Exchange Rate Policy Among Trading Partners: Does it Pay to be Different?

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Statement by Author

Dedication

To my mother, who always stood by my side, my father, who has motivated me in life through words and deeds, and all my family, for supporting me through the years. Most of all, to my wife, who has been a source of comfort, inspiration and, above all, laughter.

My sincerest gratitude also goes to my mentor, Dr. Darryl McLeod, who's vast knowledge in the field and dedication to his students has given me with the insight and tools required for my academic endeavors.

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INTRODUCTION

Monetary regimes have struggled with the question of rules versus discretion in formulating policy from the very origins of the field of international economics. The question regarding the choice between fixed exchange rates and a floating regime has been posed and answered many times, with often conflicting conclusions. Following the dawn of the European Monetary Union and recent crises in major economies such as Argentina and Mexico, economic theory has returned to discussions on optimal monetary regimes. The collapse of the Bretton Woods system, a large number of the major currencies have been allowed to float freely for the longest period of time in economic history. Smaller monetary authorities, however, have adopted fixed exchange rate policies, pegged to major currencies, exemplified by the Exchange Rate Mechanism of the European Monetary System.

The importance of exchange rate policy has been growing with the development of global financial markets. The influence of capital mobility can be seen by the pervasiveness of capital flows in the world economic arena. Spot foreign currency transactions have volumes exceeding US$ 1 trillion per day and, given the free nature of world capital markets, have a significant potential for destabilization. Capital is able to flow more or less freely between countries in the industrialized world and the more advanced developing economies. Despite ongoing debate concerning the need for the control of capital flows, measures that attempt to partly curtail the movement of capital introduce major unintended distortions and are often circumvented. Edwards (1999) analyzes historical data and concludes that controls seldom achieve the desired effect of reducing the volatility of flows. Even successful implementations such as in Chile in 1991 and 1998 have not created significant benefits compared to the increased cost of funds.

Regardless of the success of capital controls, it has become clear that financial flows to countries are a significant aspect of the monetary equation in any large economy and, as such, present great challenges to policymakers. This is evident in the recent crises in Mexico (1994), Brazil (1999), and Argentina (2001), where pressures brought about by the capital account destabilized monetary policy and forced governments to give in and swim with the current of capital markets.

These recent exchange rate developments around the world, in Mercosur in particularly, have been the inspiration for this work. Argentina and Brazil both have a history of significant inflation due to irresponsible and short–sighted monetary policies that were designed to finance government spending. After the debt crisis, both countries tried to address this systemic problem by implementing a number of monetary reforms, ranging from strict price controls to the replacement of their currencies with new denominations. Finally, both nations adopted rigid monetary pegs to the US Dollar, shoring their exchange rate and controlling inflation. Argentina went a bit further than its neighbor and instituted a convertibility plan centered on a currency board. Brazil, instead, decided to follow the path of the less rigid peg with a pre–announced exchange rate band and its Central Bank actively defended this.

Here credibility played a large part. Brazil, following significant pressures from capital flight on its reserves, was forced to devalue its currency and eventually allow it to float freely. The cost of defending the peg was too high and the Central Bank had positioned itself, with sufficient transparency, to provide credibility on an inflation–targeting policy instead. Argentina, however, maintained its hard peg to the US Dollar and saw a significant appreciation of its currency *vis–à–vis* its neighbor, even as it maintained a stable domestic monetary sector. What resulted was a classic description of competitive devaluation. Trade balances shifted strongly to Brazil's favor and Argentina was unable to react. The US Dollar was strong and the country was firmly committed to maintaining the 1–to–1 rate. Production and labor started to shift to Brazil, which assumed economic control over the region to the detriment of Argentina.

The same effect can be seen today in regional monetary unions such as the CFA Franc Union in West Africa. Countries are recognizing the benefits of monetary pegs but are not opting to take this step alone, lobbying hard to ensure that trading partners follow suit. The largest and most successful example of this cooperation is in the European Monetary Union.

The traditional argument for a fixed exchange rate regime, where monetary policy is synchronized with that of a foreign country or group of countries, relies on its stability and credibility. By removing the ability of a government to generate seigniorage revenue, policymakers become divorced from the tools that can be used to hurt themselves and thus have no incentives to cheat. A floating regime, on the other hand, has the benefit of allowing a government to use a powerful tool to affect economic performance. An effective monetary policy must be used to adjust to shocks and positively affect growth and unemployment, increasing welfare. The debate can be traced back to Friedman (1953) and Mundell's work on Optimal Currency Areas (1960, 1961a, 1961b, 1963), and has been developed substantially into many areas, including Game Theory and micro–foundations.

A large body of work has argued that a major issue to be considered when electing an exchange rate regime is the transmission of economic disturbances across nations. The existence of spillovers from foreign nations' macroeconomic and trade policies means that uncoordinated policies are likely to lead to inefficient outcomes compared to what would otherwise be reachable with coordination. This follows from pioneering work by Hamada (1976), which showed that since two governments have, by definition, different objective functions, policymaking becomes a non–cooperative game and there are likely to be gains from coordination.

However, with the increasingly interdependent nature of national economies came a game–theoretic approach to examining the welfare effects of monetary policy in the context of growth. This discussion follows closely that presented by Canzoneri and Henderson (1991) where the authors lay out the different strategies available to players when setting monetary policy and in light of macroeconomic interdependence. It also takes from Corsetti and Pesenti (2000 and 2001) where the authors develop a baseline macroeconomic model for interdependent economies and analyze the welfare effects of monetary and fiscal policy choices. This paper builds on their conclusion that outside extreme cases of either zero or complete pass–through, countries can gain from engaging in cooperative agreements. *De facto* cooperation, in the form of similarity in monetary policies regardless of any formal mechanism, will benefit a developing economy.

The topic of monetary cooperation necessitates a discussion about commitment and much has been said about the time inconsistency problem and successful commitment technologies necessary to establish a credible cooperative arrangement. The exhaustive treatment of the topic permits us to point to the existing literature for any questions regarding incentives to cheat and focus instead on the comparison of the successful implementation of monetary policies in light of choices made by trading partners. The discussion thus necessarily gravitates towards the symmetry of the players' monetary stance, both as they relate to each other and to the rest of the world, where the shocks are generated.

This symmetry is manifested in the choice of exchange rate regime and monetary policy in each country, and the effects such a choice may have on growth. Monetary policy choices are not independent of the rest of the world. Specifically, the choice of fixing the exchange rate in the context of the model suffers from critical assumptions which oversimplify the case. Not all targets are alike, especially since international effects occur through trade and in reality countries are not always able to follow an optimal policy. This paper argues that the choice of exchange rate regime depends not only on the comparison between rules and discretion, but also on whether trading partners are making similar decisions.

When analyzing the effect of this "similarity" in monetary policies, the discussion begins with the standard literature and a 2–country world. An interesting result of this model is that it provides a solution where different monetary policy choices are equivalent. We then introduce a third, large country and the choice between monetary regimes is analyzed in terms of its effect on the welfare function of the small players. Here the choice in the target of a peg becomes important. For example, to the extent that countries choose to peg themselves to the US dollar without consideration for the US's reaction to shocks, it is possible that the country will reach a point inferior to the Nash equilibrium and thus higher inflation and unemployment. At the very least they will reach a non–efficient solution. If these nations choose instead to follow a country or set of countries who are symmetrically exposed to the same exogenous shocks, they will then able to achieve a *de facto* coordination of monetary policy and thus the Pareto–efficient solution, as per the standard model.

In other words, when shocks are symmetric countries can use either floating or fixed rate regimes to reach the Nash equilibrium. If the choice is made to fix, however, the exchange rate should be fixed to a country that faces similar shocks (symmetric), otherwise it is best to float. If the neighboring country changes its exchange rate regime, our country may find it optimal to fix or float depending on the preferences of the home country and the pattern of productivity shocks. In this paper we introduce a complication to this bilateral exchange rate story, reflecting the fact that each country trades with many others and may be slow to change its exchange rate regime in response to policy changes by trading partners.

Our new benchmark case is a situation where two countries have a monetary peg to the currency of a third (large) country. Then, due to a change in government preferences (new weights in the loss function) or an exogenous shock, one of the two smaller countries lets its currency float against the third country. The remaining small (home) country then has two choices: remain fixed to the third country or float its currency as well. The country may choose to remain fixed either because it wants to retain the stability benefits of pegging or because it believes its small partner country will reverse itself and return to a peg.

The consequences of choosing to remain pegged (choosing to be "different") are explored in this paper. Certainly the pegged regime may be undermined. The floating small country may exploit its floating rate to gain a competitive advantage either *vis–à–vis* the large country or the home small country. In this case the choice of exchange rate regime matters as it dictates monetary policy, but the choices of others matter as well. Taking into account the choices of third countries gives a more complete characterization of the consequences of a given exchange rate regime, but it is an aspect often ignored in theoretical models and in empirical studies of exchange rate policy. This paper explores how the choice to be "different" can matter in theory and tests this proposition empirically.

To do this, we begin by constructing a regional Similarity Index that measures relative changes in monetary and exchange rate regimes. Does policy synchronization pay? If so, with whom: global trading partners, geographic neighbors or capital market competitors? The divergence in exchange rate regimes suffered by Mercosur in the late 1990s, in particular that between Argentina and Brazil after 1998, is the case in point. But the same model could be applied to the ECU countries in the early 1990s following the German unification shock. Is a country bound by the degree of similarity of its economy as to this choice? The case of the EU is especially relevant here as ascension requires a high degree of macroeconomic harmonization. Can countries that choose to unilaterally link themselves to the US dollar benefit from its stability in light of asymmetric shocks? Do the stability benefits that come with dollarization outweigh any potential pro–cyclical monetary shocks?

These questions are addressed using a subset of large developing countries in order to gain a preliminary answer. Finally these results are generalized to a broader set of countries and performance indicators. Do monetary or exchange rate regime changes work better when regional partners change together? Is macroeconomic synchronization a key requirement in monetary policy coordination? Or do regime–switchers gain from independence? Is the experience of these independent regime–switchers measurably different from followers or from countries whose regime is abandoned by their neighbors? A game–theoretic approach is used to analyze the theoretical benefits of policy coordination in light of economic interdependence.

A corollary from this discussion is whether asymmetric monetary reactions between similar countries present a significant obstacle to stability and growth, or do the benefits outweigh the costs? The base source of data on regime similarity will be the IMF's Annual Report on Exchange Rate Arrangements and Restrictions and its

Direction of Trade Statistics. The expanded dataset is based on the dataset made available by Ghosh, et al. (2003).

Chapter 1

A Review of the Literature

Recent work on exchange rate choice and monetary interdependence has tended to gravitate towards an examination of the effects of exchange rate pass–through using microeconomic methods. This "New Open Economy Macroeconomics" is derived from a need to reach a greater degree of fidelity between theory and observed results, something that was lacking in previous Mundell–Fleming models. This movement, however, has not yet provided concrete tools for decision–makers leading some authors to attempt to bridge the gap between the micro–foundations approach and the more tractable general macro models.[1] This paper attempts to focus on more empirically relevant results by using a smaller, though somewhat more arbitrary model to examine the choice of monetary policy in large developing economies.

While great strides have been made in the theoretical realm, empirical work on policy interdependence has been inconclusive and incomplete. Some of the most recent work in this field includes Edwards and Yeyati (2003), where the authors analyze the impact of exchange rate regime choice on the country's ability to withstand terms of trade shocks. The authors use a sample of annual observations for 183 countries over the 1974-2000 period, and using a long–run GDP growth equation while controlling for other factors, find that economies with flexible exchange rates grow more rapidly that those with fixed regimes of the order of 0.66 and 0.85 percent per year. The authors also find that countries with more rigid exchange rate systems are twice as susceptible to terms of trade shocks than countries with flexible regimes.

This paper takes a similar approach, using a standard growth model with monetary interdependence to test the proposition that countries with a higher degree of similarity in monetary policy will perform better.

The literature on exchange rate choice incorporates many fields of economics,

[1]See Corsetti and Pesenti (1997).

from Optimum Currency Area (OCA) theory, to the "New Open Economy Macroeconomics", and including Macroeconomic Interdependence and Game Theory. The vastness of the body of work requires a brief summary of the literature and the implications for the field of Development Economics. For a more complete survey, however, we direct the reader to Cortinhas (2002), Horvath and Komarek (2002), and Lane (1999).

This chapter is organized into 3 sections: (1) Optimum Currency Area Theory; (2) "New Open Economy Macroeconomics"; (3) Monetary Interdependence and Game Theory. Each section also includes a summary of empirical studies related to that topic and references to any existing surveys for further granularity.

Optimum Currency Areas

The debate on exchange rate choice can be traced back to Friedman (1953) and Mundell's work on Optimal Currency Areas (1960, 1961a, 1961b, 1963). Friedman argued for the enhanced flexibility of relative prices afforded by flexible exchange–rates in a world where nominal goods prices adjust slowly. According to Friedman, because of this price rigidity, the only instrument capable of preventing a surge in inflation or unemployment is a flexible exchange rate. Relative price movements act to absorb some of the changes in demand that would have to be met by changes in quantities produced under fixed exchange–rate regimes, thus partly insulating a country from foreign demand shocks.

A more formal definition of Optimum Currency Areas (OCA) is presented in Mundell's work (1960, 1961a, 1961b, 1963) where he explored the role of capital mobility in the choice of exchange rate regimes. Mundell defined optimum currency areas as any area with internal factor mobility and external factor immobility. According to Mundell, the source of shocks, whether monetary or real, together with capital and other factor mobility and the relative size of countries are the main determinants of whether fixed or floating exchange rates are preferable. Mundell's original argument was that a common currency system was preferred if the impact of output disturbances on particular areas was similar. If disturbances are asymmetric, on the other hand, the necessary adjustment in relative prices to restore equilibrium could be achieved either through exchange rates or through high wage flexibility and/or high labour mobility.

A number of criticisms emerged challenging the assumptions of Mundell's work. Some include a critique of the means of adjustment, information, downward wage rigidity, political cycles, and others. The more serious challenges include Mundell's implicit assumption of a stable and downward sloping Phillips curve as well as the Lucas critique. More recent work also points out that in the long run, devaluation is likely to lead to inflationary pressures through import cost increase and wage increases.

While the early work on OCA theory centered on the choice of exchange rate regimes, that focus was lost in the 1970s and 1980s. In two later works (1973a, 1973b), Mundell changed his arguments about the optimum currency area, creating a second OCA model. Under the new rationale, countries can gain better allocation of capital if they can adopt a common currency under a common central bank without substantial change in their purchasing parities. Mundell postulated that this will remove exchange rate uncertainty and improve asset diversification. In addition, foreign reserves have to increase less than proportionally to the size of the economy, and the costs of absorbing asymmetric shocks would be spread over time.

Extensions of OCA theory

A number of papers have attempted to extend the classic theory of Optimum Currency Areas. Notably, Ingram (in Kawai (1987)) argued that capital flows smooth asymmetric shocks (which cause an imbalance in bilateral trade) in countries that have highly integrated financial markets. McKinnon (1963) argued that the benefits of flexible exchange rates are lower in countries with higher "openness" to the world because exchange rate variations will have no impact on terms of trade and real wages. Kenen (1969) suggests that higher product diversification lowers the extent of asymmetric shocks.

Empirical studies on OCA

Early studies on this matter focused on the correlation across countries of relative prices (as measured by the variability of real exchange rates or real share prices) or on output movements (as measured by their nominal or real GDP's) and argued that countries which tended to move together on those variables had relatively symmetrical shocks.

These approaches have, however, encountered criticism[2] since correlation of relative prices or output reflect the influence of both disturbances and responses, that is, if relative prices or output move together in two regions it may reflect symmetric disturbances or rapid symmetric responses.

Bayoumi and Eichengreen (1992) found a significant difference in the symmetry of shocks between core and periphery EU countries using the VAR approach, though other techniques result in varied results. Schelkle (2001) builds on these results to conclude that the original work on OCAs is not able to explain observed results. Since then, several empirical studies have attempted to isolate disturbances from other components of output (and/or relative price) movements.

For a good survey of the existing OCA literature, see Horvath and Komarek (2002).

New Open Economy Macroeconomics

There have been significant efforts in the last few years in developing a new model for open–economy analysis that will offer a superior alternative to the Mundell–Fleming model widely used as a theoretical reference in policy circles. The recent work has focused on introducing nominal rigidities and market imperfections into a dynamic general equilibrium model with well–specified microfoundations. Key to this effort is implementing imperfect competition for many reasons. Equilibrium prices set

[2]Bayoumi and Eichengreen (1992).

above marginal cost rationalize demand–determined output in the short run. Also, monopoly power allows the analysis of pricing decisions explicitly, and with monopolies, equilibrium production is below the social optimum, which can be corrected by monetary policy intervention.

The precursor of this new literature is the work by Obstfeld and Rogoff (1995), though the work by Svensson and van Wijnbergen (1989) went a long way in placing sticky–price models—with solid microfoundations and a firm intertemporal setting—at the center of the discussion. Subsequent work has attempted to endogenize the production side.[3]

Corsetti and Pesenti (1997) develop a choice–theoretic model suitable that attempts to allow for welfare analyses of the international transmission of monetary and fiscal policies. They consider the impact of unanticipated monetary and fiscal policy shocks on output, consumption, and welfare. The authors defend the "textbook" approach and the use of the classic Mundell–Fleming–Dornbush model by stating that 'microeconomic correctness' is of second–order importance:

> *Ad–hoc* models are typically presented in the literature as stylized approximations of more complex analyses. Despite their acknowledged arbitrariness, small, easily managed, 'tractable' models are useful to focus on empirically relevant issues, without resorting to the cumbersome analytical apparatus often associated with rigorously 'micro–founded' theories.[4]

With this in mind, the authors attempt to create, with a stylized model, the relevancy of recent directions of research for policy purposes.

Kimball (1995) discusses the reasons why price stickiness is emphasized as the locus of nominal rigidities. Hau (2000) departs from this and proposes a model where prices are flexible but nominal wages are set. In this scenario, both labor and product markets are monopolistic and, facing a constant elasticity of demand, firms set prices at a fixed markup over wages. This causes optimal prices to remain fixed in the

[3]Krugman (1995) provides a good summary of the issues covered in this new research.

[4]Corsetti and Pesenti (1997) p.1.

short run and the factor market rigidities produce the same transmission effect across borders as the domestic price rigidities in the *Redux* model.[5]

Staggered price setting is an alternative method of introducing price stickiness while permitting smooth price adjustment. This means that each firm must consider past and future pricing decisions of other firms in its pricing decision. Calvo (1983) assumes that each firm's opportunity to adjusts its price is stochastic, meaning that at each period a fixed proportion adjust prices.

Kollmann (1997) calibrates a model with both sticky prices and wages, comparing them to Calvo–type rules. He finds that Calvo's adjustments rules are a better match to the high serial correlation observed between nominal and real exchange rates and the price level adjustment. Kollmann's rules perform better in matching the correlations of output with other macroeconomic variables. He concludes that the responsiveness and persistence of prices depend on both their sensitivity to costs and the costs' sensitivity to output.[6]

Additional work on modeling price rigidity and micro–effects can be found in Betts and Devereux (2000) as well as Hau (1996).

Monetary Interdependence and Policy Coordination

The first generation of models to describe monetary policy coordination were introduced by Hamada (1974, 1979), Oudiz, et al. (1984), and Canzoneri and Gray (1985). These game–theoretic models provided a theoretical foundation for policy coordination, but also found that the gains from coordination were quantitatively small.

Hamada (1976) pioneered the study of the interdependent and strategic nature of monetary policies by directly applying the monetary approach to the balance of payments. He sets up a multi–country game where each nation attempts to maximize an objective function while considering the monetary policy choices in other countries. He concludes that since two governments have, by definition, different objective

[5]Obstfeld and Rogoff (1995).

[6]Other notable works on price staggering mechanisms are found in Chari, Kehoe and McGrattan (1997), Andersen (1998), and Bergin and Feenstra (2000).

functions, policymaking becomes a non–cooperative game and there are likely to be gains from coordination.

Oudiz, et al. (1984) considers each country's goals in evaluating the potential benefits of policy coordination on economic welfare. The authors attempt to measure the magnitude of the gains from coordination by applying both the Japanese Economic Planning Agency model and the Federal Reserve Board's Multicountry model as what they call "true" models of the world, and focus on policy coordination among West Germany, Japan, and the United States. They compare the resulting equilibria when each country's macroeconomic authority pursues a Nash strategy and a cooperative strategy. Their work concludes that, while the gains from coordination are present, they appear to be small.

> It does not appear that cooperation among the leading three economies could be the decisive factor in world recovery.[7]

Canzoneri and Gray (1985) examine the strategies available to each of two structurally identical countries in response to an exogenous shock common to both players. They attempt to explain the inefficiencies in Nash solutions, as well as how to reach pareto–superior results in light of the difficulties in implementing cooperative agreements. The authors, emphasizing their methodology, conclude that the preferred strategy will depend largely on the form of the welfare function and on the extreme symmetry imposed on the model.

Canzoneri and Henderson (1991) describe different strategies available to players when setting monetary policy and in light of macroeconomic interdependence. They show that policies defined as Fixed Exchange–Rate Leadership—where one country commits itself to match its monetary policy with that of the leader—leads to solutions whose efficiency—measured as welfare loss—depends largely on the symmetry of the players and of the disturbances affecting them. To the degree that this symmetry holds, the fixed exchange–rate leadership equilibrium will be the same as the

[7]Oudiz, et all (1984) p.5.

cooperative solution, where the two players are able to internalize the externalities and attain pareto–efficiency.

This is conceptually easy to grasp. If two countries are symmetrical, are faced with the same shocks, and answer in the same way to these shocks, they are in effect behaving as one country which sets optimal policy given a disturbance, or as two countries which coordinate to mitigate any negative externalities. But it is also conceptually obvious that this depends on the symmetry of the game.

Corsetti and Pesenti (2001), in parallel, lay the groundwork for the relationship between exchange–rate pass–through and the gains from cooperation.

Loisel and Martin (2000) argued that countries are interconnected mainly via trade linkages, which in the presence of price rigidities means that a devaluation brings a short term competitive advantage to the country that devalues and therefore increases the cost for trade partners not to devalue. The existence of these spillovers naturally leads to the issue of cooperation and coordination. By internalizing the externalities caused by trade linkages, governments are better able to contain a crisis or, in the context of growth, choose a monetary policy which maximizes welfare.

Obstfeld and Rogoff (1998), following modifications proposed in Corsetti and Pesenti (1997), use a stochastic version of Obstfeld and Rogoff (1995) where risk, in addition to having an effect on short–term interest rates and asset prices, impacts international trade flows and expected output through the price–setting decisions of individual producers. The authors also show how exchange risk affects the level of the exchange rate, an innovation that goes beyond the relationship between risk and the return to speculation. They further suggest that fluctuations in the level of risk premium may be a very significant source of volatility in exchange rates.

Obstfeld and Rogoff (2002) and Corsetti and Pesenti (2000, 2001) introduced a new (second) generation of policy coordination models based on New–Keynesian theory which incorporate nominal price inertia (in some form), monopolistic competition, and optimizing households. The tractability of this "Workhorse Model" is gained by three strategic assumptions:

- the current account is balanced
- constant expenditure shares
- a log specification of the utility of money.

Corsetti and Pesenti (2000, 2001) develop a baseline macroeconomic model for interdependent economies and analyze the welfare effects of monetary and fiscal policy choices. Corsetti and Pesenti (2001) lay the groundwork for the relationship between exchange–rate pass–through and the gains from cooperation. The authors conclude that outside extreme cases of either zero or complete pass–through, countries can significantly gain from engaging in cooperative agreements.[8] Betts and Devereux (2000) study a non–stochastic environment and the effect of different degrees of pass–through on exchange rate dynamics.

However, both Obstfeld and Rogoff (2002) and Corsetti and Pesenti (2001) found that there is no need for coordination in the Workhorse Model. Both extended the Workhorse Model in ways that would provide a role for policy coordination. Corsetti and Pesenti's (2001) extension allowed exporters to partially index their prices to exchange rate movements, while Obstfeld and Rogoff's (2002) extension created a role for international risk sharing. Obstfeld and Rogoff (2002) calibrated their model and found that the gains from coordination were second order when compared to the gains from simply reacting to shocks in a sensible way at the national level (as in a Nash solution). Their finding is reminiscent of the conclusions in McKibbin's (1997) survey of the first generation models; in fact, McKibbin reports that the same conclusion has attained the status of a folk theorem in the literature on first generation models.

Canzoneri, et al. (2002) compare the first and second generation macroeconomic interdependence models as they relate to the old Chicago School arguments and recent

[8] Additional work that explores the polar cases of nominal rigidities include: Benigno and Benigno (2001) and Obstfeld and Rogoff (1995, 2000a, 2000b), who focus on the PCP case. Bacchetta and Van Wincoop (2000), Chari, Kehoe and McGrattan (2000), and Duarte and Stockman (2001), who focus on the LCP case. Corsetti, Pesenti, Roubini and Tille (2000), Devereux and Engel (2000), and Tille (2001), who compare PCP and LCP allocations. Devereux, Engel and Tille (1999), who consider the interdependence between a country with zero pass–through and a country with complete pass–through.

empirical work on productivity and theoretical work on closed economy models.[9] The authors conclude that, despite the strong policy spillovers in consumption, there appears to be no need for policy coordination because central banks are able to achieve flex–price outcome in the Nash solution. They show that, since the flex–price outcome is the optimum in the model, the Cooperative and Nash solutions are equivalent.

However, Canzoneri and Minford's (1988) analysis of the structure of first generation models suggested that the gains from coordination in those models must necessarily be small.

Empirical studies

Edwards (1999) argues that despite ongoing debate concerning the need for the control of capital flows, measures that attempt to partly curtail the movement of capital introduce major unintended distortions and are often circumvented. He analyzes historical data and concludes that controls seldom achieve the desired effect of reducing the volatility of flows. Even successful implementations such as in Chile in 1991 and 1998 have not created significant benefits compared to the increased cost of funds.

McKibbin (1997) presents a good survey of the literature on Monetary Policy Interdependence as well as empirical studies.

[9]The three main assumptions of the "Workhorse Model" create an extremely simple theory of exchange rate determination embodied in the model (the exchange rate just depends on the ratio of home and foreign money supplies), resulting in limited macroeconomic interdependence.

Chapter 2

The Model

The model assumes a world of only two countries, home and foreign (denoted by an asterisk). Each country specializes in the production of one good and outputs are the same size when measured in the same good. The variables represent deviations from zero–disturbance equilibrium values and are expressed as logarithms with the exception of interest rates.

2.1 Behavioral Relations

Output (y, y^*) is an increasing function of employment (n, n^*) and a decreasing function of a world productivity disturbance (x'):

$$y = (1 - \alpha)\, n - x \tag{2.1}$$

$$y^* = (1 - \alpha)\, n^* - x^*, \tag{2.2}$$

where α is the coefficient of the production function and $0 < \alpha < 1$. The productivity disturbance is *i.i.d.* with zero mean.

Profit maximizing requires that firms employ labor up to the point where real wages equal the marginal product of labor:

$$w - p = -\alpha n - x' \tag{2.3}$$

$$w^* - p^* = -\alpha n^* - x'. \tag{2.4}$$

The left hand side of equations (2.3) and (2.4) are real wages. Marginal products fall when employment increases and when x' is positive. Workers and firms enter into wage contracts before markets meet each period, specifying nominal wages and employment rules. Nominal wages are set so that employments are at their full–employment levels of zero($\bar{n} = \bar{n}^* = 0$) in the absence of disturbances. Workers agree to supply whatever quantity of labor firms want at the nominal wages specified in the contracts. CPIs (q, q^*) are weighted averages of the prices of home and foreign goods:

$$q = (1-\beta)\, p + \beta\,(e + p^*) = p + \beta z \tag{2.5}$$

$$q^* = \beta\,(p - e) + (1-\beta)\, p^* = p^* - \beta z, \tag{2.6}$$

where the exchange rate (e) is the home currency price of the foreign currency. β is the average propensity to import, where $0 < \beta < 1$, and is the same in both countries. The relative price of the foreign good or real exchange rate (z) is:

$$z = e + p^* - p. \tag{2.7}$$

The market equilibrium conditions for the two goods are:

$$y = \delta z + (1-\beta)\,\varepsilon y + \beta\varepsilon y^* - (1-\beta)\,\nu r - \beta\nu r^* - s' \tag{2.8}$$

$$y = -\delta z + \beta\varepsilon y + (1-\beta)\,\varepsilon y^* - \beta\nu r - (1-\beta)\,\nu r^* - s'. \tag{2.9}$$

Demand for both goods increase with outputs in both countries. Residents of each country increase spending by the same fraction ($0 < \varepsilon < 1$) of increases in output. β is equal to the average propensity to import in each country. Demands for both goods decrease with expected real interest rates (r, r^*). Residents of each country decrease spending by the same amount (ν) for each percentage point increase in the expected real interest rate available to them. Expected interest rates are:

$$r = i - E_t\left[q_{t+1}\right] + q \tag{2.10}$$

$$r^* = i^* - E_t\left[q^*_{t+1}\right] + q^*, \tag{2.11}$$

where i, i^* are the nominal interest rates on home and foreign currency bonds, respectively and where E_t is the expectation operator evaluated at time t. Both depreciation of the real exchange rate and positive demand disturbances (s') shift world demand from foreign goods to home goods. Two assumptions are made here:

1. trade is balanced in zero–disturbance equilibrium

2. the response of home spending measured in home goods to changes in the real exchange rate is the same as the response of foreign spending measured in foreign goods.

These two assumptions are sufficient to ensure that the responses of demands for the two goods to changes in the real exchange rate are equal and with opposite signs. The demand disturbance is *i.i.d.* and has zero mean. The money market equilibria are simple Cambridge equations:

$$m = p + y \tag{2.12}$$

$$m^* = p^* + y^*. \tag{2.13}$$

Private agents regard bonds denominated in the two currencies as perfect substitutes, so they will hold positive amounts of both kinds of bonds only when their expected returns measured in a common currency are equal:

$$i = i^* + E_t\left[e_{t+1}\right] - e. \tag{2.14}$$

2.2 Nominal Wage Determination

Expressions for employment in terms of money supplies and nominal wages can be obtained using the money market equilibrium conditions (2.12) and (2.13); y and y^* are eliminated using (2.1) and (2.2), and p and p^* are eliminated using expressions implied by (2.3) and (2.4):

$$p = w + \alpha n + x' \tag{2.15}$$

$$p^* = w^* + \alpha n^* + x'. \tag{2.16}$$

The expressions for employment are:

$$n = m - w \tag{2.17}$$

$$n^* = m^* - w^*. \tag{2.18}$$

It is assumed that firms in both countries choose nominal wages to minimize the expected squared deviations of employment from their full–employment values of zero:

$$\left(\frac{1}{2}\right) E_{t-1}\left[n_t^2\right] = \frac{1}{2} E_{t-1}\left[(m-w)_t^2\right] \tag{2.19}$$

$$\left(\frac{1}{2}\right) E_{t-1}\left[n_t^{*^2}\right] = \frac{1}{2} E_{t-1}\left[(m^*-w^*)_t^2\right]. \tag{2.20}$$

According to the first order conditions, these expected squared deviations are minimized by setting the expected values of employment equal to their full–employment values. This is the same as setting nominal wages equal to expected money supplies:

$$\frac{\partial \left(\frac{1}{2}\right) n_{-1}^2}{\partial w} = w - m_{-1} = 0 \tag{2.21}$$

$$\frac{\partial \left(\frac{1}{2}\right) n_{-1}^{*^2}}{\partial w^*} = w^* - m_{-1}^* = 0. \tag{2.22}$$

2.3 Derivation of the Reduced Forms

The reduced forms for employment can be derived by substituting equations (2.21) and (2.22) into equations (2.17) and (2.18):

$$n = m - E_{t-1}\left[m_t\right] \tag{2.23}$$

$$n^* = m^* - E_{t-1}\left[m_t^*\right]. \tag{2.24}$$

To derive the reduced forms for the CPIs requires a bit more effort. According to (2.5) and (2.6), each country's CPI can be written as a function of that country's product price and the real exchange rate. The reduced forms for product prices are obtained by substituting (2.21) and (2.23) into (2.15) and (2.22) and (2.24) into (2.16):

$$p = E_{t-1}\left[m_t\right] + \alpha\left(m - E_{t-1}\left[m_t\right]\right) + x' = m + (\alpha - 1)\left(m - E_{t-1}\left[m_t\right]\right) + x' \tag{2.25}$$

$$p^* = E_{t-1}\left[m_t^*\right] + \alpha\left(m^* - E_{t-1}\left[m_t^*\right]\right) + x' = m^* + (\alpha - 1)\left(m^* - E_{t-1}\left[m_t^*\right]\right) + x'. \tag{2.26}$$

Several steps are required to obtain the reduced form for the real exchange rate. Subtracting (2.9) from (2.8) and rearranging yields the condition that the difference between the excess demand for the home good and the excess demand for the foreign good must be equal to zero:

$$-\left[1-(1-2\beta)\,\varepsilon\right](y-y^*)+2\delta z-(1-2\beta)\,\nu\,(r-r^*)+2s'=0. \tag{2.27}$$

Subtracting (2.11) from (2.10) and making use of (2.5), (2.6), (2.7), and (2.14) yields the condition that the real interest differential in favor of the home country must equal a constant times the expected rate of real depreciation of the home currency:

$$r-r^*=(1-2\beta)\left(E_t\left[z_{t+1}\right]-z\right). \tag{2.28}$$

Substituting (2.28) into (2.27), collecting terms and eliminating $y-y^*$ using (2.1), (2.2), (2.23), and (2.24) yields an expression for the real exchange rate:

$$z=\xi\gamma\,(1-\alpha)\left[\left(m-E_{t-1}\left[m_t\right]\right)-\left(m^*-E_{t-1}\left[m_t^*\right]\right)\right]+\zeta\gamma E_t\left[z_{t+1}\right]-2\gamma s' \tag{2.29}$$

$$\xi=1-(1-2\beta)\,\varepsilon,\qquad \zeta=(1-2\beta)^2\,\nu,\qquad \gamma=\frac{1}{\left[2\delta+(1-2\beta)^2\,\nu\right]},$$

since $0<\beta$, $\varepsilon<1$, ξ must be positive. In order to determine $E_t\left[z_{t+1}\right]$, the following assumption is made: if private agents expect the real exchange rate to increase or decrease without limit even though no fundamental determinant is causing this to do so, the path of the expected real exchange rate is said to be a *speculative bubble.* It is assumed that there are no speculative bubbles. In this model this means that $E_t\left[z_{t+1}\right]=0$. The expected values of all future disturbances based on today's information are zero, and expected real exchange rates based on this period's information are independent of expected future money supplies because expected nominal wages and output prices are perfectly flexible. Under the assumption of no speculative bubbles, the reduced form for the real exchange rate is equation (2.29) with $E_t\left[z_{t+1}\right]=0$:

$$z=\xi\gamma\,(1-\alpha)\left[\left(m-E_{t-1}\left[m_t\right]\right)-\left(m^*-E_{t-1}\left[m_t^*\right]\right)\right]-2\gamma s'. \tag{2.30}$$

The reduced forms for CPIs are obtained by substituting the reduced forms for product prices, (2.25) and (2.26) and the real exchange rate, (2.30), into (2.5) and (2.6):

$$q=m+(\rho+\alpha-1)\left(m-E_{t-1}\left[m_t\right]\right)-\rho\left(m^*-E_{t-1}\left[m_t^*\right]\right)+x'-2\beta\gamma s' \tag{2.31}$$

$$q^* = m^* - \rho\left(m - E_{t-1}\left[m_t\right]\right) + \left(\rho + \alpha - 1\right)\left(m^* - E_{t-1}\left[m_t^*\right]\right) + x' + 2\beta\gamma s' \tag{2.32}$$

$$\rho = \beta\xi\gamma\left(1 - \alpha\right).$$

The reduced form for the nominal exchange rate is derived by substituting the definition of the real exchange rate, (2.7), into the reduced form for the real exchange rate, (2.30), and eliminating product prices using (2.25) and (2.26), yielding:

$$e = \left(m - m^*\right) + \left(\xi\gamma - 1\right)\left(1 - \alpha\right)\left[\left(m - E_{t-1}\left[m_t\right]\right) - \left(m^* - E_{t-1}\left[m_t^*\right]\right)\right] - 2\gamma s'. \tag{2.33}$$

In order to simplify the reduced forms, it is assumed that wage setters expect money supplies to be zero ($E_{t-1}\left[m_t\right] = E_{t-1}\left[m_t^*\right] = 0$). Also assume that there are no conflicts between policymakers and private agents and that the policymakers want employment and CPI to equal zero, minimizing the loss function. Thus policymakers have every reason to choose zero money supplies if disturbances take on their expected values. It can be shown that wage setters set expected money supplies to zero if they believe that policymakers are behaving as Nash players. Simplifying the reduced forms for employment, CPIs, and the real and nominal exchange rates while imposing the assumption that expected money supplies are zero yields:

$$n = m \tag{2.34}$$

$$n^* = m^* \tag{2.35}$$

$$\sqrt{\eta q} = m - 2\theta m^* + x - s \tag{2.36}$$

$$\sqrt{\eta q^*} = -2\theta m + m^* + x + s \tag{2.37}$$

$$z = \xi\gamma\left(1 - \alpha\right)\left(m - m^*\right) - \left(\frac{1}{\beta\sqrt{\eta}}\right)s \tag{2.38}$$

$$e = \left[\alpha + \xi\gamma\left(1 - \alpha\right)\right]\left(m - m^*\right) - \left(\frac{1}{\beta\sqrt{\eta}}\right)s \tag{2.39}$$

$$\sqrt{\eta} = \frac{1}{\rho + \alpha} \qquad x = \sqrt{\eta}x' \qquad 0 < \theta = \frac{1}{2}\sqrt{\eta}\rho < \frac{1}{2} \qquad s = 2\sqrt{\eta}\beta\gamma s',$$

where ξ and γ are defined following equation (2.29) and ρ is defined following equation (2.32).

2.4 Reduced Forms

As shown above, an increase in each country's money supply raises employment in the country but not abroad, shown by (2.34) and (2.35). Equations (2.1), (2.2), (2.15), and (2.16), with given wages, show that nominal income changes also raises each country's employment. Since money demand depends only on each country's nominal income, changes in each country's money supply lead to changes in its nominal income and employment.

An increase in the home money supply raises CPI at home and lowers CPI abroad, shown by (2.36) and (2.37). Since domestic inflation is a function of both home output inflation and foreign output inflation, from (2.5) and (2.6), if the home money supply increases, the price of home output rises and the real exchange rate rises, shown in equation (2.38). This is conditional on equations (2.27) and (2.28).

2.5 Preferences of Policymakers

Policymakers face the following loss functions:

$$L = \frac{1}{2}\left[\sigma n^2 + \eta\left(q - E_{t-1}\left[q_t\right]\right)^2\right] \tag{2.40}$$

$$L^* = \frac{1}{2}\left[\sigma {n^*}^2 + \eta\left(q^* - E_{t-1}\left[q_t^*\right]\right)^2\right]. \tag{2.41}$$

The losses of the policymakers rise with squared deviations of employment from their full–employment values of zero. The losses of the policymakers also rise with squared changes in CPIs, whether such changes are anticipated or not. The ratio of the loss from a CPI change to the loss from an employment deviation of the same size (σ/η) is the same in the two countries. It is assumed that $E_{t-1}\left[q_t\right] = E_{t-1}\left[q_t^*\right] = 0$, so the levels of CPIs are the respective inflation rates. Substituting the reduced forms for n, q, n^*, and q^* into the loss functions yields expressions for losses in terms of the two money supplies and the disturbances:

$$L = \frac{1}{2}\left(\sigma n^2 + \eta q^2\right) = \frac{1}{2}\left[\sigma m^2 + \left(m - 2\theta m^* + x - s\right)^2\right] \tag{2.42}$$

$$L^* = \frac{1}{2}\left(\sigma n^{*^2} + \eta q^{*^2}\right) = \frac{1}{2}\left[\sigma m^{*^2} + (-2\theta m + m^* + x + s)^2\right]. \tag{2.43}$$

A quick glance at equations (2.42) and (2.43) makes it clear that in the absence of disturbances there will be no policy conflict: If there are no disturbances ($x = s = 0$), setting actual money supplies at zero ($m = m^* = 0$) yields full employment ($n = n^* = 0$) and zero CPI inflation ($q = q^* = 0$), thus zero loss for both countries.

Chapter 3
Welfare Analysis

The purpose of this chapter is to describe the method used for comparing the welfare effects of policy choices in response to an exogenous disturbance in a model of monetary interdependence, described in Chapter 2. The material presented here is meant as a background to the material introduced in the next chapter, were we depart from the existing literature and describe an ulterior possibility. This chapter is divided into two parts. The first develops a very specific example of monetary interdependence, following directly from the assumptions made in Chapter 2. The second presents a general model and the possible variations in the reaction functions, which we are then able to correspond to empirical tests. In both sections we begin with a description of the target for policymakers as a function of unemployment and inflation and develop Reaction Functions.

3.1 A Symmetric Disturbance

In order to give a more complete example of the interaction between the two countries, the first section examines the specific case of an exogenous world productivity disturbance and the equilibria under two alternative policy strategies: a non–cooperative policy and a fixed exchange rate leadership policy.[1] Perhaps the most telling result of this model is the equivalency of the results of the Fixed Exchange Rate game and that of the Cooperative game, despite the significant differences in the rules of each. Because of this conclusion, there is no *a priori* judgment on the rules versus discretion debate. Furthermore, given the extensive body of work regarding coordination efforts and the equivalency stated above, we do not discuss the implementation of coordination agreements. Instead, when required, we assume that all coordination

[1] In addition to these two policy choices, Canzoneri and Henderson (1991) present the Stackelberg and the cooperative solutions, as well as solutions under an asymmetric disturbance.

solutions are fully feasible and enforceable. This example follows directly from the assumptions made in Chapter 2.

3.1.1 Welfare loss function

In order to discuss the effects of any policy choice, we must first describe the purpose of these policies. In stabilization and development theory, the goal of policymakers is in welfare improvement, generally described as sustainable economic growth in real terms. In other words, decision–making agents aim to achieve and maintain full employment without compromising domestic price stability. Any deviation from the desired goals is considered a welfare loss. This goal can be restated mathematically as a welfare objective function of the general form:[2]

$$L = a_1 (u - u_e)^2 + a_2 (p - p_e)^2 ,$$

where “L” represents welfare loss, “u” is the unemployment rate, and “p” represents inflation. The “e” subscript indicates desired levels.

Objective functions of this type (quadratic) are the simplest and most widely used objective functions when evaluating macroeconomic policies, and has the benefits of being both intuitive and tractable. Functions of this form, however, have some significant drawbacks. According to Mayer (2002), the four main criticisms of this type of loss function are:

1. A quadratic function omits the higher moments of the variances of output and inflation.[3]
2. Deviations above and below the target are assigned equal weights.
3. The quadratic form has no *a priori* justification beyond its tractability.
4. Both $u < u_e$ and $p < p_e$ are treated as losses.

More complex objective functions exist and can be incorporated into the model. The additional insight gained from doing so, however, does not impact the theoretical

[2]Pearce (1999).
[3]See Cecchetti (2000).

conclusions of this work, though it becomes more important in empirical tests. Having defined a target welfare loss function, we now derive Reaction Functions and the resulting equilibria from an exogenous shock under different policy strategies.

3.1.2 A productivity shock

An exogenous productivity disturbance affects all nations in the same way, in contrast to a demand shift which would affect each nation in equal, but opposite directions. In the example below we will show the effect of a negative productivity disturbance, defined as $x > 0$. Other forms of shocks can be analyzed using the general form of the model, described in Section 3.2.

Prior to any monetary adjustments, the productivity shock will impact each country's loss function by increasing domestic inflation (q, q^*), though it will have no effect on employment (n, n^*).

As employment is determined by nominal income variations in the model, any impact of the productivity shock can be analyzed in terms of changes in output and output price. A negative exogenous shock lowers output as shown in equations (2.1) and (2.2). The decrease in output is offset by an equal increase in output price, shown by (2.15) and (2.16). Because nominal income does not change, employment is unaffected prior to any monetary adjustments. Given the constant level of employment and the decrease in labor's marginal productivity, the necessary increase in output prices translates into higher domestic CPI inflation.

Since the countries are affected symmetrically by the disturbance, output levels fall by the same amount and excess demand remains at zero, according to equation (2.27). Equal real interest rate increases ensure equilibrium in the goods markets and consequently, there is no change in nominal or real exchange rates.

The positive rate of inflation creates a stabilization game where each country has an incentive to pursue contractionary monetary policy in order to lower inflation and to minimize welfare losses.[4] The ensuing changes in the exchange rates, however,

[4]According to the terminology of Drazen (2000), this is an example of *strategic complements.*

create a negative external effect on the neighbor, spurring further exchange rate appreciations and the classic competitive devaluation problem (in this example we have a competitive appreciation problem though it is trivial to see that a positive productivity shock would have the opposite effect.) This case is illustrated in Figure 3.1.

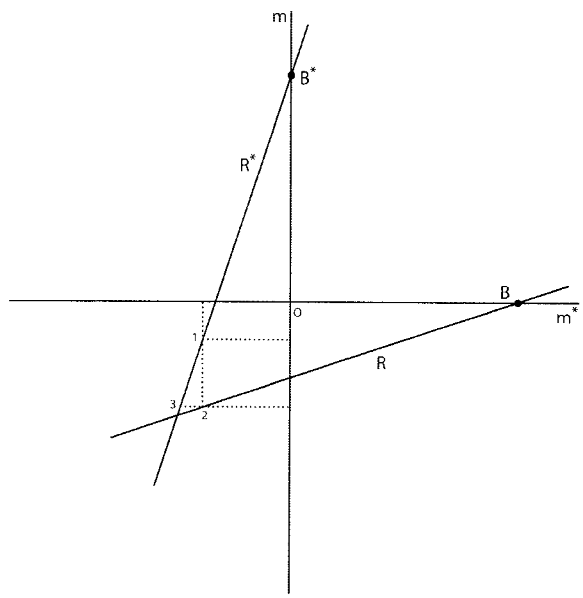

Figure 3.1: *Stabilization game under a symmetric productivity disturbance*

3.1.3 The Nash–Cournot non–cooperative solution

The non–cooperative equilibrium is a natural choice to begin this analysis. In order to define the Nash–Cournot equilibrium, we must first derive reaction functions for each country. A country's Reaction Function (R) is the locus of points showing the level of money supply adjustment (m) required to minimize the country's loss function, given the other country's choice in money supply (m^*).

$$\frac{\partial L}{\partial m} = (1+\sigma)\, m - 2\theta m^* + x \tag{3.1}$$

$$\frac{\partial L^*}{\partial m^*} = (1+\sigma)\, m^* - 2\theta m + x. \tag{3.2}$$

Negatively sloped reaction functions, where an increase in one country's instrument induces the other country to decrease its policy instrument, are cases of *strategic substitutes.*

Solving the first–order condition for each country's instrument provides us with reaction functions:

$$m = \left[\frac{2\theta}{1+\sigma}\right] m^* - \left[\frac{1}{1+\sigma}\right] x \tag{3.3}$$

$$m^* = \left[\frac{2\theta}{1+\sigma}\right] m - \left[\frac{1}{1+\sigma}\right] x, \tag{3.4}$$

where the slope of the reaction functions are < 1.

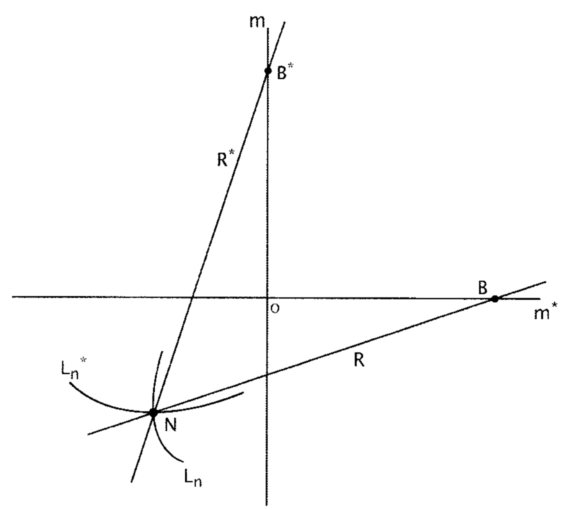

Figure 3.2: *The Nash–Cournot non–cooperative equilibrium*

In order to solve for the values of m and m^* which correspond to the Nash–Cournot equilibrium, we must find the point where the reaction functions intersect ($m = m^*$). Using this condition in equation (3.3) yields the equilibrium money supply (m_N):

$$m_N = m_N^* = x\mu_N = -\frac{x}{1 - 2\theta + \sigma} < 0. \tag{3.5}$$

Using (3.5) in equations (2.42) and (2.43) yields losses at equilibrium:

$$L_N = L_N^* = x^2 l_N = \frac{x^2\left(\frac{1}{2}\right)\sigma\,(1+\sigma)}{(1 - 2\sigma + \sigma)^2}. \tag{3.6}$$

The welfare loss functions, given by equations (2.42) and (2.43), are equations for loss ellipses which show the pairs of m and m^* consistent with given values of welfare loss, L and L^*. Each country has an optimum solution, or bliss point (B), where its loss is zero. In order to reach the bliss point, the country must chose $m = 0$ in order to maintain full–employment, and require that $m^* > 0$ so as to offset the effect of the productivity shock through the real exchange rate. Each country's bliss point loss L_B is derived by setting its money supply equal to zero. Using equations (3.3) and (3.4) yields the home country's bliss point in terms of the foreign country's money supply:

$$m^* = \frac{x}{2\theta} > 0. \tag{3.7}$$

The converse is true for the foreign country's bliss point:

$$m = \frac{x}{2\theta} > 0. \tag{3.8}$$

Using equation (2.42):

$$L_B = L_B^* = 0. \tag{3.9}$$

Again it is important to note that m_N and m_N^* are < 0 and the bliss–point monetary adjustment is zero. Note also that the partial derivative of each country's loss function with respect to the other's instrument is < 0, so that an increase in each country's money supply lowers the loss in the other country.

$$\frac{\partial L}{\partial m^*} = 2\theta\left(2\theta m^* - m - x\right), \tag{3.10}$$

and

$$\frac{\partial L^*}{\partial m} = 2\theta\left(2\theta m - m^* - x\right). \tag{3.11}$$

Substituting (3.5) into (3.10) and (3.11):

$$\left[\frac{\partial L}{\partial m^*}\right]_N = \left[\frac{\partial L^*}{\partial m}\right]_N = \frac{-x\sigma 2\theta}{1 - 2\theta + \sigma} < 0. \tag{3.12}$$

It is now possible to show the slopes of the loss ellipses with respect to the m^*–axis:

$$\left[\frac{dm}{dm^*}\right]_{L,N} = -\frac{\left[\frac{\partial L}{\partial m^*}\right]_N}{\left[\frac{\partial L}{\partial m}\right]_N} = \infty, \tag{3.13}$$

and,

$$\left[\frac{dm}{dm^*}\right]_{L^*,N} = -\frac{\left[\frac{\partial L^*}{\partial m^*}\right]_N}{\left[\frac{\partial L^*}{\partial m}\right]_N} = 0. \tag{3.14}$$

Pareto–efficiency The slopes of indifference curves on the Nash–Cournot equilibrium indicate that the solution is clearly Pareto inefficient: it is possible for either nation to improve their losses without a detrimental impact on their neighbor's welfare function. The set of solutions which are Pareto–superior to the Nash–Cournot equilibrium is the *lens* defined as the intersecting area between the loss ellipses L_N and L_N^* and their respective Bliss points. In this context, a Stackelberg solution, as well as Fixed Exchange Rate and Cooperative solutions all dominate the Nash–Cournot equilibrium.[5]

A Pareto–efficient solution is reached when the indifference curves are tangent:

$$\left[\frac{dm}{dm^*}\right]_{L,N} = \left[\frac{dm}{dm^*}\right]_{L^*,N} \tag{3.15}$$

The locus of Pareto efficient equilibria is represented by a "contract curve".

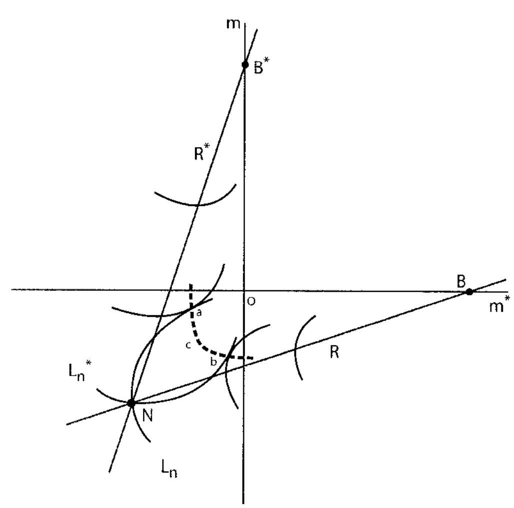

Figure 3.3: *Contract curve* $\widehat{acb}$

3.1.4 Fixed exchange rate leadership

The solution above implies that each nation still possesses the ability to conduct monetary policy and react to changes in the trading partner's conduct. However, on

[5]Canzoneri and Henderson (1991) provides an excellent analysis of each solution.

many occasions in recent history, a country has opted to forego monetary autonomy and peg their currency to another. This choice is known as Fixed Exchange Rate Leadership, where one country chooses to match changes in the other nation's monetary policy in order to maintain the pre–determined level of the exchange rate. Under this choice we have a very surprising result: the solution to the two country game is Pareto–efficient and equivalent to that of the Cooperative equilibrium, despite having very different rules.

This is conceptually easy to grasp. If two countries are symmetrical, are faced with the same shocks, and answer in the same way to these shocks, they are in effect behaving as one country which sets optimal policy given a disturbance, or as two countries which achieve a *de facto* coordination of monetary policy and thus the Pareto–efficient solution that is otherwise only reachable through policy coordination. But it is also conceptually obvious that this depends on the symmetry of the game.

The home policy maker, in deciding to be an exchange rate follower, now has a reaction function with slope=1 and passing through the origin. The money supplies are governed by two conditions:

$$\left[\frac{\partial L^*}{\partial m^*}\right] + \left[\frac{\partial L^*}{\partial m}\right]\left[\frac{dm}{dm^*}\right]_R \tag{3.16}$$

$$\xi\gamma\left(1-\alpha\right)\left(m^* - m\right) = 0. \tag{3.17}$$

Which can be rewritten as:

$$\left[\frac{dm^*}{dm}\right]_{L^*} = \frac{2\theta\left(m^* - 2\theta m + x\right)}{\left(1+\sigma\right)m^* - 2\theta m + x} = 1 = \left[\frac{dm^*}{dm}\right]_R \tag{3.18}$$

$$m = m^*. \tag{3.19}$$

(3.18) requires that the slope of the leader's loss ellipse be equal to the follower's reaction function R. (3.19) requires that the follower must maintain its commitment. Solving for the money supplies yields:

$$m = m^* = x\mu = xk\mu^N \tag{3.20}$$

where:

$$k = \frac{\left(1-2\theta\right)\left(1-2\theta+\sigma\right)}{\left(1-2\theta\right)^2 + \sigma} < 1.$$

The losses can then be computed:

$$L = L^* = x^2 l = \frac{x^2 \left(\frac{1}{2}\right) \sigma (1 + \sigma)}{1 - 2\theta^2 + \sigma}. \tag{3.21}$$

Note that because $k < 1$, monetary adjustment is less than under the Nash–Cournot equilibrium, and welfare loss under the fixed exchange rate solution is less than under the Nash solution [(3.21) $<$ (3.6)]. The tangency of the loss ellipses of both nations also ensures that this outcome is Pareto–efficient.

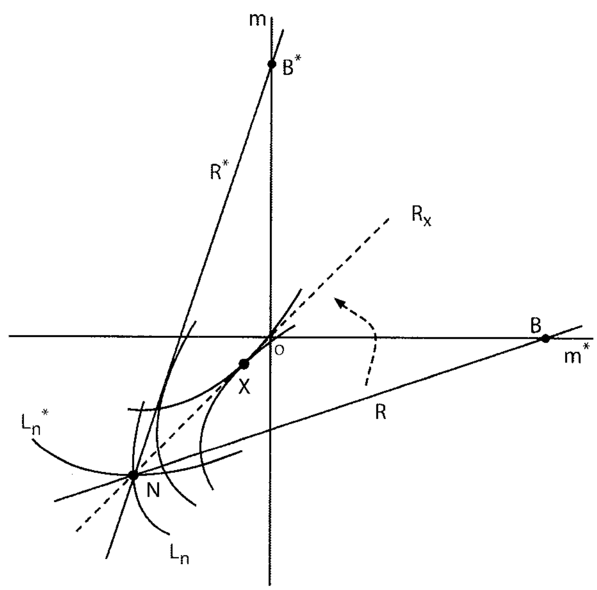

Figure 3.4: *Fixed exchange–rate leadership*

3.2 The General Case

While the section above serves well to illustrate the possible strategies and the resulting equilibria, it puts the reader at a disadvantage in that it ignores some possibilities in the transmission mechanism between trading partners, which affects the slope of the reaction functions and raises the question of the policymakers' preferences: do agents choose to target inflation or output? If monetary expansion is transmitted negatively to trading partners—via a depreciation of the currency and improvement in the trade balance of the expanding country as in the Mundell–Fleming model—we expect positively–sloped reaction functions.

The two target variables are output and current account balance, both are relative to their optimum levels. Again assuming a quadratic loss function:

$$L = y^2 + \omega x^2 \tag{3.22}$$

$$L^* = y^{*2} + \omega x^{*2}, \tag{3.23}$$

where ω and ω^* are the relative weights.

Output is assumed to be a linear function of the available policy instruments, m and m^*, both in log form:

$$y = A + Cm + Em^* \tag{3.24}$$

$$x = B + Dm + Fm^*, \tag{3.25}$$

and,

$$y^* = G + Im + Km^* \tag{3.26}$$

$$x^* = H + Jm + Lm^*. \tag{3.27}$$

Each country has two targets and only one instrument, making it impossible to unilaterally achieve its targets.

3.2.1 The Nash–Cournot non–cooperative solution

To derive the reaction function for the home country, we use (3.24) and (3.25) to differentiate (3.22) with respect to m, holding m^* constant.

$$m = M + Nm^*, \tag{3.28}$$

where:

$$M = -\frac{AC + \omega BD}{C^2 + \omega D^2}, \qquad N = -\frac{EC + \omega FD}{C^2 + \omega D^2}.$$

Following the respective procedure gives us the reaction functions for the foreign country:

$$m^* = Q + Rm, \tag{3.29}$$

where:

$$Q = -\frac{GK + \omega^* HL}{K^2 + \omega^* L^2}, \qquad R = -\frac{IK + \omega^* JL}{K^2 + \omega^* L^2}.$$

The Nash–Cournot equilibrium is defined as the intersection of the two reaction functions. Setting (3.28) and (3.29) equal yields:

$$m_N = \frac{M + NQ}{1 - NR}, \tag{3.30}$$

$$m_N^* = \frac{Q + MR}{1 - NR}. \tag{3.31}$$

The two reaction functions as well as the Nash–Cournot equilibrium are shown on Figure 3.5. The slopes of the domestic and foreign reaction functions are based on the expectation that the positive effects of money on domestic output (C and K) will be the largest in absolute value, and unless the welfare weight ω on the current account is large, the absolute value of the slope of the domestic reactions functions will be less than one.

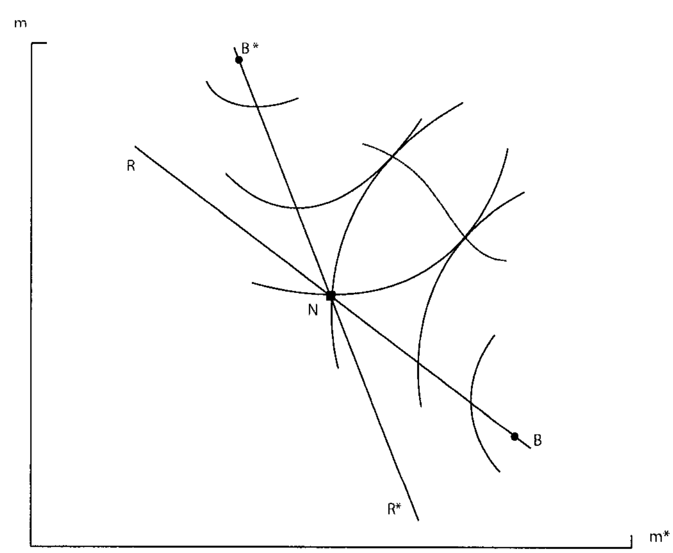

Figure 3.5: *Negatively–sloped reaction functions*

The key lesson to be observed from this example is that the signs of the slopes of the reaction functions are not necessarily negative (Figure 3.1 is an example of positively–sloped reaction functions), and will depend on the mechanism for the transmission of monetary shocks across countries, together with the the size of the welfare weight ω. If $E < 0$, so that monetary expansion is thought to be transmitted negatively to trading partners through a depreciation of the currency and improvement in the trade balance (as in the Mundell–Fleming model), the slope of the reaction functions will be positive ($N > 0$) as shown in Figure 3.1. This is the basic story of competitive devaluations. If, however, monetary transmissions have a positive external effect ($E > 0$), the slope will depend on the size of the welfare weight.[6]

[6]See Frankel and Rockett (1988) for a detailed discussion of the possibilities.

Chapter 4

Choosing to be Different

The model presented in Chapter 2 insinuates an optimal monetary policy decision by each country, where it can choose the most appropriate policy structure available and change its decision when conditions warrant. Because of this underlying assumption the various possible solutions present themselves quite clearly, but there are important reasons why countries may not be able to optimize their choice, including political and institutional inertia, the desire to attain a better bargaining position, a high value on credibility of its policies, or an expectation that trading partners will adapt (leader–follower).

Countries that are able to set an optimal monetary policy will not be susceptible to changes in policy decisions of their trading partners, by definition. If, however, there is a lag in policy adjustment, we can expect to see an impact of policies in other countries on the domestic economy. We attempt to show that countries in the real world are unable to always choose an optimal monetary policy and are indeed susceptible to policy variations by trading partners, evidenced by the effect of a monetary policy Similarity Index on real growth as well as its correlation to exposure to terms of trade shocks.

This chapter begins with an explanation of the choice in monetary policy and its relationship with exchange rate policy under the current model of interdependence. The first section starts with the choice of a monetary peg and the target of the peg. Including this logic into the model, Section 4.2 explains how we expect to see this effect in empirical tests.

4.1 Monetary Policy Choice

The model presented in Chapters 2 and 3 describes the possible equilibria under the various options available to policymakers in setting monetary policy. The example of a fixed exchange rate leadership equilibrium showed the possibility of an improvement on the Nash–Cournot solution—and the possibility of a Pareto–efficient solution—via a credible exchange rate policy commitment. The same result can be reached through a floating regime if a country is able to successfully coordinate with its trading partner as shown by Canzoneri and Henderson (1991):

> In the case of the world productivity disturbance, the fixed–exchange–rate leadership equilibrium is the same as the symmetric efficient equilibrium. ...With symmetric countries and a symmetric disturbance, the real and nominal exchange rates remain equal to the values they assumed before the disturbance if and only if the two money supplies remain unchanged or are changed by equal amounts. Thus, the symmetric efficient equilibrium must be an equilibrium in which the exchange rate remains fixed. Therefore, the fixed–exchange–rate leadership equilibrium must be the same as the symmetric efficient equilibrium.[1]

In other words, when shocks are symmetric countries can use either floating or fixed rate regimes to reach the Nash equilibrium. If the choice is made to peg, however, we contend that the exchange rate should be fixed to a country that faces similar shocks (symmetric), otherwise it is best to float. If the neighboring country changes its exchange rate regime, our country may find it optimal to fix or float depending on the preferences of the home country and the pattern of productivity shocks.

This chapter introduces a complication to this bilateral exchange rate story. It reflects the reality that each country trades with many others and may be slow to change its exchange rate regime in response to policy changes by trading partners.

Our new benchmark case is a situation where two countries have a monetary peg to the currency of a third (large) country. Then, due to a change in government preferences (new weights in the loss function) or an exogenous shock, one of the two smaller countries lets its currency float against the third country. The remaining

[1]Canzoneri and Henderson (1991) p.35.

small (home) country then has two choices: remain fixed to the third country or float its currency as well. The country may choose to remain fixed either because it wants to retain the stability benefits of pegging or because it believes its small partner country will reverse itself and return to a peg (recall the case of Argentina and Brazil discussed in the Introduction).

The consequences of choosing to remain pegged (choosing to be "different") are explored in this paper. Certainly the pegged regime may be undermined. The floating small country may exploit its floating rate to gain a competitive advantage either *vis-à-vis* the large country or the small home country. In this case the choice of exchange rate regime matters as it dictates monetary policy, but the choices of others matter as well. Taking into account the choices of third countries gives a more complete characterization of the consequences of a given exchange rate regime, but it is an aspect often ignored in theoretical models and in empirical studies of exchange rate policy. This chapter explores how the choice to be "different" can matter in theory, while the next chapter explores how the consequences of a third (and more) country's choices affect a country that has chosen to fix or float against the third currency.

The game theoretic approach to coordination models discussed above implies that neither the country's choice of exchange rate regime nor the exchange rate regime of neighboring countries should matter. Since the choice of regime might reflect a country's preference for lower inflation or lower unemployment, we may observe higher output fluctuations in countries with fixed exchange rates. However, beyond this standard inflation–output trade–off, the choice of exchange rate regime by neighboring countries should be largely irrelevant.

4.1.1 The choice of partner in the model

The choice to peg or replace one's currency with a foreign nation's can be stated in monetary terms since any credible peg relies on the synchronicity of monetary policies, whether by law or by eliminating the exchange rate. In short, a fixed exchange rate regime is equivalent to "importing" the target country's monetary policy. When the target country expands monetary supply and devalues, the home country must do the same in order to maintain the fixed exchange rate. In the model, the choice of fixing the exchange rate with trading partners is shown in Figure 3.4. Note that monetary policies are coordinated as the leader country acts as the monetary authority for both, exporting its policies to the neighbor and reaching Pareto–efficiency.

We now introduce another alternative which differentiates between the fixed exchange rate leadership mentioned above, and the choice of a nation to import the monetary policy of a country which behaves independently. The reason for this distinction is as follows: fixed exchange rate leadership, as discussed above, is analyzed under the implication that the leader country formulates its monetary policy keeping in mind the impact on the follower nation, and the subsequent effect on itself through changes in prices. In other words, the leader reacts to changes in the other country's inflation and unemployment and the foreign country's reaction function depends on the domestic country's money supply. In the model, this means that:

$$\frac{\partial R^*}{\partial m} \neq 0.$$

What happens when this condition is violated and one of the two countries decides to follow a fixed exchange rate policy with a third party? Does it matter who is chosen as the target of the peg? To address this question, we introduce a third country who is also "large", where a country's size is defined by its relative average propensity to import. As such, a large country is defined as one whose average propensity to import is negligible. With this innovation, we examine the choice of the home country to follow a fixed exchange rate policy with this large country instead of the small "foreign" nation (this is what is meant by "different").

Countries affect each other through changes in the exchange rates following (2.27) and (2.28), which in turn affect inflation, as given by equations (2.36) and (2.37). Here the average propensity to import, β, is important in determining the relationship between the two countries. After deriving the reduced forms and using them to compute expressions for the loss function, we have derived (2.42):

$$L = \frac{1}{2}\left(\sigma n^2 + \eta q^2\right) = \frac{1}{2}\left[\sigma m^2 + \left(m - 2\theta m^* + x - s\right)^2\right],$$

where $\theta = \frac{1}{2}\sqrt{\eta}\rho$ and $\rho = \beta\xi\gamma\left(1-\alpha\right)$.

When the leader country's average propensity to import from the follower is zero ("large"), it will not be affected by changes in the other nation's monetary policy, since its reaction function will not be affected by that country's exchange rate and inflation. To see this, set $\beta = 0$ and derive the reaction functions for both the "large" country and the home country. From (2.31) and (2.32):

$$\rho = \beta\xi\gamma\left(1-\alpha\right) = 0,$$

and

$$\theta = \frac{1}{2}\sqrt{\eta}\rho = 0.$$

Applying this into (2.42) will lead to a loss function which is not dependent on the other country's monetary policy:[2]

$$L_{large} = \frac{1}{2}\left(\sigma n^2 + \eta q^2\right) = \frac{1}{2}\left[\sigma m^2 + \left(m + x - s\right)^2\right], \tag{4.1}$$

where the subscript *large* denotes the relevant variable for the large country.

Reaction functions are also easily derived. Using the loss functions for the follower and the leader countries—(2.42) and (4.1) respectively—and minimizing each with respect to that nation's instrument, now gives us:

$$\frac{\partial L}{\partial m} = \left(1+\sigma\right)m - 2\theta m_{large} + x \tag{4.2}$$

$$\frac{\partial L_{large}}{\partial m_{large}} = \left(1+\sigma\right)m_{large} + x. \tag{4.3}$$

By solving the first order condition for the policy instruments:

$$m = \left[\frac{2\theta}{1+\sigma}\right]m_{large} - \left[\frac{1}{1+\sigma}\right]x \tag{4.4}$$

[2]While the loss indicated in (4.1) is not a function of another country, it is important to keep in mind that this is structured as a two–country game. When including all its trading partners, β becomes a vector of propensities, and the loss function would simply indicate that the leader has no relationship to the country from which it does not import.

$$m_{large} = -\left[\frac{1}{1+\sigma}\right] x. \tag{4.5}$$

Equation (4.4), however, is constrained by the choice of fixed exchange rate in the country—an exogenous *a priori* decision—and the reaction function is forced to:

$$m = m_{large}. \tag{4.6}$$

The equilibrium solution will now depend on the large country's monetary policy with respect to the exogenous shock, irrespective of the effect of the shock on the domestic country.

4.1.2 Reasons for pegging the exchange rate

Why do countries peg their exchange rates?[3] A quick glance at the loss functions given by (2.42) and (2.43) makes it clear that in the absence of disturbances ($x = s = 0$), setting actual money supplies at zero ($m = m^* = 0$) yields full employment ($n = n^* = 0$) and zero CPI inflation ($q = q^* = 0$), thus zero loss for both countries. If, however, a country is incapable of maintaining money supply constant for political or fiscal reasons, where $m > E_{t-1}m$, the loss function will not be minimized.

The decision to peg is a decision to change expectations (the $E_{t-1}m$ component) to match actual monetary policy. By setting $m = m_{large}$, the country hopes that $m_{large} = E_{t-1}m_{large} = m$, maintaining its loss function at full–employment levels.

The problem arises, however, when the country in question faces exogenous shocks and is unable to adjust its monetary policy and either devalue or appreciate its currency by virtue of the peg.

4.1.3 The two–country model revisited

What will be the effect of this unilateral peg to a "large" country on the losses of the home and foreign countries when faced with an exogenous shock? If the choice is

[3]It is important to remind the reader that, since movements in the exchange rate occur through monetary policy as shown by equation (2.38), the decision to fix one's currency is synonymous with the decision to link monetary policies. This is shown carefully in Section 4.1.1, above.

optimal, as implied by the model, this "difference" in monetary policy with respect to trading partners is insignificant. However, if this choice occurs for other reasons, we are likely to see an impact on economic welfare.

Going back to the two–country game with a negative productivity disturbance ($x' > 0$), we see that the reaction function of the home country (R) is now a constant given by equations (4.5) and (4.6), shown in Figure 4.1 as R'. Another way to say this is that the home country is not able to devalue or appreciate its currency in response to a similar change by its trading partners. The home country basically gives up the issue of competitive devaluation.

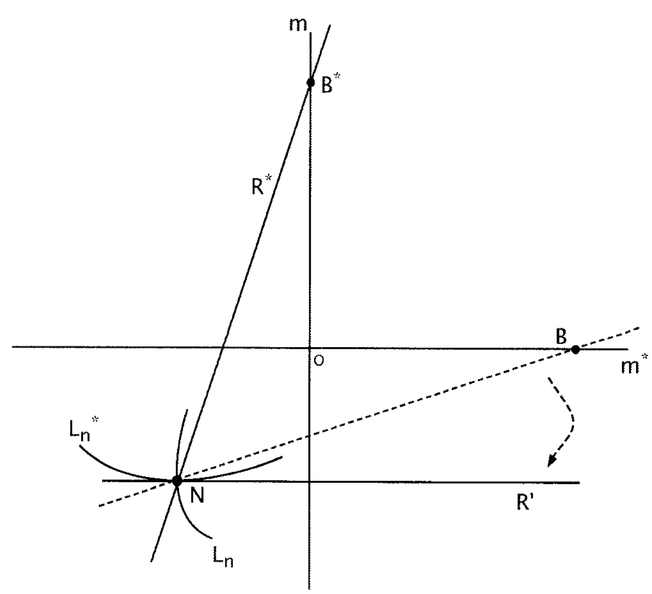

Figure 4.1: *Home country chooses to be "different"*

In the example here, the productivity disturbance requires that both countries reduce their money supplies.[4] As drawn, the home country's reaction function R' intersects R^* at the Nash–Cournot equilibrium. However, this solution is entirely dependent on the chosen monetary policy of the large country, m_{large}, and there is no mechanism to ensure this result. Moreover, in order for the home country to reduce its losses relative to the Nash–Cournot solution, the large country must set its

[4]This is examined carefully in Section 3.1.2.

monetary policy somewhere above the "lower" bound and below the "upper" bound, shown in Figure 4.2.[5] Any monetary policy beyond these two points means a lower indifference curve for the home country and greater losses in terms of employment and inflation.

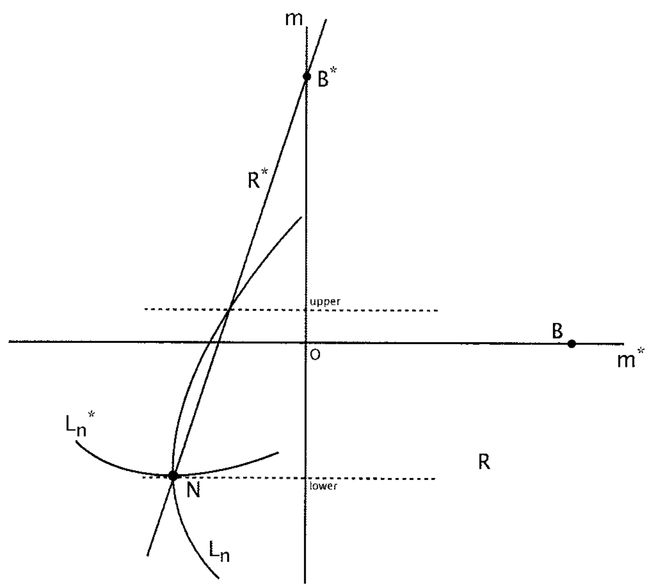

Figure 4.2: *Upper and lower bounds for home country*

This is a very important result. If a country chooses to adopt a peg for stability and credibility reasons while its trading partners maintain monetary policy autonomy, the country becomes exposed to the risk of adopting a monetary policy which is either less contractionary than required to react to the exogenous shock given the ability of its trading partners to alter the value of their currencies, resulting in higher import costs and domestic inflation, or too contractionary which would result in high losses from unemployment.

In the best circumstances, the home country may find itself in an equilibrium which, while Pareto–superior to the Nash–Cournot solution, is not Pareto–efficient,[6] shown in Figure 4.3. Notice that the new equilibrium at point (a), while an improve-

[5]These boundaries are the intersection of the home country's loss ellipse at the Nash–Cournot equilibrium, L_n, with the foreign country's reaction function.

[6]Pareto–efficient solutions are defined as tangencies between the two countries' loss functions.

ment over the Nash solution, represents a lower indifference curve, and a greater loss than the home country would have been able to achieve if it was able to adjust its own monetary policy according to its Reaction Function (R). The home country contracts monetary policy by less than the foreign country, increasing the price of foreign imports and leading to higher inflation rates. These losses from higher inflation rates are greater than the gains from employment, resulting in lower real growth.

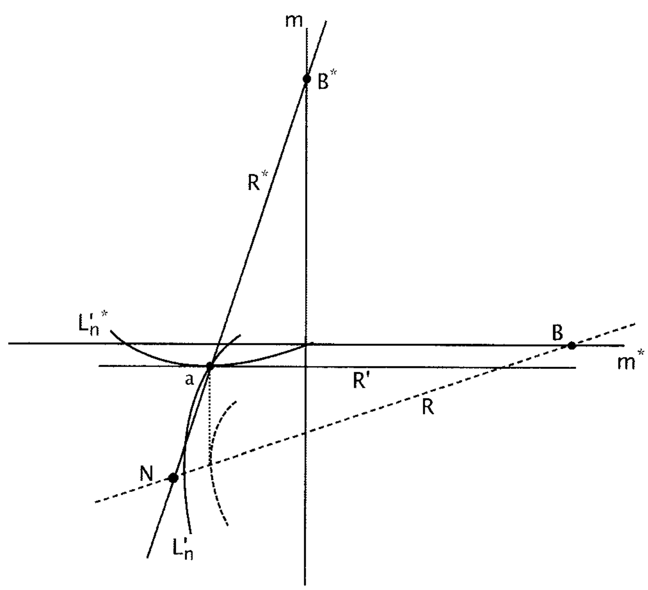

Figure 4.3: *A non–optimal improvement*

4.2 Empirical Hypothesis

Because of this conclusion, we proceed to examine the empirical evidence on the relationship between the degree of monetary policy similarity and real growth rates. If the standard model is correct, there should be no significant relationship due to optimization. However, if other factors are constraining monetary policy, in accordance with the theory presented above, we expect empirical tests to show a statistically significant effect of monetary policy similarity on real growth and terms of trade exposure. Following the terminology of the model, we expect a greater likelihood that the home country might, conditional on its choice of target for the exchange rate peg, inadvertently adopt a pro–cyclical monetary policy that is sub–optimal, resulting in a net loss in the inflation–employment trade–off and lower rates of real output growth. In addition to simply identifying a relationship, we also aim to characterize it according to monetary regime choice. Do pegged countries have a different experience than countries that float?

There are four distinct combinations of exchange rate regimes and exchange rate regime similarities. Countries can be "Fixed and Similar"; "Fixed and Different"; "Float and Different"; and "Float and Similar". The terms "Similar", and "Different" denote *relative* similarity of exchange rate regimes. In the example above, since the home country pegs to the "large" country while the foreign country floats, the two countries are classified as "Different". In the case where both countries float relative to the "large" country, they are considered "Similar". This is also the case when the home country chooses to peg to the foreign country, since they both are floating with respect to the "large" country. The possible combinations are illustrated on page 48.

"Fixed and Similar" Shown in Figure 4.4, countries in this category are able to avoid any losses or gains from competitive devaluations due to similar reactions by its trading partners. The home country decides to match movements by the foreign country to maintain an exchange rate peg. Recognizing this, the foreign country in effect controls both nations' monetary policies. Because relative prices remain constant even in the short run, we expect that this group will fully adjust to terms of trade shocks, evidenced by their small correlation to GDP growth. In the long run, the ability of the two countries to minimize their losses will translate into higher real growth rates.

"Fixed and Different" This is an example of a sub–optimal monetary policy choice. Shown in Figure 4.5, countries that are pegged and different are in no position to adjust their currencies when faced with exogenous trade shocks and the response by trading partners. This relative lack of flexibility will result in a high and positive correlation between terms of trade variations and GDP growth. This group's loss

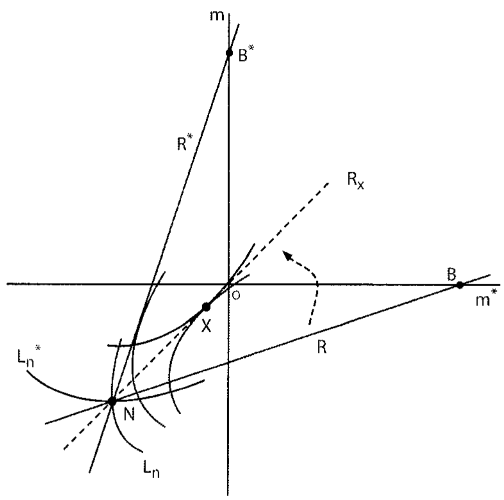

Figure 4.4: *Fixed and Similar*

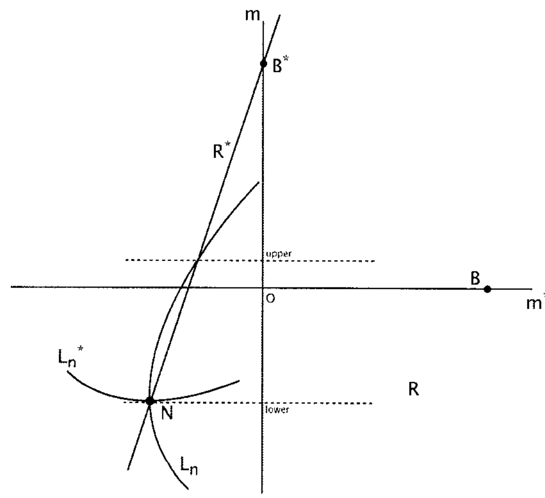

Figure 4.5: *Fixed and Different (also Float and Different)*

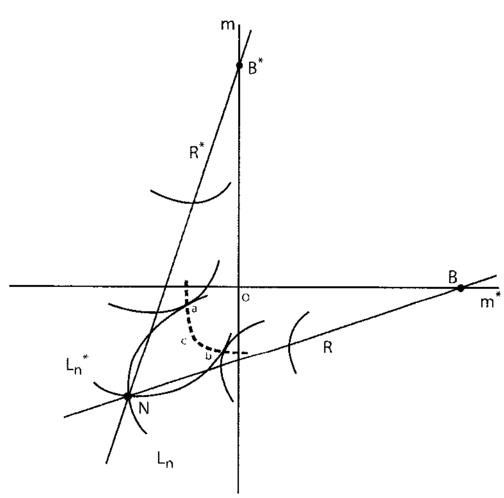

Figure 4.6: *Float and Similar*

function will always be below its optimal case given the foreign country's reaction, leading to a negative impact on the inflation–employment trade–off and resulting in lower real growth rates compared to the result for the "Fixed and Similar" case.

"Float and Different" This is the equivalent of the "Fixed and Different" case, but seen from the perspective of the foreign country with reaction function R^*, shown in Figure 4.5. In this case, the country may be closer to its Bliss point, (B^*), where domestic money supply stays at zero to maintain full employment and foreign money supply is high enough to appreciate the country's exchange rate and offset the inflationary effect of the productivity shock. We expect that countries in this case will have a low or negative correlation of terms of trade shocks and GDP growth, though the effect on real growth rates is ambiguous.

"Float and Similar" Shown in Figure 4.6, countries in this group will be unable to successfully take advantage of devaluations because of reactions from their trading partners. Despite this limitation, there is still the possibility of short–term gains between adjustment periods, as well as any benefits from coordinated efforts to avoid competitive devaluations. Their great flexibility in monetary policy, however, will translate into a low correlation coefficient between terms of trade and GDP growth, though short run effects are likely to make this correlation significant.

Chapter 5

Empirical Tests

The main interest of this work is to investigate whether countries with a similar monetary policy to that of their trading partners experience higher real growth rates and are better insulated from exogenous shocks such as terms of trade variations. More specifically, this paper is interested in the results for pegged exchange rate regimes and whether the choice in the target of the peg is important in helping the country withstand exogenous shocks. As postulated on Chapter 4, the working hypothesis is that a country which chooses to unilaterally link itself to another, in effect importing that country's monetary policy, may not be making an optimal choice and will face a greater likelihood of pro–cyclical or sub–optimal monetary adjustments to exogenous shocks. If this is true, it is expected that countries that are "different" with respect to their monetary policy will be more susceptible to exogenous terms of trade variations than countries that are "similar", and the trade–off between inflation and employment will be negative on net, resulting in lower real growth rates. In order to test this we follow three empirical methodologies: the first is a basic growth model where we control for domestic policy and examine the correlation between the variables of interest; we then apply the methodology presented by Ghosh, et al. (2003) to isolate the variable's impact on per capita growth and to differentiate between regimes. Lastly we follow the method used by Edwards and Yeyati (2003) to isolate and analyze the impact of monetary similarity on an economy's exposure to terms of trade shocks.

This chapter begins by describing the dependent variable, a proxy for the policymaker's target variable. After choosing an appropriate measure of welfare, the next step is to construct a measure of policy similarity, or Similarity Index, which captures the degree to which a county deviates from its major trading partners in its exchange rate policy. We then use this index to estimate the relationship of similarity with growth directly in a simple growth model with a small dataset. Next we expand the dataset to cover more countries and to control for more variables, following the current literature. We then isolate the impact of this Similarity Index according to the form of exchange rate regime in each country. Finally we explicitly isolate the Similarity factor in countries with pegged regimes and look at the impact of terms of trade shocks in this subset.

The empirical data is derived from two sources. The "Small" dataset is created by compiling annual observations covering 1980-2002 and is based on the IMF's *Direction of Trade Statistics Yearbook*, *Annual Report on Exchange Rate Arrangements and Exchange Restrictions*, and their *International Financial Statistics Yearbook*, in addition to using data available from the World Bank's *Global Development Finance*, *Global Development Network Growth Database*, *World Development Indicators*, and *World Development Report*. The dataset covers 23 large developing countries in Latin America, Asia, and Europe. A small number of developed European countries are also included.[1] The "GGW" dataset contains annual observations of macroeconomic variables and is available from Ghosh, et al. (2003). It covers 154 countries for the 1970-1999 period.[2] The summary statistics for both datasets are available in Appendix A.1, Tables A.1 and A.2 respectively.

5.1 Variables

Dependent variable

While empirical work on macroeconomic interdependence has typically made use of loss functions to describe the policymaker's optimizing choice, the form of the loss function to be minimized has been hotly debated and is subject to many caveats.[3] Despite these limitations, the model allows us to make conclusions about real growth being a function of inflation and employment (which in turn affects output directly).

[1] See Appendix A.4 for a list of countries.
[2] See Appendix A.5 for a list of countries.
[3] See Mayer (2002) for a discussion on the shortcomings of traditional Quadratic Loss Functions.

Another reason why Real Gross Domestic Product growth is empirically attractive is because this measure of macroeconomic welfare allows for direct comparison of results with existing empirical work in the field, as well as the ample availability of data. Changes in real output are a result of a positive or negative net trade–off between inflation and employment, as explained in the model.

In the "Small" dataset we target Real Gross Domestic Product growth, while in the "GGW" dataset we target the more widely used Real Gross Domestic Product growth per capita.

Independent variables

The vast empirical literature on macroeconomic policy suggests that there exists a large number of possible determinants of growth. We first describe the variable of interest in this paper, the Similarity Index, before discussing other controlling variables for both datasets.

The Similarity Index (ψ) is designed to capture the degree to which a country's exchange rate regime is different from that of its major trading partners and, as such, it is defined as the trade–weighted difference between the home country's regime and that of its trading partners.[4] Mathematically:

$$\psi_i = -\sum_j \alpha_{ij} \left(w_{ij} \right) \tag{5.1}$$

where: w_{ij} =proportion of country i's total trade with country j
α_{ij} =difference in ER regimes between countries i and j relative to the US
$-8 \leq \psi \leq 0$.

A country that has perfect similarity with all its trading partners would have $\psi_i = 0$, while a country which chooses to be different would have $\psi_i = -8$.

The trade weight w_{ij} is computed based on data from the IMF's *Direction of Trade Statistics* and is defined as the share of country i's total trade with country j. In order to construct α_{ij}, a little more work is required. Exchange rate regimes in

[4]See Appendix A.3 for a computational example.

the IMF's *Annual Report on Exchange Rate Arrangements and Exchange Restrictions* are classified ranging from total adoption of a foreign currency (e.g. "dollarization") through the gamut and ending with an independent float on the opposite end of the spectrum.

In order to quantify the difference in exchange rate regimes, a value between 0 and 8 is assigned according to the country's IMF classification. A value of 0 represents the complete adoption of a foreign currency, while a value of 1 is an extreme "independent float". Intermediate regimes are assigned values according to Table A.3. A crawling peg, for example, is assigned a value of 4. This exchange rate index is called the Relative Index.[5]

$$\alpha_{ij} = |\varphi_i - \varphi_j|$$

where: φ_i =country i's ER regime relative to US
φ_j =country j's ER regime relative to US
$0 \leq \alpha, \varphi \leq 8.$

Using this index it is then possible to compute the difference between a country's exchange rate regime to that of its trading partners (both relative to the US) by simply subtracting and taking the absolute value. The result is an index of similarity of exchange rate regimes, where 0 represents complete similarity and 8 means a complete divergence:[6]

Controlling variables: A number of structural, institutional, and policy variables are added following the procedure in Edwards and Yeyati (2003) and Ghosh, et al. (2003). In order to control for factor accumulation, we include the ratio of investment to GDP and the average number of years of schooling of the population. Convergence effects are controlled by including the difference between actual GDP growth and the country's steady state growth rate. Other variables included are the growth of

[5] See Appendix A.2 for a detailed description of the methodology.

[6] For computational purposes, when calculating the exchange rate regime difference between a country and the US when the latter is a major trading partner of the former, it is assumed that there exists perfect similarity (i.e. $\alpha_{us} = 1$).

government spending as a ratio of GDP, lagged terms of trade shocks,[7] as well as annual and regional dummies.

5.2 The Empirical Model and Results

Because the Similarity Index (ψ) given in equation (5.1) is a function of the country's exchange rate policy, it is important to determine to what extent the effect of ψ on growth is due to changes in domestic policy versus policy changes by trading partners. In other words, does the new variable ψ add to the model beyond what the exchange rate policy variable does.

We accomplish this for both datasets. First we test a very basic growth regression using the "Small" dataset, controlling for the exchange rate policy. If policy similarity contains useful information on growth, we expect that it will be significant. For the GGW dataset, we again explicitly control for exchange rate regime policy and add a broader set of controlling variables.

5.2.1 Similarity and Real Growth

The results for the Small dataset are shown in Table 5.1. The Similarity Index coefficient has the expected sign and is significant even after controlling for the exchange rate policy. In addition, the R^2 is slightly higher when both ψ and the exchange rate is used, allowing for the conclusion that the Similarity Index does indeed contain information that adds to our understanding of fluctuations in growth rates. The coefficient of convergence is less than 1, positive, and significant as expected. 1–year lagged shocks of terms of trade are also positive and significant, as expected.

Because of complexities that arise from estimating panels with lagged dependent variables and heteroskedastic errors, a Generalized Method of Moments estimator suggested by Arellano and Bond (1991) is used to confirm these results, shown in

[7]Terms of trade shock is defined as the percentage change of the relative price of exports to imports. Following this, a positive number indicates an improvement in the terms of trade and vice–versa.

Table 5.1: *Similarity Index and Relative ER Index—Small dataset*

	ΔReal GDP		ΔReal GDP		ΔReal GDP	
All countries	coef.	s.e.	coef.	s.e.	coef.	s.e.
Steady state gap	0.17	*0.05****	0.17	*0.05****	0.17	*0.05****
Similarity Index (lag)	3.11	*1.69**			5.17	*2.96**
Exchange rate policy (lag)			0.80	*0.94*	-1.44	*1.69*
Terms of trade delta (lag)	6.23	*1.97****	6.49	*1.96****	6.24	*1.97****
Constant term	3.98	*0.55****	2.63	*0.82****	5.59	*1.97****
Observations	377		379		377	
R^2 within	0.07		0.06		0.07	
R^2 between	0.07		0.04		0.10	
R^2 overall	0.06		0.06		0.07	

Asterisks denote significance at 10 percent (*), 5 percent (**), and 1 percent (***) levels.

Table 5.2, using the same dataset.[8] The GMM results mirror the findings of Table 5.1 where the coefficient for the Similarity Index is positive and significant even after controlling for changes in the exchange rate policy. All regressions pass the Sargan test for over–identification of the instruments and have the expected autocorrelation in residuals.

Table 5.2: *Similarity Index and Relative ER Index—GMM*

	ΔReal GDP		ΔReal GDP		ΔReal GDP	
All countries	coef.	s.e.	coef.	s.e.	coef.	s.e.
Dependent variable (lag)	0.08	*0.05**	0.08	*0.05*	0.09	*0.05**
Similarity Index (lag)	6.98	*2.29****			7.97	*4.12**
Exchange rate policy (lag)			2.59	*1.26***	-0.71	*2.43*
Terms of trade (lag)	6.44	*2.14****	6.77	*2.15****	6.44	*2.14****
Constant term	-0.04	*0.04*	-0.04	*0.04*	-0.03	*0.04*
Observations	381		383		381	
Sargan Test ($prob > \chi^2$)	0.12***		0.17***		0.13***	
AR(1) in Resid ($prob > z$)	0.00***		0.00***		0.00***	
AR(2) in Resid ($prob > z$)	0.69		0.73		0.68	

Asterisks denote significance at 10 percent (*), 5 percent (**), and 1 percent (***) levels.

With these results we can proceed to more precisely address the impact of variations in the Similarity Index on the growth rate, controlling for other factors. Again using the same dataset we estimate a linear model of Real GDP Growth, controlling for changes in investment, growth of government expenditures, and shocks in terms

[8]The GMM estimators used are described by Arellano and Bond (1991), an augmented version outlined in Arellano and Bover (1995) and fully developed in Blundell and Bond (1998). Arellano and Bond/Bover estimator can fit two closely related dynamic panel data models.

of trade. The results are shown in Table 5.3.

Table 5.3: *Similarity Index and Real GDP growth—Small dataset*

	ΔReal GDP		ΔReal GDP		ΔReal GDP	
All countries	coef.	s.e.	coef.	s.e.	coef.	s.e.
Similarity Index (lag)	3.19	*1.35***	3.61	*1.60***	4.02	*1.62***
Investment/GDP	22.03	*3.50****	20.84	*3.96****	23.60	*5.10****
Gov't expenditures	9.86	*1.79****	10.03	*1.88****	9.72	*1.89****
Terms of trade (lag)	6.61	*1.71****	7.33	*1.86****	7.41	*1.85****
Schooling			-0.13	*0.16*	-0.10	*0.15*
Initial income			0.00	*0.00*	0.00	*0.00*
latam					-0.27	*1.29*
asia					-0.85	*1.76*
eu					-1.96	*1.54*
Constant term	-1.24	*0.85*	0.04	*1.26*		
Observations	383		339		339	
R^2 within	0.19		0.20		0.20	
R^2 between	0.65		0.57		0.66	
R^2 overall	0.26		0.26		0.28	

Asterisks denote significance at 10 percent (*), 5 percent (**), and 1 percent (***) levels.

The coefficients of all the base variables have the expected sign and are highly significant. Higher investment in physical or human capital is associated with faster GDP growth, as is higher levels of government expenditures. In addition, an improvement in the terms of trade results in an improvement in the growth rate in the subsequent year, also as predicted by theory. We then estimate the same regression with the addition of two variables: the average number of years of schooling of total population age 25 and older and the income level in 1971 (initial income), following the growth literature. Interestingly, neither are significant, which can be explained by the model's focus on short term effects. Schooling can be considered a state variable, with low variability and only a long–run impact on GDP and initial income has the expected sign. We further test the robustness of the regression by adding regional dummies for Latin America, Asia, and Europe, and find that they all have the expected sign and slightly increase the correlation coefficient, but are not significant. Notably, in all three regressions the Similarity Index takes on the expected sign and is significant at the 5 percent level.

Table 5.4 compares these results with the FGLS and GMM estimation procedures respectively, both producing similar results. Using the Feasible Generalized Least

Squares estimator, the Similarity Index has the expected sign and is significant at the 5 percent level, as are investment share of GDP, government expenditures, terms of trade shocks, which are significant at the 1 percent level. In turn, the Arellano–Bond Generalized Method of Moments estimator is specified using the following instrumental variables: Similarity Index (lag); investment share of GDP (lag); government consumption (lag); terms of trade shocks. Again the Similarity Index has the expected sign and is significant at the 5 percent level and both investment share of GDP as well as government consumption variables also have the expected signs and are significant at the 1 percent level. The model also passes the Sargan test for over–identification of the restrictions and has expected results for serial autocorrelation of the error term.

Table 5.4: *Similarity Index and Real GDP growth—Small dataset*

	OLS		FGLS		A–Bond[a]	
All countries	coef.	s.e.	coef.	s.e.	coef.	s.e.
Similarity Index (lag)	3.19	*1.35***	3.01	*1.28***	9.78	*4.15***
Investment/GDP	22.03	*3.50****	21.79	*3.14****	69.09	*21.39****
Gov't expenditures	9.86	*1.79****	9.94	*1.78****	12.85	*3.54****
Terms of trade (lag)	6.61	*1.71****	6.47	*1.71****		
Constant term	-1.24	*0.85*	-1.24	*0.77*	-9.95	*4.76****
Observations	383		383		383	
R^2 / Sargan Test[b]	0.26				0.96	

Asterisks denote significance at 10 percent (*), 5 percent (**), and 1 percent (***) levels.
[a]Arellano–Bond dynamic panel–data estimation, one–step GMM results. Instruments: lag Similarity Index, investment/gdp, change in government expenditures, change in ToT.
[b]The Sargan test null is that the chosen instruments are uncorrelated with error term, a condition appropriate instruments should fufill. We report $prob > \chi^2$.

The GMM results provide the best insight on the magnitude of the impact of similarity on GDP growth. The coefficient shows that countries which are similar to their trading partners will experience growth of 3-10 percent higher over a 25–year period than countries which are different.

While these results are interesting and shed some light on the short term dynamics of growth, a long term growth model requires a broader set of observations and regressors. We use the Ghosh, et al. (2003) dataset in conjunction with the Similarity Index as well as the Relative Exchange Rate Index based on the IMF Classification, described in Section 5.1. In addition to its size, this dataset provides three different exchange rate classification methods: *De Jure*, *De Facto*, and *Consensus* classifications. The *De Jure* classification is based on the stated intentions of the monetary authorities, as reported in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* and is similar to the Relative Index. The *De Facto* classification is based on actual movements of the exchange rate as measured by an annual score based on the mean and the variance fo the monthly depreciation rates.[9] The *Consensus* classification is the simple intersection of the *De Jure* and *De Facto* classifications.[10]

Using this dataset we want to test the hypothesis that greater Similarity will improve real growth over the long run and will reduce a country's exposure to terms of trade shocks over the short run. In Ghosh, et al. (2003), the authors attempt to estimate both the impact of exchange rate regimes on inflation and on growth of per capita GDP. In their work, the authors control for investment, education, initial income, trade openness, tax, budget balance, terms of trade, population growth and size, as well as annual dummies. They proceed to add exchange rate regime dummies to the equation, measuring both their direct and indirect effects on growth. They find that:

> Overall, the differences in growth performance are neither paltry nor spectacular. They imply that, over a twenty–five–year period, and controlling for other determinants, per capita output in a country with a pegged or intermediate regime would be some 10 to 20 percent higher than in a country that had maintained a floating regime.[11]

In order to examine the long run effects of similarity on growth, we transform the dataset into 5–year period averages, eliminating business–cycle fluctuations and reducing the impact of any spurious correlation. Using the distribution of the Simi-

[9]Mathematically: $z = \sqrt{\mu_{\Delta e}^2 + \sigma_{\Delta e}^2}$, where $\mu_{\Delta e}$ is the average monthly rate of change of the nominal exchange rate during the year, and $\sigma_{\Delta e}^2$ is the variance of those monthly changes.

[10]For a detailed explanation on the differences of each, please see Ghosh, et al. (2003), Chapter 4.

[11]Ghosh, et al. (2003), p.93.

larity Index variable, we create dummies for countries that are Similar, Medium, and Different. Countries are classified as "similar" if their Similarity Index falls below 1.5. A country with an index value between 1.5 and 3 is classified as "Medium", while anything above 3 is "Different". The results are shown in Tables 5.5 and 5.6.

Using Fixed Effects OLS, we begin with only a small set of determinants of growth in per capita GDP: shocks in the country's terms of trade, population variables, and education. In this specification most variables have the expected sign and are significant. Both population growth and educational attainment are as predicted and significant. Having a floating regime has a negative impact on per capita growth, as found by Ghosh, et al. (2003). Controlling for inflation and trade openness improves the model's R^2. As expected, inflation has a negative impact on per capita GDP growth and countries with larger trade/GDP ratios have greater growth rates. Using only the exchange rate classification dummies or the Similarity dummies in the model shows that there is little interactivity between the controlling variables and the dummies. Notably, in addition to gaining 10-20 percent growth over 25 years by adopting a pegged regime, as concluded by Ghosh, et al. (2003), if a country is similar, it can gain an additional 1-3 percent growth in per capita GDP over that same period.

While Similarity is shown to have a positive impact on real growth, we must still examine whether countries that are pegged have a different experience than countries that are floating. Using annual data, we divide the GGW dataset into countries that are Pegged, Intermediate, and Floating. The result, on Table 5.7, shows that countries that are not "similar" experience lower real growth when they adopt fixed exchange rates, as postulated on Section 4.2.

Countries with an intermediate exchange rate regime, shown in Figure 5.8 give inconclusive results due to the lack of observations for countries that are intermediate and "different".

For countries that opt for a flexible regime, however, we find surprising evidence of a positive impact of similarity on growth. As Table 5.9 indicates, countries that are "Different" have a negative impact on real growth, indicating perhaps that the

Table 5.5: *Real GDP growth—GGW Dataset (5–yr avg)—Consensus Index*

	GDP/Capita Growth		GDP/Capita Growth		GDP/Capita Growth		GDP/Capita Growth	
Fixed Effects. 5yr Avgs	coef.	*s.e.*	coef.	*s.e.*	coef.	*s.e.*	coef.	*s.e.*
Pegged [a]	-0.98	*0.83*	-1.16	*0.82*			-1.49	*0.78**
Intermediate [a]	-1.44	*0.90*	-1.50	*0.88**			-1.09	*0.86*
Floating [a]	-4.16	*1.02****	-3.77	*1.02****			-3.20	*0.98****
Similar	1.82	*0.72***	1.54	*0.71***	1.12	*0.70*		
Medium								
Different	-0.04	*0.77*	0.11	*0.76*	0.35	*0.72*		
ToT Growth	2.40	*3.72*	2.06	*3.65*	1.57	*3.72*	2.23	*3.67*
Inflation			-0.10	*0.04***	-0.13	*0.04****	-0.10	*0.04***
Population Growth	-87.18	*27.6****	-82.87	*27.13****	-79.98	*27.48****	-85.15	*27.27****
Population	0.00	*0.01*	0.00	*0.01*	0.00	*0.01*	0.00	*0.01*
Schooling	0.69	*0.29***	0.49	*0.29**	0.26	*0.28*	0.56	*0.28***
Openness [d]			2.73	*1.18***	0.25	*1.20***	3.12	*1.17****
Constant Term	-0.63	*1.66*	-1.42	*1.71*	-1.11	*1.58*	-1.47	*1.72*
Obs. / Countries	365 / 113		365 / 113		365 / 113		365 / 113	
R^2 Within	0.14		0.18		0.13		0.16	
R^2 Between	0.00		0.00		0.01		0.00	
R^2 overall	0.04		0.05		0.04		0.05	

Asterisks denote statistical significance at the 10 percent (*), 5 percent (**), and 1 percent (***) levels.

[a] Pegged, Intermediate, and Floating regime classification determined by GGW's Consensus Index.

Table 5.6: *Real GDP growth—GGW Dataset (5–yr avg)—Relative Index*

	GDP/Capita Growth		GDP/Capita Growth		GDP/Capita Growth		GDP/Capita Growth	
Fixed Effects. 5yr Avgs	coef.	*s.e.*	coef.	*s.e.*	coef.	*s.e.*	coef.	*s.e.*
Pegged [a]							-0.78	*0.70*
Intermediate [a]	0.73	*0.99*	0.73	*0.96*				
Floating [a]	1.07	*1.03*	1.21	*1.01*			0.34	*0.73*
Similar	1.36	*0.69**	1.29	*0.68**	1.44	*0.65***		
Medium								
Different	0.85	*0.99*	1.00	*0.96*	0.29	*0.72*		
ToT Growth	0.62	*3.84*	0.27	*3.75*	0.43	*3.73*	0.78	*3.75*
Inflation			-0.13	*0.04****	-0.13	*0.04****	-0.13	*0.04****
Population Growth	-140.2	*28.1****	-136.3	*27.5****	-134.8	*27.3****	-137.8	*27.6****
Population	0.00	*0.01*	0.00	*0.01*	0.00	*0.01*	0.00	*0.01*
Schooling	-0.30	*0.32*	-0.43	*0.32*	-0.29	*0.30*	-0.24	*0.30*
Openness [d]			1.67	*1.21*	1.83	*1.20*	1.82	*1.21*
Constant Term	3.54	*1.63***	3.14	*1.66**	2.99	*1.61**	3.65	*1.77***
Obs. / Countries	379 / 110		378 / 109		378 / 109		378 / 109	
R^2 Within	0.12		0.17		0.16		0.16	
R^2 Between	0.00		0.00		0.00		0.00	
R^2 overall	0.03		0.06		0.07		0.06	

Asterisks denote statistical significance at the 10 percent (*), 5 percent (**), and 1 percent (***) levels.

[a] Pegged, Intermediate, and Floating regime classification determined by Relative ER Index.

Table 5.7: *Similarity and Real growth for Pegged regimes—GGW dataset—Relative Index*

	ΔGDP/Capita		ΔGDP/Capita		ΔGDP/Capita	
Fixed Effects	coef.	s.e.	coef.	s.e.	coef.	s.e.
Medium	-2.99	*1.50***	-3.02	*1.53***	-2.86	*1.50**
Different	-2.78	*1.59**	-2.73	*1.63**	-2.72	*1.60**
ΔToT	1.49	*1.54*	1.25	*1.57*	1.33	*1.54*
Inflation	-0.10	*0.03****			-0.11	*0.03****
ΔPopulation	-1.24	*0.19****	-1.26	*0.19****	-1.23	*0.19****
Population			-0.01	*0.01*	-0.01	*0.01*
Schooling			-0.21	*0.43*	-0.41	*0.43*
Openness					3.18	*1.40***
Constant term	5.87	*1.55****	7.00	*2.44****	5.66	*2.46***
Obs./Countries	547 / 67		547 / 67		547 / 67	
R^2 within	0.13		0.10		0.14	
R^2 between	0.11		0.01		0.02	
R^2 overall	0.13		0.04		0.06	

Asterisks denote significance at 10 percent (*), 5 percent (**), and 1 percent (***) levels.

Table 5.8: *Similarity and Real growth for Interm. regimes—GGW dataset—Relative Index*

	ΔGDP/Capita		ΔGDP/Capita		ΔGDP/Capita	
Fixed Effects	coef.	s.e.	coef.	s.e.	coef.	s.e.
Medium	-0.67	*0.44*	-0.61	*0.44*	-0.48	*0.45*
Different						
ΔToT	1.23	*1.39*	1.28	*1.39*	1.28	*1.39*
Inflation	-0.09	*0.10*			-0.08	*0.10*
ΔPopulation	-0.91	*0.26****	-0.90	*0.26****	-0.88	*0.26****
Population			0.01	*0.02*	0.01	*0.02*
Schooling			0.21	*0.33*	0.11	*0.33*
Openness					3.18	*1.46***
Constant term	3.49	*0.46****	1.81	*1.76*	0.04	*1.94*
Obs./Countries	705 / 78		705 / 78		705 / 78	
R^2 within	0.03		0.03		0.04	
R^2 between	0.07		0.15		0.23	
R^2 overall	0.06		0.11		0.14	

Asterisks denote significance at 10 percent (*), 5 percent (**), and 1 percent (***) levels.

trade–off between inflation and growth is more pronounced than expected in floating regimes. Another possible explanation is that countries that have flexible monetary regimes do engage in some sort of cooperative agreement with trading partners, achieving higher growth rates relative to the Nash–Cournot equilibrium. This analysis is beyond the scope of this paper, however. The low R^2 values for this regression also call into question the reliability of these results.

Table 5.9: *Similarity and Real growth for Floating regimes—GGW dataset—Relative Index*

	ΔGDP/Capita		ΔGDP/Capita		ΔGDP/Capita	
Fixed Effects	coef.	s.e.	coef.	s.e.	coef.	s.e.
Medium	-0.46	*0.77*	-0.43	*0.78*	-0.37	*0.77*
Different	-6.17	*3.33**	-5.90	*3.35**	-6.66	*3.34***
ΔToT	3.97	*2.19**	3.48	*2.19*	3.85	*2.18**
Inflation	-0.04	*0.02***			-0.04	*0.02***
ΔPopulation	-0.55	*0.12****	-0.54	*0.13****	-0.55	*0.13****
Population			-0.01	*0.02*	-0.01	*0.02*
Schooling			0.39	*0.73*	0.61	*0.74*
Openness					-3.10	*1.49***
Constant term	1.40	*0.42****	-0.63	*4.27*	0.08	*4.23*
Obs./Countries	509 / 84		509 / 84		509 / 84	
R^2 within	0.07		0.06		0.08	
R^2 between	0.00		0.04		0.00	
R^2 overall	0.06		0.00		0.03	

Asterisks denote significance at 10 percent (*), 5 percent (**), and 1 percent (***) levels.

Following these results, we attempt to shed some light on the mechanism by which the Similarity Index affects growth. We do this by regressing the index on three components of GDP growth: the nominal interest rate, export, and investments. As shown in Table 5.10, similarity has a negative impact on interest rates in countries with Pegged regimes. This is a compelling result as it supports the theory that cooperation among trading partners in monetary policy leads to lower interest rates in light of exogenous shocks. When exports are used as the dependent variable, we see a reflection of previous results. Pegged regimes have a positive impact from similarity, while other regimes are negatively affected. Again this is consistent with competitive devaluations. Finally, investments seem to be affected in Intermediate regimes, possibly indicating that foreign capital pursues a middle ground. This is however not clear from this regression and would require further study.

Table 5.10: *Indirect Effects—Ghosh, et al. (2003) dataset*

	Interest Rate		ΔExports		Inv/GDP		Inflation	
All countries	coef.	s.e.	coef.	s.e.	coef.	s.e.		
Similarity (lag)–Peg	-16.26	*6.60***	0.06	*0.02***	0.00	*0.01*	-0.29	*1.14*
Similarity (lag)–Interm.	-6.21	*14.84*	-0.11	*0.06**	0.05	*0.02***	0.62	*2.64*
Similarity (lag)–Float	10.31	*18.43*	-0.17	*0.07***	0.02	*0.02*	-7.67	*3.42***
Inflation	1.41	*0.10****						
ΔConsumption	61.48	*13.80****						
ΔToT			-0.19	*0.00***				
Nom. Int. Rate					0.00	*0.00*	-0.04	*0.01****
Money growth							1.49	*0.04****
Constant term	-2.57	*1.73*	0.05	*0.03****	0.21	*0.01****	-0.19	*0.27*
Obs. / Countries	932 / 89		1169 / 101		1009 / 97		1014 / 98	
R^2 within	0.20		0.05		0.01		0.58	
R^2 between	0.22		0.00		0.00		0.77	
R^2 overall	0.22		0.04		0.00		0.65	

Asterisks denote significance at 10 percent (*), 5 percent (**), and 1 percent (***) levels.

5.2.2 Similarity and Terms of Trade

Next, we test the proposition that countries with more similar exchange rate regimes are less exposed to exogenous trade shocks. We follow the estimation procedures outlined in Edwards and Yeyati (2003) to test the relationship between exchange rate policy and the impact of terms of trade variations on per capita GDP growth. The authors divide their sample into countries with pegged, intermediate, and flexible regimes following the methodology proposed by Yeyati and Sturzenegger (2002) and compare the coefficients of terms of trade shocks. We follow their lead and estimate the following model:

$$\Delta y = \beta_0 + \beta_1 \psi_{t-1} + \beta_2 invgdp + \beta_3 \Delta gov + \beta_4 \Delta ToT + \beta_5 y71 + \beta_6 school + \epsilon. \quad (5.2)$$

Following traditional growth literature and the empirical procedures outlined therein, Edwards and Yeyati start by deriving a steady state level of GDP growth:

$$g_j^* = \alpha + x_j\beta + r_j\theta + \omega_j$$

where: g_j =rate of GDP growth in country j
x_j =vector of structural, institutional, and policy variables
r_j =vector of regional dummies
ω is an error term.

x_j includes initial (1960) income, savings rate, education, and population growth. This follows the standard literature on growth, as summarized by Barro and Sala–I–Martin (1995), whom we also use in the specification of the equation, together with Sachs and Warner (1995) and Dollar (1992), among others. The steady state growth rate is derived using 1960-1997 data from Jones (2002) for 109 countries.[12]

Once the steady state rate of growth is computed, a second equation is formulated, capturing the short term dynamics of growth.

$$\Delta g_{tj} = \lambda[g_j^* - g_{t-1,j}] + \varphi v_{tj} + \gamma u_{tj} + \xi tj$$

where: g_j =rate of GDP growth in country j at time t
v_{tj} and u_{tj} are uncorrelated, zero mean shocks with finite variance
ξ is an error term.

More specifically, the variable v_{tj} represents monetary policy shocks relative to trading partners (changes in the Similarity Index). The vector u_{tj} captures other shocks, mainly terms of trade shocks. Other exogenous shocks are: the ratio of investment to GDP; enrollment in secondary education (as a proxy for human capital); the log difference of government consumption; and an index of civil liberties.[13] The rate of convergence to the steady state is λ. It is expected that the parameter φ will be positive, indicating that countries with higher degrees of monetary policy similarity are better able to manage external shocks which also affect trading partners.

In Table 5.11 we follow a similar method to test the impact of terms of trade shocks on GDP under regimes that are classified as either similar or not. We use the *Consensus* classification in Ghosh, et al. to separate countries that are Pegged, Intermediate, or Floating as described above.

The convergence coefficient has the expected sign, is significant and less than 1. The point estimates are lower than found by Edwards and Yeyati (2003), meaning

[12]The educational attainment variable is taken from Barro and Lee (2000). Other data are taken from the Penn World Tables 5.6 and the World Bank's Global Development Network Growth Database.

[13]The Similarity Index and other independent variables are from both IMF and World Bank data. With the exception of civil liberties and Similarity Index, the data were obtained from the IMF and the Wold Bank databases. Civil liberties data was obtained from Freedom House.

Table 5.11: *Terms of Trade and Real GDP growth—GGW dataset*

All countries	ΔGDP/capita coef.	s.e.	ΔGDP/capita coef.	s.e.	ΔGDP/capita coef.	s.e.
Deviation from SS (lag)	0.47	*0.22***	0.47	*0.22***	0.49	*0.22***
ΔToT	2.59	*1.33***	2.57	*1.33**	2.57	*1.33**
ΔToT–Peg+Similar (lag)	3.79	*2.93*			3.81	*2.92*
ΔToT–Peg+Different (lag)			12.51	*4.89****	12.53	*4.88****
Constant term	1.31	*0.16****	1.33	*0.16****	1.33	*0.16****
Obs. / Countries	1046 / 79		1046 / 79		1046 / 79	

Asterisks denote significance at 10 percent (*), 5 percent (**), and 1 percent (***) levels.

that a unitary shock to GDP growth will take longer to be eliminated. Terms of trade also has the expected positive sign and is significant, indicating that improvements in the terms of trade has a (temporary) positive impact on GDP growth. In accordance with the results of Edwards and Yeyati, the coefficient for variations in terms of trade in pegged regimes is always positive, indicating that the effects of terms of trade shocks on growth are larger under fixed exchange rate regimes than under floating regimes. In addition, countries that have pegged regimes are expected to be more susceptible to shocks in terms of trade if their partners are not pegged—or not similar. As expected, the coefficient for terms of trade shocks in countries which have pegged regimes and are Different is positive and significant, where the coefficient for countries that are similar is positive but not significant.

Conclusions and Policy Implications

In this paper we examined the impact of monetary policy choice in a country that differs from the monetary policy of its trading partners. This "similarity" has not been considered in previous theoretical work though recent currency crisis has brought the rules versus discretion debate back to the forefront of development theory. By creating a Relative Exchange Rate classification and using it to derive an index of Similarity, we were able to test whether the benefits of a pegged exchange rate are inherent to the monetary system, or if countries' policy decisions are not always optimized and thus the target of the peg is important for economic growth. More precisely, we tested whether the degree of policy similarity between trading partners puts a country in a better position to withstand exogenous shocks and increase growth rates.

We found that the standard interdependence model's assumption of optimized monetary policies does not hold, as evidenced by the positive impact of Similarity on real Gross Domestic Product growth. This correlation was present in both long run and short run specifications, indicating that countries do not currently consider this effect. These results, however, were found to be statistically significant but not very economically important: countries which chose a pegged exchange rate policy—in addition to the additional 10-20 percent growth from the peg itself—can expect an additional 1-10 percent increase in their growth rate over 25 years compared to a country that differs from its trading partners.

We also found that fixed and floating regimes have different experiences as similarity impacts interest rates, exports, and inflation in opposite ways, consistent with competitive devaluations. Another important finding is that policy similarity in countries with pegged exchange rate regimes reduces their exposure to terms of trade shocks.

The implications for this are interesting: when trading partners float, the benefits of a pegged regimes diminish. In light of increasing world trade and the monetary dilemma between stability and growth, countries are wise to consider a relevant target for their peg based on their trading partners, likely their regional trading bloc. The case of Argentina is a very vivid example of this. The devaluation of a significant trading partner in 1998 (Brazil) translated into significant negative externalities for Argentina, who saw its exports decrease and lost considerable output. Had its currency board arrangement been indexed to the Brazilian Real in addition to, or instead of the US Dollar, a portion of the decrease in output could have been staved off.

This model, however, suffers from limitations inherent to its structure. While it is apparent that countries do not always optimize monetary policy, we do not incorporate this decision explicitly. In addition, there is a legitimate question as to the macroeconomic target since the model is founded on a quadratic loss function with all its failings. Also, the mechanism by which exchange rate similarity impacts growth is interpreted to be competitive devaluations based on the signs of some coefficients and the assumption that the Mundell–Fleming model holds. This needs to be more formally examined in light of the possibility that the reaction functions are negatively sloped. While the stability benefits of a fixed exchange rate regime are widely accepted, it is also clear that they are largely dependent on commitment technologies. This fact needs to be more explicitly modeled and weighted against the ability of the country to adjust to exogenous shocks as well as the negative impacts of competitive devaluations. Empirically, the long run growth model requires a more complete set of regressors to further understand the magnitude of the effects.

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Appendix

A.1 Summary Statistics and Data Description

Table A.1: *Summary Statistics—Small Dataset*

Variable	Obs	Mean	S.D.	Min	Max
Real GDP growth	479	3.06	4.45	-14.42	13.95
Similarity Index	480	1.91	1.22	0.08	6.10
Investment/GDP	492	0.22	0.06	0.10	0.48
Gov't Exp. Growth	456	0.03	0.10	-1.07	0.50
GDP to SS growth gap	414	0.00	0.04	-0.20	0.12
Relative ER index	528	6.00	2.14	0.00	8.00
ToT growth	458	-0.01	0.10	-0.63	0.42
Schooling	440	5.80	1.67	2.80	10.09
Initial Income (1971)	529	1.5e+11	3.1e+11	2.6e+09	1.4e+12

Table A.2: *Summary Statistics—Ghosh, et al. (2003) Dataset*

Variable	Obs	Mean	S.D.	Min	Max
GDP/capita growth	4727	1.45	7.80	-99.9	241.9
Similarity Index	2776	2.24	1.43	0.03	6.43
Initial Income gap	2268	0.05	0.66	-2.48	1.10
ToT growth	4691	0.01	0.19	-0.85	5.99
Inflation	4732	0.56	5.65	-0.34	237.6
Population growth	4726	0.02	0.02	-0.43	0.37
Population	4890	28.5	104.7	0.00	1253
Schooling	3295	4.79	2.94	0.04	12.18
Openness	4382	0.87	1.10	-1.48	25.52
Relative ER index	3008	5.10	2.44	0.00	8.00

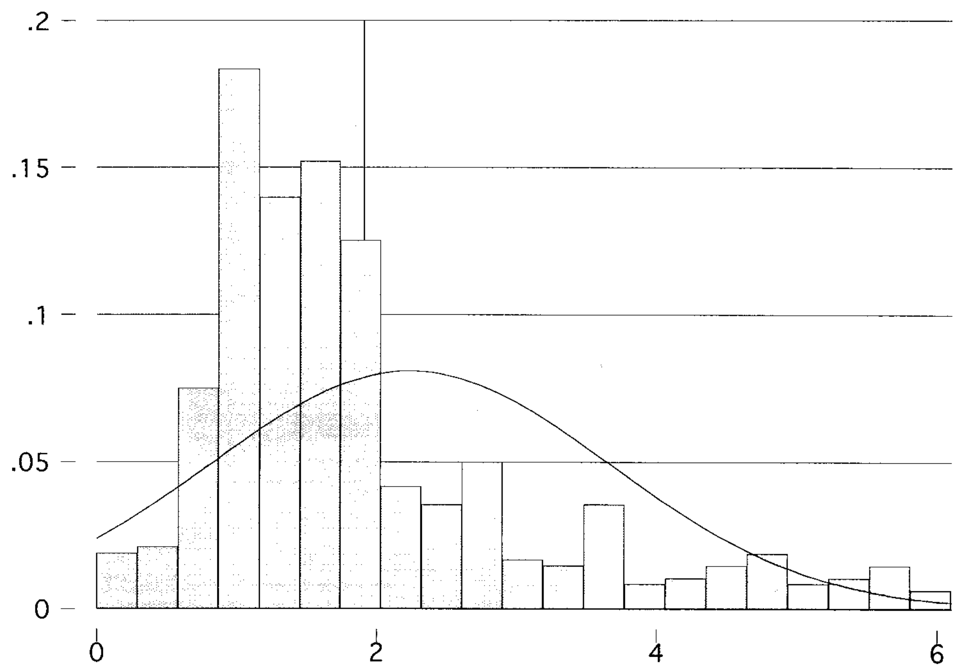

Figure A.1: *Similarity Index Histogram—Small dataset*

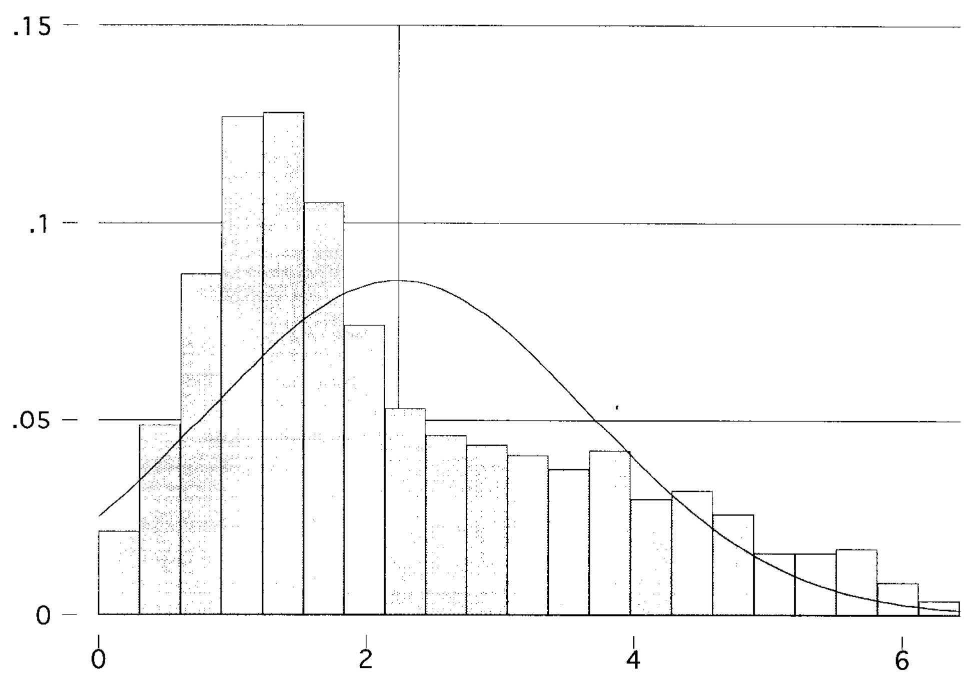

Figure A.2: *Similarity Index Histogram—GGW dataset*

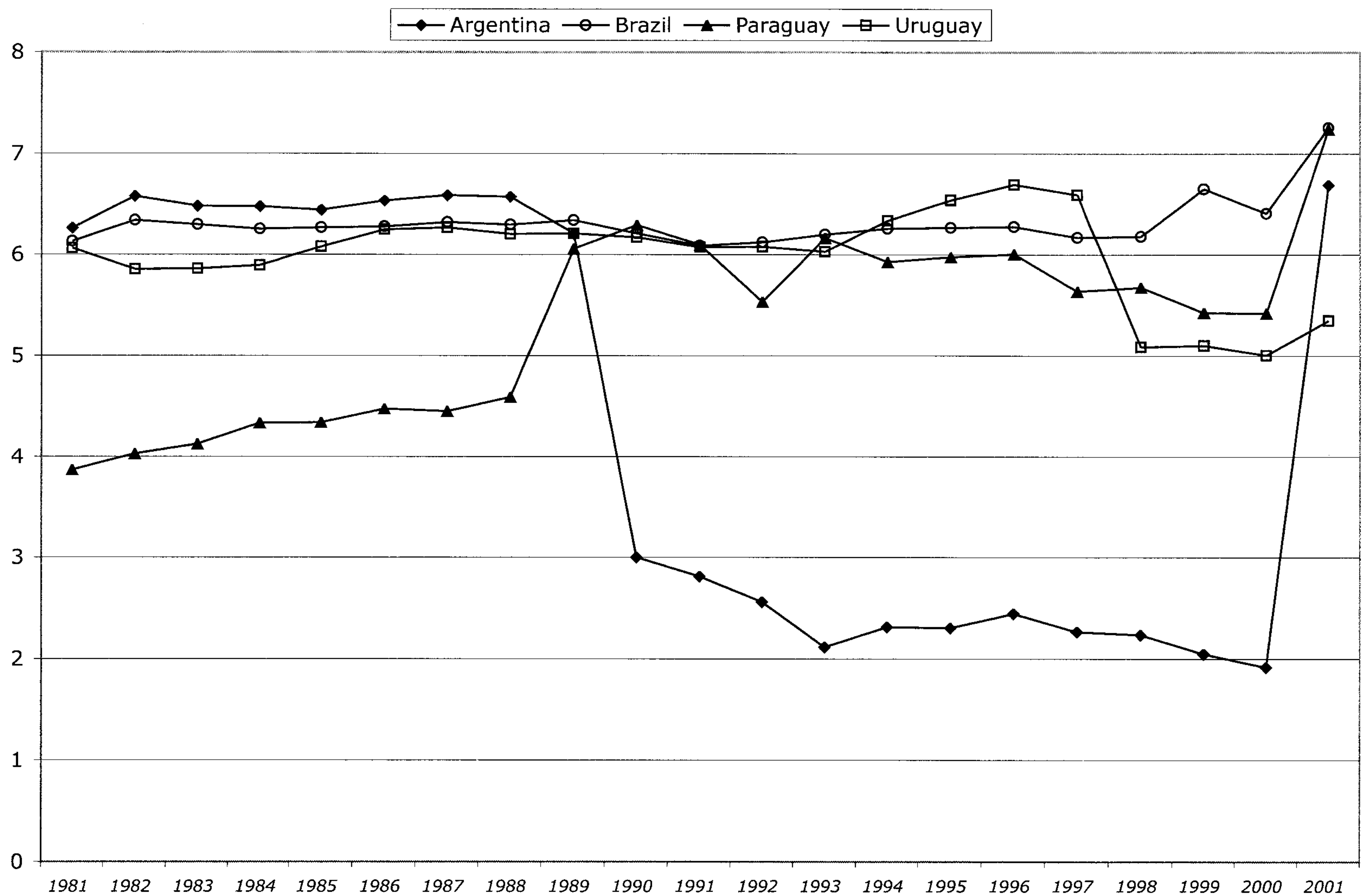

Figure A.3: *Similarity Index—Mercosur*

A.2 Exchange Rate Methodology

This Exchange Rate classification system was constructed for the purpose of quantifying the similarity of each nation's monetary system to its trading partners. Because of this, the system requires that each exchange rate regime be classified in relation to a third party.

Standard classification systems simply look at an individual country's stated policy. A nation which has a hard peg is classified as such and is the opposite of a country with a floating regime. An obvious problem arises when countries base their exchange rate decisions on different partners, which may or may not have synchronized regimes. How does one compare Ecuador and Germany? They both state the highest level of currency rigidity in that they have adopted a foreign currency as legal tender. However, the exchange rate between Ecuador and Germany's respective currencies is certainly not fixed. More importantly, their reactions to global shocks will be dictated by the reactions of the US and EU. The effect of a monetary expansion in the US are not as clear in Germany as they are in Ecuador and the classification system has to account for this difference in effective policy.

In order to address this issue there is an obvious need of a basis for comparison. By classifying each nation's exchange rate regime as it relates to the US Dollar, we are able to compare exchange rate regimes across nations as they relate to a common shock. In the example above, while Ecuador is classified as having a fixed exchange rate with no monetary policy discretion, Germany is considered to have a floating regime. This is appropriate when you consider that the Euro is allowed to float against the dollar and the ECB has discretion in monetary policy.

The Similarity Index is computed by using data from the IMF's *Direction of Trade Statistics* and the IMF's *Annual Report on Exchange Rate Arrangements and Exchange Restrictions.* One issue that was addressed is the change in the IMF's classification scale over the years, and there was a need to standardize the data. A key explaining the various classifications and their equivalents in the current system is available in Appendix A.6. The classification ranges from 0 to 8 and covers the

1976-2000 period and 187 countries.

Table A.3: *Relative Exchange Rate Index Classification Key*

IMF Classification	**Relative Index**
No separate legal tender	0
US dollar	0
EMU	8
French Franc	†
Currency board	1
Conventional peg	2
Peg with range	3
Crawling peg	4
Crawling band	5
Adjusted according to set of indicators	6
Managed float with no preannounced path	7
Independent float	8

†Varies according to French Franc classification.

A.3 The Case of Argentina

As an example of the calculations required for the model, we compute Argentina's Similarity Index, Relevancy Weight, and Exposure to Capital Flows for 2000 below.

Similarity Index (ψ):

Argentina's 5 major trading partners in 2000 are Brazil (26.9%), the US (11.9%), Chile (10.3%), Spain (3.8%), Uruguay (3.5%). The rest of the world comprises (43.7%).[1] Their respective exchange rate regimes relative to the US, as classified by the IMF and mapped on Table A.4, are:

Argentina:	Currency Board Arrangement	$\varphi = 1$
Brazil:	Independent Floating	$\varphi = 8$
Chile:	Independent Floating	$\varphi = 8$
Spain:	Independent Floating (Euro)	$\varphi = 8$
Uruguay:	Crawling Band	$\varphi = 5$
ROW:	Independent Floating (assumed)	$\varphi = 8$

In order to construct αs for Argentina, take the absolute value of the difference between its φ and that of each trading partner (j):

$$\alpha_{AR,j} = |\varphi_{AR} - \varphi_j|.$$

The resulting αs are:

$\alpha_{AR,BR} =$ 7
$\alpha_{AR,CL} =$ 7
$\alpha_{AR,SP} =$ 7
$\alpha_{AR,UR} =$ 4
$\alpha_{AR,ROW} =$ 7
$\alpha_{AR,US} =$ 7

Computing the similarity index is now a simple matter of calculating the trade weighted sum:

$$\psi_{AR} = \sum_j \alpha_{AR,j} \left(w_{AR,j} \right) = 6.08$$

where $\psi = 8$ means complete divergence.

[1] This was added for simplicity. In the model every country is included.

A.4 List of Countries — Small dataset

Argentina
Bolivia
Brazil
Chile
Colombia
Costa Rica
Ecuador
Germany
Hungary
Indonesia
Italy
Korea
Mexico
Morocco
Paraguay
Peru
Philippines
Singapore
Spain
Thailand
Turkey
Uruguay
Venezuela

A.5 List of Countries — GGW dataset

Afghanistan
Albania
Algeria
Antigua
Antilles
Argentina
Armenia
Australia
Austria
Azerbaijan
Bahamas
Bangladesh
Barbados
Belarus
Belgium
Belize
Benin
Bolivia
Bosnia and Herzegovina
Botswana
Brazil
Bulgaria
Burkina Faso
Burundi
Cameroon
Canada
Cape Verde
Central African Republic
Chad
Chile
China
Colombia
Comoros
Congo, Dem. Republic
Congo, Republic
Costa Rica
Cote D'Ivoire
Czech Republic
Denmark
Djibouti
Dominica
Dominican Republic
Ecuador
El Salvador
Equatorial Guinea
Estonia
Ethiopia
Fiji
Finland
France
Gabon
Gambia, The
Georgia
Germany
Ghana
Greece
Grenada
Guatemala
Guinea
Guinea-Bissau
Guyana
Haiti
Honduras
Hong Kong
Hungary
Iceland
India
Indonesia
Ireland
Italy
Jamaica
Japan
Kazakhstan
Kenya
Korea
Kyrgyz Republic
Lao
Latvia
Lesotho
Liberia
Libya
Lithuania
Luxembourg
Madagascar
Malawi
Malaysia
Maldives
Mali
Malta
Mauritania
Mauritius
Mexico
Moldova
Morocco
Mozambique
Myanmar (Burma)
Nepal
Netherlands
New Zealand
Nicaragua
Niger
Nigeria
Norway
Pakistan
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Poland
Portugal
Romania
Russia
Rwanda
St. Vincent and Grenadines
Samoa
São Tomé and Príncipe
Senegal
Seychelles
Sierra Leone
Singapore
Slovak Republic
Slovenia
Solomon Islands
Somalia
South Africa
Spain
Sri Lanka
St. Lucia
Sudan
Suriname
Swaziland
Sweden
Switzerland
Tajikistan
Tanzania
Thailand
Togo
Tonga
Trinidad and Tobago
Tunisia
Turkey
Turkmenistan
Uganda
Ukraine
United Kingdom
United States
Uruguay
Uzbekistan
Vanuatu
Venezuela
Vietnam
Zambia
Zimbabwe

A.6 Exchange Rate Classification Key and Data Tables

Table A.4: *IMF to Relative ER classification adjustment map*

ER	1977-1981	1982-1995	1996-1997	1998-
0				No separate tender
1				Currency board
2	Narrow band (a-d)	Peg to single currency (ai-aiv)	Peg to single currency	Conventional peg
3	Composite (f)	Composite (av), Flex. lim. (bi)	Flex. lim. (+), Composite	Peg with range
4				Crawling peg
5	Flex. limited (e)	Flex. limited (bii))	Flex. limited (▽)	Crawling band
6		Set of indicators (ci)		
7		Other managed float (cii)	Managed float	Managed—no path
8	Independent float	Independent float (ciii)	Independent float	Independent float

Table A.5: *Similarity Index Data*

Country	'81	'82	'83	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01
Afghanistan	1.4	2.7	3.0	3.0	2.9	3.0	3.7	3.3	3.1	3.1	3.2	1.4	1.3			1.5	1.5	1.2	0.3	1.3	1.3
Albania							2.0				2.8	1.1	0.9	0.7	0.7	2.4	2.8	1.2	0.0	0.2	0.2
Algeria	3.3	3.0	2.8	2.8	2.8	2.8		2.9	2.7	2.7	2.6	3.3	3.4	1.4	1.4	1.5	1.5	1.2	1.1	1.0	1.0
Angola									5.0	5.1	4.9	5.1	5.3	1.1	1.1	5.3	5.5	3.8	0.8	0.8	1.5
Antigua	5.8	4.8	4.2	3.3	3.8	5.7	5.8	5.8	5.3	4.5	4.3	5.8	5.6	5.9	5.7	5.5	5.3	5.6	5.8	6.1	6.1
Argentina	1.7	1.4	1.5	1.5	1.6	1.5	1.4	1.4	1.8	5.0	5.2	5.4	5.9	5.7	5.7	5.6	5.7	5.8	6.0	6.1	1.3
Armenia												0.7	0.9	2.5	1.2	1.3	1.3	2.6	0.1	2.1	1.1
Aruba														3.4	3.4	3.8	4.1	4.5	4.8	4.8	5.1
Australia	1.3	1.6	2.2	1.6	1.5	1.3	1.1	1.1	1.1	1.2	1.2	0.9	0.8	0.8	0.8	0.9	0.7	1.2	0.8	1.2	1.2
Austria	2.0	1.9	1.9	1.9	1.9	2.0	2.0	2.1	2.0	2.0	2.0	2.9	2.9	1.3	1.3	1.0	1.0	0.7	0.4	0.5	0.6
Azerbaijan												0.6	0.4	0.6	0.9	1.0	1.1	1.9	1.2	1.2	1.0
Bahamas	5.5	5.7	5.8	5.8	5.9	5.9		5.9	5.4	4.9	4.5	5.4	5.3	5.2	5.0	5.0	5.2	5.8	5.8	5.8	5.8
Bahrain	1.6	1.8	2.0	2.2	2.2	2.2		2.5	2.4	2.7	3.0	3.8	3.6	3.3	3.0	2.5	3.5	3.8		4.3	4.3
Bangladesh	2.1	2.2	2.4	2.6	2.6	2.8		3.2	3.2	3.1	3.2	3.9	4.0	4.0	3.9	3.6	3.8	5.5	5.5	5.6	5.6
Barbados	4.0	4.2	4.6	4.8	4.8	4.7	4.5	4.2	3.6	3.1	3.1	4.6	4.8	4.7	4.5	4.1	4.7	4.5	3.8	3.7	4.4
Belarus												0.6	1.1	1.2	0.5	0.5	0.4	1.0	1.4	0.9	2.3
Belgium	0.9	0.8	0.9	0.9	0.9	0.9	0.8	0.9	0.8	0.5	0.5	1.5	1.1	1.1	1.1	0.8	0.9				
Belize	5.3	5.2	5.2	5.2	5.3	5.4	5.6	5.5	5.3	4.7	4.7	5.7	5.7	5.8	5.8	5.6	5.7	5.8	5.6	5.7	5.8
Benin	1.0	1.2	1.2	1.2	0.8	1.0	1.3	1.5	1.7	1.5	1.2	1.5	1.7	1.7	1.6	1.5	1.7	1.0	0.7	0.9	1.0
Bhutan																					
Bolivia	5.0	4.7	4.8	4.7	1.1	1.2	1.2	1.4	1.1	3.1	3.0	2.3	1.9	1.6	1.4	1.4	1.6	3.4	3.5	3.5	3.5
Bosnia															1.2	1.9	1.9	1.9	0.4	0.6	0.7
Botswana																					
Brazil	1.9	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.8	1.9	1.9	1.8	1.7	1.7	1.7	1.8	1.8	1.3	1.6	0.7
Brunei Darossalam															0.9	0.9	0.2	6.7	6.7	6.8	6.6
Bulgaria										3.0	2.5	1.8	1.7	1.5	1.5	1.7	1.9	1.8	0.7	0.7	0.7
Burkina Faso	0.5	0.7	0.8	0.8	0.6	0.4	0.4	0.4	0.3	0.4	0.5	1.2	1.2	1.2	1.4	1.3	1.5	0.8	0.5	0.7	0.7
Burundi	4.5	3.9	2.4	1.9	2.0	2.0	2.2	2.1	2.3	2.2	2.2	3.0	3.8	4.4	4.5	4.4	4.3	6.0	1.0	0.9	0.9
Cambodia									2.7			2.2	2.3	2.1	1.9	1.5	0.6	1.0	1.9	1.9	1.3
Cameroon	1.3	1.2	1.0	0.7	0.5	0.5	0.6	0.7	0.6	0.5	0.4	1.2	0.9	0.9	0.9	0.4	0.4	0.4	0.4	0.4	0.4
Canada	0.6	0.6	0.5	0.4	0.4	0.3	0.3	0.4	0.4	0.4	0.4	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1
Cape Verde	2.7	2.3	2.2	1.5	1.5	1.6	1.9	1.7	1.9	2.5	2.2	3.2	3.3	3.3	2.8	2.4	2.8	6.0		6.0	6.0
Central African Rep.	0.7	0.5	0.4	0.3	0.3	0.4	0.4	0.5	0.6	0.6	0.6	0.3	0.2	0.2	0.2	0.4	0.7	0.7	0.2	0.9	1.0
Chad	0.6	1.1	1.1	1.2	0.8	0.8	0.8	1.0	0.9	1.2	0.7	0.9	1.0	0.9	0.9	0.8	0.9	0.6	0.2	0.2	0.2
Chile	4.4	1.5	1.5	1.6	1.6	1.5	1.5	1.5	1.5	1.6	1.7	1.9	1.9	1.8	1.8	1.4	1.8	2.9	0.8	0.9	0.5
China	3.6	3.2	3.2	3.2	3.2	1.2	0.9	0.9	0.8	0.8	0.7	0.8	0.8	0.9	0.8	0.7	0.9	4.4	4.5	4.6	4.6
Hong Kong	1.5	1.8	1.8	2.0	2.0	1.1	0.9	0.9	0.9	1.0	1.0	0.9	0.8	0.8	0.8	0.7	0.7	4.5	4.5	4.6	4.6
Colombia	2.0	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.7	1.7	1.7	1.9	1.6	1.6	1.5	1.1	1.1	2.5	0.5	0.6	0.2
Comoros	1.1	0.9	0.9	1.0	0.9	1.0	1.1	1.3	1.2	1.0	1.0	1.3	1.3	1.2	1.2	1.0	1.0	5.8		5.8	5.8
Congo, DR		2.0	1.7	2.5	2.5	2.5	2.5	2.4	2.4	2.3	2.2	1.8	1.7	1.6	1.7	1.6	1.3	0.1	0.0	0.2	0.2
Congo, Rep.	1.4	1.7	2.2	2.3	2.2	1.7	1.5	1.4	1.3	1.3	1.3	2.4	2.4	2.2	1.8	1.3	1.7	0.5	0.5	0.5	0.6
Costa Rica	2.5	2.3	2.2	2.1	1.7	1.8	1.8	1.7	1.5	1.3	1.4	0.9	0.8	0.8	1.1	1.1	1.1	3.6	3.6	3.6	3.6
Cote D'Ivoire	0.9	0.9	0.9	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	1.5	1.0	1.1	1.0	0.8	0.8	0.3	0.2	0.3	0.3
Croatia												1.6	1.5	1.5	1.3	1.5	1.4	4.4	0.9	1.1	1.2
Cyprus	3.1	2.4	2.5	2.5	2.3	2.2	2.5	2.8	3.0	2.4	2.6	3.5	3.6	3.7	3.6	3.6	3.4	3.0		3.6	3.6
Czech Republic										1.3	1.8	2.9	2.4	2.4	2.5	2.4	1.8		0.9	1.0	0.5
Denmark	1.6	1.5	1.5	1.6	1.6	1.5	1.5	1.3	1.4	1.0	1.0	1.8	1.7	1.7	1.6	1.3	1.5	4.5		4.7	4.7
Djibouti	0.9	0.9	1.7	1.5	1.4	1.5	0.6	0.9	0.9	2.6	2.6	2.5	5.4	5.7	2.6	5.5	5.3	6.4	6.3	6.4	6.4
Dominica	4.3	5.3	5.2	4.7	4.6	4.9	5.7	5.7	5.1	4.1	4.0	5.9	5.8	5.6	5.5	4.2	5.5	5.4	4.9	5.0	5.2
Dominican Republic	4.0	4.5	4.7	5.2	0.5	0.5	1.5	1.2	5.0	5.1	0.8	1.2	0.8	1.2	1.2	1.1	1.1	1.0	1.0	1.0	1.0
Ecuador	4.9	5.0	1.0	1.0	1.0	1.2	0.8	4.9	1.0	1.1	1.2	1.2	1.1	1.6	1.1	1.0	1.1	0.9			
Egypt	3.5	3.4	3.3	3.1	2.9	2.4	2.3	1.7	2.3	1.9	1.5	1.6	1.5	1.4	1.4	1.5	1.6	4.4		4.1	4.1
El Salvador	3.6	3.5	3.8	4.0	1.9	4.4	4.2	4.0	1.2	1.0	1.0	0.9	0.6	0.9	1.1	1.0	1.0	5.0		5.0	
Equatorial Guinea	1.6	2.0	2.1	2.2	0.9	0.9	1.0	1.5	0.1	0.2	0.2	0.8	0.6	1.0	1.3	1.2	1.5	1.3	1.3	1.3	1.3
Eritrea																					
Estonia												0.8	0.7	0.9	1.3	1.9	2.1	5.4	5.7	5.7	5.8
Ethiopia	3.7	3.3	3.3	3.3	3.1	3.1	3.0	3.2	3.1	3.2	3.2	3.8	2.3	2.3	2.3	2.5	2.0	1.9	1.4	2.0	2.1

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Table A.5: continued

Country	'81	'82	'83	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01
Fiji	3.8	3.4	3.2	3.7	4.3	4.5	4.6	4.4	4.6	3.8	3.7	4.8	4.7	4.8	4.7	4.2	4.5	5.4	5.3	5.3	5.4
Finland	1.7	1.6	1.7	1.8	1.8	1.8	1.9	2.0	2.0	1.7	1.8	1.6	1.4	1.4	1.4	1.7	1.7	1.2	0.8	1.0	1.0
France	1.2	1.1	1.2	1.2	1.2	1.1	1.1	1.2	1.0	0.7	0.7	1.7	1.5	1.5	1.5	1.2	1.3	0.8	0.4	0.6	0.6
Gabon	1.5	1.4	1.4	1.5	1.4	1.3	1.1	1.2	1.1	1.3	1.4	1.8	1.9	2.1	2.3	2.3	2.4	1.0	0.9	0.9	0.9
Gambia, The	1.7	2.8	2.7	3.1	2.7	2.1	1.2	1.1	1.2	1.6	2.1	1.5	1.3	1.5	1.7	1.9	2.0	0.4	0.3	0.4	0.5
Georgia												5.1	0.7	1.1	0.4	0.5	0.7	2.0	1.3	0.9	0.9
Germany	1.3	1.2	1.2	1.3	1.3	1.3	1.2	1.3	1.2	0.9	0.9	2.0	1.7	1.7	1.6	1.4	1.5	0.8	0.4	0.6	0.6
Ghana	1.0	2.7	2.4	2.6	3.5	1.0	1.2	1.4	1.8	2.5	2.2	1.9	1.7	1.9	1.9	2.1	1.8	0.4	0.2	0.3	1.0
Greece	2.6	2.1	2.3	2.2	2.1	2.0	1.8	1.9	1.9	2.0	2.0	1.8	1.7	1.6	1.5	1.6	1.3	3.9		1.1	1.1
Grenada	4.6	4.0	3.8	3.8	4.1	4.2	4.5	4.6	4.4	3.8	4.0	4.9	4.9	4.7	4.5	4.2	4.4	5.6	5.8	5.8	5.9
Guatemala	3.3	3.2	3.5	3.6	4.2	3.8	3.8	3.7	1.3	0.9	1.0	0.8	0.6	0.7	0.9	0.8	0.7	1.1	1.0	1.5	1.1
Guinea	3.8	3.5	3.5	3.3	3.2	1.8	1.8	1.5	1.7	1.7	1.8	1.6	1.6	4.3	1.6	1.8	1.8	0.5	0.4	0.5	1.0
Guinea-Bissau	2.7	2.3	1.9	2.3	1.7	1.2	1.0	1.2	1.2	0.9	1.2	1.6	1.6	1.7	1.6	1.3	1.6	0.9	1.2	1.7	1.7
Guyana	1.8	3.7	3.8	3.8	3.8	3.8	4.5	4.5	4.7	4.0	1.8	0.8	0.6	1.0	1.1	1.1	1.1	1.0	1.0	1.1	1.6
Haiti	5.1	5.2	5.2	5.2	5.2	5.2	5.2	5.3	5.4	5.5	0.5	0.4	0.5	0.6	0.6	0.6	0.3	0.0	0.0	0.1	0.1
Honduras	4.6	4.6	4.6	4.6	4.7	4.7	4.9	5.0	5.2	1.3	0.9	0.9	0.8	1.2	1.1	1.1	1.1	2.9	2.7	2.9	2.8
Hungary	1.0	0.9	0.9	1.0	0.9	1.0	1.1	1.2	1.4	1.5	1.8	2.7	2.8	3.1	1.5	1.6	1.6	2.7	2.8	2.9	4.8
Iceland	1.0	1.1	1.1	1.2	1.2	1.3	1.3	3.2	3.1	2.5	2.4	3.8	3.8	3.8	3.7	3.1	3.6	4.6		0.4	0.4
India	1.3	1.4	1.5	1.4	1.3	1.4	1.2	1.4	1.4	1.5	1.5	1.5	1.4	1.4	1.4	1.5	1.4	1.6	1.0	1.9	1.8
Indonesia	1.1	3.8	1.6	1.6	1.5	1.4	1.0	1.0	1.1	1.1	1.1	1.1	1.0	1.0	1.0	0.7	0.9	1.2	0.8	1.2	1.4
Iran	3.2	3.0	2.9	2.9	2.7	2.8	2.9	2.9	2.8	2.8	3.1	0.9	0.9	1.0	1.1	1.0	1.3	4.8		5.0	1.5
Iraq	4.2	3.9	4.1	4.1	4.1	4.1	4.1	4.3	4.4	4.0	2.9	1.9	1.5	1.2		2.0	3.1	5.2		5.6	1.3
Ireland	1.9	1.8	1.8	1.8	1.7	1.7	1.7	1.7	1.6	0.6	0.6	2.0	1.8	1.8	1.7	1.5	1.7	0.4	0.2	0.3	0.3
Israel	1.7	1.9	2.0	1.3	1.4	3.7	3.8	3.8	3.7	3.5	1.4	1.4	1.2	1.2	1.2	1.1	1.1	2.9	2.9	3.0	2.9
Italy	1.5	1.3	1.3	1.3	1.3	1.2	1.2	1.3	1.1	0.9	0.9	2.2	2.1	2.0	2.0	1.3	1.3	1.0	0.5	0.7	0.7
Jamaica	4.6	2.7	1.8	1.2	1.4	1.6	1.5	1.4	4.6	1.8	1.8	0.7	0.5	0.5	0.6		0.7	1.0	1.0	1.1	1.0
Japan	1.5	1.8	1.8	1.6	1.5	1.2	1.1	1.2	1.3	1.4	1.5	1.2	1.1	1.1	1.1		0.8	1.3	1.0	1.3	1.3
Jordan	2.4	1.3	1.3	1.4	1.5	1.6	1.9	2.0	2.2	2.1	2.2	2.8	2.7	2.6	2.4	2.4	2.5	2.8		2.6	3.2
Kazakhstan												1.1	1.0	0.9	1.3	1.4	0.7	1.4	1.0	1.3	1.2
Kenya	2.7	2.6	2.7	2.8	2.8	2.5	2.6	2.6	2.3	1.9	1.8	3.3	1.4	0.9	0.9	1.0	1.1	1.2	0.9	1.2	1.2
Kiribati						3.6	3.5	2.5	2.4	1.9	2.6	2.0	2.4	2.1	2.3	2.1	1.9				
Korea	1.1	1.5	1.6	1.5	1.4	1.4	1.2	1.2	1.3	1.3	1.3	1.2	1.1	1.1	1.0	0.8	0.9	1.9	1.4	1.8	1.7
Kuwait	3.5	2.9	2.8	2.9	2.8	2.8	3.2	3.3	3.4	3.3	3.5	4.1	4.2	3.7	3.8	3.0	4.4	5.6	5.2	5.6	5.5
Kyrgyz Republic												0.3	0.3	0.5	0.5	0.6	0.5	0.9	1.2	1.0	1.0
Lao	2.3	3.8	2.3	2.4	2.3	4.2	3.9	3.5	2.3	2.5	2.7	2.5	2.1	1.9	2.6	1.8	0.7	0.8	2.2	2.2	0.6
Latvia												1.2	1.0	1.2	1.1	1.3	3.5	4.6	4.8	4.8	4.8
Lebanon	1.9	2.4	4.3	4.1	3.4	3.2	2.9	3.4	3.3	3.4	3.4	3.2	3.2	3.1	3.3	3.4	3.4	3.1		3.0	3.2
Lesotho																					
Liberia	3.9	3.8	3.8	3.8	3.8	3.6	3.7	3.4	3.2	2.7	2.8	4.2	4.0	3.9	3.7	3.9	1.7	1.0	0.6	0.7	0.6
Libya	4.3	4.1	4.1	4.1	3.9	2.7	2.4	2.5	2.2	2.2	2.2	3.5	3.5	3.6	3.7	2.5	2.4	4.4		5.8	5.8
Lithuania												2.0	1.5	5.8	5.6	5.5	5.1	5.0	5.4	5.5	5.3
Luxembourg																0.7	0.7	0.3	0.2	0.2	0.2
Macedonia													1.0	1.1	1.0	1.1	1.3	4.9		5.7	5.7
Madagascar	1.6	2.7	2.9	2.9	2.9	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.4	1.9	1.8	2.0	2.0	0.3	0.3	0.3	0.4
Malawi	3.5	3.5	3.4	3.5	3.7	3.7	3.6	3.7	3.5	3.1	3.2	3.7	1.1	1.1	1.2	1.3	1.2	1.3	1.1	0.4	0.5
Malaysia	3.0	2.7	2.8	2.9	3.1	3.2	3.9	3.9	3.9	3.8	3.8	1.0	0.9	0.9	0.9	0.8	0.8	5.1		5.1	5.1
Maldives	2.8	1.7	1.4	1.8	2.4	3.0	1.9	1.9	1.7	2.1	1.4	1.1	1.1	1.0	1.0	1.2	1.4	5.0		5.5	5.4
Mali	0.8	0.7	0.8	0.8	0.7	0.4	0.4	0.7	1.0	1.0	0.9	1.5	1.4	1.4	1.5	1.4	1.5	0.7	0.3	0.5	0.6
Malta	2.5	2.4	2.4	2.4	2.3	2.3	2.4	2.4	2.4	2.0	2.0	3.6	3.7	3.7	3.6	2.9	3.2	5.4	5.4	5.4	5.4
Marshal Islands																					
Mauritania	3.2	3.1	3.1	2.9	2.7	2.6	1.3	1.5	1.5	1.5	1.5	3.7	3.6	3.6	1.4	2.0	1.6	1.1	1.0	1.1	1.1
Mauritius	4.0	3.9	3.9	3.9	3.8	3.7	3.6	3.6	3.6	2.4	2.4	3.7	3.8	1.3	1.4	1.4	1.4	0.1	0.1	0.1	1.1
Mexico	0.6	1.1	1.1	1.1	1.0	1.1	1.1	1.2	1.2	1.2	1.1	1.1	1.1	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1
Micronesia																					
Moldova												0.2	0.2	0.4	1.0	1.1	1.3	1.2	0.4	0.9	1.1
Mongolia											4.5	5.1	0.6	0.5	0.6	0.7	0.6	2.3	2.7	2.8	2.7
Morocco	2.0	2.3	1.5	1.6	1.5	1.5	1.5	1.6	1.8	2.2	2.3	2.7	2.8	3.0	3.0	2.5	2.9	5.5	5.5	5.6	5.6

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Table A.5: continued

Country	'81	'82	'83	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01
Mozambique				2.7	2.7	2.9	4.6	4.8	3.7	1.4	1.5	1.9	1.6	1.3	1.1	1.2	1.1	0.4	1.3	1.2	1.6
Myanmar (Burma)	3.0	2.3	2.6	2.6	2.6	2.7	3.2	3.3	3.2	3.3	3.5	4.2	4.1	4.1	4.1	3.7	4.2	4.8	4.8	4.7	1.3
Namibia																					
Nepal	1.3	1.0	0.9	0.9	0.9	0.9	1.1	1.3	1.4	1.5	1.4	1.7	1.6	1.6	1.5	1.4	1.3	0.4	0.5	1.0	0.8
Netherlands	0.9	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.8	0.5	0.5	3.9	1.1	1.1	1.1	0.9	1.0	0.5	0.2	0.4	0.4
Antilles	4.2	4.5	4.6	4.7	4.6	4.3	4.0	3.7	3.7	4.0	4.7	4.6	1.3	4.6	4.6	4.4	4.9	5.2	5.0	4.9	5.2
New Zealand	1.1	1.3	1.6	1.5	1.3	1.1	1.0	0.9	0.9	1.2	1.2	0.8	0.8	0.7	0.7	0.8	0.7	1.0	0.6	1.0	0.9
Nicaragua	4.2	3.9	3.9	4.0	4.0	3.8	3.7	3.6	4.0	1.1	4.8	5.1	1.7	1.7	1.5	1.1	1.1	3.6	3.6	3.6	3.6
Niger	1.3	1.1	0.9	0.9	0.6	0.5	0.3	0.4	0.4	0.4	0.4	0.5	0.7	0.9	1.0	0.7	1.1	0.2	0.3	0.3	0.3
Nigeria	1.9	1.8	1.8	1.7	1.7	1.8	1.4	3.8	1.3	1.2	1.4	1.3	4.8	4.8	4.8	4.7	1.3	1.1	1.1	1.0	0.9
Norway	3.2	3.0	3.0	3.0	3.0	2.8	2.8		2.8	2.0	2.0	1.7	1.4	1.4	1.4	1.5	1.5	1.3	1.0	1.2	0.4
Oman	1.5	1.8	2.0	2.0	1.9	2.2	2.4	3.0	3.1	2.5	1.7	1.1	1.3	1.4	1.6	1.7	1.1	1.8	1.1	2.4	2.1
Pakistan	3.7	2.2	2.4	2.2	1.9	1.8	1.6	1.7	1.6	1.7	1.8	1.6	1.5	1.5	1.4	1.3	1.4	2.0		2.0	1.9
Palau																					
Panama																					
Papua New Guinea	3.9	3.6	3.4	3.6	3.6	3.7	3.9	4.0	4.0	4.0	4.4	4.7	4.7	0.5	0.6	0.6	0.5	0.4	0.4	0.4	0.5
Paraguay	4.1	4.0	3.9	3.7	3.7	3.5	3.6	3.4	1.9	1.7	1.9	2.5	1.8	2.1	2.0	2.0	2.4	2.3	2.6	2.6	0.8
Peru	1.8	1.7	1.3	1.6	4.5	4.4	4.4	4.4	4.5	1.4	1.4	1.0	0.9	1.0	1.0	1.0	0.9	0.8	0.5	0.6	0.5
Philippines	0.9	1.3	1.4	1.1	1.1	1.1	0.9	0.9	0.8	1.0	1.0	0.9	0.7	0.8	0.8	0.8	0.7	0.8	0.6	0.9	0.9
Poland						1.4	1.4	1.5	1.6	1.5	1.9	2.0	1.8	1.8	1.6	1.7	1.5	2.6	0.5	0.7	0.7
Portugal	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.5	1.5	2.1	0.6	1.3	1.1	1.0	1.0	0.9	0.9	0.4	0.1	0.3	0.3
Qatar	2.0	3.0	3.0	3.0	3.2	3.2	3.7	3.8	3.9	4.2	4.3	4.4	4.4	4.4	4.3	1.6	4.5	4.6		5.4	5.4
Romania	2.0	1.9	1.5	1.5	1.4	1.5	1.7	1.7	1.8	1.8	1.4	1.7	1.7	1.8	1.7	2.2	1.5	1.6	1.1	1.3	2.9
Russia												1.9	1.6	1.4	1.1	1.2	1.1	1.7	1.0	1.4	1.5
Rwanda	3.2	4.0	2.8	2.6	2.4	2.4	2.5	2.6	2.7	2.4	2.3	2.4	2.6	2.2	1.9	2.0	1.8	0.8	0.4	1.2	1.2
S. Kitts and Nevis	6.7	6.5	6.6	6.6	6.6	6.6	6.6	6.7	6.7	5.7	5.6	6.7	6.8	6.8	6.7	6.6	6.6	6.8	6.7	6.7	6.7
S. Lucia	5.3	5.8	6.1	6.3	6.2	6.1	6.0	6.1	6.2	4.4	4.3	6.2	6.1	6.1	6.2	6.2	6.3	6.1	5.6	5.6	5.8
S.Vincent and Granadines	3.9	3.6	4.3	4.6	4.5	3.9	4.0	4.4	4.5	3.1	3.0	5.1	4.6	4.1	4.1	3.9	4.4	4.3	3.8	3.9	4.4
Samoa	1.1	0.8	1.0	0.9	1.1	1.2	1.2	4.2	4.0	4.3	4.7	5.0	4.9	4.9	4.8	4.7	4.7	5.8	5.9	5.9	5.8
San Marino																					
São Tomé e Príncipe	2.2	2.2	2.3	2.2	2.2	2.1	2.3	2.6	2.3	2.7	1.3	2.0	1.8	2.0	1.9	2.3	2.2	0.3	0.4	0.4	0.4
Saudi Arabia	1.6		3.3	3.3	3.2	3.3	3.5	3.6	3.6	3.6	3.7	3.9	3.9	3.9	3.8	2.9	3.8	4.2		5.1	5.1
Senegal	0.9	0.8	0.7	0.8	0.8	0.7	0.7	0.8	0.7	0.6	0.7	1.3	1.2	1.4	1.5	1.1	1.0	0.3	0.2	0.4	0.4
Seychelles	1.8	3.8	4.0	4.3	4.2	3.7	2.8	2.1	1.8	1.9	2.1	3.4	3.5	3.9	4.1	3.3	3.2	6.0	6.0	6.0	5.9
Sierra Leone	4.1	1.3	4.4	3.9	3.0	1.7	4.6	4.7	4.7	2.0	1.9	1.4	1.6	1.7	2.1	1.7	1.4	0.0	0.1	0.1	0.1
Singapore	3.0	2.6	2.5	2.7	2.8	2.9	1.7	1.7	1.8	1.8	1.8	1.2	1.1	1.0	1.0	0.9	0.8	2.5	1.5	2.5	2.3
Slovak Republic												2.8	1.7	1.8	2.1	2.0	3.1	1.0	0.8	0.9	1.2
Slovenia												1.7	1.7	1.5	1.4	1.5	1.4	1.5	0.9	1.1	1.1
Solomon Islands	4.3	4.2	3.9	3.8	3.5	3.6	3.5	3.6	3.7	3.5	3.7	4.1	4.1	4.2	4.2	1.8	1.0	5.4	5.2	5.2	3.6
Somalia	5.3	0.3	2.8	2.7	2.4	2.3	1.6	1.3	1.3	2.9	3.1	3.2	3.2	4.0		4.3	4.1	4.0	0.2	5.0	5.0
South Africa																	1.2	0.7	0.7	0.8	0.9
Spain	2.4	1.9	2.0	1.9	1.8	1.7	1.6	2.2	1.0	0.8	0.6	1.4	1.3	1.3	1.3	0.9	1.0	0.7	0.4	0.5	0.4
Sri Lanka	2.3	2.0	2.2	2.2	2.1	1.9	1.5	1.6	1.7	1.8	1.7	1.6	1.4	1.4	1.3	1.2	1.2	2.8	2.7	1.4	1.3
Sudan	3.9	2.2	2.4	2.4	1.6	1.9	3.1	3.4	3.4	3.1	2.9	2.6	2.1	1.9	2.1	1.9	1.9	2.4	1.2	2.8	2.7
Suriname	3.3	3.3	3.3	3.3	3.4	3.4	3.5	3.1	3.1	3.0	3.1	4.0	5.0	1.3	1.2	1.2	1.2	0.9	0.8	4.5	5.8
Swaziland				6.0	6.0	6.0															
Sweden	2.3	2.2	2.3	2.4	2.4	2.4	2.5	2.5	2.4	2.1	2.1	1.6	1.5	1.5	1.5	1.8	1.7	1.1	0.5	0.9	0.8
Switzerland												1.9	1.9	1.8	1.8	2.0	1.9	0.7	0.4	0.6	0.6
Syria	2.5	2.0	2.0	1.9	1.8	1.8	1.7	1.8	1.9	2.2	2.7	4.5	4.5	4.4	4.3	3.5	3.4	4.2	4.1	4.6	4.6
Tajikistan													0.8	1.2	1.7	1.6	1.1	1.0	0.8	0.7	0.6
Tanzania	2.8	2.5	2.5	2.5	2.5	2.5	2.8	2.8	2.9	2.7	2.5	3.0	1.8	1.5	1.3	1.3	1.1	0.6	0.3	0.7	0.7
Thailand	2.9	2.5	2.6	2.8	2.7	2.9	3.4	3.5	3.6	3.5	3.6	4.0	4.1	4.1	4.1	3.2	0.9	1.3	0.9	1.3	1.6
Togo	0.9	0.6	0.6	0.5	0.7	0.9	1.2	1.4	1.3	1.4	1.4	2.0	1.9	2.0	1.9	2.0	1.9	0.8	0.3	0.5	0.6
Tonga					0.2	0.2	0.2	0.3	0.3	0.2	0.2	4.8	4.9	4.9	4.9	2.0	4.7	5.6	5.7	5.7	4.8
Trinidad–Tobago	4.6	4.5	4.6	4.9	5.0	5.0	5.0	4.9	4.7	4.7	4.8	1.2	1.0	1.2	1.3	1.2	1.2	1.2		4.8	1.5
Tunisia	2.9	2.6	2.6	2.5	2.3	1.7	1.6	1.9	2.0	2.1	2.1	2.0	1.9	1.8	1.7	1.9	1.9	3.7	3.6	1.3	1.2
Turkey	3.0	2.5	2.7	2.7	2.5	2.3	2.1	2.2	2.1	2.1	2.0	1.9	1.8	1.7	1.5	1.5	1.4	3.3	3.3	0.9	0.9

continued on next page

Table A.5: continued

Country	'81	'82	'83	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01
Turkmenistan												1.5	1.1	5.1	1.1	0.9	0.5	3.2		4.4	5.2
Uganda	1.5	1.4	1.5	1.5	1.4	4.7	4.6	4.5	3.0	2.6	2.4	2.5	1.9	2.0	2.1	2.3	2.1	0.8	0.4	0.6	0.7
Ukraine												1.3	1.1	1.0	0.7	0.7	0.7	3.4	1.4	1.3	1.4
U. Arab Emirates	1.5	3.5	3.6	3.6	3.6	3.6	3.8	3.9	3.9	3.8	3.8	4.3	4.4	4.4	4.4	2.1	4.5	4.4		5.1	5.2
United Kingdom	2.2	2.4	2.5	2.4	2.3	2.3	2.2	2.2	2.4	1.1	1.0	2.1	1.9	1.8	1.8	2.0	2.0	0.8	0.4	0.7	0.6
United States	1.5	1.7	1.8	1.6	1.5	1.5	1.3	1.3	1.3	1.5	1.4	1.2	1.0	1.0	1.0	1.0	0.9	0.9	0.5	0.8	0.7
Uruguay	1.9	2.1	2.1	2.1	1.9	1.8	1.7	1.8	1.8	1.8	1.9	1.9	2.0	1.7	1.5	1.3	1.4	2.9	2.9	3.0	2.7
Uzbekistan												1.6	1.4	1.2	0.7	0.7	0.6	1.0	1.0	0.9	0.9
Vanuatu	3.3	2.8	2.5	2.3	2.6	2.9	3.2	3.3	3.1	3.0	3.1	3.6	3.8	3.8	3.7	2.1	3.8	5.5	5.6	5.5	5.4
Venezuela	3.5	3.5	3.3	4.1	4.4	4.9	4.9	4.8	1.1	1.0	0.7	0.6	1.1	5.5	5.3	1.1	1.2	2.7	2.9	2.9	0.7
Vietnam	3.2	2.7	2.7	2.0	1.4	1.3	1.7	1.9	0.7	0.8	0.8	0.9	0.8	0.8	0.7	0.6	0.9	1.5	4.2	4.3	1.3
Yemen Republic	2.1	1.3	1.4	1.9	2.0	1.7	2.4	3.2	4.1	4.0											
Yemen PDR	3.0	2.7	2.9	2.9	2.9	2.9	2.9	3.2	3.2												
Yugoslavia	2.0	1.7	1.7	1.6	1.5	1.6	1.6	1.7	1.7	2.5	2.6										
Zambia	3.3	3.0	3.1	3.0	2.0	1.9	3.9	3.1	3.2	1.7	1.8	2.2	1.9	1.8	1.7	1.7	1.3	0.9	0.4	0.7	1.3
Zimbabwe	2.9	2.9	3.0	3.0	3.1	3.1	2.9	2.9	2.8	2.7	2.7	3.6	4.0	1.0	1.0	1.1	1.1	0.9	5.0	3.7	5.1

Table A.6: *Relative Exchange Rate Data*

Country	'76	'77	'78	'79	'80	'81	'82	'83	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02
Afghanistan	8	8	8	8	8	8	3	3	3	3	3	2	2	2	2	2	8	8			8	8	8	8	8	8	7
Albania												3				3	8	8	8	8	8	8	8	8	8	8	8
Algeria	3	3	3	3	3	3	3	3	3	3	3		3	3	3	3	3	3	7	7	7	7	7	7	7	7	7
Angola														2	2	2	2	2	7	7	2	2	4	8	8	7	7
Antigua	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Argentina	2	2	6	8	8	8	7	7	7	7	7	7	7	8	1	1	1	1	1	1	1	1	1	1	1	7	7
Armenia																	8	8	8	8	8	8	8	8	8	8	8
Aruba													2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Australia	8	8	8	8	8	8	7	5	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Austria	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	5	5	5	5	8	8	8	8	8
Azerbaijan																	8	8	8	8	8	8	7	7	7	7	7
Bahamas	2	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Bahrain	2	2	8	8	8	8	3	3	3	3	3		3	3	3	3	3	3	3	3	3	3	3		2	2	2
Bangladesh	8	8	8	3	3	3	3	3	3	3	3		3	3	3	3	3	3	3	3	3	3	2	2	2	2	2
Barbados	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Belarus																	8	7	7	7	7	7	7	7	7	5	5
Belgium	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8	8	8	8	8
Belize						2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Benin	8	8	8	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8	8	8	8	8
Bhutan						8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	2		2	2	2
Bolivia	2	2	2	8	2	2	2	2	2	8	8	8	8	8	8	8	8	8	8	8	8	7	4	4	4	4	4
Bosnia																				8	8	8	8	8	8	8	8
Botswana	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2
Brazil	2	2	6	6	6	6	6	6	6	6	6	6	6	6	8	8	8	8	7	7	7	7	8	8	8	8	8
Brunei Dar.																				8	8	8	1	1	1	1	1
Bulgaria															8	8	8	8	8	8	8	8	8	8	8	8	8
Burkina Faso	8	8	8	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8	8	8	8	8
Burundi	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	7	7	7	7
Cambodia														2			7	7	7	7	7	7	7	7	7	7	7
Cameroon	8	8	8	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8	8	8	8	8
Canada		8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Cape Verde			3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	8	2		2	2	2
C. African Rep.	8	8	8	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8	8	8	8	8
Chad	8	8	8	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8	8	8	8	8
Chile	2	2	6	2	2	2	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	5	8	8	8	8
China	2	2	2		3	3	3	3	3	3	7	7	7	7	7	7	7	7	7	7	7	7	2	2	2	2	2
Hong Kong	8	8	8	8	8	8	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	1	1	1	1	1
Colombia	2	2	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	7	7	7	5	8	8	8	8
Comoros		8	8	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	2		2	2	2
Congo, DR	3	3	3	3	3		3	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Congo, Rep.	8	8	8	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8	8	8	8	8
Costa Rica	2	2	2	2	8	8	7	7	7	7	7	7	7	7	7	7	8	8	8	7	7	7	4	4	4	4	4
Cote D'Ivoire	8	8	8	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8	8	8	8	8
Croatia																	8	8	8	7	7	7	3	7	7	7	7
Cyprus	3	3	3	3	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3
Czech Rep.															3	3	3	3	3	3	3	7		7	7	8	8
Denmark	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3		3	3	3
Djibouti			2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1
Dominica	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dominican Rep.	2	2	2	2	2	2	2	2	2	8	8	9	7	2	2	8	8	8	7	7	7	7	7	7	7	7	7
Ecuador	2	2	2	2	2	2	2	7	7	7	7	8	2	8	7	7	7	7	6	7	7	7	8	0	0	0	0
Egypt	2	2	2	2	2	2	2	2	2	2	2	8	7	8	7	7	7	7	7	7	7	7	2		3	3	7
El Salvador	2	2	2	2	2	2	2	2	2	6	2	2	2	8	8	8	8	8	8	7	7	7	2		2	0	0
Eq. Guinea	2	2	3	8	8	8	8	8	8	5	5	5	5	5	5	5	5	5	5	5	5	5	8	8	8	8	8
Eritrea																			7	7	7	8	8	8	2	2	2
Estonia																	8	8	8	8	8	8	1	1	1	1	1
Ethiopia	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	8	8	8	8	7	7	7	7	7	7

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Table A.6: continued

Country	'76	'77	'78	'79	'80	'81	'82	'83	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02
Fiji	3	3	3	3	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2
Finland	3	3	3	3	6	3	3	3	3	3	3	3	3	3	3	3	8	8	8	8	5	5	8	8	8	8	8
France	8	8	8	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8	8	8	8	8
Gabon	8	8	8	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8	8	8	8	8
Gambia, The	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	7
Georgia																	2	8	7	7	7	7	8	8	8	8	8
Germany	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8	8	8	8	8
Ghana	2	2	8	8	8	8	3	3	3	2	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	7	7
Greece	8	8	8	8	8	8	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	5	3		8	8	8
Grenada	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Guatemala	2	2	2	2	2	2	2	2	2	2	2	2	2	8	8	8	8	8	8	8	8	8	8	7	7	7	7
Guinea	3	3	3	3	6	3	3	3	3	3	8	8	7	7	7	7	7	7	2	8	8	8	8	8	8	7	2
Guinea–Bissau		2	3	3	6	3	3	3	7	7	7	7	7	7	7	7	7	7	7	7	5	5	8	8	8	8	8
Guyana	2	2	2	2	2	8	3	3	3	3	3	2	2	2	2	8	8	8	8	8	8	8	8	8	8	7	7
Haiti	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	8	8	8	8	8	8	8	8	8	8	8	7
Honduras	2	2	2	2	2	2	2	2	2	2	2	2	2	2	7	8	8	8	7	7	7	7	5	5	5	5	5
Hungary						3	3	3	3	3	3	3	3	3	3	3	3	3	3	7	7	7	5	5	5	3	3
Iceland	8	8	8	8	8	8	7	7	7	7	7	7	3	3	3	3	3	3	3	3	3	3	3		8	8	8
India	3	3	3	8	8	8	7	7	7	7	7	7	7	7	7	7	8	8	8	8	8	8	8	8	7	7	7
Indonesia	2	2	8	8	8	8	3	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	8	7	7
Iran	3	3	8	8	6	3	3	3	3	3	3	3	3	3	3	3	8	8	8	7	7	7	2		2	7	7
Iraq	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		2	2	2		2	7	7
Ireland	8	8	8	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8	8	8	8	8
Israel	3	8	8	8	8	8	8	8	7	7	3	3	3	3	3	7	7	7	7	7	7	7	5	5	5	5	5
Italy	8	8	8	5	5	5	5	5	5	5	5	5	5	5	5	5	8	8	8	8	5	5	8	8	8	8	8
Jamaica	2	2	8	2	2	2	5	7	8	8	7	7	7	2	8	8	8	8	8	8		8	7	7	7	7	7
Japan	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8		8	8	8	8	8	8
Jordan	3	3	3	3	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2		2	2	2
Kazakhstan																	8	8	8	8	8	7	7	8	7	7	7
Kenya	3	3	3	3	6	3	3	3	3	3	3	3	3	3	3	3	3	8	8	8	8	7	7	7	7	7	7
Kiribati											8	8	8	8	8	8	8	8	8	8	8	8	0	0	0	0	0
Korea	2	2	2	2	8	8	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	8	8	8
Kuwait	3	3	3	3	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2
Kyrgyz Rep.																	8	8	8	7	7	7	7	7	7	7	7
Lao		2	2	2	2	2	8	2	2	2	2	2	2	7	7	7	7	7	7	8	7	7	7	7	7	7	7
Latvia																	8	8	8	7	7	3	2	2	2	2	2
Lebanon	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	2		2	2	2
Lesotho	2	2	2	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	2		2	2	2
Liberia	2	2	2	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	8	8	8	8	8	8
Libya	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3		2	2	2
Lithuania																	8	8	1	1	1	1	1	1	1	1	1
Luxembourg																				5	5	5	8	8	8	8	8
Macedonia																		8	7	7	7	7	2		2	2	2
Madagascar	8	8	8	5	5	5	3	3	3	3	6	6	6	6	6	6	6	6	8	8	8	8	8	8	8	8	8
Malawi	3	3	3	3	6	3	3	3	3	3	3	3	3	3	3	3	3	8	8	8	8	7	7	7	8	8	8
Malaysia	3	3	5	3	6	3	3	3	3	3	3	3	3	3	3	3	7	7	7	7	7	7	2		2	2	2
Maldives			2	8	8	8	3	3	3	3	3	8	8	7	8	7	7	7	7	7	7	7	2		2	2	2
Mali	8	8	8	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8	8	8	8	8
Malta	3	3	3	3	6	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2
Marshal Islands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mauritania	3	3	3	3	6	3	3	3	3	3	3	7	7	7	7	7	3	3	3	8	8	7	7	7	7	7	7
Mauritius	3	3	3	3	6	3	3	3	3	3	3	3	3	3	3	3	3	3	7	7	7	7	8	8	8	7	7
Mexico	8	8	6	8	8	8	7	7	7	7	7	7	7	7	7	7	7	7	8	8	8	8	8	8	8	8	8
Micronesia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Moldova																	8	8	8	8	8	8	8	8	8	8	7
Mongolia																2	2	8	8	8	8	8	8	8	8	7	7
Morocco	3	3	3	3	8	8	8	7	7	7	7	7	7	7	3	3	3	3	3	3	3	3	2	2	2	2	2

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Table A.6: continued

Country	'76	'77	'78	'79	'80	'81	'82	'83	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02
Mozambique									3	3	3	2	2	3	6	6	8	8	8	8	8	8	8	8	8	8	8
Myanmar	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	7	7
Namibia															8	8	8	8	8	8	8	8	2		2	2	2
Nepal	3	3	3	8	8	8	7	7	7	7	7	7	7	7	7	7	8	8	8	8	8	8	8	8	7	7	7
Netherlands	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	2	5	5	5	5	5	8	8	8	8	8
Antilles	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	8	2	2	2	2	2	2	2	2	2
New Zealand	3	3	3	8	8	8	7	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Nicaragua	2	2	2	2	2	2	2	2	2	2	2	2	2	2	7	2	2	6	6	6	7	7	4	4	4	4	4
Niger	8	8	8	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8	8	8	8	8
Nigeria	8	8	8	8	8	8	7	7	7	7	8	8	3	8	8	8	8	2	2	2	2	7	7	7	7	7	7
Norway	5	5	3	3	3	3	3	3	3	3	3	3		3	3	3	8	8	8	7	7	7	7	7	7	8	8
Oman	3	3	3	8	8	8	7	7	7	7	7	7	7	7	7	7	8	8	8	8	8	8	8	8	7	7	7
Pakistan	2	2	2	2	2	2	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7		7	7	7
Palau																							0	0	0	0	0
Panama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pap. N. Guinea	8	8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	8	8	8	8	8	8	8	8	8
Paraguay	2	2	2	2	2	2	2	2	2	2	2	2	2	8	8	8	8	8	8	8	8	8	7	7	7	7	7
Peru	2	8	6	8	6	6	6	7	6	2	2	2	2	2	8	8	8	8	8	8	8	8	8	8	8	8	8
Philippines	8	8	8	8	8	8	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Poland											3	3	3	3	3	7	7	7	7	7	7	7	5	8	8	8	8
Portugal	8	3	6	6	6	6	6	6	6	6	6	6	6	6	7	5	5	5	5	5	5	5	8	8	8	8	8
Qatar	8	8	8	8	8	8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		2	2	2
Romania	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	7	8	8	8	8	8	7	7	7	7	5	5
Russia																	8	8	8	7	7	7	7	8	7	7	7
Rwanda	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	8	8	8	8	8	8	7	7	7
S. Kitts	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
S. Lucia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
S.Vincent	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Samoa	3	3	3	8	8	8	7	7	7	7	7	7	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2
San Marino	8	8	8	5	5	5	5	5	5	5	5	5	5	5	5	5	8	8	8	8	5	5	8	8	8	8	8
S. Tomé and P.		3	3	3	3	3	3	3	3	3	3	3	3	3	3	7	7	7	8	8	8	8	8	8	8	8	8
Saudi Arabia	8	8	8	8	8	8		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		2	2	2
Senegal	8	8	8	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8	8	8	8	8
Seychelles		8	8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2
Sierra Leone	8	8	3	3	3	3	7	2	2	3	8	2	2	2	8	8	8	8	8	8	8	8	8	8	8	8	8
Singapore	5	3	3	3	3	3	3	3	3	3	3	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Slovak Rep.																	7	3	3	3	3	3	7	7	7	7	7
Slovenia																	7	7	7	7	7	7	7	7	7	7	5
Solomon Is.			2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	7	2	2	2	4	4
Somalia	2	2	2	2	2	2	3	6	6	6	6	2	3	3	7	7	7	7	8		8	8	8	8	8	8	8
South Africa	2	2	2	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Spain	3	8	8	8	8	8	7	7	7	7	7	7	8	5	5	5	5	5	5	5	5	5	8	8	8	8	8
Sri Lanka	3	8	8	8	8	8	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	5	5	7	7	8
Sudan	2	2	2	2	2	2	2	2	2	3	3	2	2	2	2	2	8	7	7	8	7	7	8	8	7	7	3
Suriname			2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	8	7	7	7	7	7	3	2	2
Swaziland	2	2	2	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	2		2	2	2
Sweden	5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	8	8	8	8	8	8	8	8	8	8	8
Switzerland																	8	8	8	8	8	8	8	8	8	8	8
Syria	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Tajikistan																		8	8	8	8	7	7	7	8	8	7
Tanzania	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	8	8	8	8	8	8	8	8	8	8
Thailand	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	7	8	8	8	7	7
Togo	8	8	8	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	8	8	8	8	8
Tonga										8	8	8	8	8	8	8	3	3	3	3	3	3	2	2	2	3	3
Trin. and Tob.	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	8	8	8	8	8	8	8		2	7	7
Tunisia	3	3	3	3	3	3	3	3	3	3	7	7	7	7	7	7	7	7	7	7	7	7	4	4	7	7	4
Turkey	2	8	8	8	8	8	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	4	4	8	8	8

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Table A.6: continued

Country	'76	'77	'78	'79	'80	'81	'82	'83	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02
Turkmenistan																	8	7	2	8	7	7	2		2	2	2
Uganda	3	3	3	3	3	8	7	7	7	7	2	2	2	3	3	3	8	8	8	8	8	8	8	8	8	8	8
Ukraine																	8	8	8	7	7	7	3	7	7	7	2
U. Arab Emir.	2	2	3	3	8	8	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		2	2	2
United Kingdom	8	8	8	8	8	8	8	8	8	8	8	8	8	8	5	5	8	8	8	8	8	8	8	8	8	8	8
United States	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Uruguay	8	2	6		8	8	8	8	8	8	8	8	8	8	8	8	7	7	7	7	7	7	5	5	5	5	8
Uzbekistan																	8	8	8	7	7	7	7	7	7	7	7
Vanuatu						3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2
Venezuela	2	2	2	2	2	2	2	2	2	2	2	2	2	8	8	8	8	7	2	2	7	7	5	5	5	8	2
Vietnam	3	3	3	3	3	3	3	3	3	3	2	2	2	7	7	7	7	7	7	7	7	7	7	3	3	7	7
Yemen Republic	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	8	8	8	8	8	8	8
Yemen PDR	2	2	2	2	2	2	2	2	2	2	2	2	2	2													
Yugoslavia	8	8	8	8	8	8	7	7	7	7	7	7	7	7	8	8									7	7	7
Zambia	3	3	3	3	3	3	3	3	3	8	8	2	3	3	6	6	8	8	8	8	8	8	8	8	8	7	7
Zimbabwe				2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	8	8	8	8	8	2	4	2	2

Exchange Rate Policy Among Trading Partners: Does it Pay to be Different?

Marcelo T. LaFleur, Ph.D.
Fordham University, April 28, 2004

Dissertation directed by Darryl McLeod, Ph.D.

Most models of monetary coordination overlook two important aspects of exchange rate regimes in developing countries: countries generally peg to a single currency, and they may or may not adopt the same exchange rate regime as many of their trading partners, especially during periods of financial instability (such as the 1990s). This paper develops a model in which two trading partners initially peg their currency to that of a "large" country. Then we ask: does it matter if these countries adopt different currency regimes? We show that under certain circumstances the choice of a trading partner to float can impair the economic performance of the economy which maintains a hard peg. In other words, countries that maintain a pegged exchange rate can suffer welfare losses if their trading partners switch to more flexible forms of exchange rates.

To test the empirical impact of these "third country" effects, we develop a new index of exchange regime "similarity" across trading partners using a variation of the *de jure* exchange rate regime derived from the IMF's *Annual Report on Exchange Rate Arrangements and Restrictions*. Estimates based on panels of 23 and 154 countries show the decision of one's trading partners to adopt "different" (more flexible) regimes imposes a statistically significant cost in terms of slower real growth and higher interest rates. Terms of trade shocks also impact pegged and different economies more, suggesting that flexible rate countries can shift some of the burden of adjustment to less flexible trading partners. The policy implications of these results are straightforward: when trading partners float, the benefits of a pegged regimes diminish. An example of this phenomenon is Argentina during the late 1990s. Post 1994 both Argentina and Brazil linked their currencies to the dollar. In 1998 Brazil switched to floating rate regime while Argentina ignored the decision of her trading partner at considerable cost in lost output. The empirical results of this paper show that these "third country" effects are common to other countries as well.

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Marcelo LaFleur was born in Itabuna, Brazil on October 3, 1975. At the age of 15 he moved to California where, after completing High School, he studied economics at Saint Mary's College of California until 1997. He received a Masters of Arts in International Political Economy and Development from Fordham University in 1998, as well as a Masters of Arts in Economics in 1999 before completing his Ph.D. in Economics from Fordham University in 2004 as a research fellow.