants located apart from the "headquarters" where the asset resides closely fits Dunning's definition of an ownership advantage and is a source of increasing returns to scale which plays a role in motivating multinational ventures.[7]

Helpman's (1984) results combine the insights of the new trade theory of the time with the backbone of the old. As in Krugman (1979), intra-industry trade in this model occurs due to specialization arising from increasing returns to scale within a monopolistically competitive market structure. Intersectoral trade, as in traditional trade models, arises from differences in relative factor endowments across countries, or comparative advantage in the traditional sense, which translates into a locational advantage in the context of the OLI framework. Helpman assumes that there is a cost to hire or develop the intangible asset, leading him to conclude that the location of the company headquarters will also be determined by differing factor endowments: The company will cultivate a source of the intangible asset where it is most plentiful and therefore cheapest. Hence, Helpman exploits the new emphasis on monopolistic competition and increasing returns to scale to introduce multinational firms into general equilibrium models of trade, while still allowing factor endowments to drive the location of production activities and the overall volume of trade.

In Helpman (1985), he adds an intermediate good into the original model (Helpman (1984)) and draws the same general conclusion. He finds that the role of intra-firm trade of an intermediate good, as well as the overall volume of trade, are larger when relative factor endowments across countries are asymmetric. However, in this later study, he notes that if differences in factor endowments are too great, "the shifting by multinational corporations of intermediate input product lines to subsidiaries can reduce the volume of trade and the share of intra-firm trade" (p. 456). The idea that dramatically different factor endowments can actually reduce trade when firms can pursue direct investment abroad is the principal effect of adding the intermediate input and hence vertically integrated firms. Helpman and Krugman (1985, Chapter 13) reaffirm the positive but discontinuous relationship between asymmetric country endowments, intra-firm trade, and the volume of trade in the presence of FDI.

James R. Markusen (1984) conducts a similar analysis in that he motivates foreign direct investment through the existence of an intangible, nonrival factor input, which causes economies of scale within the firm (the ownership advantage).[8] However, Markusen surgically removes the engines of traditional trade models (locational advantages) from his study. He assumes that countries share identical endowments, technology, and preferences "to neutralize the usual Heckscher-Ohlin, Ricardian, and demand bases for trade" and thereby "show clearly how multi-plant economies of scale can affect the pattern of trade and production (1985, p. 20)." Whereas in Helpman's models the split of plant-level production and corporate activity is driven by factor endowments, Markusen demonstrates that the existence of increasing returns to scale at the firm level is by itself sufficient to motivate multinational activity and intersectoral trade.[9]

He describes a world with two goods produced using labor an capital, with capital split between corporate activity (creating the ownership advantage) and plant-level manufacturing. Due to his assumption of two standardized goods, in Markusen's model, either a duopoly – consisting of one firm in each country – will prevail in equilibrium, or a multinational monopolist will emerge to dominate the entire world market. Markusen focuses on evaluating the welfare implications of a global monopoly. His results are ambiguous, as he concludes that the multinational monopolist can produce with greater technical efficiency, but "at the possible expense of higher exercised market power (p. 224)." That is to say, there is the possibility that when producing overseas, the MNE may forgo the exploitation of firm-level scale economies in favor of curtailing output in both countries to draw greater monopoly rents, leaving the world economy with unexploited gains from trade.

2.3. Why Not License? The Internalization Advantage

Helpman, Helpman and Krugman, and Markusen thus incorporate ownership and locational advantages in the first general equilibrium models depicting the multinational firm. But Dunning (1980) contends that the joint existence of ownership and locational advantages does not in itself compel a firm's decision to produce overseas. The firm must also perceive that there are benefits to internalization – undertaking overseas production itself – rather than licensing the activity to a foreign firm. Such an internalization advantage might arise if a home firm does not want to risk defection by a licensee that might compromise its market power,[10] if there are high costs involved in transmitting information or negotiating contracts, if there is a need to protect the firm's reputation or brand name in the marketplace, or in the presence of certain types of uncertainty (Dunning 1980).

Wilfred J. Ethier (1986) constructs an internalization advantage to endogenize the emergence of the MNE within the new general equilibrium framework explored by Helpman, Krugman, and Markusen. He still depends upon a firm-level increasing returns to scale technology, but introduces a randomized shock affecting the quality of an intermediate good produced by the home-country firm. The probability that the intermediate good is of high quality is subject to this shock, but is also positively influenced by the amount of resources the home firm invests in research and development. A risk-averse foreign firm contemplating purchasing a license from a home firm to assemble the final product abroad might demand a contract to buffer itself from the possibility that the intermediate goods to be assembled turn out to be of poor quality. That is, the prospective licensee would push for a state-contingent licensing fee, hinged on the actual quality of the intermediate good, since it cannot verify ex ante how much the home-country firm invested in research.

If the home firm is also risk averse and the quality of the good is difficult to quantify in a standardized manner, it will be difficult to construct an ironclad contract, or the contract may entail costly quality inspections to assure quality. Hence, in the presence of uncertainty the home firm may find that it is cheaper or more convenient to internalize the transaction altogether in the form of direct investment in the foreign country.[11] Ethier's model successfully emulates observed intraindustry (and intrafirm) trade, as well as two-way direct investment between countries. As in the previous studies, there is no explicit physical capital good in this model, which uses a knowledge-capital-intensive intermediate good to allow dislocation between headquarters and production of the final good abroad. However, it is interesting to note that in this model, direct investment and intraindustry trade are complements, contrasting with the traditional perception of trade and cross-border factor transfers as substitutes to equalize the marginal returns in countries with differing factor endowments.

Gene M. Grossman and Assaf Razin (1985) design a model of MNE behavior using managerial capital that can not be applied in multiple overseas production facilities. Managerial know-how in this case does not result in firm-level economies of scale, or ownership advantage. Instead, they motivate the decision to invest in overseas production as a means of hedging country-specific risk in the form of a productivity shock. Although the authors do not explicitly base their premise on Dunning's OLI theory, the opportunity to engage in risk-sharing acts as an internalization advantage compelling direct investment: establishing a plant abroad allows a home firm to avoid having all of its production activity simultaneously subject to the same negative productivity shock. Like Ethier (1986), uncertainty is the engine driving multinational production. In contrast, however, the uncertainty in this model compels FDI as a mechanism for risk-sharing, rather than as a mechanism to cope with asymmetric information.

Grossman and Razin consider the case where there are no flows of physical capital, as in the Helpman, Helpman-Krugman, and Markusen models, as well as a case where both intangible management capital and physical capital are perfectly mobile. The authors analyze the effects of uncertainty on multinational firms' use of factor inputs and resulting impacts on host-country welfare. They determine that in either case, if a firm must install its capital before and hire labor after the productivity shock materializes, a multinational firm will choose more capital-intensive production techniques to avoid fluctuations in labor market conditions. Like Markusen (1984), Grossman and Razin find that the welfare effects of multinational production on the host country are ambiguous. Their results indicate that because importing capital from abroad tends to reduce payments to domestic capital resources, direct investment is beneficial only when physical capital is immobile, or when capital markets in the host country are incomplete. Due to the absence of increasing returns to scale within the Grossman-Razin framework, the structure of factor-input markets – a locational consideration – can also interfere with the degree of risk-sharing the home firm can achieve when it invests abroad by impacting its choice of production practice. Therefore, when there are no ownership advantages involved in multinationalization, locational considerations play an important role in determining the welfare effects of FDI.

2.4. Introducing Trade Costs into GE Models of FDI

In the late 1980s, scholars began to investigate the effects of locational considerations in the form of trade barriers – as opposed to local markets for factor inputs – on the formation and behavior of multinational firms (Markusen 1995). James Levinsohn (1989) shows that in an oligopolistic setting, a tariff in itself is sufficient to entice an overseas firm to establish a plant in the protected market. He provides a proof of this conjecture with no assumption of firm-level increasing returns to scale. Since FDI occurs entirely due to the tariff and not as a means of exploiting economies of scale in Levinsohn's model, any foreign venture is detrimental to the host country's welfare.

Ignatius Horstmann and Markusen (1992), as well as S. Lael Brainard (1993), and Markusen and Anthony Venables (1998) introduce not only tariffs, but also transport costs into their models of FDI. However, the effects of the trade barriers are secondary to the principal motivation of multinational production explored in earlier studies. The fundamental force compelling the firm's direct investment abroad is still the ownership of an intangible input that generates increasing returns to scale as it is applied simultaneously to production in multiple plants. In a new breakthrough, Horstmann and Markusen also endogenize the market structure as an equilibrium outcome of their GE model. In prior studies, multinational production by the firm was either assumed or compared to a pure trade scenario as an exogenous state.[12]

Horstmann and Markusen argue that a domestic monopolist exporting goods abroad is more likely to engage in production overseas when firm-specific fixed costs, like research and development, are large relative to any plant-specific fixed costs that must be incurred to set up shop overseas. They also show that transport costs and tariffs of sufficient size can tip the scales in a firm's decision-making process in favor of a direct investment venture, compelling a domestic monopolist who originally exported to change its strategy and establish a new plant abroad. The size of the trade barriers and corporate economies of scale relative to plant-level economies of scale determines whether the monopolist will export from within its own country or invest in a plant abroad. Deciding to invest abroad generates an oligopolistic market structure in equilibrium.

In monopolistically competitive environments, the effect of trade barriers on firms' decisions to produce in multiple locations is less clear. Brainard (1993), like Horstmann and Markusen (1992), concludes that barriers to trade act as a catalyst for FDI, making it more likely that a firm will endeavor to exploit its ownership advantage by building an overseas plant. She imposes a monopolistically competitive market structure, which gives rise to observed two-way intra-industry FDI between countries with similar factor endowments. She assesses the influence of plant-specific economies of scale, which would discourage dividing production across borders, versus the cost advantages to locating a plant in close proximity to a large foreign market. She also follows Helpman (1984 and 1985) in exploring vertical versus horizontal foreign production activities[13] by introducing two- and three-stage production processes. The results are similar to Horstmann and Markusen (1992) insofar as two-way horizontal foreign direct investment is more likely to occur when firm-specific fixed costs are large relative to plant-specific fixed costs and when transport costs are high. The driving force of the models, again, is the ownership advantage: Brainard specifically points out that in the event that corporate fixed costs (and thus economies of scale) are zero, there is no multinational production.

Markusen and Venables (1998) explore the implications of locational considerations in the form of both factor endowments and trade barriers within a similar monopolistically competitive market structure. They find that multinational production strategies are more likely when countries have similar endowments and concur with the previous papers that they are also more likely when trade costs are high. Markusen and Venables (2000) qualify this conclusion by considering the effects of trade barriers when factor inputs are mobile across national borders. In this case, "it also becomes possible that international mobility of the factor used intensively in the increasing returns sector is destabilizing," yielding the possibility that a single industry will become "agglomerated" exclusively in one country, with no production occurring in plants overseas. Ethier and Markusen (1996) show that in an environment where contracts can not protect intellectual property (the ownership advantage), large trade barriers may discourage FDI. A home firm facing large export costs in their model may instead favor a licensing agreement to extract maximum rents and avoid the risk that managers in a direct investment venture might defect and start up their own competing plants with the home firm's technology. Therefore, there is no consensus that trade barriers necessarily foster FDI.

2.5. Welfare Implications of FDI for the Host Country

Should a country pursue policies that promote or discourage FDI? In the context of the general equilibrium models above, the answer is clear: it depends upon why firms are deciding to produce abroad. In general, if a firm decides to establish a plant abroad as a means of exploiting corporate increasing returns to scale arising from the presence of an "ownership advantage," FDI can be welfare-improving by increasing the real income of the host country. Markusen (1984) points out that the emergence of investment ventures from abroad can also provide helpful competition, reducing the market power of a domestic monopolist. Even when there are no apparent economies of scale involved in multinational production, FDI can still be beneficial when capital markets in the host country do not function well, when there are barriers hindering the mobility of capital across borders, or as a means of coping with uncertainty arising from productivity shocks and asymmetric information (Grossman and Razin 1985, Ethier 1986).

Notwithstanding, there are scenarios when FDI has undesirable effects or is actually detrimental to host-country welfare. In early models, where the location of firms was determined by relative factor endowments, multinational production leads to a redistribution of income toward the factor used intensively by the new plant in the host country (Helpman 1984 and 1985, Ethier 1986). Depending on the domestic political circumstances, a dramatic redistribution of income may or may not appeal to policymakers. Grossman and Razin show that when domestic capital markets are well developed, an influx of capital from overseas can reduce the returns to domestic capital in the host country, diminishing overall host-country welfare.

Further, when an increase in tariffs causes a firm to curtail its exports and establish a production facility in the protected market, the impact is unequivocally detrimental to the host country. Consumer surplus in the host country may increase when overseas firms "jump" the tariff barriers, eliminating tariffs and transport costs that used to be tacked onto the price of the imported good. However, the lost profits of domestic producers in the host market will outweigh any additional surplus reaped by consumers (Levinsohn 1989, Horstmann and Markusen 1992). Brainard (1993) also points out that in a monopolistically competitive framework, consumers may lament the loss of variety when multinational firms push some local varieties out of the host-country market more than they appreciate the new reduced prices on goods that were previously imported.

There are numerous other issues impacting welfare in the host country that are not captured in the models above, but which may be important to policymakers. In particular, general equilibrium models tend to overlook the effect of foreign direct investment on the rate of unemployment (Levinsohn 1989). There are also potential spillover effects if direct investment ventures bring technology transfers and encourage the development of infrastructure and human capital (Caves 1996, World Bank 1993). The models above abstract from the complexities involved in multinational corporations' choice of environmental practices and working conditions in developing countries. With the exception of Markusen and Venables (2000), they also tend to overlook problems that may arise when corporate returns to scale are large enough that firms entering from abroad virtually eliminate competing local companies, leaving the MNEs in a position to drain consumer surplus from the host-country market.

3. General Equilibrium Models in the Fixed vs. Flexible Rate Debate

A growing literature applies general equilibrium modeling to the debate over optimal exchange rate regimes. Bayoumi (1995) develops a one-period general equilibrium model to provide a formal analytical framework for the most extreme fixed regime, a currency union. His model builds on the tenets of Optimum Currency Area theory introduced by Mundell (1961) and McKinnon (1963), providing a welfare metric in place of the optimized levels of employment and price stability considered in previous work. With his multi-country model, Bayoumi's finds that countries can attain increased welfare by establishing a currency union.[14]

More recent work focuses on the dynamic effects of uncertainty in determining the optimal exchange rate. The implications for monetary policy in this literature are less clear. Corsetti and Pesenti (1998) prove that in dynamic stochastic models using a welfare metric a country can actually make itself worse off by devaluing its currency, despite the traditional belief in the benefits of a "competitive devaluation," which stood previously as an unchallenged argument against currency unions. Obstfeld and Rogoff's (1998) dynamic stochastic general equilibrium model provides evidence that exchange rate volatility can also reduce individuals' welfare, particularly in small countries. However, they find in a subsequent study (Obstfeld and Rogoff 1999) introducing sticky wages that allowing exchange rates to float can offset the welfare-dampening effects of uncertainty arising from asymmetric productivity shocks.

Devereux and Engel (1999) find that the choice of exchange rate regime depends on the market structure. If exports are priced in local currency,[15] rather than the producer's currency valued at the prevailing exchange rate, the case for maintaining floating rates as a buffer against large real shocks is weakened. However, they show that a float is superior to a fixed regime in the presence of a stable money supply and negligible output shocks. Bacchetta and van Wincoop (2001) provide evidence that welfare comparisons favor a fixed exchange rate when consumption and leisure are complements and a floating regime when they are substitutes. The authors offer the rationale that consumption and leisure are more negatively correlated under a fixed exchange rate regime, so that consumers who express complementary preferences will benefit from a fixed regime.

3.1. Investment in General Equilibrium Open-Economy Models of Monetary Policy

Given that empirical estimates of the benefits of super-fixed regimes rest on the favorable implications of eliminating exchange rate uncertainty for investment, it is important to ascertain the effects of fluctuations in investment on country welfare. Asset flows in general can enhance welfare in a global economy by allowing for risk-sharing, which permits consumers to buffer themselves against asymmetric transitory output shocks. In most general equilibrium models, consumers share risk through an international bond or equity market. Several studies have inculcated cross-border flows of investment goods, using its role in risk-sharing as an engine driving the transmission of money and productivity shocks. Ricketts and McCurdy (1995) find that allowing for cross-investment generates a relative ranking of deviations in output, consumption, and investment within each country that match their observed volatility somewhat better than previous general equilibrium models. Shrikhande (1997) constructs a model with cross-border investment subject to fixed transactions costs that successfully replicates the property of mean-reversion in an endogenously determined real exchange rate. Boileau (1999) concludes that allowing for trade in investment goods helps correct for the tendency of previous models to underpredict volatility in net exports and the terms of trade. Lubik (2000) matches observed comovement in output more closely than in previous models by providing for the presence of complementarities among traded investment goods. Hence, there is substantial evidence that the passage of investment goods through national borders is an important factor in the general equilibrium analysis of the global economy.

Devereux and Engel (1999) conceptualize a model of foreign direct investment where home agents invest overseas to expand production of the home-country good. They make the assumption that there is no cross-border trade in goods. All "exports" from the home country are now produced by home firms in the foreign country, and vice versa. The model accounts for physical capital flows in an implicit manner, as the production technology is simplified to include only labor inputs, but profits of home plants operating overseas accrue to the firms' owners in the home country. Trade effectively occurs in profits, rather than goods, so that the usual terms of trade channel is shut down. Eliminating trade in goods enhances the model's analytical tractability, generating a more transparent solution for welfare comparisons.

This study combines Devereux and Engel's (1999) conceptualization of foreign direct investment with the cash-in-advance framework used by Bacchetta and van Wincoop (2000) to analyze the responsiveness of capital flows to exchange rate uncertainty. It is simplified to a one-period benchmark model. Like Devereux and

Engel (1999), it brings the direct impact of exchange rate uncertainty on cross-border investment decisions to the foreground by shutting down trade in goods. The assumption that all exports of home goods are produced in the foreign country is extreme, but the abstraction has some basis in theoretical and empirical findings. In recent theoretical work, Obstfeld and Rogoff (2000) assert that tariff- and non-tariff barriers, as well as trade costs are potentially important and largely overlooked factors influencing the movement of real exchange rates, cross-country comovement in consumption, and home bias in trade and equities.

Empirically, policy barriers to trade and "iceberg"-type trade costs could account for the considerable magnitude and observed growth of production and investment in overseas affiliates of multinational corporations (MNEs). In 1998 for example, sales of goods by nonbank foreign affiliates of U.S. multinational firms totaled $1.7 trillion, more than double the value of U.S. exports, which amounted to $0.7 trillion (Mataloni 2000). Robert Lipsey (1998) calculates that internationalized production[16] constituted 16.3% of manufacturing production worldwide in 1990, and estimates that it grew to encompass a much larger share in the mid-1990s. The Bureau of Economic Analysis (BEA) reports that the value of direct investment positions for U.S. firms worldwide almost doubled between 1994 and 1999. During the same time period, positions of U.S. MNEs in Brazil and Mexico more than doubled and almost tripled in Argentina (BEA 2000). Hence, although the assumption that there is no trade in goods, only profits, is an abstraction from reality, for some countries it is perhaps less of a leap than assuming the existence of trade in consumption goods and excluding cross-border investment.

Bacchetta and van Wincoop (2000) conclude that a floating exchange rate may reduce net capital flows when there is a preference for a domestic bond. Here, we posit that a floating exchange rate may also depress capital flows when there is a fixed cost involved in foreign direct investment. Shrikhande (1997) argues that multinational firms incur additional costs when investing abroad in order to tackle the challenges of establishing distribution networks and surmounting the competitive advantage enjoyed by incumbent firms with existing customer bases. Fixed costs have been found in past studies to produce persistent responses to monetary shocks by introducing external increasing returns to scale among firms operating under internal constant returns to scale technology (Hall 1987, Kiley 1997), as well as to generate observed patterns of "lumpiness" in cross-border investment (Shrikhande 1997). Considering the additional fixed costs incurred by firms expanding production abroad intensifies the effects of exchange rate uncertainty on producers in this model who would otherwise seek to exploit increasing returns to scale in overseas markets.

4. Theoretical Model

The principal argument espousing fixed exchange-rate regimes asserts that eliminating foreign-exchange risk will lead to an increase in investment. The model presented here examines whether a fixed exchange rate will have positive or negative implications for foreign direct investment, which is an important source of capital inflows for developing countries. It is a bare-bones, two-country, one-period general equilibrium model based on a monetary model of foreign direct investment put forth by Devereux and Engel (1999) and drawing from two additional monetary models by Bacchetta and van Wincoop (2000) and Shrikhande (1997).

The new facet of this model is the introduction of fixed costs and an entry condition governing the firm's decision to enter the overseas market and the equilibrium level of profits in the industry. The interaction of corporate and plant-level fixed costs with the condition representing the firm's need to cover its fixed costs (the entry condition) is the key engine in the treatment of multinational firms within models of trade and industrial structure. The presence of plant-level fixed costs in combination with the entry condition is also precisely what causes exchange-rate volatility to impact whether and how much a firm will produce overseas. The benchmark model isolates this impact by examining the effect of a fixed cost applied only to an overseas plant-- a simplified "cost of doing business abroad."

4.1. A Benchmark Model: The Consumer's Problem

The representative agent in the models maximizes expected utility with respect to consumption and leisure, subject to an income constraint. There is a continuum of identical individuals over [0, n] in the home country and over [n, 1] in the foreign country, who can purchase any of a continuum of home-country goods over [0, n] and foreign-country goods over [n, 1]. Leisure enters the utility function linearly. Following Devereux and Engel, the home-country consumer's problem is therefore

$$\max E[U(C,l)]$$

subject to

$$\int_0^n p_H(i)c_H(i)di + \int_n^1 p_F(i)c_F(i)di = w(1-l)+\pi$$

where

$$U(C,l) = \frac{1}{1-\rho}C^{1-\rho} + \eta l.$$

C is a general consumption index over both goods of Cobb-Douglas form,

$$C = \frac{c_H^n c_F^{1-n}}{n^n (1-n)^{1-n}},$$

with separate constant-elasticity-of-substitution (CES) indexes for the consumption of goods produced by home and foreign-country firms defined by

$$c_H = \left[n^{-\frac{1}{\mu}} \int_0^n c_H(i)^{\frac{\mu-1}{\mu}} di \right]^{\frac{\mu}{\mu-1}}$$

$$c_F = \left[(1-n)^{-\frac{1}{\mu}} \int_n^1 c_F(i)^{\frac{\mu-1}{\mu}} di \right]^{\frac{\mu}{\mu-1}}.$$

The general price index, P, is the amount necessary to purchase one unit of the general consumption basket.[17] It is expressed as

$$P = p_H^n p_F^{1-n}.$$

The individual price indexes, representing the cost of buying one unit of the home-good basket and the foreign-good basket, respectively, are given by

$$p_H = \left[\frac{1}{n} \int_0^n p_H(i)^{1-\mu} di \right]^{\frac{1}{1-\mu}}$$

$$p_H = \left[\frac{1}{1-n} \int_n^1 p_F(i)^{1-\mu} di \right]^{\frac{1}{1-\mu}}.$$

Both prices in the home economy are given in terms of the home currency. There is a corresponding problem facing the foreign consumer, who has identical preferences. The maximum level of labor the consumer can supply is normalized to 1, so that labor earnings are *w(1-l)*, with w representing the wage and l leisure. Home consumers receive all profits, π, accrued by home-owned firms. Noting that nominal income is labor earnings plus profits from owned plants, the consumer's nominal income (as in Bacchetta and van Wincoop (2000)) is therefore

$$Y = w(1-l) + \pi.$$

A cash-in-advance constraint is imposed,[18] such that nominal income equals the money supply, or

$$Y = M.$$

The problem now yields demand curves for both goods and a labor-supply relation:

$$c_H(i) = \frac{1}{n}\left(\frac{p_H(i)}{p_H}\right)^{-\mu} c_H$$

$$c_F(i) = \frac{1}{1-n}\left(\frac{p_F(i)}{p_F}\right)^{-\mu} c_F$$

$$p_H c_H = \int_0^n p_H(i) c_H(i) di$$

$$p_F c_F = \int_n^1 p_F(i) c_F(i) di$$

$$c_H = \frac{nM}{p_H}$$

$$c_F = \frac{(1-n)M}{p_F}$$

$$w = \frac{\eta P}{C^{-\rho}}.$$

Similar demand and wage equations emerge for the foreign consumer. Variables in the foreign country are denoted with an asterisk (*) and prices given in the foreign currency:

$$c_H^*(i) = \frac{1}{n}\left(\frac{p_H^*(i)}{p_H^*}\right)^{-\mu} c_H$$

$$c_F^*(i) = \frac{1}{n}\left(\frac{p_F^*(i)}{p_F^*}\right)^{-\mu} c_F$$

$$p_H^* c_H^* = \int_n^1 p_H^*(i) c_H^*(i) di$$

$$p_F^* c_F^* = \int_n^1 p_F^*(i) c_F^*(i) di$$

$$c_H^* = \frac{nM^*}{p_H^*}$$

$$c_F^* = \frac{(1-n)M^*}{p_F^*}$$

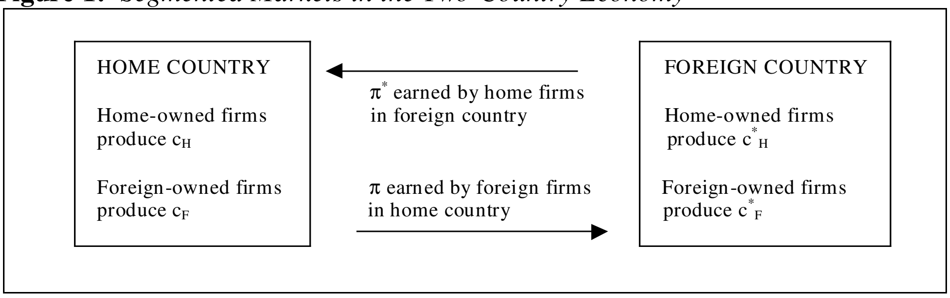
$$w^* = \frac{\eta P^*}{C^{*-\rho}}.$$

4.2. The Firm's Problem

The firm maximizes the expected market value of profits. This means that the firm's owners – the consumers – are concerned with the covariance of profits with their personal well-being given the production and monetary shocks that emerge in the economy. They value a unit of revenue only for its capacity to purchase a unit of the consumption basket. With this in mind, the firm weights nominal profits by a stochastic discount factor, or state-price density, which represents how much the firm's owners will value an extra unit of consumption in each potential outcome of monetary and productivity shocks. The marginal utility of consumption, $U_c = \partial U/\partial C$, is used to represent the stochastic discount factor in a firm's decision making process (Campbell et. al. 1997, Cochrane 2001).

Following Devereux and Engel's model of internationalized production, goods must be produced in the country where they are consumed. Markets are therefore implicitly segmented by insurmountable barriers to trade in goods. Figure 1 illustrates the manner in which only profits from foreign direct investment ventures cross national borders. Physical goods do not leave the country where they are produced.

Figure 1: *Segmented Markets in the Two-Country Economy*



As indicated above, one new element of this model is the addition of a fixed cost of production incurred when a firm begins production in another country. This fixed cost can represent a plant-level fixed cost – which must be paid regardless of whether the firm is producing domestically or overseas[19] – or it can be an additional cost of "doing business abroad." Fixed costs relevant to both domestic and overseas plants are incorporated into a number of trade models with FDI explored above in Section 2.4. The existence of a fixed cost specific to overseas production only is proposed by Dunning (1977 and 1981) as an obstacle facing any multinational firm.[20] Whether the fixed cost is applied only to overseas production activity or to both domestic and overseas production activity does not change the results of the model. For simplicity, the benchmark model applies the fixed cost only to overseas plants of home and foreign firms. Here, the fixed cost forms the basis for an MNE's entry constraint. A firm will not produce abroad if it can not expect to recover the fixed cost incurred in overseas operations.

Firms set prices in advance within a monopolistically competitive market structure. They set prices understanding the demand and labor-supply relations of consumers and with the goal of at least covering their fixed cost. As in Dixit and Stiglitz (1997, pp. 299-300), the threat of entry by new rivals forces profits in both the domestic and overseas market to zero. After prices are set and fixed costs of entry into overseas production are paid, money-supply and productivity shocks materialize. The firms then hire labor, sell their goods, and transfer revenues to their owners. Figure 2 illustrates the order of events in a time-line format.

Figure 2: *Timeline of Events*

Firms set prices, goods purchased, pay fixed cost to produce abroad	Shocks occur (Exchange rate materializes)	Labor is hired, production occurs Money transfers occur

Technology is linear in labor:

$$c_H(i) = \theta L_H(i)$$

$$c_H^*(i) = \theta^* L_H^*(i).$$

A home firm's problem is therefore

$$\max_{c_H(i),c_H^*(i)} E[U_c \pi]$$

where

$$\pi = \left(p_H(i) - \frac{w}{\theta} \right) c_H(i) + S\left(p_H^*(i) - \frac{w^*}{\theta^*} \right) c_H^*(i) - f.$$

The term f is a fixed cost the home firm must pay denominated in the home currency. It can be surmised that a fixed cost of amount φ would actually be paid in the local (foreign) currency, but it enters the home firm's optimization problem converted to home currency at some exogenous initial exchange rate, S_0, so that $f = S_0\varphi$. First-order conditions yield unrestricted pricing rules for the home good sold at home and in the foreign country, stating that price will be equal to a markup times the risk-weighted wage,

$$p_H(i) = \left(\frac{\mu}{\mu - 1} \right) \frac{E\left[U_c \frac{w}{\theta} \right]}{E[U_c]} \qquad (1)$$

$$p_H^*(i) = \left(\frac{\mu}{\mu - 1}\right) \frac{E\left[U_c S \dfrac{w^*}{\theta^*}\right]}{E[U_c S]} \tag{2}$$

The foreign firm's unrestricted pricing rules are similar:

$$p_F(i) = \left(\frac{\mu}{\mu - 1}\right) \frac{E\left[U_{c^*} \dfrac{w}{S\theta}\right]}{E[U_{c^*}]} \tag{3}$$

$$p_F^*(i) = \left(\frac{\mu}{\mu - 1}\right) \frac{E\left[U_{c^*} S \dfrac{w^*}{\theta^*}\right]}{E[U_{c^*}]} \tag{4}$$

The unrestricted pricing rule from the firm's profit-maximization problem is subject to the entry condition

$$0 \leq E\left[U_c S\left(p_H^*(i) - \frac{w^*}{\theta^*}\right) c_H^*(i)\right] - f$$

and it is assumed that the fixed cost, f, is equal to expected variable profits so that this expression equals zero, following Christiano, Eichenbaum, and Evans (2001). Rearranging, the equilibrium condition can be written as

$$p_H^*(i) = \frac{E\left[U_c S \dfrac{w^*}{\theta^*} c_H^*(i)\right] + f}{E[U_c S c_H^*(i)]} \tag{5}$$

for the home firm and

$$p_F(i) = \frac{E\left[U_{c^*} \dfrac{w c_F(i)}{S\theta}\right] + f^*}{E\left[U_{c^*} \dfrac{c_F(i)}{S}\right]} \tag{6}$$

for the foreign firm. It is important to note that this study will assume perfect labor mobility to generate factor price equalization ($w = Sw^*$) in the following analysis. Factor price equalization (FPE) is an important reason why variance in the foreign money supply does not impact expected consumption in the home country in Devereux and Engel's (1999) model. In their model, FPE arises due to the existence of a complete set of state-contingent bonds, rather than labor mobility, and helps preserve the equality between prices charged for home and foreign goods within the domestic market. In order to show that it is the fixed cost and not disparity in factor costs driving this paper's results, FPE is integrated into this model, as well.

To begin solving for a reduced form of the foreign firm's pricing rule in the home market, one can set (3) equal to (6). Making appropriate substitutions from the demand equations and price index equations, and using the fact that all home firms have identical cost structures and face identical demand curves (so that $p_H^*(i)$ will be the same for all i) a pseudo-reduced form for $p_F(i)$ emerges. Before substituting for the exchange rate, S, the pseudo-reduced form is defined by

$$p_F(i) = \left[\frac{\eta k_1 q_1}{f^*}\left(\frac{\eta k_2 q_2}{f}\right)^{\beta}\right]^{\frac{1}{1-\beta\gamma}}, \tag{7}$$

where α represents the markup, $(\mu/(\mu\text{-}1))$, and

$$k_1 = \left(\frac{\alpha\eta E\left[\frac{1}{\theta^*}\right]}{E[M^{*-\rho}]}\right)^{\frac{1-n}{1-(1-n)(1-\rho)}},$$

$$k_2 = \left(\frac{\alpha\eta E\left[\frac{1}{\theta}\right]}{E[M^{-\rho}]}\right)^{\frac{n}{1-n(1-\rho)}},$$

$$q_1 = \frac{\alpha E\left[\frac{1}{\theta}\right]E\left[M^{*-\rho}\left(\frac{1}{S}\right)M\right]}{E\left[M^{*-\rho}\left(\frac{1}{S}\right)\right]} - E\left[\frac{M}{\theta}\right],$$

$$q_2 = \frac{\alpha E\left[\frac{1}{\theta^*}\right]E\left[M^{-\rho}SM^*\right]}{E\left[M^{-\rho}S\right]} - E\left[\frac{M^*}{\theta^*}\right],$$

$$\beta = \frac{n}{1-(1-n)(1-\rho)}, \text{ and } \gamma = \frac{1-n}{1-n(1-\rho)}.$$

To solve for the exchange rate, S, one can use Bacchetta and van Wincoop's method, which uses the fact that the total revenues of all home firms must equal the money supply,

$$M = p_H c_H + S p_H^* c_H^*,$$

to find that the exchange rate is proportional to the ratio of the home and foreign money supplies:

$$S = \tau \frac{M}{M^*}$$

where $\tau = ((1-n)/n)$.[21] Substituting this ratio for the exchange rate in the results in the expression

$$p_F(i) = \left\{ \left[\frac{\eta k_1}{f^*} \left[\frac{\alpha E\left[\frac{1}{\theta}\right] E\left[M^{*1-\rho}\right]}{E\left[M^{*1-\rho}\left(\frac{1}{M}\right)\right]} - E\left[\frac{M}{\theta}\right] \right] \right] \left[\frac{\eta k_2}{f} \left(\frac{\alpha E\left[\frac{1}{\theta^*}\right] E\left[M^{1-\rho}\right]}{E\left[M^{1-\rho}\left(\frac{1}{M^*}\right)\right]} - E\left[\frac{M^*}{\theta^*}\right] \right) \right]^{\beta} \right\}^{\frac{1}{1-\beta\gamma}}$$

and specifying M, M^*, θ, and θ^* as independently distributed random variables produces the pseudo-reduced form

$$p_F(i) = \left\{ \left[\frac{\eta k_1}{f^*} \left[\frac{\alpha E\left[\frac{1}{\theta}\right]}{E\left[\frac{1}{M}\right]} - E\left[\frac{M}{\theta}\right] \right] \right] \left[\frac{\eta k_2}{f} \left(\frac{\alpha E\left[\frac{1}{\theta^*}\right]}{E\left[\frac{1}{M^*}\right]} - E\left[\frac{M^*}{\theta^*}\right] \right) \right]^{\beta} \right\}^{\frac{1}{1-\beta\gamma}}.$$

5. Results

Assuming that M, M^*, θ and θ^* are distributed lognormally with means $m-(\sigma_m^2/2)$, $m^*-(\sigma_{m^*}^2/2)$, and $1-(\sigma_\theta^2/2)$, and $1-(\sigma_{\theta^*}^2/2)$ and variances σ_m^2, $\sigma_{m^*}^2$, σ_θ^2, and $\sigma_{\theta^*}^2$, respectively, gives the reduced-form pricing equation

$$p_F(i) = \left(\frac{\eta}{f^*}\right)^{\frac{1}{1-\beta\gamma}} \left(\alpha\eta e^{\rho m^* - \bar{\theta}^* - \frac{1}{2}\rho(\rho+1)\sigma_{m^*}^2 + \sigma_{\theta^*}^2}\right)^{\delta} \left(\frac{\eta}{f}\right)^{\beta\varepsilon} \left(\alpha\eta e^{\rho m - \bar{\theta} - \frac{1}{2}\rho(\rho+1)\sigma_m^2 + \sigma_\theta^2}\right)^{\frac{\beta\varepsilon}{1-\beta\gamma}} \tag{8}$$

$$\times \left(\alpha e^{m^* - \bar{\theta}^* - \sigma_{m^*}^2 + \sigma_{\theta^*}^2} - e^{m^* - \bar{\theta}^* + \sigma_{\theta^*}^2}\right)^{\frac{\beta}{1-\beta\gamma}} \left(\alpha e^{m - \bar{\theta} - \sigma_m^2 + \sigma_{\theta^*}^2} - e^{m - \bar{\theta} + \sigma_\theta^2}\right)^{\frac{1}{1-\beta\gamma}},$$

where $\delta = (1-n)/[1-(1-n)(1-\rho)]$ and $\varepsilon = n/[1-n(1-\rho)]$. Thus, the price of the foreign good in the home market is a function of the variance in both the home and foreign money supplies. This means that the home price level,

$$P = \left(\frac{\alpha\eta E\left[\frac{1}{\theta}\right]}{E[M^{-\rho}]} \right)^{\frac{n}{1-n(1-\rho)}} p_F(i)^{\frac{1-n}{1-n(1-\rho)}}$$

is also a function of the variance in the home and foreign money supplies. The cash-in-advance constraint, $M = PC$ (or, rearranged, $C = M/P$), implies that home consumption and therefore home utility is also a function of the variance of both money supplies.

This result can be shown explicitly. If one extracts productivity shocks altogether to focus on the role of monetary policy, the log price of the foreign good in the home country is

$$\ln p_F(i) = \frac{1}{1-\beta\gamma}[\ln z + (\delta\rho + \beta)m^* - \frac{1}{2}\delta\rho(\rho+1)\sigma_{m^*}^2 + (\beta\varepsilon\rho + 1)m$$

$$-\frac{1}{2}\beta\varepsilon\rho(\rho+1)\sigma_m^2 + \ln(\alpha e^{-\sigma_{m^*}^2} - 1) + \ln(\alpha e^{-\sigma_m^2} - 1)],$$

for

$$z = \left(\frac{\eta}{f^*}\right)\left(\frac{\eta}{f}\right)^{\beta\varepsilon}(\alpha\eta)^{\delta+\beta\varepsilon}.$$

Since δ, β, and $1/(1-\delta\beta)$ are positive for $\rho \geq 1$, it is evident that $\ln(p_F(i))$ is decreasing in σ_{m*}^2, as long as $\alpha exp(-\sigma_{m*}^2)-1 \geq 0$ (alternatively phrased as $q_2 \geq 0$), which must be true for $p_F(i)$ to be nonnegative. Then, defining $p = \ln P$,

$$p = \left(\frac{n}{1-n(1-\rho)}\right)(\ln(\alpha\eta) - \ln E[M^{-\rho}]) + \left(\frac{1-n}{1-n(1-\rho)}\right)\ln p_F(i),$$

or,

$$p = \varepsilon\ln(\alpha\eta) - e^{-\rho m + \frac{1}{2}\rho(\rho+1)\sigma_m^2} + \gamma\ln p_F(i).$$

5.1. Foreign Money-Supply Volatility and Home Consumption

Now it is possible to determine the effect of variance in the foreign money supply on expected consumption in the home economy. Using (1), the home firm's unrestricted pricing rule for the home good, and making the relevant substitutions for marginal utility

$$p_H(i) = \frac{\alpha E\left[C^{-\rho}\left(\frac{\eta P}{C^{-\rho}}\right)\right]}{E[C^{-\rho}]} = \frac{\alpha \eta P}{E[C^{-\rho}]}$$

and the home-country wage, one can derive an expression for expected consumption (again extracting the productivity parameter from the analysis)

$$E\left[C^{-\rho}\right] = \frac{\alpha \eta P}{p_H(i)}.$$

Since P and $p_H(i)$ are functions of log-normally distributed random variables, one can take the logarithm of (9) to find

$$-\rho E[c] + \frac{1}{2}\rho^2 \sigma_c^2 = \ln(\alpha\eta) + p - \ln p_H(i),$$

or

$$E[c] = \frac{1}{\rho}\left[\ln p_H(i) + \frac{1}{2}\rho^2\sigma_c^2 - \ln(\alpha\eta) - p\right].$$

Note that from the cash-in-advance constraint, $c = m\text{-}p$, meaning that $\sigma_c^2 = \sigma_m^2$. (The variance of the price level, σ_c^2 equals zero because prices are set in advance of monetary shocks and purchases of goods. Now it is possible to use (9) and the log of $p_H(i)$ to show that

$$E[c] = \frac{1}{\rho}\left\{\begin{array}{l}\frac{1}{1-n(1-\rho)}\left[(1-n)\ln(\alpha\mu) - \rho(1-n)\left(\frac{1}{2}(\rho+1)\sigma_m^2 - m\right) + (1-n)(2-\rho)\ln p_F(i)\right] \\ +\frac{1}{2}\rho^2\sigma_m^2\end{array}\right\}.$$

Because $\ln(p_F(i))$ is decreasing in σ_{m*}^2, expected consumption is increasing in σ_{m*}^2 if firm owners (consumers) are sufficiently risk averse ($\rho > 2$). That is, as the threat of wide oscillations in the money supply – and therefore expenditure on their products as well as the purchasing power of their overseas revenues – grows, firms are compelled to set lower prices to assure that enough units are sold to cover their fixed costs regardless of the state of the economy. The more risk averse the owners are, the lower they will feel compelled to set prices abroad as a means of making sure fixed costs of FDI are recouped in the event of a negative monetary shock in their native market, when they could least afford a loss should the overseas market experience a simultaneous negative shock. The lower price increases expected consumption in the host country. If firm owners are less risk averse, they will set prices with an eye toward the opportunity to earn higher profits, even at the risk that they will lose money if a contraction in the money supply of their native country (M^*) is sufficiently large to cause a net loss on overseas operations.

This result is in contrast to expected consumption in the absence of the fixed cost and entry condition, which would appear as

$$E[c]=\frac{1}{\rho}\left[\frac{1}{2}\rho^2\sigma_m^2-\ln(\alpha\eta)\right],$$

completely independent of foreign monetary shocks.

5.2. Fixed vs. Flexible Exchange Rates

If $\ln p_F(i)$ is computed instead using a fixed exchange rate normalized to equal one ($S = 1$), it is still a function of $\sigma_{m^*}{}^2$, but takes on a somewhat different form:

$$\ln p_F(i)=\frac{1}{1-\beta\gamma}[\ln z+(\delta\rho+\beta)m^*-\frac{1}{2}\delta\rho(\rho+1)\sigma_{m^*}^2+(\beta\varepsilon\rho+1)m$$

$$-\frac{1}{2}\beta\varepsilon\rho(\rho+1)\sigma_m^2+(1+\beta)\ln(\alpha-1)].$$

As long as $\sigma_m{}^2$ and $\sigma_{m^*}{}^2$ are greater than zero,

$$(\alpha-1)>(\alpha e^{-\sigma_{m^*}^2}-1)(\alpha e^{-\sigma_m^2}-1),$$

so that the price of the foreign good in the home country will be higher under a fixed exchange rate than a floating rate, or

$$p_F(i)|_{FER}>p_F(i)|_{FLOAT}\ .$$

This means that in the presence of fixed costs, expected consumption will be higher under a flexible exchange rate regime.[22]

6. Conclusions

The purpose of this paper is to combine salient features regarding the conceptualization of multinational firms in the literature on trade and industrial structure with a modern model of optimum currency theory. In doing so, a new result emerges: In a pricing-to-market model with multinational firms, the inclusion of a fixed cost prevents the insulation of expected consumption in the home country from shocks in the foreign money supply. If firm owners are sufficiently risk averse,[23] they will respond to volatility in the money supply in their native market by lowering prices on their goods produced and sold abroad, to minimize the possibility of a net loss if a negative shock simultaneously threatens to dampen demand in the host market. In order to sell enough units to recover the sunk cost in expectation, firms set the price low enough to sell more units than would be necessary for variable profits to cover the fixed cost under perfect foresight. If they are less risk averse, they will set higher prices while running the risk that in the event of an adverse monetary shock, too few units will be sold to recoup sunk costs incurred at the beginning of the period.

How realistic is this result? Given that firm owners are sufficiently risk averse, it corresponds with the observations by Goldberg and Kolstad (1995) that exchange rate volatility tends to increase the productive capacity multinational firms choose to locate abroad. The result also explains why the rate of return for branches of foreign firms located in the U.S. are significantly and consistently lower than returns for U.S. companies operating in the same industries. Risk sharing as well as transfer-pricing are two other factors that may contribute to this phenomenon; however, Mataloni (2000) attributes the recent narrowing of the gap to "age effects," referring to the diminishing fixed costs incurred in overseas operations as a company ages (p. 55), which reconciles well with the findings here.

However, there are a number of weaknesses to this model. First, it is built upon the behavior of a representative firm, so that if expanded to a dynamic framework, the impact of entry and exit would be ignored. It therefore assumes that all firms either operate in both countries or not at all, which is not realistic. Finally, the tractability of the model hinges on the assumption that profits for the multinational firm's overseas plant is zero, which begs the question of why firms would invest abroad in the first place. Risk sharing is one possibility, but in the presence of a set of state-contingent bonds, FDI would not be necessary to smooth consumption across states of the economy. This model forces expansion of production overseas, since the Cobb-Douglas preferences and absence of trade in physical goods would drive the price of either country's specialized type of good infinitely high if there were no resident firms to produce them. Endogenizing the fraction of firms choosing to invest overseas, expanding the model to a multi-period framework to incorporate borrowing and lending, and allowing multinational firms to earn positive profits in equilibrium would help achieve a somewhat more robust result for policy analysis.

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Notes

1. Ph.D. Candidate, Department of Economics, Johns Hopkins University. Email: k.niles.russ@jhu.edu.

2. As Wilfred Ethier declares, "Before turning to recent developments in trade theory, consider the ability of conventional theory to accommodate direct investment and the multinational firm. This is easy: The core of conventional theory has nothing to say (1995, p. 109)."

3. For the purposes of this paper, cross-border capital flows are defined as the export or domestic purchase of physical capital goods to be used for production in an overseas facility using the technology available in the host economy. This is distinct from foreign direct investment, which entails the actual ownership of – or collection of profits from – an overseas plant which uses technologies available in the home

country, which may or may not be the same as those available in the host country. FDI in this context does not necessarily include the transfer of physical capital. In the special case of the Heckscher-Ohlin-Samuelson framework with constant returns to scale, cross-border capital flows may be considered a form of FDI, since technologies are identical across countries and profits are zero.

4. Basing his analysis of production patterns on work by MacDougall (1960) and Kemp (1966), Ronald Jones (1979, Chapter 13), finds that capital mobility can change world production in a Ricardian setting, where comparative advantage arises due to differing technologies rather than differing factor endowments. Nevertheless, he concurs with Mundell in the sense that he identifies a "flat" range in the world transformation frontier wherein relative commodity prices are equalized and cross-border transfers of capital will not affect total world production. Jones suggests that a specific-factors approach is a more appropriate way to consider overseas investment behavior within the traditional general equilibrium trade model. He and several other theorists modify the effort to incorporate cross-border capital flows into the standard model by making certain intangible capital assets (for instance, managerial skills) sector-specific. The physical capital with which the intangible assets are associated is mobile across countries, but not across sectors. Returns to capital therefore equalize across countries, but not across sectors, resulting in the cross-hauling of capital investment between countries (Caves 1996).

5. A sample of early models of trade incorporating increasing returns includes Meade (1955), Negishi (1965), and Chacoliades (1970).

6. Caves (1996) calls factors generating this type of firm-level scale economy a "proprietary advantage" or "mobile proprietary asset" (p. 44).

7. Note: With this conceptualization of an ownership advantage, there is no need for cross-border flows of physical capital to represent foreign direct investment.

8. Markusen refers to increasing returns to scale at the firm level as "economies of multi-plant operation" (p. 205).

9. Intra-industry trade is not considered here, as in this model there are only two homogeneous goods, with one in a perfectly competitive industry.

10. The reluctance of a home-country firm to transfer technology to a foreign company in an effort to protect its monopoly power was also proposed by Jones (1979, Chapter 16) as an important motivation for FDI.

11. This is assuming that there are imperfect capital markets, preventing either firm from hedging.

12. Horstmann and Markusen argue that Levinsohn (1989) can not be characterized as endogenizing market structure. In their words, Levinsohn (1989) "shows how a tariff or quota can induce a shift in market structure by causing an exporter to enter the market as a multinational, but the paper does not focus on the positive economics of what determines the market structure in the first place (1992, p. 10)."

13. Markusen (1995) provides a practical description of the distinction between horizontal and vertical FDI, which is employed in this paper. Horizontal FDI is "the

foreign production of products and services roughly similar to those the firm produces for its home market, " whereas vertical FDI entails "fragmenting the production process geographically, by stages of production (p. 170)."
14. The earlier findings of Canzoneri and Henderson's (1991) game-theoretic approach also support the traditional premise of OCA theory that a fixed exchange rate system will yield a Pareto superior outcome when productivity shocks are symmetric, but not necessarily when shocks are asymmetric.
15. The pricing of exports in the currency of the market where they are purchased is also referred to as "local-currency pricing" (LCP) (Devereux and Engel 1999) and "pricing to market" (PTM) (Devereux and Engel 2001).
16. Lipsey defines "internationalized production" as goods produced by overseas affiliates of multinational firms.
17. Please see the Technical Appendix, available from the author upon request, for detailed derivations of all of the following demand and pricing equations, as well as of the analytical results in Section 5.
18. The cash-in-advanced constraint is accompanied by the usual assumption that a lump-sum tax of size M occurs at the end of the period to compel firms operating in the home country to accept money (Bacchetta and van Wincoop 1998).
19. At this point, it is important to emphasize that "domestic" refers to plants and production activity within the country where the owners of a firm reside, whereas "overseas" refers to plants and production outside the country where the firm's owners reside.
20. Helliwell and McKitrick (1998, p. 9) assert that the segmenting influence of the national border on economic activity can be interpreted as evidence of "persistent barriers to trade and investment posed by cross-border regulations, or as evidence that economic networks are denser and more costly to access within national borders." This assertion is supported by Zhang (2002), demonstrating that the institutional integration occuring during the implementation of the European Monetary Union is acting as a catalyst to intra-European FDI.
21 To solve for the exchange rate, S, I note that all revenues received by the home firm, once converted into the home currency, must equal the amount of home currency in circulation, M. Thus,

$$M = p_H c_H + S p_H^* c_H^*$$
$$\quad = nM + S(nM^*)$$
$$(1-n)M = nSM^*$$
$$S = ((1-n)/n)(M/M^*) = \tau(M/M^*).$$

22. In this respect, the results do concur with the findings of Devereux and Engel (2000).
23. In this case, "reasonably" refers to the result's requirement that $\rho > 2$ – within the reasonable limits of empirical estimations of ρ, which lie between 1.3 and 6 (Deaton 1992).

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The Impact of the Single Market and of the Single Currency on Foreign Direct Investment in the European Union

Olivia Galgau[1]
University of Brussels

Khalid Sekkat[2]
University of Brussels

Abstract. The object of this paper is to examine the impact of the single market and the single currency on FDI both in an intra-EU context and from outside the European Union. The single market increased FDI to EU countries from other EU members, but it did not have a significant effect on non-EU FDI into the EU. The single currency may lead to a decrease in FDI from EU countries by eliminating exchange rate volatility and may increase FDI from non-EU countries.

1. Introduction

Launched in 1987, the Single Market Program (SMP) resulted, by 1993, in an internal market common to all EU member states. It was created for a number of reasons, not least as an engine for Europe's continued economic and political integration. By eliminating all remaining barriers to trade, it was supposed to act as a catalyst for the creation of new jobs, for renewed investment in Europe's market and businesses, stimulating economic growth and benefiting consumers as costs and prices fell.

Further steps towards deeper integration were taken at the beginning of 1999 when eleven EU members adopted the single currency, which should result in the elimination of exchange rate volatility among member countries and in better price transparency.

While there is a significant amount of literature dedicated to the impact of the single market and of the single currency on trade (see Sapir et al 1994 for a survey), the research done on the impact of the SMP on FDI is more limited, while that on the impact of the single currency on FDI is non-existent.

A representative study on the theoretical effects of economic integration on FDI is Blomstrom and Kokko (1997). According to the article, the effects of trade liberalization and reduction in investment restrictions implied by the formation of a Regional Integration Agreement (RIA) on FDI depend on whether the latter was induced by the tariff-jumping argument or by the exploitation of intangible assets by multinationals. If the first argument is valid, then regional integration should lead to less intra-regional FDI as exporting from the home country becomes more attractive than FDI as a way of serving the regional market. There should also be an increase in inter-regional FDI if the RIA raises fears about future protection. If the second argument is valid, then we should see an increase in intra-regional FDI as multinationals are able to operate more efficiently across international borders. A larger integrated common market can bear the fixed costs for the establishment of new foreign affiliates and should therefore also attract more FDI from outside the RIA.

Empirically, Belderbos (1997) studied the link between FDI and antidumping measures. He finds that antidumping actions in the EU are more threatening for exports and are more likely to induce tariff-jumping FDI, while the usual tariff barriers lead to more FDI.

Girma et al (1999) studied the role of trade policy and anti-dumping actions in determining the distribution of FDI and also uncovered evidence in favor of the tariff-jumping argument.

A number of papers have specifically studied the impact of the single market on FDI. Barrell and Pain (1999) looked at the impact of host country institutions on location decisions in the EU and found that initially the SMP decreases market entry costs which in turn favors agglomeration, as industries exploit economies of scale and locate close to large markets. But as integration deepens, dispersion may be encouraged if the prices of immobile factors and goods at core locations increase and outweigh the economies gained from newly established agglomerations. Van Aarle (1996) analyzes the impact of the internal market on trade and FDI and finds that the SMP has had a greater impact on FDI than on trade.

Even though our data ends in 1994, five years before the launch of the single currency, we can still evaluate if the latter is susceptible to having an effect on FDI in an indirect manner by investigating the relationship between exchange rate volatility and FDI. A significant relationship between the two would imply that the single currency is susceptible to having an effect on FDI since it led to the elimination of exchange rate variability among EMU members. If we find an insignificant relationship between volatility and FDI we can conclude that the single currency will not have an impact on FDI.

In the literature, a number of papers analyzed the effects of exchange rate variations on investment. Cushman (1985) considers four models depending on where the firm produces and sells its output (in the host country or abroad), on how it finances its capital and on whether it uses host country or foreign inputs. He found that the direct effect of risk-adjusted expected real foreign currency appreciation is to decrease the foreign cost of capital, which in turn stimulates direct investment. When the costs of the other inputs are affected, induced changes in productivity or in output prices may offset the direct effect. If this happens, then direct investment is reduced.

Empirically, Cushman (1985) found significant decreases in US FDI linked with increases in the current value of foreign exchange, as well as evidence that increases in risk consistently raise FDI. Goldberg and Kolstad (1995) examine the implications of short-term exchange rate variability for FDI flows. They found that exchange rate volatility tends to stimulate the share of investment located abroad. Darby et al (1999) found that exchange rate volatility can have an important negative impact on investment and that exchange rate stability would increase investment in Europe on average.

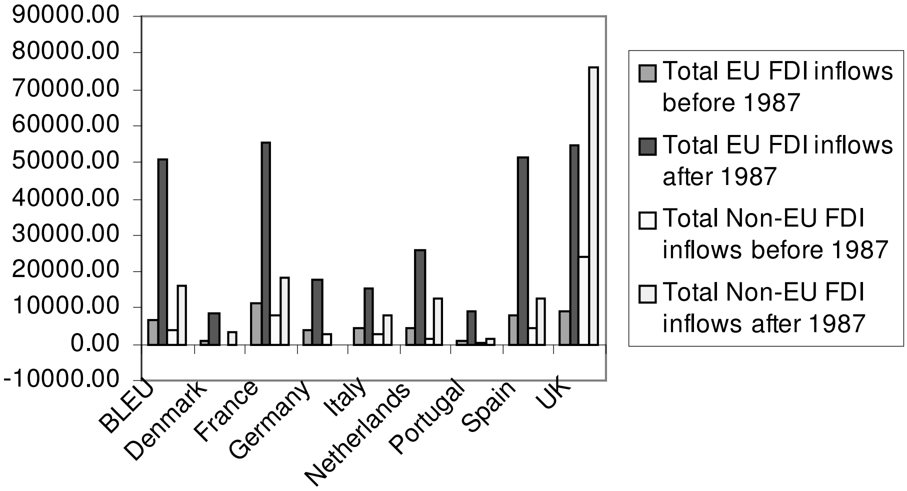
The paper is organized as follows. In the second section we use descriptive statistics to analyze FDI trends from a bilateral perspective, in the third section we describe the data, the regression models and the results and the fourth section concludes.

2. Bilateral FDI Trends Before and After the Single Market Program

Before formally estimating the models, we used descriptive statistics to analyze FDI trends at the bilateral level in the sample countries.

We began by examining FDI inflows (see Figure 1) over the 1980-1994 period for nine European Union (EU) countries (Denmark, Portugal, Spain, Belgium and Luxembourg together, France, Italy, the UK, the Netherlands, Germany) and eight non-EU countries (US, Australia, Japan, Switzerland, Norway, Sweden, Finland and Austria).

Figure 1: EU and Non-EU FDI Inflows Before and After the Single Market Program



For each country in the sample we divided total FDI inflows into two groups: FDI inflows coming from EU countries and inflows from non-EU countries. In order to obtain the two groups, we aggregated total FDI inflows coming from EU and non-EU sources, respectively, to get the two observations (EU and non-EU) for each year. We then compared the amount of FDI received before and after 1987 by summing up for EU and non-EU FDI inflows respectively, total FDI received during the 1980-1987 period on the one hand and during the 1988-1994 period on the other hand.

The graph shows an increase in EU FDI inflows after 1987 in all the EU countries under consideration. But the magnitude of the increase differs from one country to another. The countries that have benefited the most from the single market in terms of FDI inflows are France, the UK, Belgium and Luxembourg and Spain. It is interesting to compare the case of Spain to that of Portugal since both became members of the EU at the same time and both benefited from the simultaneous effects of becoming members of a customs union and of the implementation of the Single Market Program. Spain experienced a substantially stronger increase in FDI inflows after 1987 than Portugal. One possible explanation for this may be the difference in market sizes between the two countries, making Spain a more attractive location for FDI than Portugal.

The increase in FDI in Germany and Italy after 1987 was weaker than in other countries. This can be explained, in the German case at least, by the fact that Germany tends to have an overall position as a home country for FDI rather than as a host country.

The increase in non-EU FDI inflows after 1987 was significantly lower compared with the increase in EU FDI inflows for all of the countries in the EU sample with the exception of the UK.

By examining the pattern of FDI movements in individual EU member states, we can distinguish two groups·

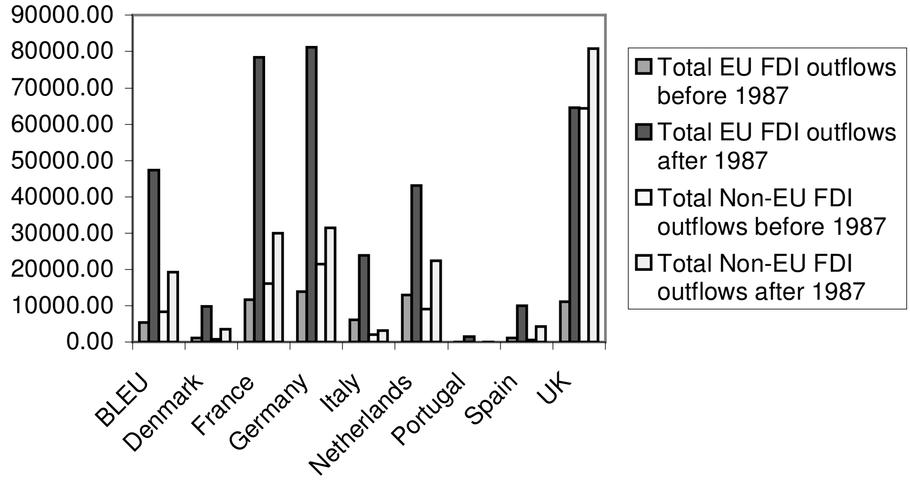
In the first group, which includes Denmark, Portugal, Spain, Belgium and Luxembourg, France and Germany, there is an almost "parallel" evolution between EU and non-EU FDI inflows, with EU flows being systematically higher than non-EU flows since 1986-1987.

In the second group of EU countries (Italy, the UK and the Netherlands) there is a much more "chaotic" movement in EU and non-EU FDI inflows, with EU flows higher than non-EU flows most of the time. However, there are portions in which reversals take place.

We are unable to distinguish any specific pattern in terms of FDI inflow movements among non-EU countries.

We now turn to FDI outflows (see Figure 2) for the same period. The observations were obtained in a similar way as for FDI inflows: we aggregated total FDI outflows from EU and non-EU sources respectively, to get the two observations for each year and then we compared the amount of FDI outflows before and after 1987 by summing up for EU and non-EU FDI outflows respectively, total outflows in the 1980-1987 and 1988-1994 subperiods.

Figure 2: EU and Non-EU FDI Outflows Before and After the Single Market Program



We found results similar to those for FDI inflows, namely, an increase in EU FDI outflows after 1987 for all EU countries, a lower increase for non-EU FDI outflows for all EU countries with the exception of the UK, and the emergence of two groups of EU members. The countries in the group characterized by an almost "parallel" evolution between EU and non-EU FDI outflows are Germany, Portugal, Italy and France, whereas the countries presenting a more "chaotic" evolution of FDI outflows are Denmark, the Netherlands, Belgium and Luxembourg, the UK, Spain and Finland.

This brief descriptive analysis allows us to draw some preliminary conclusions. The emergence, in the EU sample, of two groups of countries for FDI inflows and outflows justifies the use of the panel data approach as an estimation method, since it can isolate country-specific effects that are obviously present. The usual core-periphery division of Europe does not seem to apply in the FDI case, as there are countries from both the core and the periphery in each sub-group of the sample, indicating a similar behavior in the pattern of FDI inflows and outflows.

In all EU countries there is a strong increase in both FDI inflows and outflows since 1986-1987 due to the launch of the Single Market Program, which is a specific phenomenon of European economic integration. Therefore, the preliminary data seem to be indicating a significant and strong single market effect on both FDI inflows and outflows for EU countries.

The SMP seems to have had a stronger effect on intra-EU FDI, as shown by the systematically higher EU FDI inflows and outflows as compared to non-EU flows. The single market has induced EU companies to raise their investments in EU countries, whereas the response of non-EU countries to the single market apparently has not been as enthusiastic.

Comparing these results with the theoretical effects of regional integration as described by Blomstrom and Kokko (1997), we can conclude that tariff-jumping FDI does not play a very important role in the EU since access to a large, unified common market should have led to a surge in non-EU FDI inflows.

Intra-EU FDI inflows seem to follow the internalization model since the reduction in non-tariff barriers operated under the SMP has enabled multinationals to operate more efficiently across international borders and led to an increase in flows.

3. Empirical Analysis

3.1. Data and Methodology

This section studies the impact of the single market on bilateral FDI flows using the gravity model.

A basic specification was estimated first using classical explanatory variables appearing in almost all empirical models in the literature as determinants of FDI.

One such variable is market size, which appears in all empirical studies on FDI. We should expect a positive relationship between market size and FDI, since the bigger the market, the more attractive it is for a foreign firm to locate production in that market. Furthermore, all empirical studies have verified this relationship in practice.

In the gravity model we use both the market size of the host and the home countries as proxied by their respective GDPs (GDPCOR = GDP of the home country and GDPC = GDP of the host country in millions of current US dollars).

Another basic variable is unit labor costs, which measures the cost of labor, corrected for productivity. Again, it is a variable that appears in most models. From a theoretical point of view, the relationship between unit labor costs and FDI can go either way. On the one hand we should expect that an increase in wages in the host country will lead to a decrease in foreign direct investment, since a more expensive labor force should render the host country a less attractive location for a firm to establish production. But on the other hand, if there is a strong substitution effect between capital and labor, then an increase in wages will determine a substitution of labor by capital and lead to an increase in FDI.

In practice however, the overwhelming majority of studies have found a negative relationship between host country unit labor costs and FDI. Only Nicholas Billington (1999) has found a non-linear relationship between these variables in the case of Japanese investment in the UK, but at a regional and not at a country level. In the case of the relationship between home country unit labor costs and FDI, Lucas (1993) has found a positive relationship between the two, indicating that an increase in wages in the home country would lead firms to locate production abroad.

In our model, we use the real unit labor costs of the home country as such and a transformation of the real unit labor costs of the host country by multiplying the latter by an index constructed from the bilateral nominal exchange rate between the host and home countries and assuming 1991 as the base. According to previous empirical results, we should see a positive relationship between FDI and home country unit labor costs and a negative relationship between FDI and host country unit labor costs (REALCOR = the real unit labor costs of the home country and R1ALLC = the real unit labor costs of the host country).

We also consider the geographic distance in kilometers between the capital cities of the home and host countries as one of the basic variables (DISTGAB). There should be a negative relationship between FDI and distance, since locating production abroad still implies transport costs for both goods and human capital.

Our final basic variables are the spread or difference between the long term interest rates of the host and home countries respectively (SPREAD) and the level of the nominal bilateral exchange rate between the host and home countries (NIVN). An increase in the exchange rate means a depreciation of the host country's currency. From a theoretical point of view, the effect of a depreciation in the host country's currency can imply both an increase and a decrease in FDI. On the one hand a depreciation in the host country's currency will make it cheaper for investors to establish production in that country and increase FDI. On the other hand a depreciation in the host country's currency may decrease FDI if the costs of other inputs are affected.

Even from an empirical point of view the effect of a depreciation in the host country's currency is inconsistent and ultimately it depends on the changing export and imported input orientation of producers.

After estimating the basic gravity model we introduced integration variables to study the impact of the internal market on FDI, giving us our second specification.

We used several integration variables. A first variable, SMPI, is aimed at capturing the effect of the single market on FDI. It is a dummy variable that equals 0 between 1980 and 1987 for all the countries in the sample. It then takes a value of 1 from 1988 to 1994 for FDI inflows into EU member states whatever the donor country (EU or non-EU member). The variable is always equal to 0 for FDI inflows into non-EU countries. The SMPI variable takes the value 1 starting with 1988 even though the single market was implemented in 1987, as a certain period of time was necessary for it to start generating effects.

We also included country specific dummy variables (SPAINI, SPAINO, PORTI, PORTO) for Spain and Portugal, which became members of the EU during the implementation of the Single Market. Doing so allows us to distinguish between the classical effects of joining a customs union and the effects of implementing the SMP. These variables are equal to 0 up to 1986 and to 1 from then on.

We also made a distinction between FDI inflows and outflows, such that, for example, variable SPAINI equals 1 for all EU and non-EU FDI inflows into Spain between 1986-1994 and 0 otherwise. SPAINO equals 1 for Spanish outflows into EU and non-EU countries for the same period and 0 otherwise.

From a theoretical point of view (see Blomstrom and Kokko (1997)), there are two models that explain changes in FDI flows when countries form a Regional Integration Agreement (RIA): the tariff-jumping model and the internalization model.

In the tariff-jumping model, factor mobility and trade are viewed as substitutes and high tariff barriers increase FDI. For intra-regional FDI flows, the dismantling of trade barriers should decrease FDI, whereas for inter-regional FDI flows trade barriers should determine an increase in flows.

According to the internalization model, the main reason for incurring FDI is the exploitation of intangible assets. According to this model we should see an increase in both intra- and inter-regional FDI flows. The effect of the SMP and of joining a customs union is therefore inconclusive for EU member states from a theoretical viewpoint. It depends on which of the two models is really at work. In practice all the studies done on the effect of the SMP on FDI have found a positive relationship between the two.

According to both the tariff jumping and internalization models, the SMP should lead to an increase in FDI flows into the EU from non-EU countries.

In the third specification we introduced different exchange rate volatility measures. The theoretical effects are mixed: in the model developed by Darby, Hughes Hallet, Ireland and Piscitelli (1999) there is an important negative impact of exchange rate volatility on FDI. In models developed by Goldberg (1993) there can be a positive impact on FDI of exchange rate volatility.

Empirically, most studies have found an insignificant relationship between FDI and exchange rate volatility. Goldberg found a change in the relationship between FDI and volatility over the years in the case of some US sectors. Goldberg and Kolstad (1995) and Cushman (1985) found a positive relationship between exchange rate volatility and FDI.

The data covers the 1980-1994 period and the estimations were done using the fixed effects panel data approach.

We divided the sample in two parts: the EU sample made up only of FDI inflows to EU countries from EU members and the non-EU sample made up of FDI inflows to EU countries from non-EU countries. The non-EU countries considered in the sample are: the United States, Canada, Australia, Japan, Switzerland, Norway, Sweden, Austria and Finland.

The models are estimated in double-log and the dependent variable is the inflow of FDI expressed in millions of current US dollars. We used a total of 999 observations for the EU sample and 855 observations for the non-EU sample.

3.2. The Results

The estimations were done using the panel data approach. Table 1 presents the results for the EU sample. We tested the null hypothesis of a common intercept for all countries in the sample against the alternative of the existence of different fixed effects. We reject the null hypothesis at the 5% confidence level for all the models in the EU sample. We then used the Hausmann test to see if the choice of the fixed effects model is pertinent compared to the possibility of using the random effects model. We reject the null hypothesis of the random effects estimators being more appropriate than the fixed effects estimators at the 5% confidence level for all the models in the EU sample. The choice of the fixed effects model is therefore appropriate for all specifications.

Table 1: *European Union Sample - Double Log*

Explanatory Variables	**Basic Model = (1)**	**(1) + Integration Variables = (2)**	**(1) + Volatility Measures = (3)**		
			V1	**V2**	**V3**
LGDPCOR	1.221	0.230	0.165	0.203	0.254
	(7.47)	(0.85)	(0.61)	(0.75)	(0.94)
LGDPC	0.877	0.841	0.830	0.815	0.835
	(18.57)	(18.66)	(18.35)	(17.88)	(18.56)
LR1ALLC	0.058	-0.041	-0.033	-0.054	-0.047
	(1.43)	(-0.75)	(-0.61)	(-1.00)	(-0.87)
LREALCOR	2.569	3.014	2.897	2.760	3.271
	(2.37)	(2.66)	(2.56)	(2.44)	(2.88)
DISTGAB	-0.0010	-0.0012	-0.0013	-0.0013	-0.0013
	(-9.59)	(-12.25)	(-12.44)	(-12.63)	(-12.47)
SPREAD	0.062	0.044	0.041	0.038	0.042
	(4.16)	(2.94)	(2.72)	(2.53)	(2.77)
SMPI	-	0.490	0.559	0.586	0.485
		(2.68)	(3.01)	(3.17)	(2.65)
SPAINI	-	1.525	1.542	1.540	1.540
		(9.24)	(9.35)	(9.37)	(9.34)
SPAINO	-	0.706	0.750	0.706	0.829
		(2.06)	(2.18)	(2.06)	(2.39)
PORTI	-	1.493	1.508	1.606	1.575
		(5.74)	(5.81)	(6.15)	(6.01)
PORTO	-	0.325	0.398	0.507	0.495
		(0.77)	(0.94)	(1.19)	(1.15)
NIVN	0.000	0.000	0.000	0.000	0.000
	(-1.88)	(-0.64)	(-0.51)	(-0.34)	(-0.40)
ETCHN	-	-	0.106	-	-
			(2.07)		
CVNIVN	-	-	-	7.349	-
				(3.19)	
ST5AV	-	-	-	-	3.444
					(2.21)
Adjusted R^2	0.64	0.68	0.68	0.68	0.68
Observations	999	999	999	999	999
Fixed effects	$F(9,982)$ $=19.72$	$F(9,977)$ $=13.13$	$F(9,976)$ $=13.24$	$F(9,976)$ $=13.47$	$F(9,976)$ $=13.47$
Random effects	$\chi^2(7)$ $=18.17$	$\chi^2(9)$ $=28.22$	$\chi^2(10)$ $=30.41$	$\chi^2(9)$ $=30.18$	$\chi^2(10)$ $=27.13$

Note: t-statistics are in parenthesis

In the basic model we found a positive relationship between FDI and the GDPs of both the host and home countries, with highly significant coefficients. There is evidence that an increase in real unit labor costs in the home country will lead to an increase in FDI in the host country, as multinationals start locating production abroad possibly in search of cheaper labor. However, the relationship between host country unit labor costs and FDI is insignificant.

We found the expected effect of an increase in the geographic distance on FDI, namely the larger the distance between home and host countries, the less FDI takes place between them. While the coefficient on the geographic distance variable is significant, the magnitude of the effect is very small. An increase in the spread between long term interest rates of the host and home countries will increase FDI. There is some evidence that a depreciation in the host country's currency will lead to a decrease in FDI, given that a t-statistic of –1.88 means that the coefficient associated with the bilateral nominal exchange rate is insignificant at the 5% confidence level, but it is significant at the 10% confidence level. In terms of explanatory power, the basic model succeeds in explaining over 64% of the changes in FDI.

The introduction of the integration variables in the second model rendered the coefficient associated with the GDP of the home country insignificant. However, the relationship between the GDP of the host country and FDI remained positive and highly significant. The coefficient associated with the nominal bilateral exchange rate became insignificant even at the 10% confidence level. There was no other meaningful change in the sense or significance of the relationships between the other variables from the basic model and FDI.

We found that the implementation of the single market increased FDI inflows from other EU countries. In the case of Spain and Portugal, simply joining a customs union led to a rise in FDI inflows from other EU members as well as to more Spanish FDI outflows into other EU countries. By incorporating integration variables into the regression, the explanatory power of the model was raised to over 68% of the changes in FDI inflows.

In the third model we investigated whether the introduction of the single currency is susceptible to having an effect on FDI inflows into the EU, by studying the relationship between exchange rate volatility and FDI. We used three different volatility measures, obtaining three versions of the model: the standard deviation of the level of the monthly nominal bilateral exchange rate (ETCHN), the standard deviation of the percentage change in the level of the monthly nominal bilateral exchange rate (CVNIVN) and the 5-year moving standard deviation of the annual percentage change of the bilateral exchange rate (ST5AV).

There was no change in the sense or significance of the relationship between the variables present in the integration model and FDI. Whatever the exchange rate volatility measure used in the regressions, we always found that a rise in exchange rate volatility led to an increase in FDI inflows into the host country. This is in line with the empirical evidence found by Cushman (1985) according to which increases in risk consistently raise foreign direct investment, as well as by Goldberg and Kolstad (1995) who found that volatility tends to stimulate the share of investment activity located abroad. The relationship between exchange rate volatility and FDI allows us to draw some conclusions on the impact of the introduction of the single currency on FDI. Given that the launch of the single currency led to the elimination of exchange rate volatility and the risk associated with it among EMU member states, it may lead to a decrease in FDI inflows into EMU countries from other EMU countries. The explanatory power of the three versions of the model is over 68%.

Table 2 in the annex presents the results for the non-EU sample. The fixed effects tests reject the null hypothesis of a common intercept for all countries at the 5% confidence level for all the models used for the non-EU sample. The Hausmann test rejects the null hypothesis of random effects estimators being more appropriate than the fixed effects estimators at the 10% confidence level for the second and third model. We can not reject the null hypothesis for the first model either at the 5% or the 10% confidence level. Despite this we still prefer the fixed effects model to the random effects model, since we can give an economic interpretation to fixed effects but not to random effects. Also, in order for comparisons with the results obtained in the literature to be possible, we have to use the fixed effects model.

In the basic model we found a positive and significant relationship between the GDPs of both the host and home countries and FDI. An increase in home country real unit labor costs led to an increase in FDI inflows in the host country, whereas the relationship between host country real unit labor costs and FDI was negative, but insignificant. We again found the expected relationship between geographic distance and FDI, whereas the coefficient associated with the spread is negative and insignificant. The estimation results show that a depreciation in the host country's currency led to a decrease in FDI inflows, although the magnitude of the effect was small. The basic model succeeds in explaining over 59% of the changes in FDI.

In the second model, where we introduced integration variables alongside the basic explanatory variables, the coefficient associated with the GDP of the home country became insignificant. There is evidence that an increase in host country labor costs led to a decrease in FDI from non-EU countries. There is no other change in the significance or the sign of the coefficients associated with the explanatory variables that were also present in the basic model. We did not find any significant relationship between the implementation of the single market and FDI inflows from non-EU countries into EU countries. The fact that Spain joined a customs union when it became a member of the EU did not have any meaningful impact on FDI inflows into Spain from non-EU countries. However, there is some evidence Portuguese membership in a customs union led to an increase in FDI inflows from non-EU countries, as the coefficient associated with the PORTI dummy variable is significant at the 10% confidence level. The explanatory power of the model is over 59% of the changes in FDI.

In the versions of the third model there is no change in the sign or significance of the coefficients associated with the variables which were also present in the integration model. When we introduced the short-term exchange rate volatility measure ETCHN in the regression, we found that an increase in volatility led to a

Table 2: *Non-European Union Sample - Double Log*

Explanatory Variables	Basic Model = (1)	(1) + Integration Variables = (2)	(1) + Volatility Measures = (3) V1	V2	V3
LGDPCOR	0.551	0.413	0.359	0.380	0.306
	(2.21)	(1.29)	(1.12)	(1.18)	(0.94)
LGDPC	0.816	0.796	0.801	0.798	0.798
	(15.78)	(15.13)	(15.29)	(15.19)	(15.20)
LR1ALLC	-0.066	-0.159	-0.175	-0.153	-0.163
	(-1.42)	(-2.43)	(-2.67)	(-2.33)	(-2.49)
LREALCOR	3.775	3.590	4.141	3.695	3.680
	(2.78)	(2.60)	(2.98)	(2.67)	(2.66)
DISTGAB	-0.00014	-0.00014	-0.00014	-0.00014	-0.00014
	(-3.20)	(-3.30)	(-3.27)	(-3.23)	(-3.25)
SPREAD	-0.023	-0.018	-0.0099	-0.014	-0.015
	(-1.25)	(-0.92)	(-0.52)	(-0.75)	(-0.78)
SMPI	-	0.151	0.160	0.142	0.158
		(0.76)	(0.81)	(0.71)	(0.79)
SPAINI	-	-0.143	-0.152	-0.141	-0.155
		(-0.78)	(-0.83)	(-0.77)	(-0.84)
SPAINO	-	-	-	-	-
PORTI	-	0.628	0.612	0.573	0.632
		(1.88)	(1.84)	(1.70)	(1.89)
PORTO	-	-	-	-	-
NIVN	-0.001	-0.001	-0.001	-0.001	-0.001
	(-4.36)	(-4.32)	(-4.50)	(-4.36)	(-4.37)
ETCHN	-	-	-0.174	-	-
			(-2.91)		
CVNIVN	-	-	-	-3.830	-
				(-1.49)	
ST5AV	-	-	-	-	-2.812
					(-1.99)
Adjusted R^2	0.60	0.60	0.60	0.60	0.60
Observations	855	855	855	855	855
Fixed effects	F(8,839) =28.15	F(8,836) =25.96	F(8,835) =26.87	F(8,835) =26.19	F(8,835) =26.54
Random effects	$\chi^2(7)$ =10.05	$\chi^2(8)$ =13.72	$\chi^2(8)$ =14.55	$\chi^2(8)$ =13.95	$\chi^2(8)$ =14.71

Note: t-statistics are in parenthesis

decrease in FDI inflows from non-EU countries. The same result holds for the long-term volatility measure ST5AV, although this relationship is significant at the 10% confidence level, but not at the 5% level.

In the versions of the third model there is no change in the sign or significance of the coefficients associated with the variables which were also present in the integration model. When we introduced the short-term exchange rate volatility measure ETCHN in the regression, we found that an increase in volatility led to a decrease in FDI inflows from non-EU countries. The same result holds for the long-term volatility measure ST5AV, although this relationship is significant at the 10% confidence level, but not at the 5% level.

Comparing the regression results for the EU and non-EU samples, there is a difference in terms of the impact of labor costs, spread, trade integration and exchange rate volatility on FDI.

When deciding whether or not to locate production abroad, EU multinationals take the evolution in labor costs in their country of origin into consideration, but not the developments in labor costs in other EU members. On the contrary, if labor costs in the home country increase, non-EU multinationals locate production in EU countries, and if costs in the host country rise, they reduce their FDI to that country.

There is always a positive and significant relationship between the spread of long-term interest rates and FDI in the EU sample, but it is always insignificant in the non-EU sample.

The implementation of the single market led to an increase in intra-EU FDI, but did not meaningfully influence FDI flows from outside the EU.

For Spain, joining a customs union significantly increased FDI from other EU members and Spanish FDI towards the European Union, but not non-EU FDI. Portugal also benefited from more EU FDI after it became a member of the union, but its investment flows towards the EU were not significantly affected. There is some evidence that by becoming a member of a customs union, Portugal succeeded in attracting more FDI from outside the EU.

The introduction of the single currency may lead to a decrease in intra-EU FDI by eliminating exchange rate volatility between EMU members. It may also increase FDI from non-EU countries by reducing exchange rate volatility.

4. Conclusions

The regressions on bilateral FDI flows uncover evidence that the implementation of the single market significantly increased FDI inflows into EU countries from other EU member states, but it did not meaningfully affect FDI inflows into EU countries from non-EU member states.

Given these observations and comparing them to the potential effects on FDI inflows of a Regional Integration Agreement (RIA) as described by Blomstrom and Kokko (1997), in the case of intra-regional flows it seems that the main motive for incurring FDI is the exploitation of intangible assets. This implies that a reduction in trade barriers enables multinationals to operate more efficiently across international borders, leading to an increase in intra-regional FDI inflows. Since we observe an increase in intra-regional FDI inflows, we have to assume that the internalization model applies, as the other possibility given by the tariff-jumping argument would have implied a reduction in FDI inflows in the case of a Regional Integration Agreement. The reduction in trade barriers would make serving the market via exports from the home country more attractive.

From a theoretical point of view, for inter-regional FDI flows, i.e. FDI inflows from non-EU countries in this case, whatever the pre-existing motive for FDI (tariff jumping or the internalization model) there should be an increase in FDI inflows from non-EU members. We do not see a significant increase in FDI from non-EU countries due to the single market. An explanation for the smaller impact of the single market on FDI inflows from non-EU countries is the following. The theoretical models developed to assess the effects of forming a Regional Integration Agreement on FDI flows from non-member countries assume that there are two entities in the world: a group represented by the RIA and an individual country that is not a member of the RIA. It also assumes that the non-RIA member has pre-existing investment in the member countries and assesses the effects on this investment of the other countries forming a RIA. In reality the non RIA member country can be a member of another rival RIA, which is the case for four of the countries in our non-EU sample (the US and Canada are members of both NAFTA and APEC, while Japan and Australia are both members of APEC). And so the smaller effect of the single market on FDI inflows from non-EU countries can be due to the fact that the non-EU countries' FDI flows could for the most part be directed inside rival Regional Integration Agreements. Developments in the other RIA (in this case the EU) may not be very successful in changing that pattern despite the obvious advantages of access to a large, integrated single market. One direction of future research into FDI can be to assess how deep integration in one Regional Integration Agreement can change the FDI pattern of a country that is a member of one of several rival RIAs.

Spanish integration into a customs union significantly increased FDI inflows into Spain from other EU countries, but did not affect FDI inflows into Spain from non-EU countries. It also significantly increased Spanish FDI outflows into other EU countries. Portuguese integration into a customs union significantly increased FDI inflows into Portugal from other EU countries and there is some evidence that it may have increased FDI inflows from non-EU countries. Portuguese integration into the EU did not affect Portuguese FDI outflows towards other EU countries.

There is some evidence that multinationals from EU countries do not take into account the evolution of labor costs in other EU countries when deciding whether to locate production abroad or not, but they do look at the evolution in labor costs in their country of origin. If the latter increase, they locate production in other EU countries. On the contrary, multinationals from non-EU countries take both host and home country labor costs into consideration when deciding whether to locate production abroad or not: if labor costs in their country of origin increase, they locate production in EU countries and if labor costs in the host country increase, they reduce their FDI to that country.

Another conclusion is that multinationals take the market size of the host country into consideration when deciding to invest abroad, but they do not take into account the market size of the home country.

We found an insignificant relationship between the nominal bilateral exchange rate and FDI in the EU sample, but we found some evidence of a negative relationship between the two in the non-EU sample.

In the EU sample we found that an increase in exchange rate volatility will significantly increase FDI inflows. This allows us to do a preliminary assessment on the impact of the single currency on foreign direct investment. Given that the single currency led to the elimination of exchange rate variability among EMU countries we can conclude that it may lead to a decrease in FDI inflows into EU countries from other EU countries.

In the non-EU sample we found some evidence that an increase in exchange rate volatility will lead to a decrease in FDI inflows into EU countries from non-EU countries. The single currency may therefore increase FDI inflows into the EU from non-EU countries by reducing exchange rate volatility.

Notes

1. Research Fellow at the Department of Applied Economics, University of Brussels. E-mail: ogalgau@ulb.ac.be.
2. Professor at the Department of Applied Economics, University of Brussels. E-mail: ksekkat@ulb.ac.be.

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Real Exchange Rates and Productivity Shocks in a Small Open Economy

Simon Neaime[1]

American University of Beirut

Abstract. A dynamic macroeconomic model with habits and durability in consumption is employed in this paper to explore the effects of productivity shocks on the real exchange rate and sectoral output adjustments. It is shown that a productivity improvement in the traded (or manufactured) sector causes the permanent income of the representative agent to increase and draws resources from the non–traded sector (taking advantage of this productivity improvement) to the traded sector. The supply of non–traded goods will thus decrease. If the durability effects are dominant in the short run, and habits in the long run, then after a productivity improvement in the traded sector, total expenditures, and the price of non–traded goods will increase by a large amount in the short run leading to a huge appreciation of the domestic currency. On the other hand, a productivity improvement in the non–traded sector has ambiguous effects on the real exchange rate, but will unambiguously increase the supply of non-traded goods.

1. Introduction

Considerable attention in dynamic macroeconomics has been given lately to the Real Business Cycle (RBC) approach to economic fluctuations as pioneered by Kydland and Prescott (1982). This approach has succeeded in explaining some key empirical regularities that characterize economic fluctuations. In this framework, productivity shocks are the main driving force of economic fluctuations. Backus and Kehoe (1989), and Backus, Kehoe, and Kydland (1994) document evidence from various open economies. The stylized facts are as follows. First, a country's savings and investments are positively correlated. Second, after an increase in output, the country's net foreign asset position will deteriorate.[1] Third, the trade balance is negatively correlated with current and future movements in the terms of trade, but positively correlated with past movements. And the current account and the trade balance tend to move counter cyclically. Real Business Cycle models have thus been used widely to account for these empirical regularities.

Mendoza (1991) explores the first two empirical regularities by extending the basic RBC approach proposed by Kydland and Prescott to the case of a small open economy. He employs a dynamic stochastic model using Canadian data to explore the dynamics of savings and investments. In contrast to the RBC framework, and as in Obstfeld (1981), and Uzawa (1967), the rate of time preference is endogenously determined. It is shown that the model can duplicate many of the stylized facts only in the presence of capital–adjustment costs, and temporary rather than persistent shocks. In his framework, a temporary productivity shock increases investment. Also, a transitory productivity shock raises the permanent income temporarily and thus savings, through the consumption smoothing motive.

In another paper, Mendoza (1995) employs an intertemporal general equilibrium framework to explore the effects of random shocks to productivity and the terms of trade. Stylized facts suggest that movements in the real exchange rate are procyclical. Also, observed terms of trade shocks are largely weakly procyclical but persistent. Cycles in less developed countries are large but both developed and developing countries have similar variability ratios, autocorrelations, and GDP correlations. Mendoza's results are consistent with these empirical regularities. It is shown that terms of trade shocks are the main driving force behind almost half of GDP and real exchange rates variability. The key feature in the model's dynamics is the persistence, magnitude, and current correlation of terms of trade and productivity shocks, and the elasticity of substitution between traded and non–traded goods. The covariance and autocorrelation structures of shocks are important because after any shock income effects will impinge on optimal saving behavior. The elasticity of substitution between traded and non–traded goods is also important, since these goods are in general gross substitutes in less developed countries, and gross complements in developed countries, implying divergence for cross-price and cross- expenditure effects.

Ricketts and McCurdy (1995) extend the basic RBC model by employing a stochastic international model with money.[2] They use a sample of US and Canadian data to calibrate the moments of the forcing processes, and were able to compute a perfectly pooled equilibrium solution for their stochastic growth model. It is shown that changes in the rate of growth of money cause fluctuations in consumption and investment. And the effects on goods and asset prices can be substantially different from that in endowment models. It is also shown that monetary fluctuations are transmitted to other countries via exchange rates and terms of trade adjustments.

Backus, Kehoe, and Kydland (1994) employ a two–country dynamic general equilibrium model to study the effects of shocks to productivity in a production economy, which uses capital and labor to produce its output. It is assumed that the two countries produce imperfectly substitutable goods. Using plausible parameter values they are able to replicate key empirical regularities from eleven developed countries. It is shown that after an increase in domestic output the trade balance deteriorates, and is negatively correlated with current and future movements in the terms of trade, but positively correlated with past movements.[3] The intuition for this result is as follows. A positive productivity shock raises domestic output and thus reduces its relative price, leading to a terms of trade deterioration. Because this shock is persistent, consumption and investment will also rise. The country will therefore experience a trade deficit because the increase in consumption and investment outweighs the gains in output. This dynamic response pattern gives rise to counter–cyclical movements in the trade balance as is observed in the data. The dynamics of investment are crucial in generating the above result. By eliminating capital from their theoretical model, the trade balance will be driven by output dynamics and consumption smoothing. If that is the case, then after a positive shock, the trade balance will improve because preference for smooth consumption results in a smaller increase in consumption than in output. The trade balance will thus be pro–cyclical. At the same time, the price of domestic goods falls, and there is an improvement in the terms of trade.

On the other hand, considerable attention in monetary and financial economics has been given recently to the habit persistence model of Ryder and Heal (1973), in which instantaneous utility depends not only on current consumption, but also on the habitual standard of living, modeled as a weighted average of past levels of consumption. For example, Constantinidis (1990) was able to solve the equity premium puzzle using this model. Also, Backus, Gregory, and Telmer (1994) use this model to account for the high variation in the expected return on the forward relative to spot exchange rates. The popularity of the Ryder–Heal preference stems from the fact that with it we can have adjacent complementarity in consumption, and, thus, a very high degree of consumption smoothing motive.

Empirical studies regarding the behavior of asset prices find evidence that the simultaneous presence of habits and durability in consumption improves the performance of consumption-based asset–pricing models. Heaton (1995), for example, assumes that the consumption good exhibits durability and instantaneous utility depends on the services provided by the consumer durables. In addition, habits are introduced as in Ryder and Heal, to allow for the possibility of intertemporal complementarity. Hence, habits are assumed to be a weighted average of past levels of the services provided by the consumer durable. Durability tends to make consumption in adjacent dates substitutable while habits allow for adjacent complementarity. He finds that "habit persistence substantially improves the model's ability to fit stock and bond returns *only if local substitution is also present"*. (p. 683). Moreover, the durability effects are dominant over a period of four months; but they are dominated by the habit effects after that.

In a recent paper, Mansoorian and Neaime (2000) use the preference structure proposed by Heaton (1995) to examine the effects of tariff protection on the current account. It was shown that, with short–run substitutability and long–run complementarity in consumption, an increase in tariffs will likely lead to a current account surplus followed by a deficit. In the opposite case a deficit will be followed by a surplus.

In this paper, the same preference structure (with habits and durability) as the one used by Heaton (1995), and Mansoorian and Neaime (2002 and 2003), will be employed to discuss the effects of productivity shocks on real exchange rates and sectoral adjustment of output. A productivity improvement in the traded (or manufactured) sector causes the permanent income of the representative individual to increase. As a result, his habitual standard of living will increase in the steady state. To sustain these higher standards, the steady state stock of durables will also increase. Thus, a productivity improvement in the traded sector draws resources from the non–traded sector (taking advantage of this productivity improvement) to the traded sector. The supply of non–traded goods will thus decrease. If the durability effects are dominant in the short run, and habits in the long run, then after productivity improvement in the traded sector, total expenditures, and the price of non–traded goods will go up by a large amount in the short–run. Then, gradually, total expenditures and the price of non-traded goods will be falling over time until the habits effects become dominant. At that point both variables will start to increase again until we reach the new steady state. On the other hand, a productivity improvement in the non–traded sector has ambiguous effects on the price of non–traded goods and thus on total expenditures, but will unambiguously increase the supply of non-traded goods.

This paper is organized as follows. The model is laid out in section two. In section three, a calibration exercise is used to solve the model. In section four, the effects of a productivity improvement in the non–traded and traded sectors are discussed. Some concluding remarks are made in section five.

2. The Model

The objective function of the representative agent is a two-good variant of that used by Heaton

$$\int_0^{\infty} e^{-\theta t} U(s_t + \omega_t, h_t)\, dt, \tag{1}$$

where θ is the rate of time preference, and for any time t, ω_t is a utility measure of the services provided by the agent's current purchases of the foreign and home goods, c_t^f and c_t^h. It is defined as

$$\omega_t = \omega(c_t^f, c_t^h), \tag{2}$$

where $\omega(.)$ is a homothetic subutility function.

s_t is modeled as a weighted sum of ω_τ ($\tau < t$), with exponentially declining weights given to more distant values of ω_τ:

$$s_t = \int_{-\infty}^{t} e^{\delta(\tau - t)} \omega_\tau d\tau, \tag{3}$$

where $\delta > 0$.

In a one-good model, s_t would be a weighted sum of past levels of consumption expenditures. Then, s_t would be the stock of durable goods available at time t, and δ the rate of depreciation of the durables. In the present two-goods model, on the other hand, ω_τ is a utility measure of the goods purchased at time τ. Modeling durability in this way, instead of durability in each of the two goods separately, will simplify the analysis. Alternatively, one can view this way of modeling durability as attempting to capture an important aspect of preferences rather than modeling durability per se. Note that $s_t + \omega_t$ is the total services of the durable goods that are enjoyed at time t.

From (3) it follows that evolution of s_t is given by

$$\dot{s}_t = \omega_t - \delta s_t . \tag{4}$$

The habitual standards of living are developed over the flow of past consumption services. Thus, h_t is a weighted sum of $(s_\tau + \omega_\tau)$ $(\tau < t)$, with exponentially declining weights given to more distant values of $s_\tau + \omega_\tau$

$$h_t = \rho e^{-\rho t} \int_{-\infty}^{t} e^{\rho \tau}[s_\tau + \omega_\tau] d\tau, \tag{5}$$

where $\rho > 0$. From (5) it follows that the evolution of h_t is given by

$$\dot{h}_t = \rho[s_t + \omega_t - h_t]. \tag{6}$$

We maintain assumptions (P.1)–(P.5) of Ryder and Heal (pp. 2–3), regarding the momentary utility function. Thus, momentary utility is assumed to be: (P.1) increasing in the current flow of services consumed, $U_1 > 0$; (P.2) non–increasing in habits, $U_2 \le 0$; (P.3) increasing in uniformly maintained ω, i.e., $U_1(x,x) + U_2(x,x) > 0$ for all $x > 0$; (P.4) concave in its two arguments; and (P.5) $\lim_{x\to 0} U_1(x,h) = \infty$ and $\lim_{x\to 0} [U_1(x,x) + U_2(x,x)] = \infty$.

There are two sectors in the economy; a traded and a non–traded sector. The foreign good is taken to be the numeraire, and its price is given by $p_t^T = 1,$ at time t. The price of the non–traded good is determined by its domestic supply and demand, and in equilibrium is given by: $P_t^{NT} = \Psi(Z, c),$ at time t. Where c is a productivity parameter, and Z is aggregate expenditures. The world rate of interest, r, and the price of the internationally traded bonds are also fixed abroad. Thus, the flow budget constraint of the agent is

$$\dot{B}_t = rB_t + \gamma[(p), c] - Z_t, \tag{7}$$

where γ (the value of output produced) = $s_t + p_t^{NT} s_t^{NT}$ (s_T and s_N are output supplied by the traded and non-traded sectors respectively). Z_t is aggregate expenditures at time t ($p_t^{NT} c_t^h + c_t^f$), and B_t is the country's net foreign asset position.

Finally, the intertemporal solvency condition,

$$\lim_{t\to\infty} e^{-rt} B_t \geq 0, \tag{8}$$

prevents the representative agent from borrowing without bound.

In what follows, it will be important to keep a clear distinction between aggregate expenditures (Z) and real consumption (ω). The former is the value of goods purchased, while the latter is a utility measure of the services provided by these goods.

The problem of the representative agent is to choose a sequence of consumption levels (c_t^f, c_t^h), to maximize his utility subject to the constraints (4), (6)–(8), and the initial conditions, s_0, h_0, and B_0. There is no labor/ leisure choice in the model.

The marginal rate of substitution between home and foreign goods at any point in time is independent of the consumption levels at other dates. Hence, as the subutility function $\omega(.)$ is homothetic, the agent's maximization problem can be done in two stages.

In the first stage, for a given level of expenditures, Z_t, choose $(c_t^f \text{ and } c_t^h)$, to maximize $\omega(c_t^f, c_t^h)$, subject to $Z_t = p_t^{NT} c_t^h + c_t^f$. In the second stage choose the values of Z_t.

The first stage of the problem gives the indirect utility function $Z_tV(p)$, where $V' < 0$. The second stage of the problem then is

$$\underset{\{Z_t\}}{\text{Max}} \int_0^\infty e^{-\theta t} U(s_t + Z_t V(p), h_t) dt, \tag{9}$$

subject to (4), (6)–(8), and the initial conditions, s_0, h_0, and B_0.

The Hamiltonian for this problem is

$H = U(s_t + Z_tV, h_t) + \phi_t [Z_tV - \delta s_t] + \lambda_t [\rho (s_t + Z_tV - h_t)] + \mu_t [rB_t + y - Z_t]$,

where ϕ_t, λ_t and μ_t are the shadow prices of s_t, h_t and B_t, respectively.

The optimality conditions are

$$H_z \equiv U_1 V + \phi V + \lambda \rho V - \mu = 0 \tag{10}$$

$$-H_s + \theta\phi \equiv -U_1 + \phi\delta - \lambda\rho + \theta\phi = \dot{\phi}, \tag{11}$$

$$-H_h + \theta\lambda \equiv -U_2 + \lambda\rho + \theta\lambda = \dot{\lambda}, \tag{12}$$

$$-H_B + \theta\mu \equiv -r\mu + \theta\mu = \dot{\mu}, \tag{13}$$

and the standard transversality conditions.

From (13) it is clear that a steady state can be reached only if

$$r = \theta. \tag{14}$$

This is a standard assumption that is made in the literature, and we will maintain it from now on. From (13) and (14) it follows that $\dot{\mu} = 0$, and that μ is always at its steady state level.

Along the perfect foresight path, the actual price equals the equilibrium price. And since the equilibrium price is determined by the supply and demand of non-traded goods, it follows that $P_t^{NT} = \Psi(Z, c)$.

Linearizing (10) around the steady state, using the fact that $\dot{\mu} = 0$, we obtain

$$(Z_t - \bar{Z}) = -\frac{U_{11}}{\Delta}(s_t - \bar{s}) - \frac{U_{12}}{\Delta}(h_t - \bar{h})\frac{\rho}{\Delta}(\lambda_t - \bar{\lambda}) - \frac{1}{\Delta}(\phi_t - \bar{\phi}), \quad (15)$$

where bars over variables denote steady state values, and

$$\Delta = \Psi_Z V'[U_{11}Z + (U_1 / V) + (\phi / V) + (\lambda\rho / V)] + U_{11}V.$$

Linearizing (6), (11) and (12) around the steady state, using (14) and (15), we obtain[4]

$$\begin{bmatrix} \dot{h}_t \\ \dot{\lambda}_t \\ \dot{\phi}_t \\ \dot{s}_t \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} \\ a_{21} & a_{22} & a_{23} & a_{24} \\ a_{31} & a_{32} & a_{33} & a_{34} \\ a_{41} & a_{42} & a_{43} & a_{44} \end{bmatrix} \begin{bmatrix} h_t - \bar{h} \\ \lambda_t - \bar{\lambda} \\ \phi_t - \bar{\phi} \\ s_t - \bar{s} \end{bmatrix} \quad (16)$$

In the differential equation system (16), h and s are state variables, while λ and ϕ are both jump variables. Therefore, for saddlepoint stability of the system the coefficient matrix should have two positive and two negative eigenvalues. It is clearly not possible to solve the differential equation system (16) analytically to get the stable path; it will thus be solved numerically. To this end, we define some functional forms for the different equations in our model.

3. Calibration Exercise

The functional forms that will be used in this calibration exercise are as follows. First, we use a log–linear preference function of the form

$$U = \text{Log}\,[\omega + s - ah], \quad (17)$$

where a > 0.

Second, ω (.) is now Cobb–Douglas and is given by

$$\omega(.) = \sqrt{c_t^h c_t^f}\,. \quad (18)$$

Maximizing (18) subject to $Z = p^{NT} c_t^h + c_t^f$ gives the demand for the non-traded and traded goods respectively: $c_t^h = Z / 2p_t^{NT}$ and $c_t^f = Z / 2$. The indirect utility for one unit of expenditure Z is $V = 1/2\sqrt{p}$.

On the production side, the production function of the traded (or manufactured) sector uses capital and labor to produce its output, and is given by $Y_M = \sqrt{L_M K_M}$. The non-traded sector uses capital and labor to produce its output, and its production function is given by $Y_N = cL_N$, (where c is a productivity parameter). Maximizing the production function of the traded sector subject to the standard market clearing conditions for capital and labor, and the production function of the non–traded sector gives the supply of traded goods

$$Y_M(\overline{K}, \overline{L}, \overline{Y}_N) = \sqrt{[\overline{L} - \overline{Y}_N / c]}\sqrt{\overline{K}}\,. \tag{19}$$

Differentiating (19) with respect to Y_N gives us

$$-(1/2c)\sqrt{[\overline{L} - \overline{Y}_N / c]}\sqrt{\overline{K}}\,, \tag{20}$$

which is the slope of the production possibility frontier for both traded and non–traded goods. Finally, to obtain the supply function of non–traded goods set (20) equal to the negative of the price ratio to get

$$Y_N = c\overline{L} - c[1/2cp]^2\,\overline{K}\,.$$

The equilibrium price of non–traded goods is thus obtained by setting the demand for non-traded goods equal to the supply. This gives us a quadratic equation in P. Solving this equation for the positive root of P we get

$$p(\overline{Z}, c) = [\overline{Z} + \sqrt{\overline{Z}^2 + 4\overline{LK}}\,]/4c\overline{L}. \tag{21}$$

The total value of total output produced γ is given by $(\overline{K}/4pc) + pc\overline{L}.$

To solve for the a_{ij} coefficients in the system of differential equation (16), we need to consider the initial steady state of the model, which is characterized by equation (10), and by equations (4), (6), (7), (11), and (12), with $\dot{s} = \dot{h} = \dot{B} = \dot{\lambda} = \dot{\phi} = 0.$ These are six equations in seven unknowns s_0, h_0, B_0, Z_0, ϕ_0, λ_0 and μ_0.

The seventh equation for Z_0 is obtained by first differentiating (10) with respect to time to get

$$U_{11}V^2\dot{Z} + U_{11}V\dot{S} + U_{12}V\dot{h} + \dot{\phi}V + \dot{\lambda}\rho V = 0 \tag{22}$$

Then solving this equation for Z and using (4), (6), (11), and (12) gives

$$\dot{Z} = \Omega_t(.)\,. \tag{23}$$

Evaluating (23) at the initial steady state, using (8) and the flow budget constraint of the representative agent, we get the following expression for Z_0

$$\begin{aligned} Z_0 = {} & [B_0 + (\overline{K}/4pcr) + (pc\overline{L}/r)][(-1/V)(Z_0V - \delta S_0) + \\ & (-U_{12}/U_{11}V)(S_0 + Z_0V - h) + (-1/U_{11}V)(-U_1 + \delta\phi - \lambda\rho + \theta\phi) \\ & + (-\rho/U_{11}V)(-U_2 + \lambda\rho + \lambda\theta) - r] \end{aligned}$$

After solving the seven non-linear equations at the initial steady state we obtain the values of the seven unknowns (Z_0, B_0, s_0, λ_0, ϕ_0, μ_0, h_0).[5] Then, plugging back the values of these unknowns obtained into the a_{ij} expressions, equation system (16) becomes

$$\begin{bmatrix} \dot{h}_t \\ \dot{\lambda}_t \\ \dot{\phi}_t \\ \dot{s}_t \end{bmatrix} = \begin{bmatrix} 0.01 & 0 & 0 & -0.0063 \\ -5719.57 & 0.022 & -0.989 & 37.358 \\ 37.358 & 0.0063 & 1.825 & -38 \\ 0.989 & 0 & 0 & -0.199 \end{bmatrix} \begin{bmatrix} h_t - \bar{h} \\ \lambda_t - \bar{\lambda} \\ \phi_t - \bar{\phi} \\ s_t - \bar{s} \end{bmatrix}$$

which could be written (in vector notation) as

$$\dot{y}_t = A(y_t - \bar{y}) \tag{24}$$

For stability and uniqueness of this differential equation system, the coefficient matrix A should have two positive and two negative eigenvalues. Solving for the eigenvalues of A gives

$$\lambda_1 = -0.162,\ \lambda_2 = -0.026,\ \lambda_3 = 0.025,\ \lambda_4 = 1.821.$$

The model is sensitive to the parameter values used.[6] With large deviations from these values the model may not converge. To derive the stable path of the differential equation system in (24), we first define the row vector

$$w(t) = X^{-1}(y_t - \bar{y}),$$

where X^{-1} is the inverse of the matrix of eigenvectors of A. Then along the adjustment path: w(t) = M w(0), where M is a diagonal matrix with $e^{\lambda_{It}}$ on its diagonal, and w(0) is the w(t) column vector evaluated at time zero. Thus letting (y_t - $\bar{y}$) = X w(t), and setting the coefficients on the positive eigenvalues equal to zero gives us the stable path.[7]

$$\begin{aligned}(h_t - \bar{h}) &= (h_0 - \bar{h})[-0.255e^{\lambda_{1t}} + 1.26e^{\lambda_{2t}}] \\ &+ (s_0 - \bar{s})[0.046e^{\lambda_{1t}} - 0.046e^{\lambda_{2t}}],\end{aligned} \tag{25}$$

$$\begin{aligned}(\lambda_t - \bar{\lambda}) &= (h_0 - \bar{h})[-7077e^{\lambda_{1t}} + 13850e^{\lambda_{2t}}] \\ &+ (s_0 - \bar{s})[1283e^{\lambda_{1t}} - 5063.5e^{\lambda_{2t}}],\end{aligned} \tag{26}$$

$$\begin{aligned}(\phi_t - \bar{\phi}) &= (h_0 - \bar{h})[-107.25e^{\lambda_{1t}} - 347.26e^{\lambda_{2t}}] \\ &+ (s_0 - \bar{s})[19.44e^{\lambda_{1t}} + 12.69e^{\lambda_{2t}}],\end{aligned} \tag{27}$$

$$(s_t - \bar{s}) = (h_0 - \bar{h})[-6.98e^{\lambda_1 t} + 7.23e^{\lambda_2 t}]$$
$$+ (s_0 - \bar{s})[1.26e^{\lambda_1 t} - 0.26e^{\lambda_2 t}]. \tag{28}$$

To obtain the solution for B_t linearize (7) around the steady state, and use (15), (25)-(28) to get

$$\dot{B}_t = r(B_t - \bar{B}) + [63.45(h_0 - \bar{h}) - 11.44(s_0 - \bar{s})]e^{\lambda_1 t}$$
$$+ [196.11(h_0 - \bar{h}) - 7.28(s_0 - \bar{s})]e^{\lambda_2 t}.$$

The solution to this differential equation is

$$B_t = \bar{B} + \Lambda_1 e^{\lambda_1 t} + \Lambda_2 e^{\lambda_2 t} + [(B_0 - \bar{B}) - \Lambda_1 - \Lambda_2]e^{rt}, \tag{29}$$

where, $$\Lambda_1 = -362.4(h_0 - \bar{h}) + 65.36(s_0 - \bar{s}), \tag{30}$$

and $$\Lambda_2 = -5162.4(h_0 - \bar{h}) + 190.02\,(s_0 - \bar{s}). \tag{31}$$

Clearly, for (29) to converge we will need

$$[(B_0 - \bar{B}) - \Lambda_1 - \Lambda_2] = 0, \tag{32}$$

which for given values B_0, h_0 and s_0, shows how B, h, and s should be related for saddle point stability. With this condition (29) reduces to

$$B_t - \bar{B} = \Lambda_1 e^{\lambda_1 t} + \Lambda_2 e^{\lambda_2 t}. \tag{33}$$

Thus equations (25)-(28), and (33) give us the stable path of the model to the steady state.

4. The Effects of a Productivity Improvement

In this section we first examine the effects of a productivity improvement in the traded (or manufactured) sector, then we consider the effects of a productivity improvement in the non–traded sector. To this end, we will first consider the steady state of the model, which is characterized by equations (4), (6), (7), (10), (12), with $\dot{s} = \dot{h} = \dot{B} = \dot{\phi} = \dot{\lambda} = 0$. These are six equations in seven unknowns: $\bar{s}, \bar{h}, \bar{B}, \bar{Z}, \bar{\phi}, \bar{\lambda}$, and $\bar{\mu}$. The seventh equation is obtained from (32), which gives us the following relationship for the changes in the steady-state levels of the state variables, B, s, and h.

$$d\bar{B} = -5525\ d\bar{h} + 255.4\ d\bar{s}. \tag{34}$$

Differentiating (4), (6), and (7) in the steady state, and using (34), we obtain

$$d\bar{h} = 0.0003 \tag{35}$$

$$d\bar{s} = 0.00036. \tag{36}$$

A productivity improvement in the traded sector causes the real permanent income of the representative agent to increase. As a result, his habitual standard of living will increase in the steady state. To sustain these higher standards, the steady–state stock of durables should also increase. Thus, a productivity improvement will increase the demand for both the traded and non–traded goods.

Moreover, this productivity improvement draws resources from the non–traded sector (taking advantage of this productivity improvement) to the traded sector. The supply of non-traded goods will thus decrease. If the durability effects are dominant in the short run and habit effects in the long run, then after a productivity improvement in the traded sector, total expenditures and the price of non–traded goods will go up by a very large amount in the short–run. Then, gradually total expenditures, and the price of non–traded goods will be falling over time until the habit effects become dominant. At that point, both variables will start to increase until we reach the new steady-state equilibrium. The adjustments of p^{NT}, and s_{NT} are shown in figures (1), and (2).

Figure 1: *Adjustment of p^{NT} after a productivity improvement in the traded sector*

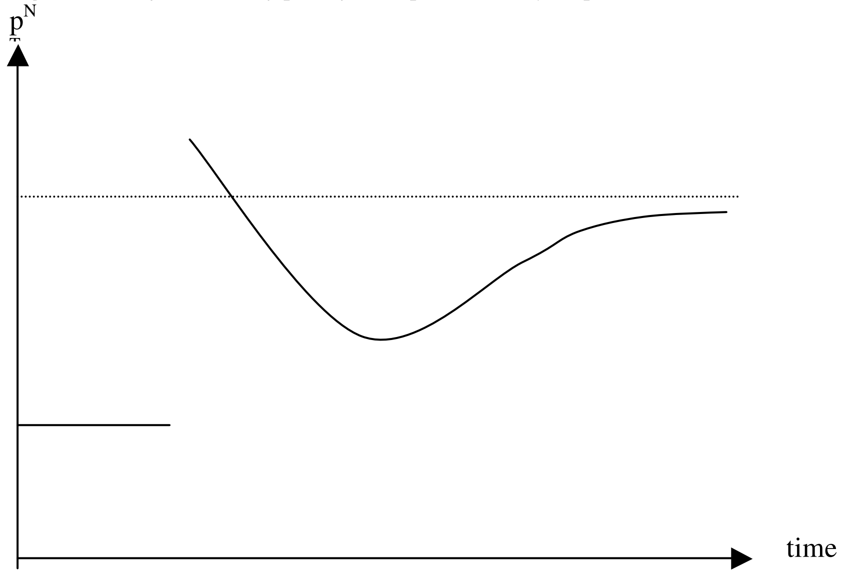
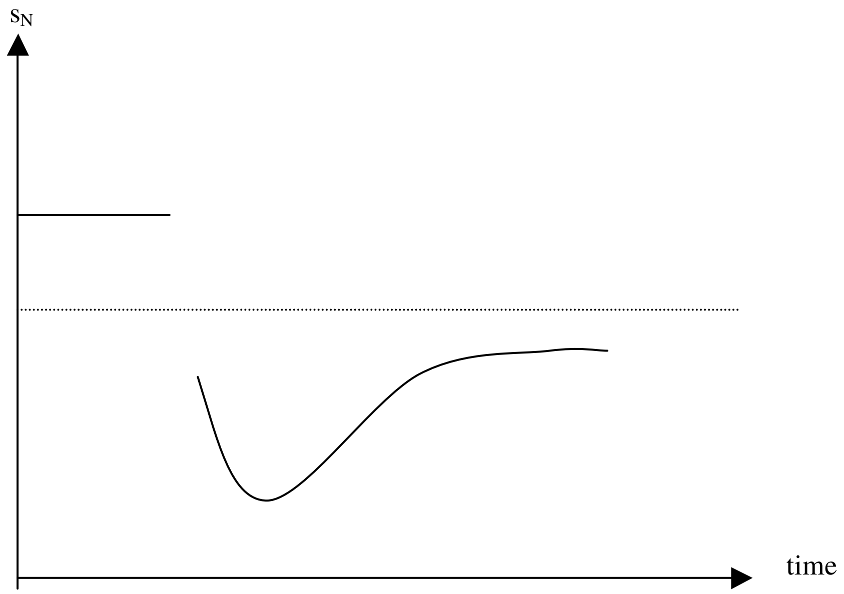


Figure 2: *Adjustment of output of non-traded goods s_{NT} after a productivity improvement in the traded sector*



To examine the effects of a productivity improvement in the non−traded sector we differentiate (4), (6), and (7) in the steady state using (34) to obtain

$$d\bar{h} = 0.016, \tag{37}$$

$$d\bar{s} = 0.02. \tag{38}$$

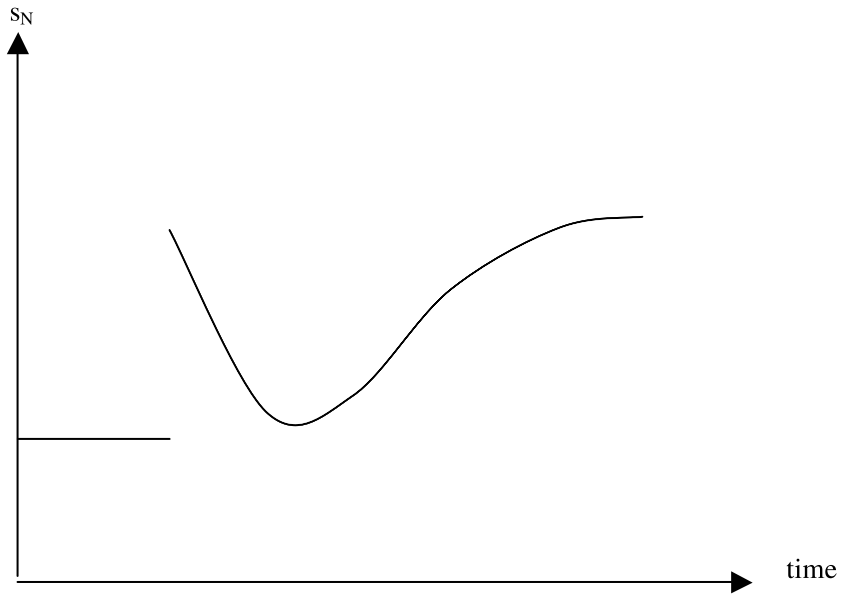
A productivity improvement in the non-traded sector causes the real permanent income of the representative agent to increase. Thus, his habitual standards of living will increase in the steady−state. To sustain these higher standards, the steady-state stock of durables should also increase. Thus, the effects of a productivity improvement in the non−traded sector on the price of non−traded goods, and thus, on total expenditures is ambiguous: the representative agent's income is now higher, he will thus demand more of both goods. Also, the supply of non-traded goods will increase by a large amount in the short, resulting in this ambiguity. The dynamics of the supply of non−traded goods is shown in figure (3).

5. Concluding Remarks

In this paper, the effects of a productivity improvement in the non-traded sector and traded sectors have been explored. It was shown that a productivity improvement in the traded sector leads to a huge appreciation of the real exchange rate in the short run as the durability effects are dominant. Then, the real exchange rate will depreciate over time until the habit effects become dominant. At that time the real exchange rate will start appreciating again until we reach the new steady-state. The output of the non-traded good will jump down by a large amount in the short run, and it will keep on decreasing until the new steady state is reached.

A productivity improvement in the non-traded sector has ambiguous effects on the real exchange rate, but will unambiguously increase the supply of non-traded goods by a large amount in the short run. Then the supply of non-traded goods will start falling until the habit effects become dominant. At that point it will start to increase again.

Figure 3: *Adjustment of output of non-traded goods after a productivity improvement in the non-traded sector*



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Notes

1. Associate Professor at the Department of Economics/Institute of Financial Economics, American University of Beirut. E-mail: sn01@aub.edu.lb.

2. Obstfeld (1986) shows that after persistent productivity shocks and with perfect capital mobility a non-stochastic dynamic model produces positive correlation between savings and investments. On the other hand, and in an overlapping generation framework, Finn (1990) employs a two-country model to show that the correlation between savings and investments depends on the stochastic process of the underlying technology.
3. Their work builds on the work of Backus, Kehoe, and Kydland (1992) who allow for international borrowings in an international business cycle model in which countries experience different productivity shocks.
4. Terms of trade are defined as the relative price of imports to exports. The trade balance is the ratio of net exports to output.
5. The a_{ij} coefficients are given by
$$a_{11} = [(\beta/\Delta)U_{12} + 1]\rho,\ a_{12} = [(-\rho^2\beta)/\Delta],\ a_{13} = [(-\rho\beta)/\Delta],$$
$$a_{14} = [1-(\beta U_{11})/\Delta]\rho,\ a_{21} = [(U_{12}{}^2\beta)/\Delta],$$
$$a_{22} = [r + \rho + (\rho\beta U_{21})/\Delta],$$
$$a_{23} = [\beta U_{12}/\Delta],\ a_{24} = [-1+(U_{11}\beta)/\Delta]U_{21},$$
$$a_{31} = [-1+(U_{11}\beta)/\Delta]U_{21},\ a_{32} = [-1+(U_{11}\beta)/\Delta]\rho,$$
$$a_{33} = [(U_{11}\beta/\Delta) + r + \delta],\ a_{34} = [-1+(U_{11}\beta)/\Delta]U_{11},$$
$$a_{41} = [-\beta U_{12}/\Delta],\ a_{42} = [(-\rho\beta)/\Delta],\ a_{43} = [-(\beta)/\Delta],$$
$$a_{44} = [-(\beta U_{11}/\Delta) - \delta], \text{ and where } \beta = [\Psi_Z V'Z + V].$$
6. The solution of the model at the initial steady state is: $Z_0 = 2.351$; $B_0 = 97.612$; $s_0 = 0.424$; $\lambda_0 = -75.763$; $\phi_0 = 2.701$; $\mu_0 = 0.716$; $h_0 = 0.767$.
7. The Parameters used to solve the seven non-linear equations are those of Heaton (1995): $a = 0.938$; $r = 0.012$; $\theta = 0.012$; $\beta = 0.998$; $\rho = 0.983$; $\delta = 0.807$; $\overline{L} = \overline{K} = 0.1$; $c = 1$.
8. See mathematical Appendix in Pikoulakis (1995), for a more comprehensive derivation of the stable path with two state, and two jump variables.

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Exchange Rate, Price Level and Output: A Structural Cointegrating VAR Approach for Malaysia

Kamal Uddin Ahmed[1]
The University of Sydney

Abstract. Exchange rates have been at the center of economic debates in the emerging economies and most economic models of exchange rates predict a significant relationship between the exchange rate, output and the price level. This paper uses standard a structural VAR model to examine the above relationship for Malaysia using data from 1973 to 1999. The long-run relationship between the exchange rate, price level and output appears consistent with most of the theoretical and empirical studies. The short-run results do not always support the long-run relationship among the exchange rate, price level and output.

1. Introduction

The volatility and unpredictability of exchange rates and the effects of movements in exchange rates on major macroeconomic variables such as the national price level, output, money and interest rates are a controversial issue in international macroeconomics. A large number of articles addressed the issue both theoretically and empirically and found different results which has fueled the debate further. The studies by Dornbusch (1987), Dornbusch and Fisher (1986), Papell (1994), Woo (1984), Froot and Klemperer (1989), Hafer (1989), Hooper and Mann (1989), Kamin and Rogers (2000), Upadhaya and Upadhaya (1999) received considerable attention.

Exchange rate movements can influence domestic prices through their effects on aggregate supply and demand. On the supply side, exchange rates should affect prices paid by the domestic buyers of imported goods directly. In general when a currency depreciates it will result in higher import prices if the country is an international price taker, while lower import prices result from appreciation. The strength and timing of this direct effect on domestic prices is not clear, however, given the nature of long-term contracts, the possible short-run non-price responses of foreign firms to sizable exchange rate changes and the relative proportion of imports in the overall economy.

Exchange rate fluctuations could also induce indirect supply effects on domestic prices. The potentially higher cost of imported inputs associated with an exchange rate depreciation increases marginal costs and leads to higher prices of domestically produced goods. Further, import-competing firms might increase prices in response to foreign competitors, price increases to improve profit margins. The extent of such price adjustment depends on a variety of factors such as market structure, the relative number of domestic and foreign firms in the market, the nature of government exchange rate policy and product substitutability. Most of the studies were not clear about these issues.

Exchange rate variations can also affect aggregate demand. To a certain extent, exchange rate depreciations/appreciations increase/decrease foreign demand for domestic goods and services producing an increase/decrease in net exports and hence aggregate demand. This may increase real output. Further, the expansion in domestic demand and gross national product may bid up input prices and accelerate wage demands by workers seeking higher wages to maintain real wages. The nominal wage rise may result in further price increases. Except for Kahn (1987) and Hafer (1989), most of the studies are not specific about this channel of influence on the price level. The feedback from the price level and output to the exchange rate exhibits mixed results. Kamin and Rogers' (2000) findings show that after accounting for the effects of "own shock", no other variable consistently accounts for a significant fraction of the forecast errors in the real exchange rate. The study by Kyreme (1991) shows that high price inflation leads to a weakening exchange rate (depreciation) and this along with other factors causes inflation. But Kim (1998) found no significant casual relationship from inflation to the exchange rate.

Woo (1984) finds that in the US, after adjusting for energy price increases, a 10 percent depreciation in the dollar leads to only a .02 percent increase in the price level after one year. Hooper and Lowrey (1979), Hafer (1989) and others argue that once the influence of money supply growth has been accounted for, changes in the exchange rate provide no additional explanatory power for inflation. But studies by Sachs (1985) and Kahn (1987) find that a 10% depreciation increases price levels by 1.67% and 4% respectively.

Kyreme (1991) estimates the dynamic inter-relationships among the currency exchange rate, consumer price inflation and real output growth as well as the roles of money and interest rates in output and price determination in the context of Ghana. He finds a significant relationship between exchange rates and price inflation then exchange rates and real output. Upadhyaya and Upadhyaya (1999) find that nominal devaluation affects output only if it leads to a real devaluation. If domestic prices rise at the same rate as the rate of nominal devaluation then the real exchange rate remains constant leaving no room for output adjustment. Kamin and Klau (1998) and Kamin and Rogers (2000) find that real devaluation has led to high inflation and economic contraction in Mexico.

The main problem with many of the previous studies is that they relied on traditional regression methods to analyze the relationship among exchange rates and other major macro variables. Because most of the macro variables are non-stationary, traditional regression estimates of most studies may have been spurious. Manning and Andrianacos (1993) addressed the problem by using a residual-based, single-equation cointegration method. They employed the Engle-Granger (1987) cointegration method with ADF and PP unit root tests on the OLS residuals of the cointegrating equations and found evidence that series were not cointegrated. This approach is not free from criticism. Studies by DeJong (1992) and DeJong et al. (1992) documented the low power of the ADF test and the reversal of the earlier conclusion. Campebell and Perron (1991) also warned against the OLS method of estimating and testing cointegration relations and recommended use of full information maximum likelihood methods such as those of Johansen (1988, 1990) or Ahn and Reinsel (1990).

The present paper considers the effects of exchange rate variation on the price level and output for Malaysia. The paper employs an up-to-date and powerful methodology that remedies the shortcoming of the previous studies. Structural cointegrating VAR with long-run and short-run analysis would provide an appropriate framework. The main strength of the cointegration method is its ability to incorporate short-run dynamics with long-run equilibrium relations among variables. We employ the Johansen (1988) model, which was expanded by Johansen and Juselius (1990, 1992). One Monte Carlo study by Gonzalo (1994) finds that out of five alternative cointegration methods, Johansen's procedure performed best in estimating and testing cointegration relationships.

The remainder of the paper is as follows. Section 2 develops the structural cointegrating VAR model. Section 3 outlines an analysis of the time series properties. Section 4 is the analysis of short-run dynamic specification of the model and section 5 is the conclusion.

2. Empirical Model

Malaysia is a small open economy and we would like to examine how exchange rates affect output and the price level. Initially, we develop a structural VAR model consisting of six critical macroeconomic series for a vector of endogenous and exogenous variables given by X_t = [LIP, LRER, LCPI, LM,USTB LUSM]′, where LIP is the log of the industrial production proxy for GDP, and LRER is the log of the real exchange rate. The real exchange rate is defined as RER=ER*USCPI/CPI. LCPI is the log of the Malaysian consumer price index. LUSM is the United States money supply (M3) and used as a proxy for foreign money. USTB is United States Treasury Bill rate and used as a proxy for the foreign interest rate. The joint dynamics of X_t are modeled by the following structural VAR.

$$AX_t = A(L)X_{t-1} + BZ_t + u_t \qquad (1)$$

where A is a 6 x 6 matrix of structural (contemporaneous) coefficients, A(L) is a polynomial of order p in the lag operator L and Z is a vector of deterministic terms with associated coefficients matrix B. The vector of structural shocks $u_t = [u_{lip}, u_{ler}\ u_{lcpi}\ u_{ustb},\ u_{lm}\ u_{lusm}]'$ are the idiosyncratic shocks associated with each of the endogenous variables that drive aggregate fluctuations. Sims (1986) refers to these shocks as "behaviorally distinct sources of variation." The notation u_{lip} represents a domestic output shock, u_{ler} represents an exchange rate shock, u_{lcpi} is a domestic price level shock, u_{ustb} is a foreign interest shock, u_{lm} represents a domestic money supply shock and u_{lusm} represents a foreign money supply shock.

The structural shocks are assumed to be white noise with zero covariance terms implying each disturbance arises from independent sources so that their variance-covariance matrix $E\,(uu')= D$ is diagonal.

The problem with representation (1) is that because the coefficients in the matrices are unknown and the variables have contemporaneous effects on each other it is not possible to uniquely determine the values of the parameters in the model. The model in this form is not fully identified. However, it is possible to transform (1) into a reduced form model to derive the standard VAR representation, as shown in (2) which facilitates estimation of model parameters.

The reduced form VAR is derived from equation (1)

$$X_t = A^{-1}A\,(L)X_{t-1} + A^{-1}BZ_t + A^{-1}u_t \tag{2}$$

Or we can write (2) as:

$$X_t = F(L)X_{t-1} + GZ_t + x_t$$

Clearly, $F(L) = A^{-1}A\,(L)$ is order p and $G = A^{-1}B$. x_t is now the vector of reduced form innovations [LIP, LER, LCPI, LRER, LUSM, USTB]′, with variance-covariance matrix

$$E(x_t\, x_t') = \Sigma$$

If we compare (1) and (2), it is apparent that

$$x_t = A^{-1}u_t$$

or

$$u_t = A\,x_t \tag{3}$$

$$E\,(uu') = D = A\Sigma A' \tag{4}$$

Equations (3) and (4) show that the structural shocks u_t and their variances in D are related to the reduced form innovations and covariances respectively through the contemporaneous coefficient matrix A. Given estimation of x_t and Σ, identification of the SVAR shows that the recovery of the structural shocks and variances through the imposition of a sufficient number of restrictions on the A matrix is possible. In other words restrictions are the better way to organize the instantaneous correlations among the endogenous variables.

This paper develops six core long run relationships on the basis of a number of past studies mentioned earlier and extending the theoretical model developed by Kamin and Roger (2000).

These relationships are outlined below:

$LIP= a_{10} + a_{11}\ LRER – a_{12} LCPI + a_{13} LM - a_{14} LUSM – a_{15}\ USTB + u_{ip}$ (5)
$LRER = a_{20} + a_{21}\ LIP\ - a_{22}\ LCPI - a_{23} LM + a_{24} LUSM + a_{25}\ USTB + u_{er}$ (6)
$LCPI = a_{30} + a_{31}\ LIP + a_{32} LRER + a_{33} LM + a_{34} LUSM\ a_{35} - USTB+u_{cpi}$ (7)
$LM = a_{40} + a_{41}\ LIP – a_{42} LRER + a_{43} LCPI + a_{44} LUSM – a_{45}\ USTB+u_{cpi}$ (8)
$USTB = a_{50}+ u_{ustb}$ (9)
$LUSM = a_{60}+ u_{lusm}$ (10)

2.1. The SVAR Model for Malaysia

This is our six-variable Malaysian model. The relationship outlined in (3) between the structural shocks and the reduced form innovations is outlined below in matrix notation:

$$\begin{bmatrix} 1 & a_{21} & a_{13} & a_{14} & a_{15} & a_{16} \\ a_{21} & 1 & a_{23} & a_{24} & a_{25} & a_{26} \\ a_{31} & a_{32} & 1 & a_{34} & a_{35} & a_{36} \\ a_{41} & a_{42} & a_{43} & 1 & a_{45} & a_{46} \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} LIP \\ LRER \\ LCPI \\ LM \\ USTB \\ LUSM \end{bmatrix} + \begin{bmatrix} a_{10} \\ a_{20} \\ a_{30} \\ a_{40} \\ a_{50} \\ a_{60} \end{bmatrix} = \begin{bmatrix} u_{lip} \\ u_{lrer} \\ u_{lcpi} \\ u_{lm} \\ u_{ustb} \\ u_{lusm} \end{bmatrix} \qquad (11)$$

In a compact form $u_t = A\, x_t – a_0$ where $a_0 = (a_{10}, a_{20}, a_{30}, a_{40}, a_{50,} a_{60})'$. This means the a_0 matrix consisting of intercept terms is one part of the Z matrix.

In the above SVAR model, normalizing the diagonal entries of A to unity leaves a total of 20 free parameters in the matrix. Add to this 6 unknown variances in the D matrix and there are altogether a total of 26 elements that need to be determined, plus we have 10 restrictions in the model. This indicates that the number of unknown parameters in the structural model is therefore equal to the number of estimated parameters in the reduced form – showing our SVAR model meets the order condition for identification.

The empirical model also includes three seasonal dummies as data exhibits seasonality at least for LIP and LCPI. Since our study period includes the Asian financial crisis in the 1997-1998 period, it is reasonable to include seasonal dummies (SC_i) and an Asian financial dummy (D97) in our empirical model. The period covered under D97 is from September 1997 to September 1998.

By construction, the above specification embodies the economic theory's long-run predictions, which is better than the more usual approach where the starting point is an unrestricted VAR model, with some vague priors about the nature of the long-run relations.

2.2. Output Equation

$LIP = a_{11}\ LRER - a_{12}\ LCPI + a_{13}\ LM - a_{14}\ LUSM - a_{15}\ USTB + u_{ip}$

The variable LIP represents total industrial production (a proxy for GDP) and is predicted to be positively related with LRER. Since the real exchange rate is defined as RER=ER USCPI*/CPI, an increase in exchange rate in this case means a real depreciation of the Malaysian currency. The literature provides evidence of positive and negative effects of real depreciations on national output. Depreciation makes exports cheaper and imports more expensive. As a result the current account is likely to be improved given elasticity conditions. The price level also has a negative effect on LIP. An increase in the general price level, other things including nominal exchange rate given, implies a real appreciation, which is likely to have a negative effect on output. But there is also the possibility of a positive relationship between the price level and output. Black *et.al* (2001) provide a possible theoretical explanation for this positive relation. They explained it in terms of an environment in which inflation has a downward trend. In such a situation expansionary monetary policy may be unexpected, catching economic agents off guard. This policy action could lead to a positive impact on economic growth. When the foreign interest rate goes up, capital outflow takes place. As a result investment decreases and output decreases. The domestic money supply and the foreign money supply are expected to have positive and negative relationships with output. So we expect $a_{11} > 0$, $a_{12} < 0$ and $a_{13} > 0$, $a_{14} < 0$, $a_{15} < 0$.

2.3. Exchange Rate Equation

$LRER = a_{21}\ LIP - a_{22}\ LCPI - a_{23}\ LM + a_{24}\ LUSM + a_{24}\ USTB + u_{er}$

Open economy macroeconomic theory says that when domestic income goes up people demand more imported goods and vice versa. As imports go up net exports (X-M) go down, causing the exchange rate to depreciate. So the relationship between LIP and LRER is likely to be positive. Mankiw (2000, p 215) outlined the negative relationship between the inflation differential and the nominal exchange rate. When the price level goes up people need more domestic currency to buy the same unit of foreign currency. This leads to depreciation of the exchange rate. So the expected relationship between LCPI and LER is negative. An increase in the domestic money supply will have an uncertain effect on RER The effect of a change in the foreign money supply on the Malaysian exchange rate is also uncertain. Moreover, we are assuming Malaysia is a small open economy with perfect capital mobility in our study period, so the foreign interest rate plays a role in exchange rate determination. When the foreign interest rate goes up relative to the domestic interest rate, a capital outflow is expected which will put pressure on the exchange rate (demand for foreign currency will be higher than supply). So the nominal exchange rate is expected to rise, indicating a positive relationship between RER and USTB.

2.4. Price Level Equation

LCPI = a_{31} LIP + a_{32} LRER + a_{33} LM + a_{34} LUSM - a_{35} USTB+ u_{cpi}

When output increases, aggregate demand goes up with a given aggregate supply. This will increase the general price level (i.e. $a_{31}>0$) and when RER goes up it will increase net exports, which will push aggregate income up. The expected price level will be higher as a result of rising aggregate income. The domestic money supply will have a positive effect on the general price level. The foreign money supply will have an uncertain effect on domestic price level.

The foreign interest rate will have a positive effect on the domestic interest rate. The rising domestic interest rate has a negative effect on investment, output and aggregate demand, pushing down the general price level.

2.5. Domestic Money Supply Equation

LM = a_{31} LIP – a_{32} LRER + a_{33} LCPI + a_{34} LUSM - a_{35} USTB+ u_{lm}

An increase in domestic output has a positive effect on money supply while a rise in the real exchange rate has a negative effect on LM. A rise in the domestic price level has a positive effect on the money supply. The effect of LUSM and USTB on LM is ambiguous.

2.6. Foreign Interest Rate Equation

USTB = u_{ustb}

This equation essentially represents the foreign interest rate as proxied by the US treasury bills rate and is assumed exogenous in this case and therefore affected only by its own shock.

2.7. Foreign Money Supply Equation

LUSM = u_{lusm}

This equation essentially represents the foreign money supply as proxied by the US money supply (M3) and is assumed exogenous in this case and therefore affected only by its own shock.

3. Data and Empirical Results

3.1. Data

Data used in this study are quarterly data from 1973 to 1999, thus giving us a total of 102 observations. The only source of the data is from the International Monetary

Fund – International Financial Statistics. Before we proceed to test for cointegration it is important to establish the order of integration of the series involved.

3.2. Unit Root Tests

Before we estimate the model, it is necessary to examine whether the order of the integration of the series is I(0). This can be carried out by the application of the DF and ADF tests[2]. The series in the present model tested are Industrial Production (IP), Real Exchange Rate (RER), Consumer Price Index (CPI), domestic money supply (M), the United States Treasury Bill Rate (USTB) a foreign interest rate and the United States money supply as foreign money supply. All series are in logs except USTB. The null of the DF and ADF tests is that each of the individual variables under examination has a unit root, against the alternative hypothesis that a root is less than one. Rejection of the null means the series in question is generated by a stationary process.

The results of the DF and ADF tests are presented in Table 1. The tests are applied to both the 'levels' and the 'first differences' of all the series for the sample period of 1973Q1 to 1999Q4. The results shows that in the case of 'levels' all series are characterized by unit root non-stationary processes, i.e. I(1). In the case of 'first difference' all the series rejected the null hypothesis of a unit root (non-stationarity) at the 5 percent significance level.

Therefore the first difference series rejects the null hypothesis of a unit root at the 5% significance level. This implies that all the series are integrated of order one i.e. I(1) and become stationary after differencing once. Since all series are integrated of the same order, the series will be tested for the existence of a long-term relationship among them, i.e. cointegration. Before the cointegration test it is necessary to determine the optimal lag lengths.

3.3. Determination of Lag Length

The second step in VAR is to choose an appropriate length of the lag to be used in the model. The length chosen should be sufficiently large to make serial correlation of the residuals unlikely. However, the longer the lag length, the greater the number of parameters to be estimated and the fewer the degrees of freedom. There are two approaches to choose optimum lag lengths in estimating VAR. The two approaches are: (1) to set appropriate lag lengths based on some statistical criterion and (2) to specify a few arbitrary alternative lag lengths as recommended by Sims (1980). The first one is popular and has been used by Hsiano (1981) and McMillin and Fackler (1984) as well as Wahyundi (1986) while the second approach has been used by Kyereme (1991) and Pearce (1983). This study uses statistical criteria such as the AIC, SBC and Likelihood Ratio tests to determine optimal lag lengths.

We determine the optimal number of lags from the highest value of AIC and SBC as we are using MICROFIT 4.0. In determination of the optimum lags, AIC chooses lag 4 while SBC and LR choose much lower lags. Since we are using quarterly data, it is reasonable to take lag 4.

Table 1: *DF and ADF Test Results*

Variable	Test Statistic with intercept	Lag Length	Test Statistic with intercept + trend	Lag Length
Series in Levels				
LIP	-0.4124	8	-2.1429	8
LER	0.14803	0	-1.8997	0
LCPI	-1.264	0	-1.6341	0
LM	-0.32289	2	-2.3789	8
USTB	-1.91	3	-2.864	6
LUSM	-1.4793	4	-3.3863	4
Series in First Differences				
DLIP	-3.3823	7	-3.3563	7
DLER	-9.0598	0	-9.2294	0
DLCPI	-10.7818	0	-10.8834	0
LM	-4.5971	5	-4.5459	5
DUSTB	-3.5909	5	-4.0579	6
DLUSM	-4.5731	0	-4.9527	0

Note: 95% critical value for the ADF statistic is –2.89.

3. 4. Cointegration: The Long Run Relationship

As the unit root tests show that the variables are I(1), cointegration techniques are appropriate to test for, where appropriate, the long run relationship between the exchange rate, price level, output and money supply. This test is carried out using the maximum likelihood approach developed by Johansen (1988) and Johansen and Juselius (1990). This approach has been shown to be superior to Engle and Granger's (1987) residual-based approach. Among other things, the Johansen approach is capable of detecting multiple cointegration relationships. Variables tested for cointegration are LIP, LER, LCPI, LM as endogenous variables and USTB, LUSM are exogenous and all in levels. Three seasonal dummies SC1, SC2, SC3 and one Asian crisis dummy D97 are also introduced. With these variables we will now specify the long run relationship between the exchange rate, output and the price level for Malaysia based on empirical model described above. These long-run relationships are outlined in equations (5) to (10) above.

The cointegration test results are provided in Table 2. They indicate both maximal eigenvalue and Trace tests reject zero in favor of at least one cointegrating vector. The results are significant at the 5% significance level for the maximal eigenvalue and for the Trace tests. Model selection criterion AIC and SBC also support finding one cointegrating vector. Now we will estimate the long run equilibrium relationships by normailizing on LIP.

LIP = .46 RER - .91 LCPI + .49LM - .009 USTB +.027LUSM (5A)

Table 2: *Johansen Cointegration Tests*

A. Maximum Eigenvalue Test

Null	**Alternative**	**Statistic**	**95% Critical Value**	**90% Critical Value**
r = 0	r =1	47.32	33.87	31.30
r<= 1	r = 2	22.90	27.75	25.21
r<=2	r = 3	17.11	21.07	18.78
r< = 3	r =4	8.58	14.35	12.27

B. Trace Tests

Null	**Alternative**	**Statistic**	**95% Critical Value**	**90% Critical Value**
r =0	r>=1	95.93	68.06	63.57
r<=0	r>=2	46.03	46.44	42.67
r<= 2	r>=3	25.70	28.42	25.93
r<=3	r=4	8.58	14.35	12.27

C. Estimated cointegrating vectors, coefficients normalized on LIP

Vector	**LIP**	**LRER**	**LCPI**	**LM**	**USTB**	**LUSM**
1	1.00	-.46O6	.91841	-.4914	.0098	.02779

Notes: 1973Q1 to 1999Q4 (104 observations). Cointegration with unrestricted intercepts and restricted trends in four lags VAR. Variables included in the cointegrating VAR are LIP LER LCPI LM, two I(1) exogenous variable, USTB and LUSM, and four dummies, SC1, SC2, SC3 and D97.

3.5. Discussion on the Coefficients of Equation 5A

Since variables in output equation are in logarithms except USTB, the coefficients of all variables except USTB yield direct estimates of elasticities. The long-run elasticity of Malaysian industrial production with respect to the real exchange rate is .46, which means a one percentage point increase in the real exchange rate will increase industrial production by about .46 percent. Similarly a one percentage point increase in the price level will reduce industrial output by .91 percent. In the case of the domestic money supply, a one percentage change in money supply increases domestic output by .49 percent

Results shown in equation 5A indicate that in the long run depreciation will have a positive effect on domestic output, which is consistent with the textbook theories and inconsistent with a few past studies (for example, Kamin and Roger 2000 and Agenor 1991), but consistent with a few studies such as Kyereme (1991). It is universally believed that high inflation is detrimental to growth, implying a negative relationship. But the nature of the inflation/growth relationship is unclear at low rates of inflation (Fischer 1996). Our estimation got the expected negative sign for LCPI, which is consistent with most of the previous studies and theoretical arguments. This finding is inconsistent with a recent study for the US by Black et. al (2001). When the consumer price level goes up it means producers face pressure to raise nominal wages in order to keep real wages constant. So it affects producers' profit and costs of production will increase. Hence this has a negative effect on output. This explanation is based on the market-clearing assumption. Under this assumption, for markets to clear continuously, prices must adjust instantly to changes in supply and demand. In fact, however, many wages and prices adjust slowly with labor contracts often set for long periods of time. Although this model assumes that all wages and prices are flexible, in reality some wages and prices are sticky. In Malaysia, the last two decades were a period of economic liberalization. The main target was to create an environment for foreign direct and indirect investment. For this purpose the government announced strict laws relating to wage rises and labor movements. So in this case we assume wages and prices are sticky but not stuck forever; eventually they do adjust to changes in supply and demand. It is better to assume price and wage flexibility for long run issues. In the short run flexibility is less plausible, because over short periods many prices are fixed at predetermined levels (Mankiw 2000). Another possible explanation, as in many developing countries, is that in Malaysia the impact of an expected change in the price level has been much more pronounced on output, supporting the general view that real investment declines when the price level is expected to rise. In this way, a rising price level has a negative effect on national output.

Finally, Malaysia, as we mentioned before, was pursuing open economy policies to encourage foreign investment. So this study started with the assumption that the foreign interest rate and the foreign money supply play a vital role in this small open economy. But our estimated long run results show that these two variables do not play a significant role in changing domestic output, which is quite opposite to the general idea of a small open economy. If the foreign interest rate goes up compared to the domestic interest rate, a capital outflow takes place, which impacts negatively on domestic investment and output and vice-versa.

4. Short-run Dynamic Specification

In the presence of a long-run relationship among the variables, it remains of interest to examine the short-run linkages among LIP, LRER, LCPI, LM, LUSM and USTB. A VAR model is able to capture all short-term relationships among the variables. In the system of equations, in the case of all endogenous variables, the current value of each variable is related to its own and other variables' past lags. There are two exogenous variables in the model. All variables are in first differences to ensure stationarity and each equation is estimated with OLS.

4. 1. Granger-Causality Tests

In the cointegration section we established a long-run relationship among the exchange rate, price level and output and it is of interest to investigate the question as to whether or not under the present operating procedure, the exchange rate provides useful information about short-run movements of future output. In a VAR model, Granger-causality tests are conducted by testing the restriction that a block of coefficients for the lags of a particular variable are equal to zero. This can be written in an autoregressive form as in equation (12). The definitions of all the variables are the same as established before.

$$LIP_t = \alpha + \sum_{i=1}^{4} \beta_i \Delta LIP_{t-i} + \sum_{i=1}^{4} \gamma_i \Delta LRER_{t-i} - \sum_{i=1}^{4} \varphi_i \Delta LCPI_{t-i} + \sum_{i=1}^{4} \psi_i \Delta LM_{t-i} + \sum_{i=1}^{4} v_i \Delta USTB_{t-i} + \sum_{i=1}^{4} \tau_i \Delta LUSM_{t-i} + \varepsilon_t \quad (12)$$

Table 3 reports the results of the Granger-causality tests. The reported F-statistic in section (a) points to the rejection of the null hypothesis at a significance level less than 10 percent except LCPI and USTB – implying that each of LRER, LM, LIP and LUSM contain information about future movements of output that is not contained in income itself but also in LRER, LM and LUSM. Although Malaysia is a small open economy, the foreign interest rate and money supply play an insignificant role in the movements of future output in Malaysia. This on the other hand implies that Malaysian future output movements depend on domestic factors such as the money supply rather than foreign factors.

Section (b) presents the Granger-causality test for the exchange rate equation. The F-statistics do not reject the null hypothesis for each of LIP, LRER, LM and USTB, LUSM – implying future movements of Malaysia's real exchange rate do not depend significantly on the output level, money supply, price level or the foreign interest rate and money supply. This is inconsistent with most of the open economy macroeconomic theories (i.e. Mundell-Fleming type models).

The reported F-statistic in section (c) points to the rejection of the null hypothesis at a significance level less than 5 percent except for LUSM and USTB – implying that each of the LRER, LIP, LCPI contain information about future movements of the money supply that is not contained in the money supply itself but also in LRER, LCPI and LIP. The non-rejection of LUSM and USTB implies that movements of Malaysia's future money supply depend on domestic factors not foreign factors in our specified model.

Section (d) of Table 3 presents Granger-causality tests for the price level equation. The F-statistic rejects the null hypothesis for LM, LCPI and LRER, implying that these variables contribute significantly to the movements of Malaysia's future price level. But the F-statistics do not reject any of the null hypotheses for LIP, USTB, LUSM – implying that these variables do not contribute significantly in the future movements of Malaysia's price level.

Table 3: *Tests for Granger-Causality*

Six variable System (LIP, LRER, LCPI, LM USTB, LUSM)

A. Output Equation	
H0: lagged values of DLRER do not cause DLIP	F(4,85) = 2.08 [0.08]
H0: lagged values of DLIP do not cause DLIP	F(4, 85)= 6.39[0.00]
H0: lagged values of DLM do not cause DLIP	F(4, 85)= 3.16[0.01]
H0: lagged values of DLCPI do not cause DLIP	F(4, 85) = 1.14 [0.34]
H0: values DLUSM do not cause DLIP	F(4, 85)= 4.21[0.04]
H0: values DUSTB do not cause DLIP	F(4, 85)= .14[0.70]
B. Exchange Rate Equation	
H0: lagged values of DLRER do not cause DLRER	F(4, 85) = .25[0.90]
H0: lagged values of DLIP do not cause DLRER	F(4, 85)= .73[0.56]
H0: lagged values of DLCPI do not cause DLRER	F(4, 85)= .48[0.74]
H0: lagged values of DLM do not cause DLRER	F(4, 85) = .24 [0.91]
H0: values DLUSM do not cause DLRER	F(4, 85)= 1.15[0.28]
H0: values DUSTB do not cause DLRER	F(4, 85)= .010[0.92]
C. Money Equation	
H0: lagged values of DLIP do not cause DLM	F(4, 85) = 6.16 [0.00]
H0: lagged values of DLRER do not cause DLM	F(4, 85)= 7.46 [0.00]
H0: lagged values of DLCPI do not cause DLM	F(4, 85)= 4.24[0.04]
H0: lagged values of DLM do not cause DLM	F(4, 85) = 8.60 [0.00]
H0: values DLUSM do not cause DLM	F(4, 85)= 1.93[0.16]
H0: values DUSTB do not cause DLM	F(4, 85)= .01[0.91]
D. Price level Equation	
H0: lagged values of DLIP do not cause DLCPI	F(4, 85)= 1.65[.16]
H0: lagged values of DLRER do not cause DLCPI	F(4, 85)= 2.01[.10]
H0: lagged values of DLCPI do not cause DLCPI	F(4, 85)= 3.21[.01]
H0: lagged values of DLM do not cause DLCPI	F(4, 85)= 2.8[.02]
H0: exogenous variable DUSTB do not cause DLCPI	F(4, 85)= 2.11[.14]
H0: exogenous variable DLUSM do not cause DLCPI	F(4, 85)= 1.06[.30]

4. 2. Variance Decomposition

Variance decompositions are one way (the other is IRF) of measuring average relative contributions to forecast error variance of each shock as a function of the forecast horizon. Table 4 presents the variance decompositions of four variables.

Table 4: *Variance Decomposition: Proportions of Forecast Error*

Forecast Horizon	**LIP**	**LRER**	**LCPI**	**LM**
Variable LIP				
1 quarter	95	1	000	2
4 quarter	62	7	19	11
8 quarter	55	6	27	11
12 quarter	43	16	28	12
16 quarter	42	16	28	13
20 quarter	41	18	27	14
Variable LRER				
1 quarter	4	94	2	0
4 quarter	12	76	5	7
8 quarter	33	44	5	17
12 quarter	39	23	6	32
16 quarter	42	19	7	32
20 quarter	40	20	8	31
Variable LM				
1 quarter	3	4	0	93
4 quarter	5	2	8	71
8 quarter	5	14	6	75
12 quarter	5	14	10	71
16 quarter	9	14	13	64
20 quarter	20	12	17	51
Variable LCPI				
1 quarter	2	3	95	0
4 quarter	12	5	73	9
8 quarter	19	6	60	15
12 quarter	20	7	53	20
16 quarter	19	8	55	19
20 quarter	19	9	54	18

Note*:* Numbers are in percentages and may not add up to 100 percent at each forecast horizon due to rounding errors.

Results are reported for forecast horizons 1, 4, 8, 12, 16 and 20 (quarters). The salient features of the variance decompositions are as follows:
(1) Mirroring results from previous studies, the predominant source of variation in domestic output (LIP) forecast errors are "own shocks" to LIP – these generally account for 40%-95% of the forecast error variance, depending on the forecast horizon. The second most important source of variation in output is the domestic price level (LCPI), then the real exchange rate (18%). Finally the domestic money supply shock counts for only 15% of the variation.
(2) Moving to VDC for the real exchange rate, domestic output shocks are seen to be mainly responsible for real exchange rate fluctuations (4%-42%). Domestic money supply shocks contribute 32% of the variations of LRER only after 12 quarters, which can be considered a long period.
(3) In case of the domestic price level, the major variations are from its own shocks. Domestic output and the money supply contribute less than 20% to the variation of the domestic price level. Most important is the real exchange rate, which contributes less than 10% to the variation of the domestic price level.
(4) Short-run variability in the money supply is mostly attributed to its own shocks, i.e. 51% to 93% depending on the horizon. Among other shocks, domestic output shocks contribute 20% of the variation of money supply. The contributions from LRER and LCPI are 12% and 17% respectively

5. Conclusion

The analysis above follows a systematic approach to modeling the exchange rate, output and the price level in Malaysia. We developed a structural cointegrating VAR model on the basis of the theoretical model initially developed by Kamin and Rogers (2000) and related empirical studies. All the relevant macro issues have been taken into consideration when selecting appropriate variables in the model. The unit root tests indicate that the cointegration technique such as Johansen (1988) and Johansen and Juselius (1990, 1992) can be applied to evaluate the long run relationship. On the basis of cointegration and causality tests, appropriate VDCs are set up to evaluate the short-run properties of the model.
(1) Cointegration test results indicate that we have one cointegrating vector. The estimated output equation shows that the long-run relationship between output and the exchange rate, price level and money supply is consistent with most of the empirical and theoretical studies (Kyereme 1991) but inconsistent with the other studies (i.e Kamin and Roger 2000 and Agenor 1991). Granger causality shows that the real exchange rate, and the domestic money supply play significant roles in the movements of output (industrial production) of Malaysia, while the domestic price level plays an insignificant role in the movements of Malaysian output. In the case of the real exchange rate, none of the LIP, LM, LCPI play significant roles in the future movement of RER. In the case of the domestic price level, the money supply and the real exchange rate play significant roles, while domestic output appears insignificant. The future movements of the domestic money supply depend on output, the real

exchange rate and the price level, which is consistent with textbook theories as well as a number of empirical studies.
(2) VDC results show that Malaysian output movements depend on output itself, the exchange rate and the domestic price level (this is not supported by Granger casuality results). The foreign interest rate and money supply do not play a significant role as exogenous variables. VDC results for the real exchange rate show that major shocks come from output, while the money supply contributes 32% only after 12 quarters. These VDC results are consistent with Granger causality tests results. The VDC for the domestic price level shows that money supply shocks (20%) are important after its own shock while real exchange rate shocks contribute less than 10% (this is inconsistent with Granger causality results). The VDC result for the money supply shows that output, price level and real exchange rate shocks are less than 20%, indicating that own shocks are important.

Notes

1. Associate Lecturer, Department of Economics, The University of Sydney. E-mail: k.ahmed@econ.usyd.edu.au
2. The theoretical discussions can be found in any standard time-series econometrics book, e.g., Enders, W (1995), *Applied Econometric Time Series*, New York: Wiley.

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PART IV

ECONOMIC INTEGRATION IN EMERGING ECONOMIES

Exchange Rate Movements, Trade Links and Labor Markets in Latin America

Ansgar Belke[1]
University of Hohenheim

Kai Geisslreither[2]
University of Hohenheim

Abstract. Evaluating the costs and benefits of exchange rate stability requires a somewhat different approach for Mercosur than for the EU as trade integration within Mercosur is much more limited. Intra-area exchange rates are thus less important than the exchange rate vis-à-vis the dollar and the euro. This contribution analyses the impact of both aspects of financial volatility (exchange rate and interest rate volatility) on investment and labor markets in the Southern Cone, finding that both exchange rate variability (mainly against the dollar and the euro) and (domestic) interest rate volatility have a significant dampening impact on employment and investment.

1. Introduction

After the forced exit from its currency board arrangements Argentina has joined its neighbors in the Southern Cone in terms of its exchange rate arrangement. Is this a reason to stop discussing the issue of monetary integration in this area of Latin America?[3] We would argue no. The costs and benefits of fluctuating exchange rates in southern Latin America deserve another look. Europe seemed to have landed in a similar situation when in 1992/3/5 speculative attacks forced all the major currencies participating in the European Monetary System to loosen their exchange rate commitment (FRF, PTE) or abandon the system completely (ITL, GBP). However, monetary union did still start on schedule because despite intense market pressure policy makers consistently stuck to the policy choices required by the project of European monetary integration. It is thus entirely possible that monetary integration will one day again become a real option for the Mercosur area as well.

Our approach was inspired by the European experience. Previous research by the authors has shown that exchange rate variability (especially intra-European exchange rate variability) can have a significant impact on the economy, and in particular on labor markets (Belke and Gros, 2001). This is not surprising in view of the importance of intra-European trade (both in absolute terms, e.g., as a percent of GDP, and relative to trade with the rest of the world). Should one expect to find similar results for Mercosur countries? It is difficult to give an immediate answer because there is one key difference between Europe and the Southern Cone: trade among the Mercosur countries used to be much less important than the trade of these countries with the rest of the world (mostly the EU and the US).

We document the difference in the degree of trade integration within the EU and within the Southern Cone in section 2 as this might be an important background for the subsequent empirical analysis.[4] The core of the paper starts in Section 3 where we investigate the impact of two aspects of financial volatility – namely exchange rate and interest rate volatility – on investment and labor markets in the Southern Cone. We present some first empirical results (Section 4) and then provide some robustness tests (Section 5). Section 6 concludes and discusses the implications of the results for the debate on the design of intra-Mercosur monetary relations.

2. Comparative picture of the degree of trade integration within the EU and within the Southern Cone

We provide first a comparative picture of the degree of trade integration within the EU and within the Southern Cone. We leave out Paraguay from our analysis, because no data were available from GTAP. Hence, in the following we define Argentina, Brazil and sometimes, if data are available, Uruguay as 'the Mercosur'.[5] This paper focuses on Argentina and Brazil, because both countries together represent 95 percent of the 215 million total population of the Mercosur and produce 97 percent of this region's GDP. Moreover, the 'peripheral' countries Paraguay and Uruguay are closely tied to Argentina and Brazil via the trade channel, and have very small internal markets and limited access to international capital markets. Hence, they cannot be analyzed according to the same criteria as Argentina and Brazil. Chile, not in Mercosur, serves as a comparator. EU means EU-15 throughout the paper.

Table 1: *Trade integration within the Southern Cone*

	Exports as % of GDP		**Intra-regional/ Extra-regional**
	Total	**Intra-regional**	
Argentina	8.9	2.7	0.44
Brazil	7.6	0.9	0.13
Chile	26.5	2.8	0.11
Spain	26.6	16.4	1.61

Sources: Center for Global Trade Analysis (2001), own calculations

Table 1 shows the importance of trade for Southern Cone countries and compares it with one EU member country, Spain (whose figures are not far from the EU average). This table shows clearly that the two Mercosur countries are outliers because of the low importance of trade (less than 10 percent of GDP for both). The data also show that Mercosur does not really qualify as a trade bloc given that for Brazil trade with Argentina amounts to less than one seventh of its exports outside the region. However, for Argentina intra-regional trade is more important. It is interesting to note that a neighboring country, Chile, which is not in Mercosur, is as integrated with this bloc as Argentina.

For the empirical analysis it will be important to keep in mind that both for Argentina and Brazil the EU is the more important trade partner (20 percent of exports) than NAFTA (10-15 percent of exports). This relation is even more pronounced for Argentina (see also Alesina and Barro 2001, p. 384).

Given the relatively low importance of trade for Mercosur countries, we would argue that for this group the analysis of the costs and benefits of regional exchange rate arrangements must be seen not only in terms of the impact stable exchange rates might have on trade, but more in terms of the overall macroeconomic stability that might result. In the following, we investigate therefore the correlation between two aspects of financial market volatility, namely exchange rate and interest rate volatility, and the real economy. If Latin America is different in the sense that there is little intra-regional trade, the link to the dollar should be more important than the intra-regional fixes.

3. Motivation

The starting assumption of most economists is likely to be that exchange rate variability cannot have a significant impact on labor markets (whether in OECD economies or in emerging markets) given that the link between exchange rate variability and the volume of trade is known to be weak. However, there are two reasons why exchange rate volatility should have a strong negative impact on emerging markets' economies and, hence, may constitute the basis for the fear of large exchange rate swings (Calvo and Reinhart 2000). First, the pattern of trade invoicing is different in emerging markets as compared to that in industrial countries. Following McKinnon (1999), primary commodities are largely dollar invoiced. Since the Mercosur countries' exports have a high primary commodity content (see Belke and Gros 2002a, Table 3), exchange rate volatility should have a significant impact on foreign trade of these countries. This is especially valid for Argentina with its primary product share of 48.2 percent of total domestic value added induced by exports (however, even the lower respective values for Brazil (25.8 percent), and Uruguay (28.5 percent) are extremely large as compared with the EU trade bloc (5.5 percent)). Second, the capital markets in emerging markets are of an incomplete nature. If futures markets are either illiquid or even nonexistent, tools for hedging the exchange rate risk are simply not available in these countries. As a complement, emerging markets are on average more intolerant to large exchange rate fluctuations because the pass-through from exchange rate swings to inflation is much higher in emerging markets (Calvo and Reinhart 2000, pp. 18 f.).

Why would an increase in exchange rate volatility lead quickly to a lower volume (flow) of trade? The theoretical models that are used in this context start typically from the idea that in order to export one needs to sustain a sunk cost. This applies to all types of production, and perhaps even more for primary goods, which require large sunk capital investments. In view of the relatively low trade linkages between Mercosur countries and the importance of primary commodities which are typically priced in dollars it might as well be argued that intra-Mercosur exchange rate variability should be of less concern than G-3 exchange rate volatility for the Mercosur countries. However, as we emphasize throughout this paper, the impact of exchange rate volatility might still be large even in the light of a relatively low degree of trade openness because the volatilities themselves were high at times for Mercosur countries.

A full-fledged model apart from the Reinhart and Reinhart (2001) spending channel is developed by Belke and Gros (2002a) to illustrate a mechanism that explains a negative relationship between exchange rate uncertainty and job creation. This model has originally been based on the idea that uncertainty of future earnings raises the 'option value of waiting' with decisions which concern *investment projects* in general (Dixit 1989, Belke and Gros 2001). In this framework, we model the labor market more explicitly. When firms open a job, they have to incur sunk costs (hiring and capital costs). Moreover, wage payments are typically also sunk since firing restrictions and employment contracts prevent the firms from firing the workers too rapidly. If the exchange rate is uncertain, firms fear an unfavorable appreciation of the (domestic) currency in which case they incur heavy losses. With high uncertainty, firms may prefer to delay job creation, and this is so even if they are risk-neutral. Moreover, the better the bargaining position of workers is, the higher is the option value of waiting and the stronger is the impact of uncertainty on employment. Since generous unemployment compensation systems, union power and firing restrictions generally improve the bargaining position of workers, we would expect that the link between exchange rate uncertainty and employment should be rather strong in scleroticized Mercosur member countries.

Is it legitimate then for us to transfer the European transmission channel to Mercosur? During the past decade, Latin American governments implemented economic reforms that affected almost every sector. Nonetheless, in most countries labor markets remain highly regulated. As of the late 1990s, only a handful of Latin American nations had reformed their labor markets in any significant way, while most continued to rely on labor legislation enacted several decades earlier (Hopenhayn, 2001, pp. 3 ff., Eichengreen, 1998, pp. 31 ff., Edwards and Cox Edwards, 2000). This legislation has favored employment protection while taxing employers heavily. Most analysts argue that the social protection provided through labor market regulation limits the market's ability to adjust wages and unemployment. Many of the rules governing labor markets in Latin America raise labor costs, create barriers to entry and exit, and, hence, introduce rigidities in the employment structure. As in continental Europe, these rigidities include the exceedingly restrictive regulations on hiring and firing practices, as well as burdensome social insurance schemes. Employment stability protection like mandated severance payments and other regulations penalizing employment termination in Latin America is *even stricter* than in the majority of the OECD countries (Heckman and Pagés 2000, Márquez and Pagés 1998).

We realize that we do not take into account the potentially very large grey or underground economy for obvious data availability reasons. The focus on the official labor market is, however, entirely appropriate. In the grey economy the costs of firing are presumably much lower because official employment regulations do not apply. This implies that our model of firing costs applies mainly to official employment and we would expect volatility to be mainly a deterrent to official employment. Data on (official) employment is usually much more accurate than data on unemployment, because the definition of who is looking for work, but unable to find it, changes often. Moreover, the geographical coverage of the unemployment statistics changes over time as well, since at times the national unemployment data reflect mainly data from one or two major provinces. Employment data, by contrast is usually nation-wide because it encompasses all people on the social security registers. Hence, on the whole, we feel justified to transfer the transmission channel, which was originally established for the EU to the Mercosur when modeling the impacts of exchange rate volatility on labor markets.

4. Empirical Analysis

We used a very simple measure: for each year of our total sample from 1970 to 2001 we calculated a standard deviation on the basis of twelve monthly observations of the first difference of the respective exchange rate and interest rate measures. Further details are given in Belke and Gros (2002a). To take the closer ties to the EU than to the U.S. as a special pattern of Mercosur foreign trade relationships into account (see Section 2), we also include the volatilities of the euro exchange rates of the Argentinean peso, and of the Brazilian real. However, the correlation between dollar and euro volatilities of the respective home currencies amount to close to 99 percent for Argentina and Brazil, as could have been expected. Finally, we include nominal and real euro-dollar exchange rate volatility in order to test whether there are real impacts of G-3 exchange rate volatilities in Mercosur countries (as projected by Reinhart and Reinhart 2001). At this stage, it is useful to illustrate the exact definitions of the exchange rate and interest volatility variables taking the example of Argentina. Here, we consider the volatility of the nominal and real exchange rate vis-à-vis the US-dollar VOLNER_ARPUSD and VOLRER_ARPUSD, of the nominal and real exchange rate vis-à-vis the euro VOLNER_ARPEUR and VOLRER_ARPEUR, of the nominal and real dollar-exchange rate of the euro VOLNER_USDEUR and VOLRER_USDEUR, of the real effective rate VOLREER_ARG, and of the nominal and real effective intra-Mercosur exchange rate VOLNEERINTRAMERC_ARG and VOLREERINTRAMERC_ARG. The volatility of the nominal short-term interest rate is called INTEREST_ARG, the one of real interest rate volatility REALINTEREST_ARG.

In this section we present and comment on the results of first tests of the importance of our array of measures of exchange rate variability and our two measures of interest rate volatility (nominal and real interest rate variability VOLINTEREST and VOLREALINTEREST) on two measures of labor market performance (changes in the unemployment rate DUNEMPRATE, employment growth EMPGROWTH) and one measure for investment (changes in real gross fixed capital formation GROWTHREALINVEST) in the Mercosur countries. To start with a summary: exchange rate variability and interest rate variability enter most of the equations with the expected sign and are in most cases statistically significant.

4.1. Methodology

Before commenting on the individual results we need to explain our methodology. For each of our variables we conducted unit root tests (available on request from the authors). While the standard ADF-tests do not reject the stationarity of the changes of all variables, the case of the level of exchange rate volatility (itself constructed by exchange rate changes) sometimes appeared borderline dependent on the sample length. The stationarity of the volatility measure is surely controversial also from a theoretical point of view due to the exchange rate crisis experienced by the Mercosur countries. However, as in Belke and Gros (2001) in cases of doubt we have always preferred *taking differences* since the disadvantages of differencing when it is not needed appear to us much less severe than those of failing to difference when it is appropriate. In the first case the worst outcome would be that the disturbances are a moving average, but the estimators would still be consistent, whereas in the second case the usual properties of the OLS test statistics would be invalidated. All macroeconomic time series and the exchange rate data we use are listed in detail in the annex.

As a first step we present the results of some simple tests. We explain the first difference of the unemployment rate and employment growth by their own past and lags of our measures of exchange rate variability and interest rate variability. The results, which are summarized below in the Tables 2a and 2b, are thus based on standard causality tests on the annual data used throughout this paper. The tables just summarize the regression results from bivariate VARs on annual data (1970-2001, sometimes shorter periods had to be used subject to data availability). The hypothesis tested is, as usual, that exchange rate variability and interest variability do not have an influence on the real economy variables investigated here.[6] All the results presented here are implicitly based on a comparison of two regression equations, exemplified here with respect to the impact of exchange rate variability on unemployment. The notations are chosen for consistency reasons (for a similar procedure see Belke and Gros 2001 and 2002):

$$\mathrm{DUE_t} = \alpha_0 + \sum_{i=1}^{N} \alpha_i \cdot DUE_{t-i} + \mathrm{u_t}, \tag{1}$$

and

$$\mathrm{DUE_t} = \alpha_0 + \sum_{i=1}^{N} \alpha_i \cdot DUE_{t-i} + \sum_{i=0}^{N} \beta_i \cdot EXV_{t-i} + \mathrm{u_t}, \tag{2}$$

where DUE_t stands for change in the unemployment rate (between period t and t-1), EXV_{t-i} specifies the level of exchange rate variability (between period t-i and period t-i-1), u_t represents the usual i.i.d. error term and N is the maximum number of considered lags (here: 2 lags). Exchange rate variability (measured by one of the indicators as explained above) can then be said to "cause" unemployment if at least one ß, i.e. one of the coefficients on the past and contemporaneous level of exchange rate variability, is significantly different from zero. In other words, these tests measure the impact of exchange rate variability on changes in national unemployment rates once the autonomous movements in unemployment have been taken into account by including lagged unemployment rates among the explanatory variables. Thus, a significant effect (of whatever sign) implies that one can reject the hypothesis that (the change in) exchange rate variability does not influence unemployment at the usual confidence levels. In order to be allowed to use the standard t-distribution for the purpose of model selection one has to use changes at least in the unemployment rate as the level of this variable is clearly non-stationary. Substituting the unemployment rate by the change in employment or in investment in the above setting describes our proceedings in the case of employment and investment instead of unemployment. The same is valid if we insert measures of interest rate volatility instead of exchange rate volatility.

Tables 2a and 2b show the results for Argentina and Brazil, using the eleven different volatility measures and the three real economy variables. In view of the analysis in Belke and Gros (2002a), we prefer to emphasize the results gained for the *limited samples* case.[7] The results based on full samples estimates for Argentina, Brazil and Uruguay can be found in Belke and Gros (2002a). For each of the real sector variables mentioned we first used as explanatory variables only their own past and lags of the exchange rate and interest rate variability measures. Hence, each table contains 33 (= 11 times 3) entries by construction. The results reported in the first row of Table 3a, for example, imply that exchange rate variability, as measured by the standard deviation of the nominal exchange rate of the peso against the US-dollar, has a significant impact on labor markets and investment in Argentina.

Only the coefficient estimate, its significance level and the lag order of exchange rate variability are displayed in the summary tables. The numbers in parentheses correspond to the lag order of exchange rate variability. According to our prior, the expected sign of exchange rate and interest rate variability is positive for (the changes in) the unemployment rate and negative for (the changes in) employment and investment. The specification of the underlying equations is based on the usual diagnostics combined with the Schwarz Bayesian Information Criterion (Schwarz 1978). The latter is chosen as our primary model selection criterion since it asymptotically leads to the correct model choice (Lütkepohl 1991). As already stated above, the sample has been chosen to be 1970 to 2001. However, in the case of Argentina it is limited in order to exclude its currency board period. The inclusion of the latter would have introduced structural breaks in the relationships because the correlation between exchange rate volatility as a variable that does not move and a real sector variable is nil per se. As usual, we add country specific dummies from time to time in order to account for possible breaks in the VAR relations. Most of the dummies were also economically meaningful (relating to the different currency regime episodes distinguished by Díaz-Bonilla and Schamis 2001) and mostly disappeared when policy variables were introduced in the robustness tests below.

4.2 Summary of Results

The results have to be read off the Tables 2a and 2b below as follows. In these tables, point estimates for the impact of exchange rate volatility and interest rate volatility are displayed together with their significance levels. For Argentina (Table 2a), the point estimate obtained from the first specification implies that a decrease of one percentage point in the variability (standard deviation) of the nominal bilateral exchange rate of the peso vis-à-vis the US-dollar is associated during the same year with a decrease in the unemployment rate of 0.06 percentage points. This is economically not significant, but it is not surprising that the effect during the same year is small. A jump in exchange rate variability from the average (9 percent) to zero, e.g. through the currency board, would yield in the same year already a more perceptible 0.5 percent. We will comment only briefly on the impact coefficients because the longer run effects depend of course on the dynamic behavior of the variables (Belke and Gros 2001 and 2002). Only the results of the best, basic specification are displayed.

Table 2a: *Regression results for Argentina (until 1990)*

	DUNEMPRATE_ARG	DEMPRATE_ARG	GROWTHREALINVEST_ARG
VOLNER_ARPUSD	0.06*** (0)	-0.02** (-1)	-0.44* (0)
VOLRER_ARPUSD	0.07*** (0)	-0.03*** (-1)	-0.51* (0)
VOLNER_ARPEUR	0.04** (0)	-0.02** (-1)	-0.65** (0)
VOLRER_ARPEUR	0.05* (0)	-0.03** (-1)	-0.78** (0)
VOLNER_USDEUR	1.38*** (0)	-0.52*** (-1)	-11.33** (0)
VOLRER_USDEUR	1.41*** (0)	-0.53*** (-1)	-10.57* (0)
VOLREER_ARG	0.05* (0)	-0.03** (-1)	-0.80** (0)
VOLNEERINTRAMERC_ARG	0.06*** (0)	-0.02** (-1)	-0.44* (0)
VOLREERINTRAMERC_ARG	0.07*** (0)	-0.03*** (-1)	-0.48* (0)
VOLINTEREST_ARG	0.01*** (0)	-0.003* (-1)	-0.11*** (0)
VOLREALINTEREST_ARG	0.01*** (0)	-0.003* (-1)	-0.10*** (0)

Note: Point estimates for the impact of exchange rate volatility are displayed together with their significance levels (***: 1 %; **: 5 %; *: 10 %). Numbers in brackets refer to the lags of the implemented volatility variable.

Table 2b: *Regression results for Brazil (until 1993)*

	DUNEMPRATE_BRA	GROWTHEMP_ BRA	GROWTHREALINVEST_BRA
VOLNER_BRR USD	0.11* (-1)	-0.50*** (-1)	-2.03*** (-1)
VOLRER_BRR USD	0.28*** (0)	-0.92*** (-1)	-4.46*** (0)
VOLNER_BRR EUR	0.12** (-1)	-0.65*** (-2)	-2.19** (-1)
VOLRER_BRR EUR	0.26* (0)	-0.82* (-1)	-5.59*** (-0)
VOLNER_USD EUR	/	-1.78** (-2)	/
VOLRER_USD EUR	/	-1.93** (-2)	/
VOLREER_BR	0.28* (0)		-7.13*** (0)
A	0.39* (-2)	-1.37*** (-1)	-4.5* (-2)
VOLNEERINT RAMERC_BRA	0.04* (-1)	-0.13*** (-2)	-0.72*** (-1)
VOLREERINTR AMERC_BRA	0.05** (-1)	-0.12* (-2)	-0.87*** (-1)
VOLINTEREST _BRA	/	-0.03** (-1)	-0.16** (-1)
VOLREALINTE REST_BRA	/	-0.03** (-1)	-0.13** (-1)

Note: Point estimates for the impact of exchange rate volatility are displayed together with their significance levels (***: 1 %; **: 5 %; *: 10 %). Numbers in brackets refer to the lags of the implemented volatility variable. / means 'not significant'.

The first upper right hand entry in Table 2a comes from a standard causality type regression. This entry refers to the impact of the variability of the nominal bilateral exchange rate vis-à-vis the US-dollar on Argentina's labor markets. The dependent variable in this case is represented by the change in the unemployment rate (DUNEMPRATE_ARG). The depicted specification of the regression equation leads to the 'best' result, i.e., the lowest realization of the Schwarz criterion, samples being the same throughout. The dummies for 1974 and 1975 approximate the stimulating fiscal and monetary policies by which the government under Isabel Perón tried to rekindle economic growth (Díaz-Bonilla and Schamis (2001), pp. 76 f.).

Let us now interpret the results summarized in the Tables 2a and 2b above, starting with Argentina, then comment on the results for Brazil and finally conclude with some general remarks. For Argentina we focus on the results up to 1990, i.e. the inauguration of the currency board regime. It is apparent that one could no longer expect exchange rate variability to have any influence on macroeconomic variables after the installation of the currency board.[8] Tables 2a and 2b above show that all the different volatility variables (whether they are based on exchange rates or interest rates) have a significant influence on labor markets and investment and that in all the cases the sign is the expected one (negative for employment and investment and positive for unemployment). Belke and Gros (2002a) show the results for the full sample, including the currency board period, 1991 to 2001. It is also interesting to note that the effect of both exchange rate and interest rate volatility are contemporaneous for unemployment and investment, but lagged one period in all cases for employment. This might be due to the fact that in times of increased uncertainty individuals might try to enter the labor market as an insurance (to be able earn an additional wage or at least to collect unemployment benefits in case other members of the household are fired). Firms can also stop first investing in machinery (investment) and the workforce (no new hiring) immediately. However, they might take some time to see how things work out before they actually start hiring (provided the labor market does not allow them quick firing as well).

Concerning individual volatility measures it is apparent that real and nominal measures have usually the same point estimates and significance levels. This is not surprising in view of the fact that in the very short run (monthly data for the volatility measures) changes in nominal and real exchange rates are highly correlated (but not exactly the same, as documented in Belke and Gros 2002a). It is also not surprising that the dollar/euro exchange rate variability has a larger point estimate than that of the volatility of the national exchange rate against the dollar because the former is much less variable than the latter.

For Brazil we obtain a similar pattern as for Argentina: the results are much stronger when we limit the sample to the period before the real plan, i.e. up to 1993.[9] For this sample period we find again that all the significant coefficients have the expected sign, and seem to act with a lag of one or two years. The latter can serve as a first hint in favor of exogeneity of the volatility variables with respect to the real sector variables (Belke and Gros 2001). As a striking fact, the lag structure is exactly the same for the unemployment rate and growth of real investment. We would give the same interpretation as above: the unemployment rate and investment can react more quickly because in times of increased uncertainty it is easier to stop immediately new hiring and investment projects. The main difference with respect to Argentina is that the dollar/euro exchange rate does not seem to be as important and interest rate volatility is not always significant. The former might be due to the difference in the geographical distribution of exports (Belke and Gros 2002a). Moreover, this exactly mirrors the empirical evidence delivered by Reinhart and Reinhart (2001) that only the volatility of the domestic currency should matter (see Section 3.1). The latter might be caused by the widespread use of indexation clauses in Brazil prior to the real plan period. The point estimates are generally higher for Brazil. This might be caused by the fact that the volatilities for Argentina are higher than those for Brazil (see Belke and Gros 2002a, Section 3). The latter implies firms have adapted to this environment, implying that impact of observed changes in exchange rate variability might be lower.

Let us now turn to some more general issues. There is practically no difference between the results using the volatility of the national currency against the US dollar or against the euro. This was to be expected as the average volatility of the dollar/euro rate VOLRER_USDEUR is at 2.37 percent (sample 1978 to 1990) so much lower than, for example, the average volatility of the Argentinean currency (or rather currencies) in real terms against either of these two major currencies, e.g., against the euro VOLRER_ARPEUR which amounts to 9.63 percent (sample 1979 to 1990). For the reasons already alluded to in Belke and Gros (2002a), interest and exchange rate volatility are highly correlated (in the case of Argentina in particular). Hence, it is not surprising that the two yield not too different results, at least with respect to the sign and the significance levels.

The results are generally weaker for unemployment than for employment. This suggests that movements in and out of the labor force dominate over flows into and out of unemployment in the adjustment of the labor market. According to Section 3, this is a quite typical finding for Latin America. The significance of entry into and exit from the labor force is clearly supported by the model in Belke and Gros (2002a). Let us now finally turn to some robustness tests of the empirical results gained so far.

5. Robustness Tests

5.1. Missing Variables?

The purpose of the following is to report the results of some tests for the robustness of the relationships found so far. We try to take into account the two most plausible ways in which our measures of exchange rate and interest rate variability could stand for some other variable. For each hypothesis we then implement the same procedure based on the SCH criterion explained above. The two hypotheses we consider are: (i) exchange rate variability is just a sign of a misalignment (i.e. a wrong level of the exchange rate); and (ii) interest rate variability just reflects the financial stress defined as high real (short-term) interest rates.

(i) A first possible reason for the significant correlation of exchange rate variability with (un-)employment and investment might be that this volatility just stands for misalignments of the real exchange rate. The sign of the correlation, negative for employment (positive for unemployment) makes it a priori unlikely that exchange rate variability just stands for a misaligned exchange rate because Mercosur currencies were usually variable when they were very weak. But this argument needs to be addressed because it represents a possible explanation for the results we obtain if devaluations are contractionary as claimed for some.

(ii) Interest rate variability could also just be the result of a tight monetary policy. The hypothesis is that this policy leads to employment losses in the short-term, and that this is exclusively assigned to interest rate variability in Tables 2a and 2b. However, this problem of identification can be reduced by explicitly adding a variable that indicates the degree of tightness to the equation. We use the *(real) interest rate* as a first indicator. This control variable actually improves the performance of the equation overall.

In order to take these hypotheses into account, we added the first difference (the level is not stationary) of the exchange rate in the regressions displayed in the Tables 3a and 3b, if the implemented volatility measure is one for exchange rate variability. In contrast, if an interest rate volatility measure enters the regression equation, the change in the respective interest rate (again, the level is non-stationary) is inserted as a control variable. Hence, in order to check for robustness, we augment the regression equations which are underlying the results depicted in Tables 2a and 2b (we use the same sample period to conceive comparability) with an additional regressor which in each case is the variable for which the respective volatility measure is calculated. For example, in row one of Table 2a we add the change in the nominal dollar exchange rate of the Argentinean peso and get the first row of Table 3a. By this, we secure overall consistency of our procedure.

Table 3a: *Robustness regression results for Argentina (until 1990)*

	DUNEMPRATE_ARG	**DEMPRATE_ARG**	**GROWTHREALINVEST_ARG**
	0.11*** (0)	-0.02*** (-1)	-0.46* (0)
VOLNER_ARPUSD	-0.006** (-1)	0.006*** (-2)	/
	0.06*** (0)	-0.02** (-1)	-0.50* (0)
VOLRER_ARPUSD	0.01** (-2)	-0.007* (-2)	/
	0.04** (0)	-0.02* (-1)	-0.61* (-1)
VOLNER_ARPEUR	/	0.004* (-2)	/
	0.05* (0)	-0.02* (-1)	-0.70** (0)
VOLRER_ARPEUR	0.02* (-2)	-0.007* (-2)	-0.21** (-1)
	1.38*** (0)	-0.70** (-1)	-13.80* (0)
VOLNER_USDEUR	-0.01* (0)	/	/
	1.45*** (0)	-0.66** (-1)	-13.15* (-1)
VOLRER_USDEUR	0.01* (0)	/	/
	0.04* (0)	-0.03* (-1)	-0.75** (0)
VOLREER_ARG	0.03** (-2)	/	-0.20** (-1)
VOLNEERINTRAM	/	/	/
ERC_ARG	-0.01*** (-2)	0.04** (-2)	/
VOLREERINTRAM	0.06***(0)	-0.03** (-1)	/
ERC_ARG	0.02*** (-2)	-0.007* (-2)	/
VOLINTEREST_AR	0.01** (0)	/	-0.10*** (0)
G	/	/	-0.06** (-1)
VOLREALINTERE	0.01** (0)	/	-0.10*** (0)
ST_ARG	/	/	-0.06*** (-1)

Note: The first numbers displayed are the point estimates for the impact of exchange rate volatility. The second numbers refer to the respective robustness variable. The respective significance levels are attached to the point estimates (***: 1 %; **: 5 %; *: 10 %; -: not significant). Numbers in brackets in each case refer to the lags of the implemented volatility variable. Regression equations include the respective robustness variable. / means ‘not significant’.

Table 3b: *Robustness regression results for Brazil (until 1993)*

	DUNEMPRATE_BRA	GROWTHEMP_ BRA	GROWTHREALINVEST_BRA
VOLNER_BRR	0.16*** (-1)	-0.66*** (-1)	-1.89** (-1)
USD	-0.006** (-1)	0.01* (-2)	/
VOLRER_BRR	0.24** (0)	-0.67*** (-1)	-4.73*** (0)
USD	-0.02* (-1)	-0.10** (-2)	-0.53*** (0)
VOLNER_BRR	0.17** (-1)	-0.64*** (-2)	-2.71** (-1)
EUR	-0.009** (-1)	/	/
VOLRER_BRR	0.65** (0)	-0.88* (-1)	-5.86*** (0)
EUR	-0.06* (-1)	/	-0.43** (0)
VOLNER_USD	/	-1.78* (-2)	/
EUR	/	-	/
VOLRER_USD	/	-1.93** (-2)	/
EUR	0.05*** (-2)	-	/
VOLREER_BR	/	-1.44*** (-1)	-4.60** (-2)
A	0.04*** (-2)	/	-0.70*** (-1)
VOLNEERINT	0.04* (-1)	-0.14*** (-2)	-0.63*** (-1)
RAMERC_BRA	/	-	+0.07** (-2)
VOLREERINTR	0.05** (-1)	-0.12* (-2)	-0.87*** (-1)
AMERC_BRA	/	/	/
VOLINTEREST	/	-0.03** (-1)	-0.14** (-1)
_BRA	/	-0.009** (-1)	-0.05** (-1)
VOLREALINTE	/	-0.03** (-1)	-0.13** (-1)
REST_BRA	/	-0.01** (-1)	-0.06** (-1)

Note: The first numbers displayed are the point estimates for the impact of exchange rate volatility. The second numbers refer to the respective robustness variable. The respective significance levels are attached to the point estimates (***: 1 %; **: 5 %; *: 10 %; -: not significant). Numbers in brackets in each case refer to the lags of the implemented volatility variable. Regression equations include the respective robustness variable. / means 'not significant'.

In contrast to the Tables 2a and 2b, point estimates are now displayed for the impact of exchange rate volatility *and for the additional robustness variable* together with their significance levels. Interpreting Tables 3a and 3b, one has to keep in mind that an increasing nominal (real) exchange rate index means a nominal (real) devaluation (appreciation) of the home currency. The results suggest that the above mentioned hypotheses that variability just stands for a wrong level do not hold a lot of explanatory power as the addition of the change in the exchange rate in only few cases (as sometimes for intra-Mercosur exchange rate volatility) changes the magnitude or significance level of the coefficient of exchange rate variability. The argument that a high degree of variability stands for the 'wrong' level does not really make sense if one looks at the dollar/euro rate. We have tabulated the results, but they are more difficult to interpret since it is not clear a priori whether a strong dollar is good or bad for Mercosur exports (since the shares of the US and the EU are not that different).

As expected, adding the real short term interest rate to the equation does in some cases change the results in the sense that the coefficient on interest rate variability does not remain significant. Nevertheless, for Argentina, we still find that in the four equations regarding unemployment and investment interest rate variability remains significant and enters with the expected sign. For Brazil there are, however, more entries in the employment and investment columns.

Our main focus is on the importance of volatility; we are thus not particularly interested in the size of the additional variables introduced to test for robustness. However, it is interesting to observe that for Mercosur countries a devaluation has in most cases a positive impact on the economy. The only exceptions are the two results gained for the impact of the real exchange rate of the Brazilian real against the dollar and against the euro on the change in the Brazilian unemployment rate. The point estimates of the parameters are usually somewhat smaller for the robustness variable (the first moment) than for the second moment.

In Section 2, we have shown that both for Argentina and Brazil the EU is the more important trade partner than NAFTA. This relation is even more pronounced for Argentina. However, we do not find that exchange rate variability vis-à-vis the euro is more important than that vis-à-vis the dollar, as the point estimates are in most cases virtually indistinguishable.

5.2. Exogeneity of volatility variables and robustness variables?

Reverse causation and missing third variables are possible objections to the simple test results presented so far. Whenever exchange rate variability influences real variables with a lag, reverse causation appears less plausible. But even in cases of a contemporaneous relationship reverse causation appears not to be a problem as suggested by additional pairwise Granger causality tests which are applied to exchange rate and interest rate variability and the real sector variables used in this contribution. Belke and Gros (2002a) display the results from numerous pairwise Granger causality tests. For the data for Argentina and Brazil we do not reject the hypothesis that the real sector variables do not Granger cause our volatility measures in 63 out of 66 cases. However, based on our estimates displayed in Tables 2a, 2b, 3a and 3b, we do in the overwhelming majority of cases reject the hypothesis that our volatility measures do not "cause" the three real sector variables. Therefore it appears that "causality" runs from volatility to the real sector.

There are some additional arguments, which speak in favor of our exogeneity hypothesis for the volatility variables. We are skeptical in general about the possibility that exchange rate and interest rate variability at our high frequency was caused by slow moving variables such as labor market rigidities or unemployment and investment. A further argument validating our methodology and our results comes from the work of Canzoneri, Vallés and Viñals (1996) and others who show for a different sample of countries that exchange rates reacted mainly to financial shocks rather than real fundamentals. Rose (1996) and Flood and Rose (1995) also emphasize that exchange rate volatility is largely noise. It does not make much sense to treat a noise series as endogenous.

6. Summary and Outlook

The data from the past investigated by us suggest that exchange rate variability (whether extra- or intra-Mercosur) and interest rate variability have had a statistically significant negative impact on employment, and investment for a number of countries like Argentina, Brazil and Uruguay. We have argued that this result is due to the fact that all employment and investment decisions have some degree of irreversibility.

We have included both intra- and extra-Mercosur exchange rate variability because the geographical distribution of trade in the countries in question is less concentrated than for European countries. We are aware of the general finding in the empirical literature that the impact of exchange rate variability on trade is small. However, we neither want, nor need, to take a stance on whether the economic impact of exchange rate variability on trade is strong or not. We simply argue that exchange rate variability has a stronger impact on investment and employment than on current production and exports, because the latter can be adjusted with existing labor through variations in utilization rates. Irreversibility of set-up costs is thus not an important consideration for production that can be sold within weeks or days, whereas it is crucial for long-run decisions, such as decisions to invest or to hire additional workers.

In general, our results are rather strong in that we find in almost all cases, and despite extensive robustness tests, that exchange rate and interest rate variability have a significant impact on investment and employment. Moreover, one would have expected that economies with relatively closer ties to the U.S. like Brazil would show a stronger impact of dollar exchange rate variability, a result confirmed by the data. The estimated impact coefficients for Argentina were in most of the cases smaller than for Brazil. But we also acknowledge that some aspects of the results remain unsatisfactory. The prior that intra-Mercosur exchange rate volatility has a higher impact on Argentina's real sector (exports to the Mercosur trade bloc amount to 2.7 percent of its GDP) than for the Brazilian one (only 0.9 percent of GDP go to Mercosur countries) is only partially corroborated by the estimations. This is a general feature also of our earlier work in the sense that for Europe we also did not find a systematic correlation between openness and the strength of the impact of exchange rate volatility on trade. This is the main reason why we do not stress the general finding of the literature on the impact of exchange rate variability on international trade, which is that for LDCs this channel is much more important.

What are the implications of the results for the debate on exchange rate policy in Mercosur and on the design of intra-Mercosur monetary relations? By accepting our main result one could jump to the policy conclusion that fixing exchange rates either within the Mercosur or against G-3 currencies should bring about significant benefits. Our estimates are not precise enough to decide which option would yield larger benefits. Whether there are benefits depends essentially on whether the gains from suppressing exchange rate variability are lost if the volatility reappears elsewhere, for example in a higher dollar variability or higher interest rate variability or the slow build up of large disequilibria.

We would argue that fixing the exchange rate might be beneficial if the underlying policies are compatible with this choice. This is a crucial condition, as the experience of Argentina shows if fiscal policy is out of control then fixing the exchange rate might just suppress the appearance of the true problem temporarily. In the case of Argentina one might even argue that the currency board worked too well for too long, thus allowing a considerable dis-equilibrium to accumulate under the surface. The explosion that followed in the end then might have such high costs that it can easily offset the benefits of a stable exchange rate that were accumulated in the preceding 10 years.

In sum, we maintain that the high degree of exchange rate variability observed from time to time in Mercosur has tangible economic costs, but that fixing exchange rates was too often considered a free lunch by irresponsible politicians.

Acknowledgements

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Data Annex

CPI_ARG: Consumer Price Index Argentina (1995=100), Source: Instituto Nacional de Estadística y Censos, (http://www.indec.mecon.gov.ar).

CPI_BRA: Consumer Price Index Brazil (1995=100), Source: IFS (IMF) series CPI (22364...ZF...) + IMF – Statistical Yearbook and various Monthly Reports.

CPI_EUR: Consumer Price Index (1995=100), Source: until December 1994 Bundesbank, from January 1995 on ECB.

CPI_US: Consumer Price Index (1995=100), Source: IFS (IMF) series CPI (11164...ZF...) + IMF – Statistical Yearbook and various Monthly Reports.

DNER_USDEUR: = D(LOG(NER_USDEUR))*100; growth rate of the nominal dollar exchange rate of the euro; the remaining exchange rate growth rates are constructed analogously.

EMP_BRA: Employment general level Brazil (in thousands): Persons aged 10 years and over. Excl. rural population of Rondônia, Acre, Amazonas, Roraima, Pará and Amapá. Sep. of each year. Prior to 1979: excl. rural areas of Northern Region, Mato Grosso, Goiás and Tocantins. 1992 methodology revised; data not strictly comparable. Source: LABORSTA (http://laborsta.ilo.org/), IFS (IMF) and http://www4.bcb.gov.br/series-i/default.asp.

EMPRATE_ARG: Evolución de la las principales variables ocupacionales (en % of employed population to total population), Empleo, Tasa de Empleo en Aglomerados Urbanos, Source: Encuesta Permanente de Hogares, INDEC. http://www2.mecon.gov.ar/infoeco/.

INTEREST_ARG: Deposit Rate (in home currency), Source: IFS (IMF) series 21360L..ZF... .

INTEREST_BRA: Money Market Rate (in home currency), Source: IFS (IMF) series 22360B..ZF... .

INTEREST_EUR: until December 1994: German money market rate, Source: Bundesbank; from January 1995 on: 3-month rate, Source: ECB, Monthly Reports.

INTEREST_US: treasury bill rate, Source: Federal Reserve Bank.
INVEST_ARG: Gross Fixed Capital Formation Argentina (millions of Arg. peso), Source: IMF Statistical Yearbook, IFS (IMF).
INVEST_BRA: Gross Fixed Capital Formation Brazil (millions of real), Source: IMF Statistical Yearbook, IFS (IMF).
NER_ARPUSD: IMF – Statistical Yearbook and various Monthly Reports.
NER_BRRUSD: IMF – Statistical Yearbook and various Monthly Reports.
NER_PYGUSD: IMF – Statistical Yearbook and various Monthly Reports.
NER_UYPUSD: Banco Central del Uruguay (until June 1973) and IMF – Statistical Yearbook and various Monthly Reports (from July 19973 on).
NER_USDEUR: Bilateral nominal US $/ECU exchange rate period av., Source: IMF – Statistical Yearbook and various Monthly Reports, IFS (IMF) series 111..EB.ZF... .
The remaining bilateral nominal exchange rate series were created via cross-rates.
NEER_EUR: Nominal effective exchange rate euro zone, Source: IFS (IMF) series 163..NEUZF...
NEER_US: Nominal effective exchange rate of the US-dollar based on unit labor costs, Source, IFS (IMF) series 111..NEUZF... .
REALINTEREST_ARG: real short-term interest rate of Argentina; INTEREST_ARG deflated by the consumer price index.
REALINTEREST_BRA: real short-term interest rate of Brasil; INTEREST_BRA deflated by the consumer price index.
REALINTEREST_EUR: Euroland real short-term interest rate; INTEREST_EUR deflated by the consumer price index.
REALINTEREST_US: U.S. real short-term interest rate of Argentina; INTEREST_US deflated by the consumer price index.
REER_US: Real effective exchange rate of the US-dollar based on unit labor costs, Source: IFS (IMF) series 111..REUZF... .
REER_EUR: Real effective exchange rate Euro area based on unit labor costs, Source: IFS (IMF), series 163..REUZF... .
REER_ARG: Annual data: Real effective exchange rate Argentina in terms of import prices, Source: Comisión Económica para América Latina y el Caribe http://www.eclac.org/publicaciones/DesarrolloEconomico. Monthly data: reer_arg = 4.739*RER_ARPJPY+22.058*RER_ARPUSD+35.402*RER_ARPEUR+35.004*RER_ARPBRR+2.797*RER_ARPUYP (weights from Center for Global Trade Analysis (2001): exports + imports).
REER_BRA: Annual data: Real effective exchange rate Brazil in terms of import prices, Source: Comisión Económica para América Latina y el Caribe http://www.eclac.org//publicaciones/DesarrolloEconomico. Monthly data: reer_bra = 8.258*RER_BRRJPY+31.974*RER_BRRUSD+41.362*RER_BRREUR+16.431*(1/RER_ARPBRR)+1.974*RER_BRRUYP (weights from Center for Global Trade Analysis (2001): GTAP 5: exports + imports).

UNEMPRATE_ARG: Evolución de la las principales variables ocupacionales (en %), Desocupación (in percent), Sources: Encuesta Permanente de Hogares, INDEC. http://www2.mecon.gov.ar/infoeco/.
UNEMPRATE_BRA: Unemployment rate Brazil (in percent), Taxa de Desemprego Aberto – Original e Dessazonalizada – Taxas Medias 30 dias; Source: http://www.ibge.gov.br.
VOLNEER_EUR: Exchange rate variability from NEER_EUR.
VOLNEER_US: Exchange rate variability from NEER_US.
VOLREER_EUR: Exchange rate variability from REER_EUR.
VOLREER_US: Exchange rate variability from REER_US.
VOL_USDEUR: Exchange rate variability from NERDOLLECU.
VOLREERINTRAMERC_ARG = 0.926*volrer_arpbrr + 0.074*volrer_arpuyp.
VOLREERINTRAMERC_BRA = 0.8927*volrer_arpbrr + 0.1073*volrer_brruyp.
VOLNEERINTRAMERC_BRA = 0.8927*volner_arpbrr + 0.1073*volner_brruyp.
VOLNEERINTRAMERC_ARG = 0.926*volner_arpbrr + 0.074*volner_arpuyp.
(weights = exports plus imports weights from Center for Global Trade Analysis 2001 for consistency reasons)

Notes

1. Professor, Department of Economics , University of Hohenheim. E-mail: belke@uni-hohenheim.de

2. Scientific Assistant, Department of Economics, University of Hohenheim. E-mail: geisslr@uni-hohenheim.de

3. Before the outbreak of the Argentina crisis, some (Eichengreen 1998 and Giambiagi 1999) discussed the possible logic of a common currency for the Mercosur member countries. Corresponding declarations of intention were made at that time by policy circles, i.e. the president of Argentina, Fernando de la Rúa, and by the president of Brazil, Fernando Henrique Cardoso. See also Levy Yeyati and Sturzenegger (2000).

4. Belke and Gros (2002a) analyze the correlation between the two aspects of financial market volatility.

5. For consistency reasons, we use the package Center for Global Trade Analysis (2001) from Purdue University, USA, for any calculations, e.g., of trade weights, throughout this contribution.

6. The significance of the coefficient estimates of the lags of the changes of the real variables and of exchange rate variability can be judged based on the student-t-distribution. See Belke and Gros (2001, 2002) and Haldrup (1990), pp. 31 f.

7. By this, we catch Argentina's transition from different attempts to fix or to control the exchange rate (Alfonsín and Menem) to the convertibility plan. In the case of Brazil, we introduced a sample split for the year 1994 (real plan).

8. For Argentina significant estimates result only if the nineties are excluded from the sample (see annex). Even experimenting with a dummy for the currency board

period did not help in this respect. In addition, it turned out that the implementation of a dummy for 1990 would have had a strong inadequate impact on the results. Our above results are corroborated by Luís Campos e Cunha and Nuno Alves based on slightly different data set in their comments to this contribution.

9. The results for Brazil and for Uruguay (both full sample) are displayed in Belke and Gros (2002a).

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A Review of the Role and Impact of Export Processing Zones in World Trade: The Case of Mexico

Mustapha Sadni-Jallab[1]
University of Lyon 2

Enrique Blanco de Armas[2]
University of Sussex

Abstract. While the number of export processing zones has risen to about 850 in 2000, their success in expanding employment and trade is mixed. The aim of this paper is to review the role and the impact of EPZs in world trade and their likely impact on host countries' economies, especially in terms of foreign exchange earnings potential, FDI, technology transfer, and employment effects on the local and national economies. To this end we will be looking at Mexico where export processing zones are very developed. Mexico seems an appropriate case study to assess the extent to which the predictions of economic theory are realised both because of the abundance and quality of available data and because of its proximity to the US, which makes it a very good example of the international division of labor. We will analyse how the variables mentioned above (employment, foreign exchange earnings potential, FDI and technology) have evolved over the last 10-15 years and how much of the change can be traced back to the maquila sector. The main source of data is INEGI, the Instituto Nacional de Estadistica Geografica e Informatica of the Mexican Government.

1. Introduction and Definitions

Over the last 15 years, the outstanding trade performance recorded by a select number of developing countries can be partly attributed to the expansion of their "processing trade". Besides multilateral and regional trade liberalization, an increasing number of countries have modified their import regime by granting, under certain conditions, duty-free access to those imports which are bound for the processing and assembling of goods destined for exports. While the number of export processing zones has risen to about 850, their success in expanding employment and trade is mixed. The object of this paper is to review the role and the impact of EPZs in terms of foreign exchange earnings potential, FDI, technology transfer, and employment effects on local and national economies, and on world trade, and their likely impact on host countries' economies, and specifically for Mexico's economy.

1.1. What are EPZs?

Export Processing Zones (EPZs) are special industrial parks providing duty relief to export-oriented firms operating in the zones. They are enclaves within a country where foreign and domestic goods may enter duty free in order to be stored, distributed, combined with other foreign and/or domestic products, or used in manufacturing operations. EPZs have become rather popular trade policy instruments in the last three decades. An EPZ is a trade policy instrument used to promote non-traditional exports. When discussing EPZs, a variety of terminologies, such as industrial free zones, special economic zones and maquiladoras are used interchangeably through most of the literature (see Table 1).

Table 1: *Terms Synonymous with Export Processing Zones (EPZ)*

Term	**Countries**
Maquiladoras/maquiladora (in-bond) enterprises	Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Panama
Free zones	Costa Rica, Honduras, Ireland, Trinidad and Tobago, Turkey, United Arab Emirates, Uruguay, Venezuela
Special economic zones	China
Industrial free zones	Cameroon, Colombia, Ghana, Madagascar, Syrian Arab Republic and Jordan
Industrial free zones for Goods and services	Colombia
Free trade zones	Bulgaria, Chile
Export free zones	Jamaica
Free trade and industrial zones	Islamic Republic of Iran
Special export processing zones	Philippines
Export processing free zones	Togo
Tax free factories	Fiji
Bonded zone	Indonesia
Free zones and special processing zones	Peru
Free economic zones	Russian Federation
Industrial estates	Thailand
"Points francs" (special industrial free zones)	Cameroon

Source: Legislation and publications of governments and EPZ authorities.

The diversity in name reflects the evolving nature and distinct purpose of each zone, and while the stated objective of the government is reflected in its terminology, the actual operation of the enclave can be quite different.

The general concept of all these terminologies is basically the same. But, according to some authors, Free Trade Zones (FTZs) include EPZs, but many export processing zones are not free trade zones. Rhee, 1990, defines an FTZ as an EPZ with free trade and other equal footing export policies, which include a realistic exchange rate, inputs and capital goods at world prices, easy access to investment licensing and financing for the creation of export production capacities. The ILO/UNCTC suggests the following definition: "… an EPZ could be defined as a clearly delineated industrial estate which constitutes a free trade enclave in the customs and trade regime of a country, and where foreign manufacturing firms producing mainly for export benefit from a certain number of fiscal and financial incentives."

For our paper, we assume, as the World Bank does, that "*an export processing zone is defined as a territorial or economic enclave in which goods may be imported, stored, repacked, manufactured, and reshipped with a reduction in duties and/or minimal intervention by customs officials.*"[3]

1.2. Why Do Countries Use EPZs?

Usually, there is agreement about the objectives of an EPZ, but there is no general consensus about their definitive characteristics. Nonetheless, there are a few common features to these zones. At first, they were conceived as fenced-in production areas. A long existing alternative is the export processing firm (EPF), which benefits from some of the EPZ incentives without being fenced in an identifiable area.

Box 1: *The Main Benefits that Host Countries Derive from EPZs*

Traditionally, there are four main benefits in establishing EPZs.

1. Provide foreign exchange earnings by promoting non-traditional exports
2. Provide jobs to alleviate unemployment or under-employment problems in the host country.
3. Attract foreign direct investment (FDI) to the host country
4. Lead to technological transfers, knowledge spillovers and demonstration effects that could act as catalysts for domestic entrepreneurs to engage in production of non-traditional products.

EPZs can be differentiated by their ability to sell their output in the market of the host country. Those which are not permitted such a transaction fit the more traditional definition of an EPZ. Some countries have adopted a more flexible stance with regards to such sales and allow some percent of the EPZ production to be sold on the domestic market after appropriate import tariffs on the final goods are paid. This is, for instance, the case for the Dominican Republic, which allows up to 20 percent of the EPZ products into its domestic market. A category of EPZ permits the free sale of its products on the domestic market. For instance, Manaus in Brazil is one such zone (Rodriguez 1996)[4].

Zones can also be divided into public and private zones. In the past 10 to 15 years, an increasing number of zones have been developed and are being managed by private entities. Traditionally, EPZs have been associated with underdeveloped economies that desire to exploit some existing comparative advantage in order to improve their economic status. In some cases, EPZs were created as open markets within an economy that is dominated by distortionary trade, macro and exchange rate regulation, and other regulatory governmental controls. (see Table 2)

Table 2: *The Potential Gains from EPZs*

Increased foreign exchange earnings
Increased gross exports
Job creation and income creation
Average wage in EPZs higher than average wage outside the zone
Good source of labor training and learning by doing
Management and supervisory training
Catalyst effect
Provides efficient industrial structure in countries that may not possess one

Source: Madani (1999).

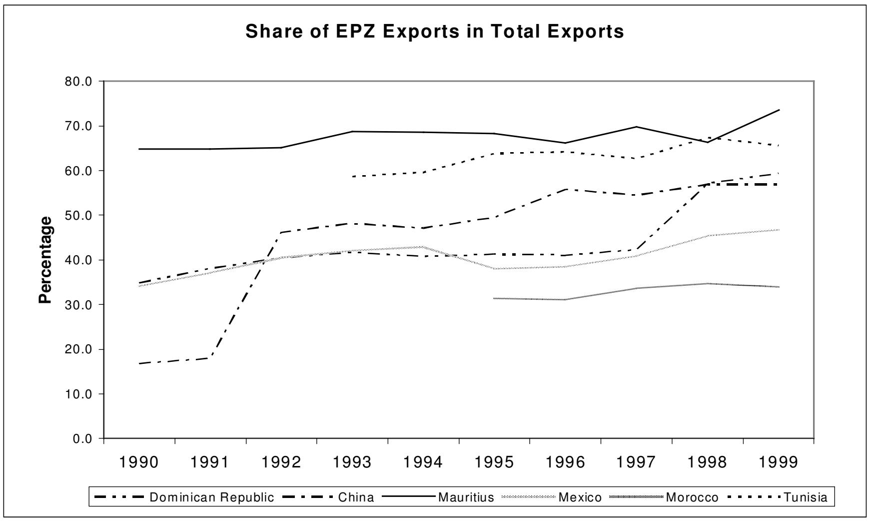
According to Madani (1999), there are four competing views on the role of EPZs in an economy. One considers it as an integral part to further economy wide reforms. EPZs are to have a specific life span, losing their significance as countries implement systemic trade, macroeconomic and exchange rate reforms. A second view sees EPZs in terms of a safety valve. They provide much-needed foreign currency to accommodate import needs for the host nation and create jobs to alleviate national unemployment or under-employment. A third view is that EPZs can be used as laboratories to experiment with market economy, outward oriented policies. Finally, all these views still consider the EPZ as a source of technological transfers and human capital development.

It is also interesting to note that in the past thirty years, EPZs have been implemented at two different development stages. One set of countries (Mauritius, Dominican Republic, China) have reverted to them in the early stages of their industrial development, with the expectation that they provide the "engine of growth" to propel their economies into industrialization. They also sought production and export diversification (see Figure 1). A second set of countries (Tunisia, Malaysia, Indonesia, Honduras) implemented EPZs when they already had a strong industrial production and export sectors.

2. The Economic Argument for EPZs

Here, we will elaborate on the main arguments for the establishment of an EPZ by using economic indicators. This exercise is necessarily a comparative one. The arguments that we will present are not ranked in order of importance because EPZs have been established with one or more of these goals in mind. The success of an EPZ, vis-à-vis the host country, should be examined dynamically. That means that we should take into consideration the stage of development of the EPZ as well as the bargaining power between the host country and the MNE and also the contribution to the objectives aimed at when the relevant zone concerned was set up. However, this analysis is beyond the scope of this paper and will not be pursued further at this stage.

Figure 1: *The Share of EPZ Exports in Total Exports*



Source: Authors' calculations

2.1. Foreign Exchange Earnings Potential

As stated in the previous section, there are static (increased capital and capital goods) and dynamic benefits (technology diffusion, export promotion) from FDI. Whilst the static benefits of FDI are not to be neglected, it is the dynamic benefits from FDI which are most important and which have raised the interest in FDI by many developing countries. We should therefore be looking at the impact that FDI in the maquila sector has had on technology diffusion, which we will do in a later section.

Foreign exchange earnings are one of the main benefits expected from an EPZ. It is argued that EPZs provide foreign exchange earnings that allow low income economies to slacken the foreign exchange constraints regarding import needs for the rest of the economy. For instance in Mauritius, EPZ exports earnings grew from 3 percent of total export earnings in 1971 to 52.6 percent in 1986 and 68.7 percent in 1994[6]. However, this first goal of EPZs – generating foreign exchange for the countries in which they are active – has not been an unequivocal success. While some countries, such as South Korea, have achieved a high level of net exports, others, such as Jamaica, have not been able to close the gap between gross and net exports.

2.2. Attract Foreign Direct Investment

The major benefits that countries derive from FDI in EPZ's can best be viewed as of two types. The first are short-term benefits, such as employment, and foreign exchange earnings and exports, which are the most formal as well as easily quantifiable and therefore the most often studied. The second type is the long-run benefits from EPZ operations, which lead to various indirect and informal externalities primarily through the development of linkages with the domestic economy (e.g. technology transfers). Profitable FDI in a zone represents a showcase for domestic firms and potential entrepreneurs to learn from and copy.

It is quite difficult to estimate the return of FDI in a given location, but we can say that externalities from foreign investment can be both positive and negative. For instance, MNEs' activities induce employment but at the same time can increase pollution levels.

2.3. Technology Transfer and Education Benefits

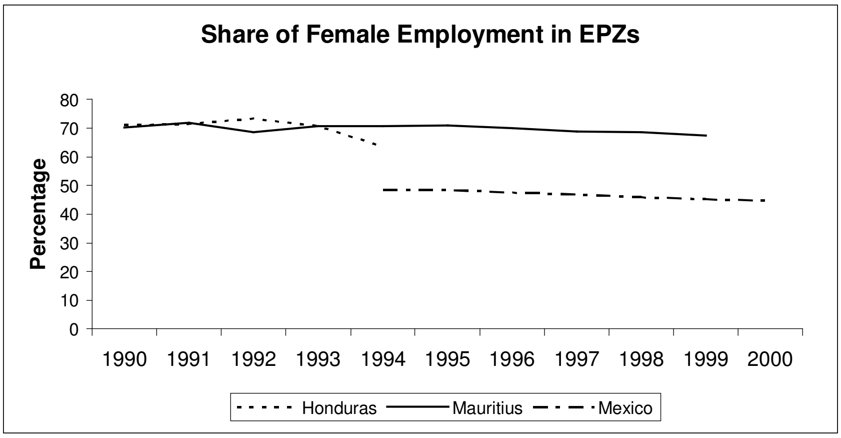
According to Blomström and Kokko (1997), much of the international transfer of technologies is linked to FDI. However, because of its nature, it has been argued that EPZs, investment does not bring the same technology content as traditional FDI. Some of the reasons outlined are a lack of forward and backward linkages with the local economy as well as the low skill assembly type production in EPZs, that leaves little room for technology diffusion. As McIntyre, Narula, Trevino (1996) proposed, this variable should be examined from two angles. The first one is tangible transfers, such as the transfer of capital equipment and spillovers such as the development of auxiliary and support industries. The second one is intangible transfers, such as the transfer of skills.

With regard to technological transfers and spillovers, EPZs are, for the most part, labour-intensive, low-tech assembly firms, with little access to advanced technologies. There is little direct research conducted on technology spillovers from EPZs. Studies such as Globerman (1979) and Nadiri (1991) suggest that spillovers have had a positive effect on host country productivity levels; other studies such as Cantwell (1989) and Haddad and Harrison (1991) suggest that spillovers either are not occurring or have not been beneficial to all industries. Kokko (1992) attempts to resolve this and finds that the extent of spillovers depends on the technology gap between local and foreign firms. According to Kokko, spillovers are most likely to occur where domestic firms have a level of technology similar to that of the MNE and where market conditions encourage competition. He notes also that these conditions are often not met by many EPZs in developing countries.

2.4. Employment Effect on Local and National Economy

Job creation is considered one of the primary goals and one of the most important contributions of any EPZ to the economy. The EPZ is often located in economically depressed areas. According to the Organisation for Economic Co-operation and Development (Basile, 1984), most EPZs have a high rate of labor turnover (from 5 to 10% per month), primarily because of the important reserves of labor that include a very large proportion of female workers who retire young from the job market. Female workers are willing to accept lower wages than their male counterparts (usually 50% lower) and are more disciplined and often show more dexterity for assembly-type jobs. (Johansson Helena, Nilsson Lars 1997) It should be noted, however, that as the EPZ evolves towards more technologically advanced sectors the proportion of the female workers in the total labour force employed tends to decrease significantly (Madani 1999).

Figure 2: *The Share of Female Employment in EPZs*



Source: Authors' calculations.

Because of the low-skill assembly type activities undertaken in EPZs, employment is usually concentrated in the lower end of the skill distribution of a country. This has several implications. On the one hand, it provides employment for those who usually face the most difficulties in labor markets. On the other hand, this low skill labor specialisation has implications for technology spillovers, wages and value added.

2.5. Conclusion

Developing countries need to be clear about the benefits they expect from EPZs. They should also consider the limited impact EPZs have often had with respect to employment, technology transfer, and foreign exchange earnings. Cost/benefit analyses must be dynamic, extending over the life of the EPZ, and should not be treated in isolation but rather as part of a complete government industrial policy (McIntyre, Narula, Trevino 1996).

3. The Impact of EPZ in Mexico's Economy

3.1. Introduction

We now turn to analyse whether the expected benefits from EPZs have materialised in Mexico. To this end we will be looking at the performance of the four main indicators mentioned in the previous sections: employment, foreign exchange earnings potential, FDI and technology diffusion. As already stated, the EPZ industry in Mexico is especially suitable to analysis because of its proximity to the US, which makes it a very good example of the international division of labor, and because of its abundance and quality in data, provided by INEGI, the statistical office of the government of Mexico. Before we analyse the different parameters it would be interesting to briefly introduce the development and current magnitude of the maquila sector in Mexico. Where does the word maquila come from? Maquila is a word of Arab origin and it means the portion of grain, flour or oil that the grinder charged the farmers for grinding its raw material. In its current usage it basically means a production process where the producer does not own part of the inputs, where production is undertaken for others. By 1942 the US had an acute shortage of labor. To counter this the US and Mexican administrations signed several treaties during the next 20 years, known as the "braceros" programs, whereby the US allowed for temporal immigration by Mexican workers to the US. These programs had a pull effect that caused an internal migration of workers to the north of the country, specifically to the border region. In 1964 the "braceros" program was terminated: the US did not renew its working permits for Mexican workers. The border region was plagued by high unemployment and the usual economic and social problems that high unemployment causes, with the aggravation that most of those affected had migrated and were uprooted from their natural surroundings. The Mexican administration then developed a program aimed at attracting US investment to the Mexican side of the border to tackle the problems of unemployment and lack of infrastructure. The maquila sector has developed much since: it can now be found all over the Mexican territory and its production is no longer exclusively for export as it was until 1988.

Table 3: *Output in constant 1988 Mexican pesos (billions)*

Year	Maquila	Manufacturing Exc.-Maquila	Whole Economy
1988	22.4	240.0	683.7
1989	24.9	242.7	727.1
1990	25.3	244.2	763.4
1991	25.3	248.3	794.7
1992	26.6	244.8	818.0
1993	28.4	235.9	836.0
1994	34.5	245.4	892.9
1995	56.4	260.6	891.0
1996	60.6	276.1	905.3
1997	63.9	281.1	933.8
1998	74.7	289.5	982.4

Source: INEGI

However critical some authors may be of the maquila sector in Mexico, very few dispute its dynamism and its crucial role in dampening the adverse economic effects of the 1994-1995 crisis in Mexico (Capdevielle, 2001; Mattar and Hernandez, 2001). Output in the maquila sector has been increasing steadily over the last decade. Tables 3 and 4 show the growth of the maquila sector for most of the nineties. It tripled in ten years. At the same time, manufacturing excluding the maquila sector and total output was also increasing, but not at a similar pace. The maquila sector is only a small percentage in the productive structure of the Mexican economy, but its importance in manufacturing has been increasing steadily.

Table 4: *Output growth (in constant 1988 Mexican pesos)*

Year	Maquila	Manuf. Non-Maquila	Whole Economy
1988	100.0	100.0	100.0
1989	110.9	101.1	106.3
1990	112.8	101.7	111.6
1991	112.9	103.5	116.2
1992	118.4	102.0	119.6
1993	126.8	98.3	122.3
1994	153.7	102.2	130.6
1995	251.5	108.6	130.3
1996	270.3	115.0	132.4
1997	285.0	117.1	136.6
1998	332.9	120.6	143.7

Source: INEGI

After acknowledging the impressive performance in terms of output growth, we now turn to consider what its impact has been on the economic parameters outlined in the previous sections.

3.2. Foreign Exchange Earnings Potential

Output or export performance is not an indicator of the foreign exchange potential of the maquila sector. As several authors have argued (Vidal, 2000; CEPAL, 1998), the maquila sector has a very high import component, using minimal domestic inputs. This implies that as exports of the maquila sector grow, imports will also grow if some switching from imported to domestic inputs does not happen and the foreign exchange earnings potential of the maquila sector will not materialise. As Vidal argues, this switching is not happening and is unlikely to happen because the export capacity of Mexico in the sectors where the maquila sector is most successful is not endogenous; for exports to grow imports will also have to grow. The export performance of Mexico is highly dependent on the international division of production and therefore its growth is very likely to imply a growth in imported inputs also, so that the foreign exchange earnings potential of this type of industry is limited. To be able to assess the foreign exchange earnings of the maquila sector we will have to look at net rather than gross exports. The following tables give us an idea of how much foreign exchange has been earned by the maquila sector.

Net exports (see Table 5) have been increasing at a similar pace to exports: the growth of exports has been accompanied by a correspondent increase in imports, so that although the absolute value of foreign exchange earnings has increased, its share as a percentage of maquila exports has not changed much. In the next table (Table 6) we have estimated the share of imports in total maquila production.

Imports have oscillated between 75% and 85% of total production for the last decade. The rise in imports in production in 1994/1995 could be more the consequence of exchange rate movements than actual changes in volumes

(Table 7). The sharp increase in the value of imports of 1995 could highlight the devaluation of the peso in 1994 and the subsequent slow recovery.

Table 5: *Net Exports of the Maquila Sector (billion US$)*

Year	Net Exports	Exports	Index NE	Index Exports
1991	4.1	15.8	100.0	100.0
1992	4.7	18.7	117.1	118.0
1993	5.4	21.9	133.6	138.0
1994	5.8	26.3	143.3	165.9
1995	4.9	31.1	121.6	196.4
1996	6.4	36.9	158.4	233.2
1997	8.8	45.2	218.1	285.3
1998	10.5	53.1	259.9	335.3
1999	13.4	63.9	331.9	403.3
2000	17.8	79.5	438.4	501.9

Source: INEGI

Table 6: *Imports in the Maquila Sector in current Mexican pesos (million)*

Year	Imports	Production	% Imports in Production
1990	29.0	39.0	74.4%
1991	35.6	47.8	74.4%
1992	43.2	57.9	74.6%
1993	51.4	68.2	75.4%
1994	68.7	88.2	77.9%
1995	163.5	194.1	84.2%
1996	231.5	280.8	82.4%
1997	287.6	357.7	80.4%
1998	390.9	487.7	80.2%
1999	481.1	609.6	78.9%

Source: INEGI

Table 7: *Exchange Rates Mexican Pesos - US$*

Year	Exchange Rate Mex. Pesos per US$
1990	2,840.91
1991	3,020.52
1992	3,095.00
1993	3.12
1994	3.38
1995	6.28
1996	7.60
1997	7.93
1998	9.15
1999	9.56
2000	9.47

Source: www.oanda.com

Capdevielle (2001) argues that most of the value added in the maquila sector is the wage bill. He calculates that only 3% of inputs in the maquila sector are domestic inputs, showing how few links there are between the maquila sector and the rest of the economy. The input composition of production is not only important because of its foreign exchange earnings potential, but it is also an indicator of the capacity of the maquila sector to generate technology spillovers and links with the local economy. The more foreign firms in the maquila sector rely on local content, the more exposed will be local firms to the modes of production and quality standards of foreign firms. Although in absolute numbers net exports has been increasing over time, their share as a percent of exports has remained very low. It would seem that the benefits of foreign exchange earnings of the maquila sector have been hampered by its extensive use of imported products.

3.3. Foreign Direct Investment

The available data on FDI in the maquila sector are very scarce. The share of maquila sector FDI in total FDI has increased from 6% in 1994 to 23% in 2000. The increase is a product of both sluggish FDI inflows in the rest of the economy after the 1994/95 crisis (in table 8 we can see the slump in FDI inflows to the rest of the economy in 1995) and impressive growth in maquila FDI.

Table 8. *Annual FDI Inflows (in current US$ million)*

Year	Maquila	Other Sectors	Total	Share of Maquila FDI in total FDI
1994	895	14,060	14,954	6%
1995	1,366	8,157	9,523	14%
1996	1,417	8,485	9,902	14%
1997	1,680	12,161	13,841	12%
1998	2,111	9,506	11,616	18%
1999	2,778	9,137	11,915	23%
2000	2,983	10,179	13,162	23%

Source: Secretaria de Economia. Direccion General de Inversion Extranjera. Gobierno de Mexico.

FDI inflows have decreased between 1994 and 2000. However, as already stated above, this is the product of the 1994 crisis. If compared to 1995 instead of 1994, total FDI, both in the maquila sector and in other sectors, has grown. The dramatic fall in 1995 could be the result of both cheaper assets (due to a devaluating peso, see Table 7) and decreasing FDI inflows due to investors' lack of confidence in the ability of the Mexican economy to recover quickly. As stated above, FDI has two components that make it interesting for developing countries: as a source of capital, although rather less so because there are other cheaper sources of capital, and technology. The extent to which FDI in the maquila sector is able to narrow the technology gap between Mexico and the US depends amongst other things on the kind of production that is being pursued in the maquila sector. It is certain that the maquila sector was initially aimed at providing employment to Mexican workers who returned after the end of the "bracero" program and lived in the border region. However, many authors argue that it was hoped that with time the type of assembly being undertaken would develop and the technology component would rise, with the maquila sector taking a leading role in the modernisation process of the country.

In the next section we will be looking at the skill composition of the maquila sector and its evolution in the last decade, trying to elucidate whether there has been an upgrading of skills in the labor force or not.

Regarding the origin of FDI in the maquila sector, the next table (Table 9) shows that maquila investment is strongly dominated by the US. One of the reasons is of course its proximity and increasing integration with the Mexican market. Another reason could be the foreign content regulation that rules the maquiladora regime that makes it less attractive for non-US firms to invest in the maquila sector. This could be reinforcing the dependence of the maquila sector on US demand that may be a cause of concern when US demand for the services of the maquila sector decreases, as it is happening currently.

Table 9: *Maquila FDI Origin 2001*

Country	Share
US	86.1%
Japan	4%
Switzerland	3.2%
Netherlands	1.3%
Singapore	1.2%
Spain	0.7%
Finland	0.6%
Others	3.0%

Source: Subsecretaria de Negociaciones Comerciales Internacionales

FDI inflows to the maquila sector have been increasing steadily for the period studied. The benefits derived from it are more evident when compared with the slump of FDI inflows to the rest of the economy in the aftermath of the 1994-1995 economic crisis. It remains to be seen whether FDI inflows benefits have been only in terms of capital or if it has also fostered technology diffusion.

3.4. Unemployment

Another of the benefits that EPZs usually bring (probably the most obvious one) is alleviation of unemployment in economically depressed areas. Because of its assembly type activity it primarily provides employment for those at the lower end of the income distribution – unskilled workers. As already mentioned the maquila sector was initially constrained to the border region with the US that suffered from high unemployment in the mid 1960s. The primary aim of the Mexican government at that time may have been to tackle the mounting unemployment problem. The maquila sector is increasingly prevalent in other parts of the Mexican territory. The share of inland maquila employment in total maquila employment increased from 7% in 1988 to 18.9% in 1997 (CEPAL 1998). The expansion of the maquila sector to other regions probably reflects the fact that the northern region in Mexico is nowadays by far not the poorest nor the region with the most pressing unemployment problem.

In order to be able to compare, before we analyse the evolution of employment in the maquila sector we should look at employment in general. In the following tables (Tables 10 and 11) we can see that from 1988 to 1998 employment grew by almost 7 million people. The largest increases were experienced in building activities, retail, restaurants and hotels and the social and personal services sector. A common characteristic of these three sectors is that they primarily signal employment in the non-tradable sectors. Manufacturing also experienced a sound increase of almost one million employees, and this could be capturing the shift in exports from agriculture and mining to manufactured products.

Table 10: *Employment (in millions)*

Year	Total	Agric.	Mineral	Manuf.	Building	Utilities	Trade	Transport	Finance	Social
1988	24.1	6.3	0.2	3.0	1.9	0.1	3.9	1.3	0.5	6.8
1989	24.8	6.1	0.2	3.2	2.2	0.1	4.1	1.3	0.5	7.0
1990	26.0	6.2	0.2	3.3	2.5	0.1	4.5	1.4	0.5	7.1
1991	26.7	6.2	0.2	3.3	2.7	0.1	4.8	1.5	0.5	7.4
1992	27.2	6.2	0.1	3.4	2.7	0.1	5.0	1.5	0.5	7.6
1993	27.5	6.2	0.1	3.3	2.8	0.1	5.0	1.5	0.5	7.7
1994	28.2	6.3	0.1	3.2	3.1	0.1	5.2	1.6	0.6	8.0
1995	27.3	6.2	0.1	3.1	2.6	0.1	5.2	1.5	0.5	7.9
1996	28.3	6.3	0.1	3.3	3.0	0.2	5.2	1.6	0.6	8.0
1997	29.3	6.1	0.1	3.6	3.4	0.2	5.4	1.7	0.6	8.3
1998	30.6	6.3	0.1	3.8	3.7	0.2	5.6	1.8	0.6	8.5
1999	31.4	6.4	0.1	3.9	3.8	0.2	5.8	1.9	0.6	8.7

Source: INEGI

Table 11: *Employment Index*

Year	Total	Agric.	Mineral	Manuf.	Building	Utilities	Trade	Transport	Finance	Social
1988	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1989	102.9	97.9	94.2	104.4	112.3	102.5	105.8	105.5	101.7	102.2
1990	107.8	99.5	97.3	107.9	130.4	107.0	114.9	113.5	103.3	104.6
1991	111.0	99.3	95.9	109.0	137.5	109.5	121.7	117.2	107.0	108.7
1992	112.8	98.4	81.2	111.4	140.9	110.5	126.9	117.5	108.8	111.0
1993	114.1	99.7	71.5	109.1	146.3	111.3	128.1	118.2	110.5	113.0
1994	117.0	100.9	68.3	106.7	157.4	110.2	132.0	124.6	112.4	116.6
1995	113.6	98.9	67.5	101.1	136.4	112.4	132.2	120.0	110.9	115.8
1996	117.5	100.8	67.5	108.0	155.4	114.1	132.4	128.2	113.5	117.3
1997	121.9	97.7	69.0	117.5	177.7	116.9	137.3	134.1	119.2	120.9
1998	127.3	101.4	70.5	124.3	191.7	121.4	142.4	141.3	120.9	124.9
1999	130.5	102.7	70.5	128.9	197.3	130.5	147.1	146.5	122.2	127.4

Source: INEGI

However, if we divide manufacturing employment in maquila employment and manufacturing excluding the maquila sector the picture that emerges is very different (Table 12). Manufacturing excluding the maquila sector has been almost stagnant between 1988 and 1998, whilst maquila employment has increased from around 300,000 workers in 1988 to almost a million in 1998. It seems that most of the manufacturing employment that has been created in Mexico in these years was in the export processing sector. This should not surprise us, if we bear in mind that the Mexican economy has undergone two major crises in little more than 10 years, which obviously must have had an impact on domestic demand. Furthermore, at the same time the US (the main market of maquila production) was probably experiencing the largest growth cycle in this century, with demand for maquila production increasing every year.

Table 12: *Employment (in millions)*

Year	Total economy	Manufacturing excluding maquila	Maquila	Maquila as a % of manufacturing employment	Maquila as % of total employment
1988	24.1	2.7	0.35	11.5%	1.5%
1989	24.8	2.8	0.41	12.8%	1.6%
1990	26.0	2.8	0.43	13.1%	1.7%
1991	26.7	2.9	0.41	12.5%	1.5%
1992	27.2	2.9	0.48	14.3%	1.8%
1993	27.5	2.8	0.50	15.2%	1.8%
1994	28.2	2.7	0.54	16.7%	1.9%
1995	27.3	2.5	0.60	19.7%	2.2%
1996	28.3	2.6	0.73	22.2%	2.6%
1997	29.3	2.7	0.88	24.7%	3.0%
1998	30.6	2.8	0.98	26.0%	3.2%

Source: INEGI

Maquila employment as a percentage of manufacturing employment has increased from little above 10% in 1988 to 26% by 1998. This is both the result of impressive employment growth in the maquila sector as well as stagnant employment in the manufacturing non-maquila sector. Whilst employment in the manufacturing non-maquila sector actually dropped during the 1994 crisis, maquila employment kept rising during those years. It seems that in terms of employment the maquila sector has brought its promised benefits. However, its share in total employment, although rising, was as little as 3% by 1998. One of the reasons for this unequal performance of the maquila sector and the rest of the manufacturing sector has been explained already, whilst the maquila sector caters to for the demand of the foreign sector, mainly the US market, the manufacturing sector excluding the maquila sector also caters to the Mexican market. The unequal performance of the US economy, growing throughout most of the 1990s, and the Mexican economy, affected by two significant crisis in the 1990s, could well explain a large share of the different performance of the two sectors.

Another likely explanation is that we have Hecksher-Ohlin[7] type effects at work. In 1994 the NAFTA agreement among the US, Mexico and Canada came into effect. It is very likely that labor costs in Mexico are much lower than in the US or Canada, so that Mexico enjoys a comparative advantage in low-skill labor abundant activities. Why is the performance in the non-maquila manufacturing sector of the economy sluggish? As argued by Adrian Wood, 1997, it could well be that Latin American countries do not have a comparative advantage in low-skill labor when compared to other countries (China, India and other Asian countries), so that part of the manufacturing industry is in retrenchment after the lowering of trade barriers.

It would be interesting to know what kind of employment is being created by the maquila sector. If we compare the skill composition of labor in the maquila sector (Table 13) and manufacturing excluding the maquila sector (Table 14) it becomes evident that skill levels in the maquila workforce are much lower than in manufacturing excluding the maquila sector.

Table 13: *Share of Skilled Labor in Total Labor in the Maquila Sector*

Year	Total	Food	Textiles	Wood	Paper	Chem-icals	Mineral no Metal	Basic Metal	Machinery	Others
1988	6.6%	8.9%	4.5%	6.8%	10.9%	7.1%	6.8%	9.9%	6.8%	7.7%
1989	6.8%	10.2%	5.1%	8.0%	13.6%	7.6%	6.5%	10.5%	6.7%	8.1%
1990	7.4%	10.1%	4.9%	8.0%	13.2%	7.2%	5.6%	9.5%	7.9%	7.3%
1991	7.8%	9.4%	4.8%	8.2%	10.4%	7.5%	5.7%	10.5%	8.7%	6.7%
1992	7.8%	9.7%	4.7%	7.9%	10.1%	7.4%	5.3%	9.2%	8.7%	6.3%
1993	7.5%	7.1%	4.5%	7.4%	8.8%	8.0%	5.3%	9.4%	8.6%	6.6%
1994	7.2%	9.4%	4.5%	7.0%	7.1%	7.9%	5.4%	7.0%	8.0%	6.9%
1995	7.1%	7.7%	4.3%	6.5%	5.3%	7.6%	5.7%	6.4%	8.1%	6.8%
1996	7.3%	6.2%	4.5%	6.5%	4.9%	7.8%	6.7%	7.9%	8.5%	6.8%
1997	7.2%	6.0%	4.5%	6.8%	3.9%	8.1%	6.7%	8.9%	8.4%	6.6%
1998	7.2%	7.2%	4.3%	6.3%	4.4%	8.8%	7.1%	10.0%	8.5%	7.0%

Source: INEGI

Table 14: *Share of Skilled Labor in Total Labor in Manufacturing exc. the Maquila Sector*

Year	Total	Food	Textiles	Wood	Paper	Chem-icals	Mineral no Metal	Basic Metal	Machinery	Others
1988	27.2%	29.2%	18.8%	15.8%	35.9%	34.8%	21.9%	28.8%	28.5%	32.4%
1989	27.2%	28.5%	19.1%	15.9%	36.7%	34.2%	22.0%	29.1%	28.5%	32.6%
1990	27.1%	28.6%	19.3%	15.7%	37.6%	33.4%	21.6%	29.5%	27.7%	32.6%
1991	27.3%	28.9%	20.0%	15.6%	39.0%	33.3%	21.7%	29.2%	27.1%	32.8%
1992	27.6%	29.4%	19.7%	16.4%	39.4%	33.5%	19.8%	30.0%	27.5%	34.5%
1993	27.6%	29.9%	19.8%	15.9%	40.2%	33.7%	21.6%	28.4%	26.7%	33.2%
1994	27.5%	29.8%	19.9%	15.9%	41.5%	33.6%	21.3%	28.8%	25.9%	31.8%
1995	28.0%	30.0%	20.0%	15.7%	42.4%	34.3%	22.1%	28.9%	26.4%	32.1%
1996	27.2%	30.1%	18.6%	14.9%	42.5%	33.7%	21.4%	28.9%	25.1%	30.8%
1997	26.7%	30.5%	18.0%	14.1%	42.0%	33.0%	20.7%	28.4%	24.4%	29.5%
1998	26.6%	30.9%	18.2%	13.8%	41.5%	33.3%	20.5%	28.4%	23.7%	30.2%

Source: INEGI

Skill composition in the maquila sector has risen from 6.6% in 1988 to 7.2% in 1998. Most of this increase could be caused by the rise in skilled employment in machinery, by far the most important sector in the maquila sector. Within this group, office/telecom and automotive products make the bulk of maquila production, together with over 60% of total output. Skill composition of the non-maquila sector has gone down from 27.2% in 1988 to 26.6% in 1998. This could hint to a further development of the maquila and manufacturing sectors, that it is those sectors with the lowest skill composition (maquila, textiles, machinery), which seem to have grown most. The skill composition of the maquila sector provides evidence of the kind of production being undertaken in the maquila sector, and the speed at which production processes are being modernised. It does not seem that skill composition is being increased due to new technologies all that fast, if at all in machinery. This, coupled with the high import composition of inputs seems to indicate that the technology diffusion that many expected from the maquila sector is not taking place or only at a very slow pace.

Regarding the gender composition of labor, female labor in manufacturing has risen from 34.8% in 1991 to 37.5% in 2000 (Table 15).

Table 15: *Share of Female Labor in each Sector*

Year	Total	Agro	Mineral	Manuf	Build-ing	Utilities	Trade	Trans-port	Finance	Services
1991	30.4%	12.3%	13.5%	34.8%	2.6%	14.3%	46.9%	8.8%	36.3%	44.9%
1993	30.7%	12.7%	3.5%	33.6%	3.4%	12.5%	47.1%	8.7%	39.2%	45.6%
1995	32.0%	14.4%	12.5%	29.9%	2.8%	15.3%	49.9%	8.6%	37.0%	45.4%
1996	32.5%	15.0%	7.1%	33.6%	2.6%	17.0%	46.5%	8.9%	33.7%	45.8%
1997	33.6%	17.5%	8.6%	35.9%	3.1%	14.0%	49.1%	7.7%	36.9%	44.9%
1998	33.5%	14.5%	7.8%	35.9%	3.1%	15.1%	48.3%	9.1%	36.0%	45.5%
1999	33.3%	14.6%	8.1%	36.3%	1.9%	12.7%	48.4%	10.9%	37.5%	45.3%
2000	34.1%	13.6%	11.6%	37.5%	2.6%	16.6%	48.6%	9.2%	37.4%	46.6%

Source: ENE (Encuesta Nacional de Empleo), Secretaria del Trabajo y Prevision Social

ENE also provides the composition of labor by gender and skill level in the maquila sector (Table 16). ENE's figures differ somewhat from INEGI's figures regarding skill composition, probably reflecting different definitions of skill levels.

Table 16: *Labor Characteristics in the Maquila Sector (in thousands)*

Year	Total Labor	Female Unskilled	Male Unskilled	Skilled	Share Unskilled	Share Female Unskilled	Share Male Unskilled	Share Skilled
1994	583.0	284.0	193.0	106.0	81.8%	48.7%	33.1%	18.2%
1995	648.3	314.2	217.6	116.5	82.0%	48.5%	33.6%	18.0%
1996	753.7	359.0	257.6	137.1	81.8%	47.6%	34.2%	18.2%
1997	903.5	422.9	312.5	168.2	81.4%	46.8%	34.6%	18.6%
1998	1014.0	465.7	357.9	190.4	81.2%	45.9%	35.3%	18.8%
1999	1140.5	515.2	406.5	218.9	80.8%	45.2%	35.6%	19.2%
2000	1285.0	574.1	466.0	244.9	80.9%	44.7%	36.3%	19.1%
2001	1255.9	552.2	454.2	249.5	80.1%	44.0%	36.2%	19.9%

Source: ENE (Encuesta Nacional de Empleo), Secretaria del Trabajo y Prevision Social

As female labor and unskilled labor are usually in the lower end of the wage scale, the gender and skill composition of the maquila sector could well explain the wage differential between the maquila and the non-maquila sector. Whilst this was 4 by 1998 in the maquila sector, it was only 2.8 in the manufacturing non-maquila sector (Tables 17 and 18 below).

By looking at the input and labor composition in the maquila sector and comparing it to the rest of manufacturing it seems that the maquila sector has specialised in low-skill labor intensive activities. Most inputs are imported, neither produced nor purchased locally, and labor is used mainly for assembly-type activities. Although the situation seems to be getting better progressively, it is far from clear that technology diffusion is taking place at all or only at an unsatisfactory pace. In order to be able to assess this better we will be looking at some case studies in the next section.

Table 17: *Constant Wage Ratio Skilled/Unskilled in the Maquila Sector*

Year	Total	Food	Textiles	Wood	Paper	Chem-icals	Mineral no Metal	Basic Metal	Machinery	Others
1988	3.2	2.9	3.3	2.6	3.5	2.7	2.5	2.7	3.3	2.6
1989	3.9	2.8	3.5	3.1	2.8	2.8	2.7	3.4	4.3	2.6
1990	3.5	2.7	3.6	3.2	2.6	2.8	2.9	3.6	3.6	2.6
1991	3.3	3.3	3.8	2.9	2.9	3.1	2.9	3.2	3.3	2.9
1992	3.4	3.1	3.9	3.0	2.2	2.9	2.9	3.0	3.4	3.2
1993	3.6	4.1	4.0	2.9	2.4	3.2	2.8	2.5	3.5	3.4
1994	3.5	3.5	3.8	2.8	2.6	3.4	2.9	3.4	3.4	3.4
1995	3.9	4.2	4.0	3.1	3.2	3.9	3.2	4.0	3.8	4.0
1996	3.9	4.5	3.7	3.2	3.3	3.9	2.9	3.8	3.7	4.4
1997	3.8	4.2	3.4	3.1	3.9	3.9	3.0	3.5	3.6	4.0
1998	4.0	3.8	3.5	3.1	4.1	4.0	3.2	2.7	4.0	4.0

Source: INEGI

Table 18: *Constant Wage Ratio Skilled/Unskilled in Manufacturing Excluding the Maquila Sector*

Year	Total	Food	Textiles	Wood	Paper	Chem-icals	Mineral no Metal	Basic Metal	Machinery	Others
1988	2.2	2.0	1.9	1.9	1.7	1.8	2.7	2.3	2.5	2.9
1989	2.4	2.1	1.9	2.2	1.7	2.0	2.9	2.4	2.7	3.1
1990	2.5	2.3	2.1	2.3	1.8	2.2	3.2	2.6	2.7	3.1
1991	2.5	2.2	2.1	2.2	1.8	2.2	3.3	2.8	2.8	3.1
1992	2.6	2.3	2.2	2.2	1.9	2.3	3.8	2.8	2.7	3.1
1993	2.6	2.4	2.3	2.3	1.9	2.4	3.3	2.8	2.9	3.2
1994	2.7	2.4	2.5	2.4	1.9	2.6	3.3	2.7	2.8	3.4
1995	2.8	2.4	2.4	2.3	1.9	2.6	3.6	2.9	3.0	3.5
1996	2.8	2.5	2.4	2.1	2.0	2.7	3.4	2.9	3.0	3.6
1997	2.8	2.5	2.3	2.1	1.9	2.7	3.3	2.7	3.0	4.0
1998	2.8	2.4	2.3	2.1	1.9	2.6	3.2	2.8	3.0	4.0

Source: INEGI

3.5. Technology Diffusion

As stated above, the benefits from investments in EPZs can be split into static and dynamic benefits. It is beyond the scope of this study to do an exhaustive study of the contribution of the maquila sector in Mexico on technology diffusion. However, reviewing the previous economic indicators and some studies that have been done on the subject we may be able to conclude something on technology diffusion.

First we could reconsider the economic indicators in the previous sections. We saw that imports in the maquila sector have been oscillating between 75% and 85% of production for most of the past decade. The value added in the maquila sector is mostly wages, with Capdevielle (2001) estimating that the local content in production is as little as 3%. This should give us an idea of the degree to which local industry is involved in the production process of the maquila sector.

Furthermore, as its name indicates, the Export Processing Zones are primarily export oriented. Although sales in the country are permitted by the Mexican legislation the literature reviewed agrees that the bulk of maquila production is exported (CEPAL 1998). Since one of the main channels of technology spillovers from foreign investors are its backward and forward linkages and its impact on the market structure of the local industry we can infer that these channels of technology diffusion via FDI are being curtailed by the very nature of the maquila sector.

Another source of spillovers is through training and skill upgrading of labor in the foreign firms that then spread the knowledge in the local economy when taking employment with local firms. It is debatable to which extent the skill upgrading in the local economy is taking place.

We saw in the previous section that the skill composition of the maquila sector is much lower than in the rest of the economy due to its assembly type production. What is even more striking, is the fact that the skill composition of the labor force has hardly experienced any change, although it is true that whilst it has increased marginally the skill composition in the manufacturing sector excluding the maquila sector has decreased marginally. There are no indicators of the mobility of labor from the maquila sector to the local economy.

It is difficult to say from this short analysis whether any spillovers from training of the local workforce are taking place, but we can say with a certain degree of assertiveness that the production being undertaken in the maquila sector has not changed much from 1988 to 1998 or at least it has not needed an upgrading in the skill composition of its labor force.

A CEPAL study in 1998 compares the technology composition of Mexico's exports with exports of other Latin American countries and finds that Mexico has increasingly made inroads in exports of higher technology goods, whilst Central America has specialised in basic manufactures (clothing). However, the papers argues that this does not mean that the technological sophistication of the production in the maquila sector in Mexico is rising, since much of the high technology exports may be just assembly-type productions of higher technology goods, without giving any indication of the sophistication of the production process in the maquila sector. The study argues that the maquila sector in Mexico started with first generation industries: only assembly-type low skill labor intensive production, with very few linkages with the domestic economy. However, currently the most common type of production in the maquila sector encompasses second generation industries, where new technologies are being introduced and where the stages of production being transferred to the maquila sector are increasing, although still showing very little integration with the domestic industry. The study also reports some cases of third generation industries with skill intensive production, where R&D activities are being transferred from the headquarters. These industries still show few linkages with the local economy, although with increasingly important intra-firm clusters. These three types of industries are currently coexisting in the maquila sector, but none of them seems to have many linkages with the local economy. Only through the gradual upgrading of skills and if these workers spread the knowledge to other firms will technology spread. It also argues that the maquila sector in Mexico, as opposed to its counterpart in Central America and the

Dominican Republic, has achieved a higher degree of diversification and is involved in higher stages of the value added chain because of its maturity. The study found evidence of increased productivity and efficiency in the maquila sector. They conclude that although there has been technological progress in the maquila sector, especially in organisation but also in human resources and technical processes, the bulk of the activities are still mainly of assembly type production. There is still primarily unskilled labor intensive production, therefore they conclude that the maquila sector is not apt to induce modernisation of the whole economy. They argue that the maquila sector will not be able to be the engine of sustained and equitable growth, but its contribution so far is positive.

Capdevielle (2001) estimates that only 3% of inputs are domestic. He argues that the level of integration between the maquila sector and the Mexican economy is very low and decreasing. It is true that products being processed in the maquila sector are increasingly complex, but the main activity is still assembly. He says that the maquila sector has been beneficial for employment and foreign exchange earnings, but there has been very little technological upgrading. He implies that the maquila sector has prevented manufacturing from declining even more, but it is not a sustainable source of growth and technological change for the future. A similar argument is advanced by Mattar amd Hernandez, 2001.

Mattar and Hernandez mention that the maquila sector has been growing so fast (when the rest of the economy has suffered the 1994-1995 crisis and again in 1997-1998 a smaller crisis) because it has operated in an extremely flexible environment and because it is highly dependent on US demand. There is already some evidence of declining activity in the maquila sector of Mexico and Central America due to the current US economic downturn. They argue that the maquila sector was the only one that was weakening the economic impact of the crisis during its duration. They also mention that there are hardly any linkages or technology spillovers from the maquila sector to the local economy, therefore they conclude that the growth of the maquila sector will not be sufficient for sustainable growth and technological spillovers.

Carrillo and Hualde (2000) compare the maquila sector in Mexico with its counterparts in Central America and the Dominican Republic and argue that the Mexican sector has undergone a modernisation procedure, its main industries being currently autoparts and electronics, whilst in Central America and the Dominican Republic the sectors are still highly concentrated in clothing. The authors introduce the case of Tijuana, where a cluster of second generation electronics firms has evolved, mainly of Asian origin. Production in these types of firms is more sophisticated and the technologies being implemented are more advanced. There is some need for human capital upgrading and the firms in these types of industries have adopted some of the organisation and production processes from their Asian parent companies. Nevertheless, the authors argue that there are still very few linkages with the domestic industry. They report that Japanese firms often develop whole manufacturing complexes, meaning they develop their own suppliers. At first these suppliers work exclusively with the Japanese firm but they increasingly serve new clients and develop new products. They conclude that although there is evidence that production in the Mexican maquila sector in Mexico is being upgraded and more complex production processes are being undertaken, which require more modern technologies and the upgrading of skills of workers, there are still very few linkages with the domestic economy. It would thus seem that the modernisation of the economy and the technology spillovers that can arise will have to come from the upgrading of human capital that works in the maquila sector that afterwards goes back to work for the local economy.

From the loose analysis of the parameters in the previous sections and the literature reviewed it would seem that there is some evidence of technological upgrading of the production being undertaken in the maquila sector, away from clothing and into electronics and away from first generation to second generation industries. However, the maquila sector still shows very few linkages with the host economies, which could be hindering a faster path of technology upgrading and modernisation of the Mexican economy.

4. Conclusion

In this second part of the paper we intended to analyse the main economic indicators that may be affected by EPZs as well as the impact of EPZs on the modernisation of the host countries taking Mexico as an example. It seems that the maquila sector has been very successful in its aim of creating and alleviating unemployment. Another question which is beyond the scope of this paper is to assess the quality of this employment and the social conditions in which workers live and work. Much has been written about this issue: at this stage it is worth remembering that the maquila sector is creating employment for those at the low end of the skill and income scale in Mexican society. It would be worth asking what would be an alternative scenario, meaning what would these workers be doing in the absence of the maquila sector? It has been less successful in its role as a foreign exchange earnings source. Due to its high import composition, that does not seem to be changing much over time: the potential of the maquila sector in providing for much-needed foreign exchange is very limited. Some scholars (Dussell, 2000) even argue that due to its high import composition the export sector was responsible for the 1994-1995 crisis and it is likely to cause new disequilibria if it continues with its high import component. Where the maquila sector has probably disappointed most is in its role as an engine for the modernisation and growth of the industrial sector in Mexico. Although there is evidence of some modernisation and upgrading of technologies in the maquila sector, it is not clear to what extent this is spreading to the rest of the economy. Due to its high import component and the low skill nature of its work force the activities of the maquila sector are unlikely to change the industrial infrastructure in Mexico. In line with what other authors have argued, we can say that the maquila sector has been successful in its initial aim which was to alleviate unemployment and has been crucial in weakening the devastating impact of the economic crisis in 1994-95. However, if it is to serve as a source of modernisation and technology upgrading of the industrial structure of Mexico in the near future, it will have to change some of its features, like the skill composition of its labor force, given by its mainly assembly-type activities, and it will also have to create more backward (through increasing the production stages being undertaken in Mexico but also by increasingly relying in local suppliers) and forward linkages.

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Notes
1. PhD Student, University of Lyon 2. E-mail: sadni@gate.cnrs.fr
2. Research Assistant, Institute of Development Studies, University of Sussex. E-mail: enriqueb@ids.ac.uk
3. Madani (1999)
4. Rodriguez (1996).
5. Madani (1999)
5. World Bank, Dorsati Madani, "A review of the Role and Impact of EPZ", 1999.
6. ibid.
7. Countries will tend to export goods whose production is intensive in factors with which they are well endowed.

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Monetary Integration in Beautiful Places: Prospects for the Caribbean

Lester Henry[1]
University of the West Indies

Abstract. This paper examines the proposed monetary union among the small open economies of the English speaking Caribbean. First, a brief background description of CARICOM and past efforts at economic cooperation is outlined. Second, the proposed costs and benefits of monetary integration for small economies are examined. In particular, arguments as to why monetary union will not succeed in the region are evaluated. For example, the structure of the economies, and the lack of trade, capital, and labor flows among the islands have been cited as serious drawbacks to integration. It is proposed that many of these arguments are based on a misunderstanding of the economic reality in the region and these authors may be putting the cart before the horse. The option of dollarization is also considered. Finally, a summary and conclusion with recommendations is presented.

1. Introduction

The successful launch of the euro has triggered renewed interest internationally in the economics of monetary integration. Other regions are seeking to emulate the apparent success of the EMU (European Monetary Union) especially since many may have considered it to be impossible a few years ago given the strong nationalist sentiments in countries such as Germany and France. The beautiful islands of the Caribbean have been struggling with this issue ever since pre-independence days that saw a proposal for a "West Indian dollar" to more recent proposals for a single regional currency (Bennett 1990 and Worrell 1992). This paper examines the prospects for monetary integration in the Caribbean Community (CARICOM). In particular, the proposal for a Caribbean Monetary Union (CMU) is evaluated in the context of the criticisms raised by Anthony and Hughes Hallett (2000). The general position taken is that despite the legitimacy of some of these objections there is still scope for monetary integration in the region.

The basic economics of monetary integration and optimal currency areas has become quite standard and can be found in most international economics texts (Schiavo-Campo, 1978, Yarbrough and Yarbrough (1999)). LaFrance and St-Amant (1999) provide a fairly comprehensive review of the recent literature. In perhaps the most comprehensive empirical study to date of the effects of monetary unions, Rose and Engel (2000) compare members of monetary unions with non-members with regard to several important variables, such as the degree of openness and specialization, price and exchange rate integration, business cycle synchronization, and the extent of risk sharing. They conclude that members of currency unions tend to experience more trade, less volatility in exchange rates, and more synchronized business cycles than do countries with their own currency. They admit, however, that the direction of causality still remains open to question since highly integrated economies are likely to form currency unions in the first place.

This leaves unresolved the debate as to whether or not OCA conditions are truly necessary pre-requisites for a successful monetary union. For example, in the case of Mercosur, Ferrari-Filho (2002) argues that the region does not meet the basic criteria of an OCA, and therefore should not create a monetary union. Anthony and Hughes Hallett (2000) come to a similar conclusion in the case of CARICOM. They also reject the idea of endogenization of the OCA criteria in the region since it can be justified only on the grounds of expected increases in intra-industry trade and CARICOM countries lack the industrial diversity for this to apply. On the other hand, there are those like Axline (1979) who argue that the standard OCA conditions should not be expected to apply to developing economies.

This paper seeks to illuminate this debate in the case of the CARICOM. It also represents a contribution to the relatively limited research on Caribbean monetary integration. The works of Bennett (1990, and 1994), Worrell (1992), and the edited volume by Farrell and Worrell (1994) are the main contributions in the 1990s. More recent work on the issue includes the contrasting views of Anthony and Hughes Harllett (2000) and Worrell (2002). The rest of the paper is as follows. Section 2 provides a brief description of CARICOM and reviews past integration efforts in the region. In Section 3 the proposed Caribbean Monetary Union (CMU) is examined with a critical appraisal of some of the arguments against its formation. It has been suggested that the region should abandon the CMU in favour of dollarization. This issue is analysed in Section 4. The final section offers a summary and conclusion.

2. A Brief Background to CARICOM and Efforts at Economic Cooperation

The group of countries that comprises CARICOM includes all of the English-speaking island states in the Caribbean, Belize in Central America, plus Guyana and Suriname on the South American mainland[2]. Its thirteen members vary significantly in geographic size, population, economic structure, and per capita income. For example, in 2000 the Bahamas and Barbados had per capita incomes of US$17,012 and US$15,494 respectively while Guyana and Jamaica had incomes of US$3,963 and US$3,639[3]. The latter two are among the largest members in terms of landmass and population. Tourism is the dominant industry for most, especially the smaller members, while Guyana, Jamaica and Trinidad and Tobago have large mineral deposits. Trinidad and Tobago has the largest economy and accounted for about 75 percent of intra-regional exports in 1998[4].

The first attempt at monetary integration in the Caribbean came with the proposal for a British West Indian dollar in the late 1940s. This came about as it was recognized that a unified currency was of great importance to trade and commerce, and particularly to the successful operation of a customs union. It would also be justified on the grounds that it would lead to a strengthening of the currency and the improvement of credit in the region. The West Indian dollar, however, was only adopted by the Leeward Islands, Windward Islands, Barbados, Trinidad and British Guyana. The exchange value was set at 4.8 West Indian dollars per £1 sterling. Jamaica, the Bahamas, and British Honduras (later to become Belize) did not participate and therefore remained with the £1 sterling at par value.

The actual implementation of the British West Indian dollar did not materialize until January 1948. Issues concerning public debt and power sharing, as it related to the raising of future loans, were not dealt with purposely. It was felt that such matters would be taken up at a comparatively advanced stage of a federation, in which major revenues would be centralized with the federal exchequer central bank). This federation almost became a reality in 1959 but the sudden withdrawal of Jamaica, one of the key states in the group, resulted in its complete collapse. The larger members then proceeded to concentrate fully on gaining their independence from Britain. Jamaica, Trinidad and Tobago, Guyana and Barbados all became independent countries in the 1960s and each established their own currency and central bank. The idea of a politically united Caribbean, or some form of economic cooperation among the islands, however, never went away (Brewster and Thomas 1967).

In 1968 the Caribbean free trade area (CARIFTA) was created. This was supposed to be the first step towards an economic union. The next step was to reach agreement on a common external tariff (CET) thereby establishing a customs union. Without ever adequately dealing with the external economic arrangements, in 1973, CARICOM was established by Barbados, Guyana, Jamaica and Trinidad and later joined by nine other countries. Along with the CET the new agreement provided for "the harmonization of fiscal incentives to industry, double taxation and tax sparing agreements, and the formation of a Caribbean Investment Corporation (CIC), designed to channel equity capital to the less developed countries" (Samuel, 1993, p. 159). So, from its inception, CARICOM was to be the main driving force for the region towards an economic union.

In 1977 an attempt at monetary cooperation was made with the establishment of the CARICOM Multilateral Clearing Facility (CMCF). The stated objectives of the CMCF were to:

(a) "facilitate settlement on a multilateral basis of eligible transactions

(b) promote the use of participants' currencies in settling eligible transactions… and thereby effect economies in the use of their foreign exchange reserves;

(c) promote monetary cooperation among participants and closer relations among banking systems…and thereby contribute to the expansion of trade and economic activity in the CARICOM region."[5]

The system seemed to be achieving its goals in the early stages. Intra-regional trade increased and the credit facility of the CMCF was expanded (Lalta 1993). Signs of trouble began to emerge when one member, Guyana, appeared to be using most of the available credit (Whitehead, 1984). The inability of Guyana, and to a lesser extent Jamaica, to repay their debts ultimately led to the collapse of the system in 1983[6]. By that time there was a general worsening of the economic conditions in the region. Barbados and Trinidad and Tobago, the two main providers of credit to the CMCF, started to go into recession. Guyana and Jamaica continued to experience severe balance of payments difficulties. Lalta (1993) argues that the collapse of the CMCF led to a major decline in intra-regional trade and an exacerbation of the foreign exchange problems for CARICOM members. Regional interest in monetary cooperation waned until the late 1980s. The West Indian Commission Report of 1992 rekindled the debate regarding the need for a deepening of Caribbean integration in general and the establishment of a monetary union in particular[7].

3. Issues for Monetary Integration in CARICOM

Traditional analysis suggests that for a region to be considered an OCA and, therefore, adopt a single currency there should be certain factors in place. These include:

(a) A high degree of openness among member countries.
(b) Some measure of similarity in their economic structures.
(c) Some amount of factor mobility within the region.
(d) A system of fiscal transfers or some form of policy coordination as a substitute.

This set of criteria clearly implies that a fair amount of integration must have already taken place for a monetary union to be viable. This is not the case with CARICOM as members tend to be more open to the United States than among themselves. There has traditionally not been a high degree of factor mobility among the islands. Also, no system of fiscal transfers exists. On these grounds, Anthony and Hughes Hallett (2000) are correct in asserting that the CARICOM region does not qualify as an OCA. Leading regional economists, however, have always acknowledged this and have called for the establishment of a single currency on completely different grounds (for examples, see Bennett 1990, Worrell 1994.) Furthermore, Axline (1979, p. 9) argues that the standard OCA conditions are really only applicable to already industrialized economies. He then suggests that the goal of integration for developing countries may not be the static or dynamic gains associated with the process but to "contribute to a structural transformation of the economy". It is in this sense that the possible endogenization of the OCA criteria may become meaningful to the small dependent and very open economies of CARICOM. Recent developments in the CARICOM region also suggest that a certain level of economic integration has been taking place and the formation of a CMU may result in a deepening of this process.

3.1. Trends in Intra-CARICOM Trade

For historical reasons the export orientation CARICOM countries has traditionally been more toward Europe and North America than with each other. Data from the

1990s confirms that they have tended to a have higher degree of openness with the US, for example, than among each other (See Tables 1 and 2).

Table 1: *Intra-Regional Exports and Imports of CARICOM Countries (% of GDP)*

Country	Year	Exports	Imports	Openness
Antigua and Barbuda	1994	0.8	10.3	11.1
Barbados	1997	5.6	6.9	12.5
Belize	1997	1.4	2.1	3.5
Dominica	1997	12.8	16.6	29.4
Grenada	1998	3.6	19.9	23.5
Guyana	1994	5.9	14.5	20.4
Jamaica	1997	0.7	5.1	5.8
Montserrat	1994	1.1	12.6	13.7
St. Kitts and Nevis	1998	0.4	6.4	6.8
St.Lucia	1998	2.0	13.3	15.3
St. Vincent and the Grenadines	1998	9.1	17.6	26.7
Suriname	1995	2.9	12.0	14.9
Trinidad and Tobago	1997	11.1	1.7	12.8

Source: IMF International Financial Statistics 2002, Caribbean Trade and Investment Report 2000

Table 2: *Exports and Imports of CARICOM countries to the USA (as a percent of GDP)*

Country	Year	Exports	Imports	Openness
Antigua and Barbuda		n.a.	n.a.	n.a.
Barbados	1998	1.4	13.0	4.61
Belize	1997	17.98	32.34	50.32
Dominica	1996	2.25	32.38	34.63
Grenada	1997	2.53	28.97	31.49
Guyana	1998	32.9	37.4	70.3
Jamaica	1998	10.1	29.8	39.9
Montserrat		n.a.	n.a.	n.a.
St. Kitts and Nevis	1997	11.58	40.49	52.07
St.Lucia	1998	1.91	29.96	31.87
St. Vincent and the Grenadines	1997	1.52	32.98	34.50
Suriname	1998	3.26	10.32	13.59
Trinidad and Tobago	1998	14.39	22.17	36.56

Source: IMF International Financial Statistics 2002, IMF Direction of Trade Statistics 1999, CARICOM Secretariat.

Only among some of the smaller OECS members was the degree of openness, in terms of intra-regional imports and exports as a percent of GDP, above 20 percent. The larger economies of Jamaica and Trinidad and Tobago appeared to be relatively closed to the region in comparison to their relationship with the US. Anthony and Hughes Hallett (2000) argue that this may suggest that a currency union would be better off if formed with the US. Intra-CARICOM trade, however, has been growing at a faster rate that extra-regional trade for the past decade.

Recent trends, however, have shown that intra-regional trade has been on the increase. As Figure 1 indicates, intra-CARICOM imports more than doubled from 1990 to 2000, and there was an even larger increase in intra-regional exports. Additionally, "since 1990, the value of intra-regional exports has grown by 8.5 per cent a year on average, compared to -1.1 percent for extra-regional exports"[8]. This growth in regional trade has taken place despite the existence of numerous treaties with North America granting favorable status for Caribbean products. In summary there has been a shift away from the US as the destination for exports for the region. There is still a fairly high dependence, however, on the US as a source of imports.

Figure 1: *CARICOM'S Intra-Regional Trade: Imports and Exports, 1990-2000 (millions of $EC*)*

Source: CARICOM Secretariat (2002)
Note: *S$1=2.70 EC dollars.

3.2. Labor Market Issues

The movement of labor in the region is still restricted despite some positive developments in recent years. The flow of emigrants tends to be from the islands to North America and Britain rather than to other islands. If one takes the issuance of work permits as a guide to labor mobility within the region then it seems clear that labor remains relative immobile (Henry and Downes 1994). Table 3 shows that only the Bahamas imports a fairly high amount of labor from within the region. The region's largest economy, Trinidad and Tobago issued only 97 permits to CARICOM nationals in 1998 as compared with 2,012 issued to non-CARICOM nationals.

Table 3: *Work Permits by Country of Origin*

Country of origin	**CARICOM**			**Non-CARICOM**			**Totals**		
	1993	1998	% Change	1993	1998	% Change	1993	1998	% Change
Bahamas	3084	3919	27.1	2322	2432	4.7	5406	6351	17.5
Barbados	316	340	7.6	717	1183	65.0	1033	1523	47.4
Belize[1]	54	67	24.1	3941	3702	-6.1	3995	3769	-5.7
Jamaica[2]	211	177	-16.1	2375	2482	4.5	2586	2659	2.8
Suriname[3]	1624	540	-66.7	441	2590	487.3	2065	3130	51.6
Trinidad[4]	n.a.	97	n.a.	n.a.	1915	n.a.	n.a.	2012	n.a.

Source: International Labor Organization, 2000.
Notes: 1. Belize's data taken for 1991 & 1995.
2. Jamaica's data taken for 1994 & 1998.
3. Suriname's data taken for 1993 & 1998 and Trinidad & Tobago data taken for 2000 only.

It can be argued, however, that this approach does not capture a significant amount of labor movement that takes place within the region. Very often, low or unskilled workers such as gardeners, maids, and laborers do not acquire the necessary permits when moving from one island to another. Furthermore, in recent years in an attempt to deepen the integration process, most countries now allow university graduates and media personnel to work without the need for permits. That is, labor mobility may be occurring to a greater extent than the recorded statistics indicate. This cannot be verified, due to a lack of primary data.

3.3. Investment: Foreign and Intra-Regional

The financial sector in the region has made some progress toward closer integration in recent years. First, there has been increased cross border ownership of banks and insurance companies. For example, Royal Bank of Trinidad and Tobago (RBTT) has established subsidiaries in eleven (11) territories in the region. Second, there is currently a cross listing of stocks on the regional stock exchanges in Barbados, Jamaica, and Trinidad and Tobago. And third, the intra-regional flow of funds has increased significantly in recent years (see Table 5).

It should be noted that "intra-regional portfolio investment (defined as less than ten per cent shareholding) has not been substantial and a number of reasons can be offered for the lack thereof."[9] Perhaps the most important seems to be the fear associated with investing in weak inconvertible currencies, especially in relation to the floating exchange rate regimes. This is certainly a problem that can be solved by a monetary union. Further, portfolio investment is low because of the underdeveloped nature of the regional capital market; there is a limited range of finance instruments available. It is precisely because of these limitations that Worrell (2002, p.15) asserts "the compelling reason for a currency union in the Caribbean – in preference to individual quasi-currency boards – is to help create a Caribbean capital market of sufficient size for the development of internationally competitive firms." In this regard, the region has seen recent signs of a bond market emerging, with a number of institutions and countries taking part in its development. The speeding up of the implementation of the Single Market and Economy will not doubt encourage more cross listings and greater participation on the part of the public as more information on regional firms becomes available.

Table 4: *FDI inflows to the Caribbean Community (US$million)*

	1992	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Antigua & Barbuda	19.5	15.2	24.7	31.4	19.3	22.9	27.3	36.4	33
Bahamas		42.2	42.9	27	88.2	209.6	146.4	149.1	249.6
Barbados		18.8	25.9	23.5	26.6	29.5	31.5	34.7	38.8
Belize		84.8	127.7	82.7	115.1	249.7	240.2	151.4	76.1
Dominica	25	13.1	22.5	53.9	17.7	21	6.5	17.9	10.8
Grenada	0.5	20.2	19.2	19.9	19.3	33.4	48.5	41.4	35.6
Guyana	37	63.3	46.8	53.4	59.1	52.6	44.2	45.9	67.1
Haiti	0.2	-2.8	0	7.4	4.1	7	10.8	30	
Jamaica	1	139.2	129.7	147.4	183.7	203.3	369.1	523.7	468.4
St. Kitts & Nevis	0.6	13.7	15.3	20.4	35.1	19.6	31.8	57.5	95.6
St. Lucia	9	35.89	33.96	35.42	21.01	51.41	86.04	86.8	27.01
St. Vincent	8	31.3	47.1	30.5	42.5	92.1	88.6	55.9	28.1
Trinidad & Tobago	1	72.6	520.9	295.7	356.3	999.6	31.9	643.3	679.5
Total	111.8	847.5	1056.7	828.6	988	1991.7	1862.8	1874	1809.6

Source: ECLAC (2002) Sub-Regional Headquarters, Port-of-Spain, Trinidad

As Table 4 indicates, the main recipients of FDI have been Jamaica and Trinidad and Tobago, with the latter attracting almost US$1 billion in 1997. Precise data on investment flows between the member countries is not readily available. Recent developments, however, point to a significant increase in intra-regional investment, particularly emanating from firms based in Trinidad and Tobago and Barbados[10].

Trinidad and Tobago based financial institutions have also become an important source of funds for some CARICOM members, precipitating the emergence of the bond market in the region. The most notable development, however, is perhaps the rise in CARICOM investment into the smaller islands of the OECS. Table 5 suggests that these islands are becoming more reliant on intra-regional capital flows than in the past. Furthermore, it is not uncommon today for the large commercial banks of Trinidad and Tobago to finance the borrowing of regional governments.

Table 5: *Carribbean Investments in the OECS 1995, 1997 and 1998*

Caribbean Investment in Receiving Country	**Value EC$'000**		
Year	1995	1997	1998
Antigua and Barbuda	290	22,491	1,500
Dominica	108,787	34,248	1990
Grenada	00	46,180	60,000
St Kitts & Nevis	5,500	11,220	5,900
St Lucia	00	71,561	117,700
Total	114,577	185,700	187,090

Source: Caribbean Trade and Development Report, 2000

It seems clear that a process of financial integration is taking place in the region and this could only be further enhanced with the formation of a CMU.

3.4. The Convergence Criteria

The convergence of the CARICOM economies was supposed to proceed along Maastricht-type criteria. Each member should maintain foreign reserves equivalent to 3 months of imports for a 12-month period and their exchange rate with the US dollar had to be stable for 36 months and the external debt ratio should be maintained at no more than 15 percent of exports. These became known as the “3-12-36-15” criteria [see Kendall 2000]. Considerable doubt has been caste on these eligibility criteria since they were outlined in the Governors Report. In fact, these criteria can turn out to be an obstacle on their own since many countries have struggled to keep up with them. Table 6 shows, using a simple co-efficient of variation approach[11], that while there are signs of convergence in interest rates and unemployment, there is still a fair amount of dispersion among members in key variables such as growth rates and, especially, inflation rates. Kendall (2000) has also shown that the exchange rate requirement is also being left unfulfilled in some countries.

The CARICOM Secretariat (2000, p. 35) concluded that the “economic performance of CARICOM countries are unlikely to converge autonomously at the desired pace to advance in a timely manner the process of creating a monetary union.” They further suggested that more direct coordination of national economic

Table 6: *CARICOM: Dispersion of Economic Performance, 1991-1999 (As represented by the co-efficient of variation for selected variables)*

	1991	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Supplementary Variables									
Growth Rates	2.2	1.6	4.2	1.0	1.6	0.9	0.8	1.0	0.7
Inflation Rates	1.2	1.4	2.0	2.3	2.3	1.5	0.7	1.3	2.3
Unemployment Rate	0.2	0.2	0.3	0.3	0.2	0.1	0.2	0.2	0.2
Fiscal balance Ratio*[12]	-3.3	-1.3	-2.0	-2.1	5.2	-3.7	-0.8	-1.2	-0.8
Interest Rate**	0.56	0.66	0.72	0.60	0.65	0.58	0.50	0.45	0.31
Eligibility Standards									
Import Cover Ratio	0.8	0.6	0.6	0.5	0.6	0.4	0.4	0.4	0.4
Debt Service Ratio	0.7	0.7	0.8	0.7	0.6	0.5	0.6	0.7	0.5
Debt-GDP Ratio***	1.2	1.6	1.4	1.3	1.3	1.0	1.0	1.1	0.9

Source: CARICOM Secretariat (2000, p.34) *Caribbean Trade & Investment Report*

policies was a necessary condition for the establishment of the CMU. More recently, there have been discussions about adjustments to the eligibility criteria but no formal agreement has yet been reached.

Whereas CARICOM countries may not be adhering to the stipulated criteria this does not necessarily mean that the CMU is not feasible. It may simply indicate that the criteria are unrealistic or, perhaps, unnecessary. For example, Dornbusch (1997, p. 221), has argued, in the case of the European Union, that the heavy emphasis on fiscal "criteria lacks a basis once an independent central bank with a precise stability mandate and a no bailout position are in place." That is, there may be other ways of achieving the desired outcome.

3.5. Fiscal Issues

Another drawback cited to the proposed CMU is the absence of a system of fiscal transfers or some form of policy coordination in the region to smooth temporary adjustment in economies hit by large asymmetric shocks. Nicholls (1996) outlined a framework for the pooling of reserves in the region. Since many of the Caribbean islands are exposed to natural disasters, especially hurricanes, and their production is highly specialized this issue is particularly critical.[13] This has been recognized. Hence the CARICOM Counsel on Trade and Economic Development (COTED) has sought to establish a "Development Fund for the purpose of providing financial or technical assistance to disadvantaged countries, regions and sector."[14] The fund is to be financed by contributions of member states plus any other regional or external source approved by the CARICOM Community. Although the members have agreed to this fund none has actually ratified the legislation enabling it to function.

On the other hand, reserve pooling with authority vested in the CMA has also been proposed as a way of attenuating exchange rate shocks (Worrell 1994). This plus the 3-12-36-15 requirements would ensure fiscal and monetary discipline within the group. However, Anthony and Hughes Hallett (2000) doubt that the stability criteria of one year of foreign reserves would be adequate to support the stability of the exchange rate over 3 years, as outlined in the Governors Report. They also question the ability of the debt-service ratio to reveal the underlying fiscal difficulties that a country's government faces. Further, they doubt the adequacy of the eligibility criteria in forcing governments to pursue sustainable fiscal and monetary policy.

The international reserve positions of the larger and more unstable CARICOM members have been improving significantly since the mid-1990s. For example, Trinidad and Tobago's foreign reserves increased from US$783.3 million in 1998 to almost US$2 billion at the end of 2002.[15] Other countries have also shown marked increases in reserves. This has generally resulted from higher oil prices, tighter fiscal controls, either voluntary or IMF-imposed, and other favorable economic developments. The larger the potential pool of reserves in the region, the greater the impact of cooperation and the less chance of currency instability. Williams *et. al.* (2001) have shown that the Eastern Caribbean currency has been of great benefit to the OECS. So there is an available example of what can result from cooperation. The proposed CMA would function in a manner similar to the ECCB (Eastern Caribbean Central Bank), that is, somewhat like a currency board with very strict limits on its ability to expand the money supply.

3.6. The Dynamic Nature of the Asymmetric Incentive Problem

Before 2001, the presence of asymmetric incentives appeared to be a major obstacle to monetary integration in the region. There seemed to be very little incentive for Barbados, Belize, and the OECS to rush into a monetary union with the rest of CARICOM. These countries had already attained macroeconomic stability and had already met the convergence criteria as set out in the Governors Report[16]. The downturn in tourism, however, as a result of the New York attacks has had a tremendous negative impact on some of the smaller economies. For example, in the OECS region, there were falls of 5 percent, 19 percent and 11 percent in stay-over tourists, excursionists and cruise-ship visitors respectively (ECLAC 2002, p.16). St. Lucia and Dominica were particularly affected by the downturn. The macroeconomic stability that was there before has now given way to a crisis situation in some cases.[17] Just prior to these developments, the larger CARICOM states were the ones struggling to attain stability. The important lesson here is that these small states are very vulnerable and being part of a monetary union may provide them with some economic protection.

The asymmetric-incentive problem also manifests itself in the case of Trinidad and Tobago. As noted before, this country dominates CARICOM's intra-regional exports, accounting for 75.2 percent of the 1998 total. This is partly due to the country's competitive exchange rate position. A single currency may erode such a competitive advantage. On the other hand, it could be argued that Trinidad and Tobago as the most dominant member of CARICOM stands to gain more relative to the other members from furthering of the integration process. Besides, if the fact that some countries are better off than others were sufficient to halt the formation of an economic bloc then the EU would not have gotten this far.

Nevertheless, given the strength of the Trinidad and Tobago economy, questions bout the distributional effects and potential distortions must be considered. More specifically, given the lack of diversity in production among the islands, it is unlikely that intra-industry trade will dominate output within CARICOM. This could result in a potential problem for economic integration process. Even if a single currency enhances economies of scale, this may lead only to more inter-industry trade due to greater specialization. This can result in less economic convergence and members can be subject to more asymmetric shocks. In the case of the EU, Hughes Hallett and Piscitelli (2002, p. 91) have argued that "asymmetric transmission of a single monetary policy tends to destabilize the business cycle and put the participating economies out of phase with one another." Also, the EU experience has shown that convergence among countries does not necessarily lead to convergence among regions. The existence of international knowledge spillovers that affect only certain sectors may lead to greater disparities within countries (Giannetti 2002).

Indeed, the manufacturing and industrial base of CARICOM is centered in, if not limited to, Trinidad and Tobago, Jamaica, and to a lesser extent Barbados. A CMU could lead to a concentration of skill and entrepreneurship in these islands. This could also lead to a concentration of capital as firms seek to reap the benefits of external economies.

4. Caribbean or US Dollar?

Given the high degree of openness of CARICOM countries with the US, Anthony and Hughes Harlett (2000, p. 132) have agued that "there is a strong economic (and political) case for using the US dollar as the common currency in the region." They assert that this is the most credible way for the region to be tied to the US dollar – just use it directly. Dollarization would ensure the fiscal and monetary stability that the region is seeking in the first place. Why "rent" stability when you can own it? There will also be no need for a CMA and hence, this would eliminate any scope for discretionary monetary policy. Further, the region generally fits the OCA criteria more so with the US than among themselves. Finally, dollarization will also solve the incentive-asymmetry problem, and will not be objected to by citizens of the region since they clearly have a "revealed preference for the US dollar"(Anthony and Hughes Hallett 2000, p. 135).

The loss of monetary sovereignty entails the loss of seigniorage revenue. This has been cited as a key reason why CARICOM countries may not be willing to forgo their national currencies in favour of single currency or the US dollar. In the Caribbean, however, there is little support for this being a major consideration. This is so, since seigniorage revenue is not significant in the region. As Table 7 indicates,[18] only in Jamaica and Guyana was this form of revenue above 1 percent of GDP for the period 1995-2000. This is not surprising since these two countries experienced large budget deficits, high external debt, inflation, and a depreciating currency during the 1990s. Anthony and Hughes Hallett (2000), compared the potential seigniorage loss with that of the transaction costs saving due to dollarization. They concluded that there may be losses to the region but this could be compensated for with an agreement with the U.S. for re-imbursement of the funds as foreign aid. Of course, this assumes a fair amount of generosity on the part of the U.S. toward the region.

Table 7: *Seigniorage* as a percentage of GDP, Selected CARICOM Countries*

Year	Barbados	Belize	Guyana	Jamaica	Trinidad & Tobago
1995	0.0055	0.0029	0.0169	0.0224	0.0031
1996	0.0040	0.0028	0.0113	0.0152	0.0038
1997	0.0029	0.0026	0.0095	0.0156	0.0038
1998	0.0053	0.0048	0.0102	0.0127	0.0040
1999	0.0063	0.0052	0.0140	0.0141	0.0040
2000	0.0054	0.0052	0.0115	0.0122	0.0036

Notes: *seigniorage= treasury bill rate * currency in circulation

There are reasons other than the loss of seigniorage for CARICOM countries not to adopt the US dollar. Adopting the US dollar, for example, implies the loss of distinction between domestic and external debt (Dornbusch 1997). As Table 8 shows, some CARICOM members have accumulated a significant amount of internal debt. This would be "dollarized" and become part of the overall stock of debt. For example, Jamaica's internal debt, when converted to US dollars, stood at over US$6 billion in 2001. This is an amount in excess of the country's GDP for that year.

Table 8: *Internal Debts of CARICOM Countries in US$ and as a percent of GDP*

Country	Internal Debt (Millions US$)			Internal Debt as a % of GDP		
	1999	2000	2001	1999	2000	2001
Bahamas	1609.9	1600.3	Na	35.1	32.5	
Barbados	1054.3	1102.0	1191.5	42.4	42.4	46.0
Belize	85.8	88	105.7	12.3	11.7	10.7
OECS	Na	Na	Na			
Guyana	230.9	259.9	274.5	39.6	44.4	46.3
Jamaica	4268.5	4121.3	6165.9	64.4	60.0	109.5
Trinidad	1521.8	1548.4	1583.6	23.8	18.9	17.8

Source: Various Central Banks

Barbados and Guyana also have internal debt that is close to half of their GDP. One major implication of this can be a significant downgrading of the country's international credit rating. This will lead to higher borrowing costs. Therefore, assuming that current national debt would be converted to US dollars at prevailing exchange rates, the external debt of Jamaica would double. This fact, along with the loss of seigniorage and monetary control can be strong deterrents to full dollarization.

4. Summary and Conclusions

While it is clear that the CARICOM region does not meet the criteria of an optimal currency area there are still important reasons why the establishment of CMU might be beneficial. First, based on the early experience of the CMCF, there is a chance that a common currency will further boost intra-region trade and investment. Second, a greater capital market can emerge from the union that will allow the development of firms on a scale large enough to compete at the global level. And third, the CMU may reduce the vulnerability faced by the smaller states by providing them with an expanded market in which there are no intra-island currency risks. The option of dollarization has been suggested as an alternative to a CMU. This can be a very costly move, however, since it would involve a complete loss of monetary control, loss of seigniorage revenue, and significant increases in US dollar debts for many CARICOM states.

The resurgence of interest in a common currency came during the late 1980s, a period in which most of the CARICOM members were facing economic hardship. Plans were developed for a monetary union and set forth in the Governors Report in 1992. The CMU was supposed to be in place by the year 2000. There has been such slow progress towards this original goal, however, that many doubt that it will ever happen. This is perhaps due to the shortsightedness on the part of regional leaders. It appears that because some of the countries are doing well on their own at the moment, in terms of reserves, trade, and inflation, they no longer see the urgency for further integration. This is probably the opposite of what should be taking place at the moment.

Notes

1. Lecturer, Department of Economics, University of the West Indies. E-mail: lhenry@fss.uwi.tt
2. For a broader description of the CARICOM see Nicholls et al. (2000).
3. Purchasing Power Parity adjusted per capita income, see United Nations, *Human Development Report 2002*, pp. 190-92.
4. See CARICOM Secretariat (2000) Caribbean Trade and Investment Report, p. 57.
5. See Lalta (1993, p. 184).
6. See Whitehead (1984, p. 4).

7. See The West Indian Commission (1992), *A Time For Action – Report Of The West Indian Commission*.
8. Caribbean Trade and Investment Report 2000.
9. The CARICOM *Trade and Investment Report 2000.*
10. A number of Trinidad based firms now have 40 to 60 percent of their asset in other islands with the region, see Business Guardian, Thursday, April 6, 2002, p. 6.
11. The coefficient of variation has been used as a measure of cross-country variation of economic performance in CARICOM Member States with regard to a representative sample of variables including two of the eligibility criteria (import cover ratio & debt-service ratio). Coefficients, which tend towards zero, are representative of low degrees of dispersion while those, which are tending towards unity of larger are representative of high levels of dispersion (see CARICOM Secretariat, 2000, p. 34).
12. * Overall Fiscal Balance as a percentage of Gross Domestic Product
** Commercial Banks' Weighted Average Loan Rate
*** This is simply a variation of one of the debt service eligibility standard
13. The recent destruction of Montserrat by Volcanic eruption is an appropriate example.
14. COTED, Protocol 2, Article 66.
15. See Central Bank of Trinidad and Tobago (2002).
16. Anthony and Hughes Hallett refer to this situation as a case of the Groucho Marx theorem, i.e. why join a club that would accept me, it must mean that their standard is to low.
17. For 2001 Real GDP growth was –5% for St Lucia, -4% for Dominica, and -3% for Grenada and Barbados (see ECLAC, 2002, p. iii).
18. Following the Bank for International Settlements (1996), Seigniorage is calculated as currency in circulation times the treasury bill rate.

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