Towards a Stable System of Exchange Rates I: Considerations in the Choice of Exchange Rate Regime

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March 2008

Abstract

Among the key responsibilities of the International Monetary Fund and its members is to "assure orderly exchange arrangements and to promote a stable system of exchange rates." This paper, part of a larger project, considers how members' choice of exchange rate regime can contribute to this objective. The paper first surveys some of the key issues and reviews the existing literature. It then presents a simple theoretical model to illustrate some of the trade-offs in the choice of exchange rate regime. Finally, the paper lays out an agenda for empirical work to further our understanding of how the choice of exchange rate regime can best serve IMF members, and contribute to the stability of the overall system of exchange rates.

JEL Classification Numbers:

Keywords: Exchange Rate Regimes

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I. Introduction

Among the key responsibilities of the International Monetary Fund and its members is to "assure orderly exchange arrangements and to promote a stable system of exchange rates." But what does this mean in practice? Article IV of the IMF's Articles of Agreement suggests an answer; to wit, a stable system of exchange rates should facilitate the exchange of goods, services and capital among countries; sustain sound economic growth with reasonable price stability; foster economic and financial stability; and avoid producing erratic disruptions.[1] This paper, part of a larger project, examines how countries' choice of exchange rate regime may affect the performance and stability of the overall system of exchange rates.[2]

To make this question manageable, it is useful to consider three distinct—albeit related—elements that could contribute to the efficient functioning and stability of the international monetary system. First, an individual country's exchange rate regime should be appropriate to its circumstances, allowing it to attain its domestic macroeconomic goals such as sound growth, low inflation, and economic and financial stability. Second, as regards the country's interaction with the rest of the system, the exchange rate regime should promote international trade and stabilizing capital flows, and facilitate smooth external adjustment—avoiding the build up of large, unsustainable imbalances and minimizing adjustment costs should they occur. Third, stability of the overall system will be enhanced if policies in the largest countries are coherent, and key currencies are not subject to erratic movements.

This paper takes an initial look at the first of these elements by laying out some of the considerations in a country's choice of exchange rate regime. While the existing literature on this topic is vast, at some risk of oversimplification it can be classified into three main strands. The first focuses on the insulating properties of regimes. Influential papers by Fleming (1962) and Mundell (1963) showed that, if nominal wages are sticky and capital is highly mobile, then pegged and floating exchange rates have starkly different implications for the conduct of stabilization policy.[3] Depending upon the availability of policy instruments, or reinterpreting monetary and fiscal policies as nominal and real shocks respectively, pegged exchange rates provide greater insulation of output in the face of nominal shocks, while floating exchange rates are better at absorbing real shocks.

The second strand, originating in postwar Europe, examines how different exchange rate regimes might foster greater economic integration. There are two underlying questions: First, do pegged exchange rates (a fortiori, a currency union) reduce uncertainty and transactions costs over relevant horizons—and does that translate into greater trade, investment, and ultimately output growth? Second, given the degree of integration, does it make sense for a group of countries to give up the nominal exchange rate as an adjustment

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[1] For a legal interpretation of the IMF's Article IV see "Article IV of the Fund's Articles of Agreement—An Overview of the Legal Framework" available at www.imf.org/external/np/pp/eng/2006/062806.pdf.

[2] Previous studies include ***Exchange Rate Regimes in an Increasingly Integrated World Economy*** (Occasional Paper 193), and ***Evolution and Performance of Exchange Rate Regimes*** (Occasional Paper 229).

[3] Throughout this paper, the terms "pegged" and "fixed" exchange rates are used interchangeably. Some authors distinguish between them, reserving the term "fixed" exchange rate to mean a regime in which the central bank fixes the price of foreign exchange and lets the money supply move in a direction that keeps the balance of payments in equilibrium (i.e., does *not* sterilize movements of reserves) and does not seek to vitiate the adjustment mechanism; see the debate between Robert Mundell and Milton Friedman ("One World, One Money?" *Options Politiques*, May 2001).

tool between them—perhaps culminating in full monetary union and a common currency (the "optimal currency area" literature).

The third strand of the literature, rooted in the high-inflation experiences of the 1970s and 1980s, focuses on the credibility enhancing aspects of exchange rate regimes. In these models, the central bank faces a credibility problem because of its incentive to reduce unemployment (or erode the real value of nominal debt) by generating surprise inflation. As the private sector factors this incentive into its expectations when setting wages, unemployment remains the same but the economy suffers an inflationary bias. This makes disinflation difficult especially if the country has a history of high inflation and the central bank lacks credibility. But by pegging the exchange rate, the central bank can "import" the anchor currency's credibility—albeit at the cost of not being able to respond to domestic shocks.

While such "exchange rate based stabilizations" were largely successful in the European context, their record in the Southern Cone Latin American countries is more mixed. Indeed, after initial success, many of these stabilization attempts ended in failure, with a collapse of the peg, a balance of payments crisis, and a resurgence of inflation. This has given rise to a literature on whether such stabilizations are inherently prone to failure and likely to end in crisis—or it is the government's inability to undertake the necessary fiscal adjustment that is to blame (and whether there is a relationship between the exchange rate regime and fiscal discipline).

More generally, since the East Asian crises of 1997/98, a literature has developed on whether pegged exchange rate regimes are more prone to capital account crises (by delaying adjustment and by encouraging foreign currency mismatches on domestic balance sheets) and to banking crises (both because of foreign currency mismatches and because the scope for central bank lender of last resort operations is curtailed under a peg). This gave rise to the "bipolar" view that countries should commit themselves either to hard pegs (such as currency boards) or to pure floats, but should not adopt simple pegs (Fischer 2000). The subsequent collapse of Argentina's currency board in early 2002 and many developing and emerging market countries' reluctance to let their currencies float freely (for fear of inflation or balance sheet disruptions, or loss of export competitiveness), however, has called the bipolar view into question.

To help illustrate some of the trade-offs discussed in the three main strands of the literature, section III of this paper lays out a simple theoretical model, developed by Ghosh, Gulde and Wolf (2003), on the choice between pegged and floating exchange rates. In particular, the constraint on the central bank to react to shocks under a pegged exchange rate needs to be weighed against the scope for monetary mischief allowed under a floating exchange rate. The theoretical model is then extended, following Wolf, Ghosh, Berger and Gulde (2008) to consider the choice between a hard peg, a soft peg, and a float. This extended model also sheds light on whether countries should be moving toward a bipolar world—that is, either a hard peg or a pure float, but not a soft peg.

Both the review of the literature and the theoretical model underscore a point emphasized by Ghosh, Gulde, Ostry and Wolf (1997)—that no single regime is likely to best serve all countries at all times. The choice of exchange rate regime must be tailored to the economic problems facing a country and its specific circumstances, while being mindful of possible repercussions for the system as a whole. While theoretical models can help identify the issues that need to be taken into account—the structure of shocks, the country's inflation history and the central bank's credibility, the degree and nature of integration with partner countries and with international capital markets—in practice, there are so many possible

effects, some offsetting, others reinforcing, that the appropriate choice of regime is ultimately an empirical issue. To this end, in lieu of a conclusion, Section IV of this paper sets out an empirical agenda for identifying the implications of various exchange rate regimes for countries' macroeconomic performance and for the stability of the overall system of exchange rates more generally.

The remainder of this paper is organized as follows. Section II briefly reviews the (vast) literature. Section III presents a formal model of the choice of exchange rate regime. Section IV lays out the empirical agenda.

II. A Brief Survey of the Literature[4]

Insulating Properties of Exchange Rate Regimes

During the late-1960s, increasing strains on the Bretton Woods system (as well as periodic balance of payments crises in individual countries) prompted a number of economists—drawing on earlier work by Milton Friedman (1953)—to argue the merits of flexible exchange rates.[5] The rationale was straightforward: the automatic adjustment of the nominal exchange rate to trade imbalances would obviate the need for the large, delayed, and often traumatic devaluations that had come to characterize the Bretton Woods system.

In the event, the move to floating exchange rates turned out to be neither the panacea that some of its more avid supporters had promised, nor the unmitigated disaster that its critics had predicted. Among the major industrialized countries, floating exchange rates appeared to be driven more by capital flows than by underlying trade imbalances (Mussa (1986)). At the same time, most countries seemed to cope reasonably well with the higher volatility of nominal and real exchange rates. Indeed, a growing body of literature sought to explain the apparently excessive volatility of nominal exchange rates in terms of underlying fundamentals or rigidities elsewhere in the economy (Dornbusch (1976)).

Meanwhile, during the 1960s and early-1970s, there had been significant advances in understanding how various regimes would operate under conditions of high capital mobility. Two seminal papers by Fleming (1962) and Mundell (1963)—following earlier work by Meade—showed that fixed and floating exchange rates had starkly different implications for the conduct of stabilization policy.

Under fixed exchange rates, a monetary expansion leads to capital outflows, and the resulting loss in reserves shrinks the money supply. In the limiting case of perfect capital mobility, the offset is one-for-one, and monetary policy is completely ineffective in stabilizing output. In contrast, under a floating regime, the outflow depreciates the exchange rate, thus stimulating output. The results are reversed for fiscal expansions. Under floating exchange rates, an expansion raises the domestic interest rate and causes a capital inflow, thus appreciating the exchange rate and deteriorating the trade balance. In the limiting case of perfect capital mobility, the crowding out is complete, so that fiscal policy is ineffective.[6] Under fixed exchange rates, since the central bank is committed to buying foreign exchange, the capital inflow induces an automatic monetary accommodation of the fiscal expansion, augmenting its effect.

These results, though somewhat specific to the particular structure of the Mundell-Fleming model, showed how the exchange rate regime could fundamentally alter the effectiveness of different policy instruments. In particular, they suggested that fixed exchange rates, open

[4] This survey builds on Ghosh, Gulde and Wolf (2003), chapter 3, which provides references to numerous surveys of the literature, and background notes prepared by Chris Crowe, Julian di Giovanni, Jun Kim, Haris Tsangarides, and Marco Terrones.

[5] Although Milton Friedman is generally associated with advocating flexible exchange rates, he did not do so for small, developing countries; for these he noted that "the best policy would be to eschew the revenue from money creation, [and] unify its currency with the currency of a large, relatively stable developed country with which it has close economic relations" (see Friedman 1973; p. 59).

[6] Lane and Perotti (2003) find that the effects on real wages and private sector profitability of increased government spending are larger under flexible exchange rates, reflecting the crowding out effect of the exchange rate appreciation. Ghosh and Rahman (2008) find that a fiscal expansion is more "non-Keynesian" under floating exchange rates.

capital accounts, and an activist independent monetary policy form an "impossible trinity" or "trilemma".

In practice, the difference between fixed and floating regimes for the autonomy of monetary policy may not be as pronounced as theory would suggest, particularly for developing and emerging market countries. Few central banks, even when they purport to follow a floating regime, are truly indifferent to exchange rate movements—on the upside because of a loss of export competitiveness, on the downside because of the pass-through to inflation or because of foreign currency exposure of domestic balance sheets.[7] Except for very large countries, therefore, the independence of monetary policy under flexible exchange rates may be illusory. Conversely, since capital is never perfectly mobile, there is likely to be at least some scope for an independent monetary policy under fixed exchange rates. The difference between fixed and floating regimes may thus be more a matter of degree than of principle—though there is at least some empirical evidence of the trilemma.[8]

While the models of Mundell and Fleming were purely deterministic, stochastic implications could be derived by re-interpreting fiscal policy as real shocks, and monetary policy as nominal shocks. Applying the same logic, floating exchange rates insulate output better against real shocks, while the balance of payments movements under fixed exchange rates offset nominal shocks. Viewed in this light, the relative incidence of nominal and real shocks becomes a key criterion in choosing the exchange rate regime.[9]

The precise configuration of shocks under which fixed exchange rates would be preferable to floating rates stimulated a lively literature that yielded a number of insights. For instance, if capital is relatively immobile, fixed exchange rates provide better insulation of output against shocks to aggregate demand, whereas, under high capital mobility, floating exchange rates are preferable. This ambiguity arises from the asymmetric effects of trade and capital flows on the balance of payments (or the exchange rate).

With low capital mobility, trade flows dominate. Under fixed exchange rates, a positive shock to aggregate demand leads to higher imports and a loss of reserves through the trade deficit. This loss of reserves, unless sterilized, contracts the money supply, partly offsetting the original shock. Under floating rates, by contrast, the trade deficit depreciates the exchange rate, increasing exports, and thus augmenting the shock to aggregate demand.

When capital is highly mobile, the results are reversed. Under fixed exchange rates, the positive demand shock raises interest rates and induces a capital inflow, which more than offsets the loss of reserves through the trade deficit. Thus the money supply increases, exacerbating the demand shock. Under floating rates, the capital inflow appreciates the exchange rate, reducing exports, and thus partly offsetting the demand shock.

These models yielded a second important insight: in the face of monetary shocks, fixed exchange rates generally provide better insulation of output. In response to a random shock

[7] See Calvo (1999), Calvo and Reinhart (2000), Frankel (1999), Hausmann et al. (1999), and Frankel et al. (2000; 2002).

[8] Borenzstein and others (2001) and Shambaugh (2004) find that interest rates in countries with exchange rate pegs respond more to rates in the base country than in countries with flexible rates;. see also Di Giovanni and Shambaugh (2008). Obstfeld and others (2005) find historical evidence of the trilemma under pegged exchange rates, in contrast to Bordo and MacDonald (1997) who find that policy was not fully constrained under the Gold Standard despite high capital mobility in that era.

[9] See Stein (1962), Fischer (1977), Turnovsky (1976), and Aizenman and Frenkel (1982).

that raises money demand, domestic interest rates increase, depressing aggregate demand and imports. Under a fixed exchange rate, this leads to an increase in reserves—whether because of lower imports (under low capital mobility) or because of larger capital inflows in response to the higher interest rates (under high capital mobility)—and a corresponding expansion in the money supply. In the limiting case, the increase of the money supply perfectly matches the higher money demand, with no effect on output. Under floating exchange rates, by contrast, the higher interest rate leads to an appreciation of the exchange rate, reducing exports and thus exacerbating the negative effect on output.

Some studies took the analysis a step further to ask whether these properties of exchange rate regimes had implications for long-term growth (as opposed to the variation of output around its potential).[10] But few strong conclusions emerge from these studies, reflecting the ambiguous effect of greater output volatility on both the level, and growth of, output.[11] Ghosh, Gulde and Wolf (2003) find somewhat faster output growth under pegged and intermediate regimes, but report that the results are not robust to fixed effects or possible simultaneity bias. Husain, Mody, and Rogoff (2005), who do not control for regime endogeneity, claim that growth performance under alternative regimes depends upon the country's level of development, while Levy Yeyati and Sturzenegger (2001, 2003) find that long-lasting pegs and hard pegs (currency boards)[12] are associated with slower output growth in developing countries but do not find any significant link between the exchange rate regime and growth in industrialized countries.[13]

One hypothesis is that pegging the exchange rate, by reducing exchange rate uncertainty, should increase trade which—by the link between trade openness and growth—also raise the long-run growth rate.[14] However, as noted below, the association between pegged exchange rates and trade is not very strong—perhaps because exchange rate risk can be hedged, and pegged exchange rates may be more susceptible to misalignment. Indeed, an

[10] Ghosh, Gulde, and Wolf (2003) find some evidence that pegged regimes are associated with greater output volatility (especially for advanced economies, where nominal rigidities are more likely to be important). Rogoff et al. (2004) find that volatility of output growth tends to increase with exchange rate flexibility in advanced and emerging market countries, but also the relationship is reversed for emerging market countries once data contamination associated with the collapse of rigid regimes is controlled for. Levy-Yeyati and Sturzenegger (2003) find that when real shocks hit an economy where short-run price rigidity is significant exchange rate flexibility helps with resource reallocation. Caporale and Pitis (1995) find increases in the volatility output of advanced economies in the post-Bretton Woods period, but also that output shocks are less persistent under flexible regimes, which could account for the lower *unconditional* volatility of output growth under flexible regimes documented in other studies.

[11] For possible mechanisms through which the exchange rate regime could affect long-term output growth, see Caballero (1991), Aizenman (1992), Ghosh and Pesenti (1994). Edwards and Levy Yeyati (2005) argue that the inability of pegged regimes to absorb shocks results in lower growth.

[12] By contrast, Wolf, Ghosh, Berger and Gulde (2008), find strong evidence that currency boards are associated with faster growth, including controlling for regime endogeneity and the fact that these regimes are often adopted in the aftermath of a crisis, when output is depressed.

[13] Dubas, Lee and Mark (2005) find that for non-industrialized countries, growth is higher under pegged regimes, while Bailliu Lafrance and Perrault (2003) argue that what matters is the presence of a nominal anchor—regimes with anchors (including the exchange rate anchor under a peg) grew faster than regimes without such anchors. Aghion, Bacchetta, Ranciere and Rogoff (2006), Bacchetta and Ranciere (2008) argue that pegged regimes are associated with faster output growth in countries with less developed financial markets, but not otherwise.

[14] Edwards (1993), Frankel and Rose (1999), Sachs and Warner (1995); for a contrary view, see Rodriguez and Rodrick (2000).

undervalued real exchange rate is sometimes argued to help output growth by stimulating exports, while an overvalued real exchange rate hurts growth.[15] Although misalignments may be more likely under pegged exchange rates, to date there has been little work systematically linking over- or under-valuation of the real exchange rate to the exchange rate regime.

By exploring the interaction between various types of shocks and country characteristics, studies of the insulating properties of the nominal exchange rate regime thus developed an entire taxonomy under which fixed exchange rates may be preferable to floating rates—or vice versa. But precisely because there are so many possible configurations, perhaps the most robust conclusion from these studies is that some form of intermediate regime is likely to serve most countries well—a result that is in stark contrast to the policy credibility literature, reviewed below.[16]

Economic Integration and the Exchange Rate Regime

Adopting an exchange rate peg implies surrendering the nominal exchange rate as an adjustment tool. It follows that the case for pegging between two countries (or adopting a common currency) is stronger, ceteris paribus, if they are subject to relatively similar, and highly correlated, output shocks. This is the central insight of the optimum currency area (OCA) literature (Mundell (1961)).[17] The ceteris paribus assumption is of some importance: the loss of the exchange rate as an adjustment tool is less serious if alternative adjustment mechanisms—notably wage and price flexibility, factor mobility or fiscal transfer systems—are available. The gains in terms of lower transactions costs increase in the extent of trade integration [McKinnon (1963)].

The European agenda of greater monetary and economic integration spurred a large literature on whether (parts of) Europe constituted an optimum currency area.[18] The question was typically framed in comparison to the states or regions of the United States. The merits of using an existing monetary union as baseline are debatable since the criteria are endogenous to the exchange rate regime (quite aside from the fact that Mundell's original work was motivated by a concern that the United States itself may not be an optimum currency area). In particular, the stability of the nominal exchange rate may affect the degree of trade integration which, in turn, may influence the correlation of shocks. The direction of each of these linkages however remains a matter of debate.

The first of these potential linkages—the effects of exchange rate variability on international trade—is the subject of a large literature in itself. The usual assumption (which underlay, for instance, the push for greater intra-European exchange rate stability) is that pegged exchange rates reduce exchange rate volatility, and that lower volatility reduces uncertainty and risk premia, thereby encouraging greater cross-border trade and investment.[19] Both assumptions are questionable. The early empirical literature, which focused on the

[15] Rodrik (2007); Hausmann, Pritchett and Rodrick (2005); Johnson, Ostry and Subramanian (2006).

[16] See Williamson (2000) for arguments in favor of intermediate regimes.

[17] See Mundell (1961), McKinnon (1963), Kenen (1969). Tower and Willet (1976) review the classic OCA literature; a more recent treatment is De Grauwe (2000).

[18] See Eichengreen (1990), Blanchard and Katz (1992), Sala-i-Martin and Sachs (1992); De Grauwe (2000).

[19] Eichengreen (1993a) and Frankel and Rose (1998).

industrialized countries, found generally small and insignificant negative effects of exchange rate volatility on international trade—perhaps because of currency hedging possibilities (particularly for the major currencies).[20] Moreover, pegged exchange rates do not necessarily reduce real exchange rate uncertainty in the relevant sense or over the relevant horizon.[21] While pegging the exchange rate may reduce short-term noise in the real exchange rate, it could expose those engaged in cross-border trade to larger, albeit less frequent, exchange rate movements, while short-term volatility under floating exchange rates might be hedged through the derivatives markets. In addition, pegged exchange rates may lead more easily to exchange rate overvaluation that hampers export growth and leads to protectionism against imports. Although the question has not been examined very systematically in the literature, the unconditional means presented in Ghosh, Gulde and Wolf (2003) suggests that export growth is lower and current account deficits are larger under pegged exchange rate regimes.[22]

An influential paper by Rose (2000), however, finds a large positive impact on a currency union on international trade. Although subject to some methodological criticisms and caveats, subsequent studies tend to confirm a positive (albeit generally smaller than Rose's estimate) effect of currency unions on trade.[23] Taking European Monetary Union (EMU) as a "case study", there is a burgeoning literature that finds that EMU has had a positive impact on trade—albeit not as strikingly large as Rose's estimates would suggest.[24] Interestingly, some of the studies find that the currency union has had a positive effect on trade with countries outside the euro area as well.

A currency union is, of course, much more than a pegged exchange rate regime. In addition to reducing exchange rate volatility (to zero between members of the union), it also eliminates exchange rate uncertainty, and saves on transactions costs. Brada and Mendez's (1988) study finds a negative effect of a simple peg on trade, though their sample coverage is

[20] Edison and Melvin (1990) and Goldstein (1995) provide surveys of the literature. See also Bailey and Tavlas (1986), Cushman (1983, 1986, 1988), Gotur (1985), De Grauwe and Bellefroid (1987), Hooper and Kohlagen (1978), IMF (1984), Kenen and Rodrick (1986), and Thursby and Thursby (1987); Frankel and Wei (1995) find evidence of a negative effect of exchange rate variability on trade during the 1960s and 1970s, but not in the 1980s. Bacchetta and van Wincoop (2000) find inconclusive results in a general equilibrium model.

[21] Mussa (1986), Baxter and Stockman (1989), and Flood and Rose (1995) find that real exchange rates are more variable under more flexible exchange rate regimes. Husain et al (2005) also report considerably higher real exchange rate volatility under more flexible regimes if the natural classification is used while noting that the opposite holds under the de jure classification. Caporale and Pitis (1995) also report similar evidence that shocks to real exchange rates for OECD countries are more volatile but less persistent during the floating period than in the pre-Bretton Woods era. Ghosh, Gulde and Wolf (2003) find that nominal exchange rate variability depends upon the income level of the country and the horizon over which the variability is calculated; in general, flexible regimes are associated with the greatest volatility. As regards real exchange rate volatility, for advanced and emerging market countries, real exchange rate volatility is greater under flexible regimes. For lower-income countries, however, nominal exchange rate movements help offset inflation differentials, implying that—at sufficiently long horizons (beyond 12 months)—real exchange rate volatility is actually lower under flexible and intermediate regimes.

[22] Ghosh, Gulde and Wolf (2003) Table 5.3, p70; and Table A.4, p 194.

[23] See Quah (2000) for caveats to Rose's results; Alesina et al. (2002), Frankel and Rose (2002), Glick and Rose (2002), and Rose and van Wincoop (2001) generally confirm the results.

[24] Micci et al. (2003), Baldwin et al. (2005), Baldwin (2006), Baldwin and Di Nino (2006), Baldwin and Taglioni (2006).

limited. Lee and Shin (2004), using a gravity model, find that pegged exchange rate regimes increase international trade. Clark et al. (2004) confirm Rose's results on currency unions, but do not find that exchange rate volatility itself has a large negative impact on trade (thus implying that most of the trade gains of currency unions stem from the reduction in uncertainty and in transactions costs). Klein and Shambaugh (2006) consider the impact of bilateral exchange rate arrangements, indirect exchange rate arrangements, and exchange rate volatility on trade. Their core results show that both direct pegs and currency unions have a positive impact on trade, while indirect pegs (two countries pegging to the same anchor currency) do not have a robust effect; exchange rate volatility is robustly negatively related to trade.[25]

Returning to the case for a monetary union, even if it could be concluded that fixed exchange rates reduce uncertainty and thereby increase trade integration, the effect on the correlation of shocks—and thus on the case for pegging or monetary union—is ambiguous. Greater trade linkages imply greater specialization and therefore a lower correlation of supply shocks.[26] But they also imply more channels of transmission for demand-side shocks, which would tend to increase the synchronization of business cycles across partner countries.[27]

While most of the integration literature has focused on trade linkages, a few studies examine the implications for cross-border foreign investment and "stabilizing" capital movements (the latter as captured by the implicit international risk-sharing). For instance, Artis and Hoffman (2006) find that risk sharing is greater among [EU?] and EMU countries than among other countries, and Giannone and Reichlin (2004) find that risk sharing has increased within the Euro area since the early 1990s.

Finally, the exchange rate regime may have implications for external (current account) adjustment. Since, under a pegged exchange rate regime, the country is giving up the nominal exchange rate as an adjustment tool (though, *in extremis*, devaluations or revaluations are still possible), imbalances are more likely to build up, and subsequent adjustment is likely to be more painful. Chin and Wei (2008) find no robust evidence that more flexible exchange rate regimes exhibit faster current account reversion. Is this result surprising? They argue not, as the current account responds to changes in the real exchange rate and there is no robust relationship between a country's nominal exchange rate regime and real exchange rate adjustment. Edwards (2004a and 2004b), however, finds that current account reversals are more costly (in terms of the output decline) under rigid or semi-rigid exchange rate regimes than under more flexible regimes.[28] Regarding the build up of unsustainable imbalances under various exchange rate regimes, although the question has not been examined systematically, Eichengreen and Adalet (2005) report that the incidence

[25] Frankel and Rose (2001).

[26] Eichengreen (1992b) and Bayoumi and Eichengreen (1994).

[27] Frankel and Rose (1998).

[28] Broda (2001) tests using a VAR framework if flexible regimes are better suited to cope with the terms of trade shocks, and finds evidence in support of the insulating properties of flexible regimes against real disturbances; similar evidence is provided by Ramcharan (2007) who focuses on the effect of natural disasters under different exchange rate regimes. Di Giovanni and Shambaugh (2006) find that interest rate increases in industrialized countries have a larger impact on smaller economies that have pegged exchange rate regimes than on those that have flexible regimes.

of sharp current account reversals has increased markedly over the past three decades, being both less common and smaller during the gold standard and Bretton Woods periods.[29]

Credibility and Crises

Although much of the original impetus for monetary union in Europe came from the desire to foster greater integration, the collapse of the Bretton Woods system derailed these plans, and by the time the European countries were again re-establishing fixed exchange rates between themselves, the main policy concern had shifted to combating inflation.

In this endeavor, pegged exchange rates were seen as providing a potential nominal anchor, lowering inflationary expectations and thus helping the central bank to achieve its inflation objective. The theoretical foundation for this argument was laid by the work of Barro and Gordon (1983), who examined a closed-economy game between wage-setters and the central bank. In their model, nominal wages must be set before the central bank sets its monetary policy (and hence determines the inflation rate).

The central bank's objective is to minimize both inflation and unemployment. The crucial assumption is that the central bank has an incentive to create "surprise" inflation in order to reduce real wages, ex-post, thereby raising employment above the economy's (sub-optimally low) "natural" rate. But rational workers, foreseeing this incentive, build it into their demands for nominal wages. Under discretionary monetary policy, the economy thus inherits an inflationary bias but remains at its natural rate of employment. A promise by the central bank not to generate surprise inflation is not credible since, the moment the workers believe this promise and lock into correspondingly low nominal wages, the central bank has the incentive to renege and inflate away real wages. Moreover, attempting to disinflate in such an environment may be extremely costly, as an "incredible" disinflation will generate high ex-post real wages and correspondingly high unemployment.

There is a way out of this conundrum: if the central bank could credibly commit to low inflation, wage-setters would build this expectation into their nominal wage demands, shifting the economy to a low inflation equilibrium (albeit at the same natural rate of employment). In a non-stochastic setting, such a pre-commitment equilibrium necessarily raises welfare; in a stochastic setting, there is more of a trade-off since tying the hands of the central bank, while increasing credibility, also limits ability to react to shocks. How can the central bank pre-commit to low inflation? In a closed economy setting, it must rely on the repeated game nature of its interaction with wage-setters, or on the appointment of hawkish central bankers (in a sufficiently independent central bank—Rogoff (1985), de Haan, Berger and van Fraassen (2001)).

In an open economy, pegging the nominal exchange rate to a low inflation country provides an alternative pre-commitment device. This does not eliminate the underlying incentive to create inflation surprises, it merely imposes a constraint on the central bank's ability to act on that incentive. Since the decision to retain the peg is itself endogenous, pegging the exchange rate provides a pre-commitment device only to the extent that the perceived (political or other) costs of abandoning the peg outweigh the benefits of generating surprise inflation.[30] Raising the costs of exiting the regime – for example, through the adoption of a hard peg enshrined in law –- can thus increase credibility, making it easier for the central

[29] Most of the literature examines sharp reversals of current account deficits; Edwards (2007) looks at reversals of surpluses.

[30] Cukierman, Kiguel and Liviatan (1992).

bank to achieve and maintain low inflation. Therefore, in contrast to the literature on insulating properties of exchange rate regimes reviewed above, the general conclusion from the policy credibility literature is that the harder the peg, the better.

The empirical literature on using the exchange rate for disinflation covers not only the European examples of the 1980s and early 1990s (such as France, Italy, Spain and Portugal), but also various Southern Cone Latin American countries where the record of success is much more mixed. Indeed, some studies have argued that such stabilization attempts are subject to an ERBS "syndrome"—immediate success in bringing down inflation, followed by a creeping real exchange rate appreciation, a consumption boom, widening current account deficit, and an eventual collapse into a fresh balance of payments crisis. But others contend that it is not the pegged exchange rate itself that is to blame, but rather the (frequent) failure in these programs of the government to follow through on the necessary fiscal adjustment—at worst, pegged exchange rates by making the disinflation appear to succeed too easily breed complacency when it comes to implementing the necessary fiscal adjustment.[31]

This raises the question of whether pegged exchange rates indeed deliver on macroeconomic stability and low inflation. The need to maintain the peg generally implies constraints on fiscal policy. Some studies, however, suggest that pegging the exchange rate, far from imposing the requisite discipline, actually allows the government to "cheat"—delivering apparently low inflation in the short-run while running an unsustainable fiscal deficit that explodes into open inflation when the peg eventually collapses. In Krugman's (1979) balance of payments crisis model, money financing a fiscal deficit inevitably leads to a speculative attack that depletes the central bank's reserves and forces it to float the exchange rate.

Even when the central bank is not money financing the fiscal deficit, however, there are limits to the fiscal deficit that is consistent with sustainability of the peg. In particular, the government's intertemporal budget constraint implies that the present value of real fiscal surpluses must equal the real value of the outstanding nominal stock of base money and government bonds. Under a "money dominant" regime, the price level is given, and the government must raise taxes or reduce expenditure to ensure that its budget constraint is satisfied. Under a "fiscal dominant" regime, the path of fiscal surpluses is given, and it is the real value of base money and government bonds that must adjust to ensure that the intertemporal budget constraint is satisfied. Under an exchange rate peg, the price level cannot jump (it is pinned down by the nominal exchange rate and either purchasing power parity or the need for the real exchange rate not to become too overvalued). Hence, for a peg to be sustainable requires a money dominant regime. But it remains an open question whether pegging the exchange rate leads to a money dominant regime, or it is the other way around—only countries with the political and institutional structures to support a money dominant regime can sustain a pegged exchange rate.

While the policy credibility literature has long recognized that there may be circumstances under which a peg may need to be abandoned (for instance, if the government has been financing an unsustainable deficit or there are adverse shocks), it was really the East Asian crises of 1997/98 that spurred a raft of studies on whether pegged exchange rate regimes are inherently prone to crisis. Three arguments are typically made. First, pegged exchange rates may delay adjustment to the point that dangerously large imbalances build up, which trigger a crisis when they eventually unwind. Second, relatedly, by implicitly or explicitly guaranteeing the exchange rate, pegged regimes foster excessive foreign currency

[31] Hamann (2001), Hamann and Pratti (2002); Ghosh et al. (2005) examine the importance of fiscal adjustment for the success of disinflation attempts under pegged and under floating exchange rates in the context of IMF-supported programs.

borrowing (and FX on-lending by the financial sector to the domestic economy) weakening balance sheets because of the FX mismatches. Third, under a pegged regime—especially a hard peg—the central bank's lender of last resort function may be curtailed.[32]

Do these arguments have merit? Certainly the spectacular emerging market capital account crises of the 1990s all occurred under implicit or explicit pegs. But partly it is a matter of definition: since currency crises are typically defined as sharp movements of the nominal (and real) exchange rate, it is not surprising that most crises happen under pegged regimes. A more telling question is whether the proportion of pegged exchange rate regime observations with general economic crises—such as a sudden decline in output growth—is greater than the corresponding proportion of flexible exchange rate observations. Here the evidence is somewhat more mixed. In addition, it is not clear that pegged exchange rate regimes lead to greater liability dollarization. Therefore, while the general conclusion of the literature that pegged exchange rates are more prone to crises is likely to be correct, the differences across regimes may not be as marked as the sample of emerging market capital account crises would suggest.[33]

Concerns about the vulnerability of pegs to crises gave rise the "bipolar view" in the late 1990s, whereby countries should either commit to hard pegs (dollarization; currency boards) or to pure floats—but not to simple pegs (Fischer 2000). The subsequent collapse of Argentina's currency board in early 2002 and many developing and emerging market countries' reluctance to let their currencies float freely (for fear of balance sheet disruptions of sudden exchange rate movements or loss of export competitiveness), however, has called the bipolar view into question—both as a normative prescription and as a positive prediction.[34]

III. A Formal Model

To help illustrate some of the considerations outlined above, this section uses the model developed by Ghosh, Gulde and Wolf (2003)—in turn drawing on Cukierman (1992)—to illustrate some of the key insights of the three strands of the existing literature on the optimal choice of exchange rate regime. Below, the model is extended to consider the choice between a hard peg, a soft peg, or a pure float.

A. Pegged versus Floating Exchange Rates

The Setup

Firms are assumed to hire workers to the point that the real wage equals the marginal product of labor. Aggregate supply depends upon the real wage and a productivity shock:

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[32] Larrain and Velasco (2001); Schuler (1999) argues that not all hard pegs should be equally susceptible to crises.

[33] Bubula and Otker-Robe (2003) examine the susceptibility of exchange rate regimes to currency crises during the period of 1990-2001, and find that: (i) pegged regimes, as a whole, are more crisis prone than floating regimes for financially more integrated countries; (ii) intermediate regimes (mostly soft pegs and tightly-managed floating regimes) are more crisis prone than both hard pegs and other floating regimes, and; (iii) the degree of crisis proneness is broadly similar across different types of intermediate regimes. Husain, Mody, and Rogoff (2005) find (based on their "natural" classification) that banking and twin crises is more likely under more rigid regimes but mainly for emerging markets and particularly so in the 1990s, which is in contrast to the finding of Ghosh et al. (2003) based on the de jure classification; evidence on currency crises is mixed.

[34] Masson, 2001; Bubula and Otker-Robe, 2002.

$$y = (p - w) + \eta$$

where y is the log of output, p is the price level, w is the nominal wage, and η is a stochastic shock with mean zero and variance σ_η^2. Nominal wages are set to achieve a target real wage (normalized to zero). For a fraction θ of the economy, wages are set one-period in advance, based on the expected price level: $w = p^e$; for the remaining workers, wages are set in the current period: $w_t = p_t$. The stochastic shock η is assumed to be observed after workers with sticky wages have set their nominal wage rate but before the central bank decides on monetary policy. Substituting into and adding and subtracting the lagged price level yields the aggregate supply function:

$$y = \theta(\pi - \pi^e) + \eta$$

If inflation turns out to be higher than expected, real wages of workers with sticky nominal wages are eroded, making it profitable for firms to increase employment and output. If all wages in the economy are flexible $(\theta = 0)$, however, monetary policy cannot affect the level of output.

The economy's rate of monetization—the real rate of growth of money demand—is assumed to depend positively on the long-run real growth rate of output (which is constant, and is normalized to zero) and negatively on expected inflation. In addition, money demand is subject to a shock, ε, which is observed after the central bank chooses its monetary policy (and after workers have set their nominal wage). Money market equilibrium is thus given by $\Delta m - \pi = \alpha \Delta \bar{y} - \upsilon \pi^e - \varepsilon$, where α is the income elasticity of money demand and $0 \le \upsilon < 1$ is the elasticity with respect to expected inflation. Normalizing $\Delta \bar{y} = 0$, and inverting yields an expression for inflation:

$$\pi = \Delta m + \upsilon \pi^e + \varepsilon$$

For simplicity, the banking sector is ignored so the money supply consists of central bank domestic credit and international reserves: $\Delta m = \Delta dc + \Delta R$. Under a pegged exchange rate, the central bank chooses Δdc while the change in reserves in endogenous. Under a floating regime, the central bank again chooses Δdc, but does not hold reserves (so $\Delta R = 0$) and the nominal exchange rate is endogenous. The model is closed by assuming purchasing power parity:

$$\pi = \pi^* + \Delta e$$

where π^* is the inflation rate in the anchor country (to which the central bank pegs the currency under a pegged regime).

The central bank is assumed to have two objectives: stabilizing output and inflation around some desired levels, $\bar{y}$ and $\bar{\pi}$; the latter is normalized to zero for simplicity. The objective function may thus be written:

$$Min\ L = \frac{1}{2} E\{A(y - \bar{y})^2 + \pi^2\}$$

where $E\{\}$ is the central bank's expectation and A denotes the weight on output (or, more generally, on the incentive to create inflation surprises). As the natural level of output is

normalized to zero, $\bar{y} > 0$ implies that the central bank is aiming for a level of output above the economy's natural rate. Why would it do so? In the original Barro-Gordon setup, it is assumed that unionization of the labor force leads to a suboptimal level of employment. Alternatively, as emphasized by Cukierman (1992), this term could reflect the incentive to erode the real value of nominal debt, in which case π^e would represent not the expectation of wage setters, but that of bondholders. More generally, $\bar{y} > 0$ represents the incentive that a central bank—especially one that lacks independence—may have to generate surprise inflation.[35]

Pegged Exchange Rate Regime

The solution under a pegged exchange rate regime is straightforward. From the purchasing power condition, as long as the peg remains, inflation must equal the foreign rate of inflation:

$$\pi = \pi^*$$

Since monetary policy is exogenous to the domestic central bank under a pegged exchange rate regime, wage setters will base their expectations on the behavior of the "anchor" currency's central bank. There are various possible assumptions. One possibility is that inflation in the anchor country is much lower and stable than in the home country—which is why the home country wants to peg its currency to it. In that case, foreign inflation can be treated as approximately constant (and equal to the low, desired rate of inflation) hence:

$$\pi = \pi^* = 0$$

Monetary shocks, ε, are passively absorbed by the change in reserves, $\Delta r = -\varepsilon$ as long as the shock is not so large as to deplete the central bank's stock of reserves and force a devaluation. The low inflation, however, comes at the cost of greater real volatility as the lack of an activist monetary policy by the home country's central bank also precludes the possibility of offsetting the productivity shock:

$$y = \eta$$

Welfare under the regime is evaluated as the ex ante expected loss:

$$L_{Peg(\pi^*=0)} = \frac{1}{2}\{A(\sigma_\eta^2 + \bar{y}^2)\}$$

Alternatively, the anchor country may be assumed to pursue an activist monetary policy but not face the time consistency problems $(\bar{y}^* = 0)$ that the home country's central bank faces. In this case:

$$\pi = \frac{-A\theta\eta^*}{1 + A\theta^2} + \varepsilon^*$$

where, for simplicity, the parameters A and θ are assumed to be the same across the two countries. Output is given by:

$$y = \frac{1}{1 + A\theta^2}\{\eta + A\theta^2(\eta - \eta^*)\} + \theta\varepsilon^*$$

[35] De Kock and Grilli (1993) develop a model in which the need to raise seignorage revenue imparts and inflationary bias to the economy, which pegging the exchange rate can help avoid.

Equation embodies the essential insight of the optimum currency area literature, namely that it is better to peg the exchange rate to a partner that is subject to similar and correlated shocks. For instance, if the productivity shocks are perfectly correlated, collapses to:

$$y = \frac{\eta}{1 + A\theta^2} + \theta\varepsilon^*$$

Comparing to shows, not surprisingly, that the productivity shock has a smaller impact on output when the country pegs to a partner that is subject to the same shock and the anchor country central bank pursues an activist monetary policy. Welfare in this case is given by:

$$L_{Peg(\pi^* = \pi^*(\eta^*))} = \frac{1}{2}\left\{ \frac{A\sigma_\eta^2}{1 + A\theta^2} + (1 + A\theta^2)\sigma_{\varepsilon^*}^2 \right|$$

Floating exchange rate regime

Under a floating exchange rate, the domestic central bank is free to pursue an activist monetary policy. Substituting and into and solving for the optimal credit policy yields:

$$\Delta dc = \frac{-A\theta\eta + A\theta\bar{y} + A\theta^2(1-\upsilon)\pi^e - \upsilon\pi^e}{1 + A\theta^2}$$

Substituting into then gives the semi-reduced form for inflation under a floating regime:

$$\pi = \frac{-A\theta\eta + A\theta\bar{y} + A\theta^2\pi^e}{1 + A\theta^2} + \varepsilon$$

From , actual inflation is increasing in the central bank's incentive to create inflationary surprises, $\bar{y} > 0$, and the private sector's expectation of inflation, π^e. The latter may be obtained by taking the mathematical expectation of :

$$\pi^e = A\theta\bar{y}$$

The central bank's incentive to create surprise inflation is thus incorporated into the private sector's expectations. Therefore, the central bank cannot systematically fool the private sector. This is evident form the reduced form for output, which is independent of $\bar{y}$:

$$y = \theta(\pi - \pi^e) = \frac{\eta}{1 + A\theta^2} + \theta\varepsilon$$

Although the central bank cannot systematically fool the private sector, its cannot credibly commit not to try to do so, which imparts an inflationary bias to the economy:

$$\pi = \frac{-A\theta\eta}{1 + A\theta^2} + A\theta\bar{y} + \varepsilon$$

Substituting and into and taking expectations gives the ex ante expected welfare under a floating regime:

$$L_{Flt} = \frac{(1 + A\theta^2)}{2}\left\{ \frac{A\sigma_\eta^2}{(1 + A\theta^2)^2} + \sigma_\varepsilon^2 + A\bar{y}^2 \right|$$

Comparison of Regimes

Comparing and or gives the conditions under which a float is preferable to a peg:

$$L_{Peg} > L_{Flt} \Leftrightarrow A\sigma_\eta^2 > \frac{A\sigma_\eta^2}{(1+A\theta^2)} + (1+A\theta^2)\sigma_\varepsilon^2 + A^2\theta^2\bar{y}^2$$

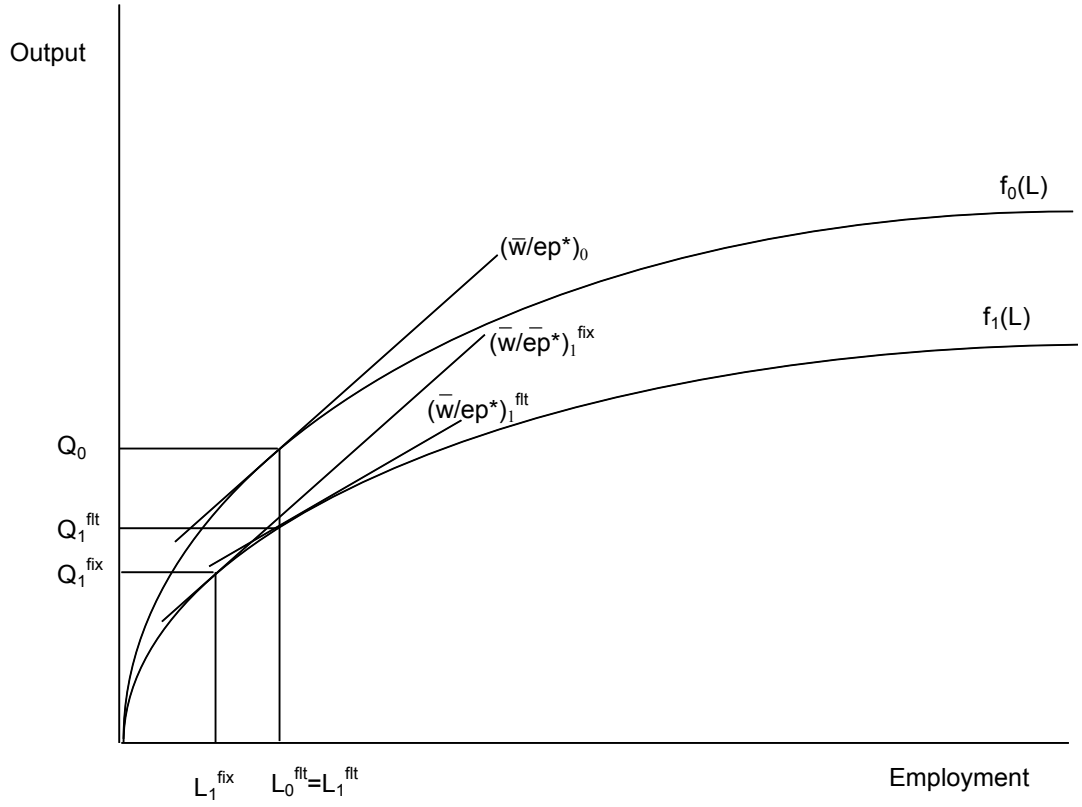
It is useful to start with some special cases. Suppose that the central bank does not have an incentive to create surprise inflation and therefore no credibility problem, $\bar{y}=0$, and that there are no monetary shocks. Then the loss under the pegged exchange rate regime is greater than the loss under a floating regime:

$$L_{Peg(\pi^*=0)} > L_{Flt} \Leftrightarrow A\sigma_\eta^2 > \frac{A\sigma_\eta^2}{1+A\theta^2}$$

This embodies the usual intuition that a floating exchange rate provides better insulation against real shocks than a pegged exchange rate. Are there circumstances (in this model) where that is not true? In two limiting cases, the pegged exchange rate regime is no worse than the floating regime. First, when the home country pegs to an anchor country that is itself subject to identical productivity shocks (see). Second, if wages are fully flexible in the economy, then $\theta=0$ and the left and right hand sides of collapse to equality.

While neither limiting case is particularly plausible, the model does underscore that a floating exchange rate is only preferable to a peg in the face of real shocks when nominal wages are sticky. Indeed, it bears emphasizing that no exchange rate regime will fully insulate the economy against real shocks. The effect of a productivity shock is illustrated in Figure 1, where given the production function $f_0(l)$, the labor force, l_0, is fully employed at the real wage, $w_0/(e_0p^*)$. In the face of a negative productivity shock, the production function moves downward to $f_1(l)$. the real wage (in terms of traded goods) can only adjust through a depreciation of the nominal exchange rate. This depreciation, under a floating regime, would reduce the real wage to $\bar{w}/(e_1p^*)$, maintaining employment at l_0, and yielding a level of output $Q_1^{Flt}=f_1(l_1^{Flt})=f_1(l_0)$. Under a pegged regime, if nominal wages are rigid, the real wage remains at $\bar{w}/(e_0p^*)$, leading to a lower level of employment, l_1^{Peg}, and a correspondingly lower level of output $Q_1^{Peg}=f_1(l_1^{Peg})<Q_1^{Flt}$. The impact of a real shock on output is thus greater under a pegged regime when there are nominal rigidities.

Figure 1: Output Volatility Under Pegged Exchange Rates and Nominal Rigidities



1. By the same token, the floating exchange rate does not eliminate the impact of the shock on output—it simply allows for part of that impact to be absorbed by prices (i.e. real wages) rather than by quantities (employment and output) alone.

Conversely, if there are no real shocks and only monetary shocks, then the pegged exchange rate regime is necessarily superior. Under the floating exchange rate, the central bank cannot offset the impact of monetary shocks on output as the shock is observed only after the policy has been set. Under the pegged exchange rate regime, although the central bank does not observe the monetary shock, it does not need to, as such shocks are passively absorbed by the change in reserves $\Delta R = -\varepsilon$.

The second special case abstracts from stochastic shocks to focus on credibility issues. Setting $\sigma_\eta^2 = 0$ and $\sigma_\varepsilon^2 = 0$ but $\bar{y} > 0$ (so the central bank has an incentive to generate inflation surprises), it is apparent from and that, on average, inflation will be lower under the pegged regime. What imparts the lower inflation? It reflects what Ghosh, Gulde, Ostry and Wolf (1995) term the "discipline" and "confidence" effects of pegged exchange rates. The discipline effect operates through lower average money growth (from and , under the pegged regime, $E(\Delta m_{peg}) = 0$ while from and , under the floating regime, $E(\Delta m_{Flt}) = (1-\upsilon) A\theta\bar{y} > 0$). The confidence or credibility effect works through inflationary expectations (expected inflation under the peg is zero but positive under the float, $\pi^e_{Flt} = A\theta\bar{y} > 0$), which implies higher money demand and therefore lower inflation for a *given* rate of money growth.

The result, of course, relies on the assumption that the anchor country's inflation rate is zero —a reasonable assumption when the home country, a high-inflation country, is pegging to a low-inflation partner (so that inflation in the anchor country is negligible by comparison). If the anchor country's central bank faces a similar inflation credibility problem, $\bar{y} = \bar{y}^* > 0$, then pegging the exchange rate does not remove the home country's inflation bias. This suggests that pegged exchange rates among country that already have low and similar inflation rates—such as the advanced economies—would bring few additional anti-inflationary benefits.

If the home country has a history of high inflation, however, pegging the exchange rate can be an effective means of solving the credibility problem; indeed, in the face of imperfect credibility, it may be prohibitively costly to disinflate without a peg. Suppose that, after a history of high inflation, the central bank changes its preferences such that it no longer has an incentive to create surprise inflation, $\bar{y} = 0$. If the new preferences are credible, then (abstracting from stochastic shocks) actual and expected inflation are zero, $\pi_{Flt(\bar{y}=0,\pi^e=0)} = A\theta\bar{y} = 0$, and the central bank incurs no welfare loss. But if the central bank has a credibility problem, and the private sector expects it to act as though it has the incentive to create inflation, then from , the central bank's optimal reaction is indeed to have a positive inflation rate: then $\pi_{Flt(\bar{y}=0,\pi^e>0)} = \frac{A\theta^2(A\theta\bar{y}^e)}{1+A\theta^2} > 0$. This is not the first-best outcome from the central bank since output falls below full employment: $y_{Flt,\bar{y}=0,\bar{y}^e>0} = \frac{-A\theta^2\bar{y}^e}{1+A\theta^2} < 0$ with associated welfare loss: $L_{Flt,\bar{y}=0,\bar{y}^e>0} = \frac{1}{2}\left\{\frac{A(A\theta^2\bar{y}^e)^2}{(1+A\theta^2)^2}\right. > 0$.

Moreover, the fact that the central bank finds it optimal to have a nonzero inflation rate

(after "promising" zero inflation) is likely to erode its credibility further. On the other hand, being resolute and pursing a zero inflation policy in the face of imperfect credibility implies an even greater output decline and welfare loss:

$y_{\pi=0,\bar{y}=0,\bar{y}^e>0} = -A\theta^2\bar{y}^e < y_{Flt,\bar{y}=0,\bar{y}^e>0} = \frac{-A\theta^2\bar{y}^e}{1+A\theta^2} < 0$. Given this loss, the central bank may well abandon its disinflation attempt—ex post justifying the private sector's initial skepticism. The only way out of this vicious cycle may be to peg the exchange rate to a strong anchor currency—essentially importing the credibility of the partner country's central bank.

To summarize, the model illustrates some of the key trade-offs in choosing between a pegged and a floating exchange rate regime. If real shocks predominate, and wages are sticky, then a floating regime allows part of the adjustment to take place through prices rather than through quantities (output, employment) alone. Consistent with the insights of the optimum currency area literature, the loss under the pegged regime will be lower if the partner country is subject to the same shocks. In the face of monetary shocks, or imperfect credibility of the central bank, a pegged exchange rate regime may be superior—especially if the country is trying to disinflate from an inflation rate that is much higher than that of the anchor currency to which it will peg. Indeed, in the face of imperfect credibility, disinflation attempts without a peg may be prohibitively costly and therefore abandoned—ex post justifying the private sector's skepticism. Conversely, if the country has already achieved a record of low inflation—and the partner central bank to which it would peg is currency is subject to similar credibility problems—then there would be relatively little additional anti-inflationary gains from pegging the exchange rate.

B. Floats, Soft Pegs, Hard Pegs and the Bipolar View

The comparison of exchange rate regimes, which uses the ex ante expected welfare, implicitly assumes that countries adopt a regime and maintain it indefinitely. In reality, around 10 percent of IMF members change their exchange rate regime in any given year.[36] While a country cannot be constantly switching regimes, changing circumstances may call for a shift in its exchange rate regime. Thus changes in the central bank's preferences ($A, \bar{y}$), or the distributions of the shocks (as captured by the variances σ_η^2 and σ_ε^2) may make it optimal for the country to switch to a peg or to a float—as discussed above.

But even if the probability distributions of the shocks remain constant, there may be sufficiently large realizations of the shocks η and ε that the central bank finds it optimal to abandon the regime. The pegged exchange rate regime, in particular, is inherently fragile. To see this, note that *if* the private sector expects that the pegged exchange rate regime will be maintained, the central bank has a positive incentive to renege on its promise and to undertake a surprise devaluation *cum* inflation:

$$G = L^{Peg}(\eta) - L^{Flt}_{(\pi^e=0)}(\eta) = A(\eta - \bar{y})^2 - \begin{cases} \frac{A(\eta-\bar{y})^2}{(1+A\theta^2)} \\ = \frac{A^2\theta^2(\eta-\bar{y})^2}{(1+A\theta^2)} \end{cases} \geq 0$$

It is noteworthy that the incentive is positive even when there is no productivity shock $\eta = 0$. This means that there must be some political or other cost, c, of abandoning the peg for the pegged exchange rate regime to be sustained. From , the model generate the sensible result that the greater the incentive to create surprise inflation, $\bar{y}$, and the more negative the

[36] See Ghosh, Gulde and Wolf (2003).

productivity shock, η, the higher the political cost of abandoning the peg must be in order to sustain the pegged regime.

What is less satisfactory about the model is that the cost of abandoning the peg, *c*, must be pulled out of the air, *deus ex machina*. That there are such political costs is undeniable: Frenkel (2005), updating Cooper's (1971) famous study, finds that, within six months of a devaluation, the chief executive of the administration loses his job in 22.8 percent of cases (compared to 11.6 percent of cases where there is no devaluation), and in the year following a devaluation, the Central Bank Governor or the Finance Minister loses his job in 58.3 percent of cases (compared to 35.8 percent of cases where there is no devaluation).

In this section, the model is extended following Wolf, Ghosh, Berger and Gulde (2008) to consider the optimal cost of exiting the peg. The starting point of their analysis is the recognition that the cost of the abandoning the peg depends, inter alia, on the institutional structure of the peg—the "hardness" of the regime. For example, currency boards are often embodied in national law—or even the constitution—and the political and economic costs of changing the regime are much higher than for a simple peg. In a similar vein, it may be easier to escape a target zone with wide bands than a simple peg. Accordingly, the choice of exchange rate regime—between a float, a soft peg or a hard peg—is isomorphic to choosing the regime with the optimal probability ρ^* that the peg is maintained. A very low (zero) value of ρ^* suggests that the country should adopt a pure float, a high value suggests a hard peg, while an intermediate value corresponds to a soft peg (i.e. a peg that is readily abandoned).

With a positive likelihood of exit, the expected inflation rate is a probability-weighted average of the inflation rates under the pegged and floating regimes[37]:

$$\pi^e = \rho \times 0 + (1-\rho)\left(\frac{-A\theta\eta + A\theta\bar{y} + A\theta^2\pi^e}{1+A\theta^2} + \varepsilon\right)$$

Solving for expected inflation gives:

$$\pi^e = \frac{(1-\rho)A\theta\bar{y}}{1+\rho A\theta^2}$$

For a given expected inflation rate by the private sector, two cases need to be considered: the peg is maintained and the peg is abandoned.

Case I: The Peg is Maintained

If the exchange rate peg is maintained, $\pi = 0$. Substituting into gives:

[37] To simplify the algebra, and without loss of generality, we assume hereafter that the growth of money demand does not depend on expected inflation $(\nu = 0)$.

$$y = -\frac{(1-\rho)A\theta^2\bar{y}}{1+\rho A\theta^2} + \eta;\; y - \bar{y} = \frac{-(1+A\theta^2)\bar{y}}{1+\rho A\theta^2} + \eta$$

Therefore:

$$L^{Peg}(\rho) = \frac{1}{2}\left\{\frac{A(1+A\theta^2)^2\bar{y}^2}{(1+\rho A\theta^2)^2} + A\sigma_\eta^2\right.$$

There are two noteworthy aspects of (21). First, when there is no possibility of exit ($\rho = 1$) collapses back to , the pure pegged exchange rate regime case. Second, the welfare loss is decreasing in the probability that the peg is maintained:

$$L_\rho^{Peg} = \frac{-A^2\theta^2(1+A\theta^2)^2\bar{y}^2}{(1+\rho A\theta^2)^3} < 0$$

The intuition is simple: from , the higher the probability of exit, the higher the expected inflation. But as long as the peg is maintained, actual inflation is lower than expected inflation, depressing output. Welfare under the pegged regime will hence be a decreasing function of the probability of exit.

Case II: The Peg is Abandoned

If the peg is abandoned and the exchange rate floats, the central bank's optimal policy is given by substituting into :

$$\pi = \frac{-A\theta\eta}{1+A\theta^2} + \frac{A\theta\bar{y}}{1+\rho A\theta^2} + \varepsilon$$

$$y - \bar{y} = \theta(\pi - \pi^e) + \eta = \frac{\eta}{1+A\theta^2} - \frac{\bar{y}}{1+\rho A\theta^2} + \theta\varepsilon$$

$$L^{Flt}(\rho) = (1+A\theta^2)\left\{\frac{A\sigma_\eta^2}{(1+A\theta^2)^2} + \frac{A\bar{y}^2}{(1+\rho A\theta^2)^2} + \sigma_\varepsilon^2\right.$$

When the probability of an exit is unity ($\rho = 0$) we are back to the case of a pure float, and collapses to . Differentiating with respect to ρ yields:

$$L_\rho^{Flt} = \frac{-A^2\theta^2(1+A\theta^2)\bar{y}^2}{(1+\rho A\theta^2)^3} < 0$$

Again, the expected loss is decreasing in the probability that the peg is maintained, albeit for different reasons than the case above. Here, the higher expected inflation (when there is a high probability that the peg is abandoned) implies higher actual inflation, given the policy response function . Although—in contrast to the pure float considered above, —the higher inflation stimulates output (since it is not perfectly anticipated), on net, it generates welfare losses for the central bank because of the usual Barro-Gordon time inconsistency problem.

Optimal Cost of Exit

With these preliminaries, it is possible to consider the optimal probability (and hence cost) of exiting the exchange rate regime. The central bank's expected loss is given by:

$$L = \rho L^{Peg}(\rho) + (1 - \rho) L^{Flt}(\rho)$$

Minimizing with respect to ρ yields the first-order condition for the optimum:

$$\partial L / \partial \rho = Z(\rho) = L^{Peg} + \rho L_{\rho}^{Peg} - L^{Flt} + (1 - \rho) L_{\rho}^{Flt} = 0$$

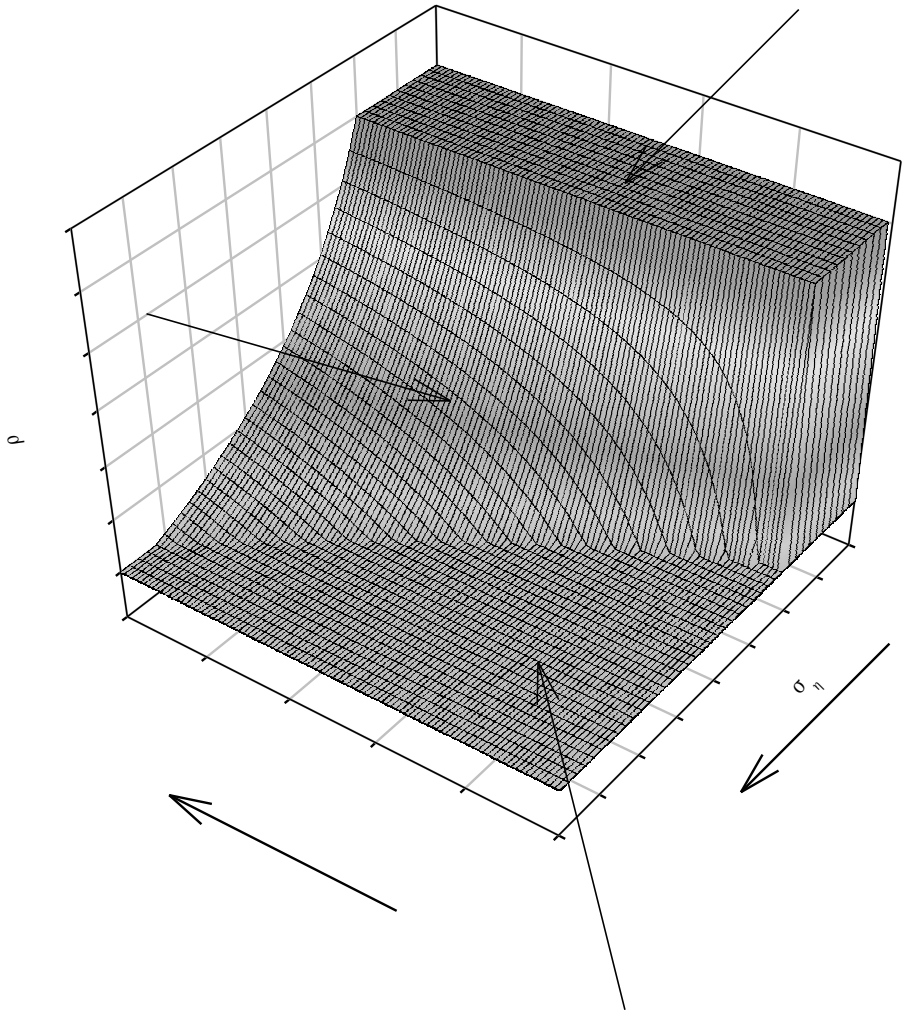
There are three possibilities in the optimization problem : a corner solution at $\rho^* = 0$, in which case the country adopts a free float; a corner solution at $\rho^* = 1$, in which case the country adopts a hard peg, such as full dollarization or a currency board arrangement; and an interior solution at $0 < \rho^* < 1$, in which case the country should adopt a traditional peg.

Under the bipolar view, countries should either adopt a pure float or a very hard peg—the corner solutions of . Under what conditions would an intermediate regime, such as an adjustable peg be optimal? For a soft peg to be optimal, the polynomial $Z(\rho)$ must have a solution $Z(\rho^*)$ $0 < \rho^* < 1$; heuristically, this requires that $Z(0) < 0$ and $Z(1) > 0$, which implies[38]:

$$\frac{A^2\theta^2\bar{y}^2}{1 + A\theta^2} + \sigma_{\varepsilon}^2 < \frac{A^2\theta^2\sigma_{\eta}^2}{1 + A\theta^2} < (1 + A\theta^2)\sigma_{\varepsilon}^2 + A^2\theta^2(1 + A\theta^2)^2\bar{y}^2$$

The first part of the condition implies that unless the real shocks to the economy are sufficiently large relative to either the monetary shocks or the policy credibility problem, a hard peg (with little scope for exit) is optimal. The second part of the condition indicates that if real shocks are too large (again relative to monetary shocks or the policy credibility problem), the country would be constantly exiting the peg and should simply adopt a float instead. When either part of the condition is violated, the optimal regime for the country is one of the extremes of the bipolar view—either a hard peg or a pure float. More generally, the trade-off in the hardness of the peg as a function of the importance of real shocks and of the credibility problem defines a hyperspace: the greater the policy credibility problem and the lower the prevalence of real shocks, the harder the peg (Figure 2).

[38] These conditions come from the requirement that, for an interior solution, $z(0) < 0, z(1) > 0$; see Wolf, Ghosh, Berger and Gulde (2008).


ρ
σ n

2.

IV. An Empirical Agenda

As Ghosh, Gulde, Ostry and Wolf (1996) note, no exchange rate regime is likely to serve all countries at all times; the policy relevant issue, therefore, is to identify the conditions under which a particular regime may best suit a country's circumstances. The model presented here, drawing together some of the main strands of the literature, illustrates a few of the key trade-offs. At its crux, the model's message is simple. Pegged regimes, especially hard pegs, may constrain macroeconomic policies, which is good if policies lack credibility, but bad if the economy has nominal rigidities and is subject to real shocks.

But of course there are many other facets of regime choice to consider—and the predictions of the theoretical literature are not always clear cut. Thus pegged exchange rates may help countries achieve low inflation through both discipline and confidence effects (as in the model presented here)—or they may allow governments to "cheat," running unsustainable deficits that explode into open inflation when the peg collapses. In the model, pegging the exchange rate to a partner with similar shocks lowers the output stabilization losses, but the correlation of shocks across countries may itself be endogenous to the exchange rate regime if, for instance, a pegged exchange rate fosters greater cross-border trade, investment, and factor mobility. Floating exchange rates may allow smooth adjustment to trade imbalances—in line with Friedman's original insight—or exacerbate the effects of speculative capital flows and result in excessive volatility.

Therefore, while theory can help identify what to look for, there are so many possible effects —some offsetting, others reinforcing—that the optimal choice of exchange rate regime cannot be settled on theoretical grounds alone. This suggests the need for an empirical agenda for examining the implications of different regimes on a country's economic performance, its interaction with the rest of the international monetary system, and ultimately the stability of overall system of exchange rates.

Exchange Rate Regimes: Classification, Trends and Transitions.

The first step in any empirical investigation is classifying exchange rate regimes. Some commentators argue that de facto classifications are more accurate than de jure classifications, while others argue that de facto classifications do not measure the exchange rate *regime* but rather the (short-run) behavior of the nominal exchange rate (which makes de facto classifications unstable as they depend upon the presence of absence of shocks).[39]

But it is important to recognize that de jure and de facto classifications do not measure the same thing: the former concerns the central bank's formal commitment to maintain the parity, the latter whether the exchange rate happens (including because of central bank intervention) to remain roughly constant against some reference currency. There is information content in both types of classifications: for instance, does the anti-inflation credibility typically associated with pegged regimes derive from the central bank's commitment? The behavior of the nominal exchange rate? Or a combination of the two? It is also of interest to understand *why* countries' de jure and de facto regimes may differ—that is, the central bank may be unwilling to undertake a formal commitment to defend a parity while still intervening at will to keep the nominal exchange rate stable. In addition, within

[39] One practical problem with using de facto classifications is that several are available. While each has its own merits, for robustness of empirical work, it is best to choose a de facto classification that has the greatest degree of consensus with other de facto classifications to help ensure that the findings are not driven by peculiarities of the regime classification employed.

(de jure or de facto) pegged regimes, it may be useful to distinguish between those where the central bank systematically sterilizes reserve movements (thus vitiating the adjustment process) and those where changes in the money supply fully reflect changes in reserves.

The theoretical model above suggests that countries with a history of high inflation may want to peg their exchange rate, while those that are subject to large real shocks (and have stick wages and prices) may prefer to float. Is there any evidence that countries behave this way? What about changes in country's regimes? The bipolar view will only hold if countries either have inflation credibility problems or are subject to large real shocks—otherwise, they may choose more intermediate regimes, including simple pegs. What is the empirical evidence? Is there a trend towards the two (or at least one) pole?

Implications for Macroeconomic Policies

In the model developed above, pegging the exchange rate constrains an independent monetary policy. This is good if the central bank has a credibility problem, bad if the economy has nominal rigidities and is subject to real shocks. But, in practice, especially for developing and emerging market countries that cannot be indifferent to the level of their exchange rate (due to concerns about balance sheet effects, inflation, or export competitiveness), do pegged exchange rate regimes constrain the ability of monetary policy to react to shocks significantly more than flexible regimes? One way to address this question is to estimate "Taylor" rules of monetary policy under alternative exchange rate regimes to see whether domestic interest rates are less responsive to output gaps under pegged exchange rates than under floating exchange rates.

In a similar vein, pegged exchange rates may constrain fiscal policies. Traditional balance of payments crisis models underscore the inconsistency between money financing the fiscal deficit (beyond the rate of growth of money demand) and maintaining the peg. As discussed above, however, the fiscal theory of the price level implies that there are limits even on bond financing of fiscal deficits if the peg is to be sustained. Conversely, inasmuch as pegging the exchange rate enhances policy credibility, it may allow the financing of larger deficits (for instance, by raising money demand). Empirically, therefore, there are two questions: are fiscal deficits systematically different under alternative exchange rate regimes? And is fiscal policy more procyclical under pegged exchange rates than under floating regimes?

Macroeconomic Performance, Susceptibility and Resilience to Shocks

One robust finding of the empirical literature is that inflation is lower under pegged exchange rates than under floating regimes. But much of this literature is based on data in the 1980s and 1990s, when inflation rates were generally higher. Does it hold for more recent periods also? Is pegging the exchange rate useful for disinflation? Is it only useful in such periods? And is it robust to regime endogeneity and cross-regime contamination? Is it the exchange rate regime that matters or the level of the real exchange rate?

While the literature has found generally strong effects of the nominal exchange rate regime on inflation, results for output growth are more mixed—which is perhaps understandable because the theoretical link between the nominal exchange rate and real variables is weaker. Nevertheless, it raises some puzzles. For instance, if pegged exchange rates (a fortiori, currency unions) are good for international trade, and trade openness is good for growth, then countries that are in currency unions should grow systematically faster than countries with floating regimes. This is does not appear to be the case[40] Therefore, it is important to

[40] Wolf, Ghosh, Berger and Gulde (2008) find that countries with currency boards have greater trade openness and, on average, grow considerably faster than countries with other exchange rate regimes.

understand the implications of the exchange rate regime—in addition to, or as distinct from, any over- or under-valuation of the real exchange rate—for growth, for growth spurts, and for the volatility of growth.

Beyond the average macroeconomic performance under various exchange rate regimes, an important consideration in the choice regime is it susceptibility to various shocks. In particular, the empirical literature—especially since the East Asian crisis—suggests that shocks are more likely and more costly under pegged exchange rate regimes (at least under soft pegs). This raises several questions. First, are the preconditions for an eventual crisis—such as an asset price bubble or a credit boom—more likely to arise under certain exchange rate regimes? Second, are various types of crises, such as banking crises, currency crises, or "growth" crises, more likely under certain regimes? Third, conditional on such a shock, does the impact on the real economy depend upon the exchange rate regime?

External Integration and Adjustment

> Turning to the country's interaction with the rest of the international monetary system, the exchange rate regime should help foster economic integration and promote smooth external adjustment. Regarding integration, while there is evidence that currency unions foster greater bilateral (and total) trade, in order to draw conclusions about other exchange rate regimes, it is important to understand the mechanisms through which this happens. In particular, is it the reduction in exchange rate volatility, exchange rate uncertainty, or transactions costs? How large is the effect on trade of simple pegs, and what is the incremental gain from full currency union? Do pegged regimes reduce exchange rate volatility and uncertainty in a manner—and over a horizon—that is relevant for trade decisions? How does the market perceive exchange rate uncertainty—and what is market risk-aversion (as embodied in options prices)—under pegged and floating exchange rates? Which is of greater concern to the private sector—the possibility of exchange rate volatility or of overvaluation?

In addition to trade integration, the exchange rate regime should help foster "stabilizing" capital flows—i.e., capital flows that help smooth consumption in the face of output shocks. To date, there has been very little empirical work on this issue, though the question of which exchange rate regime is most conducive to stabilizing capital flows is of increasing importance as developing and emerging market countries become more integrated with the global financial markets.

Finally, the exchange rate regime should promote smooth external adjustment, avoiding the build up of unsustainable imbalances (as measured by instances of sharp adjustment or deviations from, e.g., CGER norms), and minimizing the output costs of subsequent adjustment should such imbalances occur.

Conclusions

The exchange rate regime is just one facet—albeit an important one—of a country's policy framework. Both the theoretical model and the survey of the literature make clear that no single regime is likely to serve all countries at all times. Indeed, the very proliferation of exchange rate regimes since the collapse of Bretton Woods suggests that different regimes are appropriate to tackling different economic problems and circumstances facing countries. The agenda for further empirical set out here is formidable and ambitious —but it is also vital if we are to understand how the choice of exchange rate regime can best serve IMF members, and contribute to the stability of the overall system of exchange rates.

References

Alesina, Alberto, Robert J Barro, and Silvana Tenreyro, 2002, Optimal Currency Areas, NBER Macroeconomics Annual, Mark Gertler and Kenneth Rogoff, eds. (Cambridge, Massachusetts: MIT Press).

Artis and Hoffman, 2006, "Declining Home Bias and the Increase in International Risk Sharing: Lessons from European Integration," Mimeo.

Baldwin, Richard, 2005, The Euro's Trade Effect, Mimeo, University of Geneva. http://hei.unige.ch/~baldwin/RoseEffect/Euros_Trade_Effect_Baldwin_31May05.pdf

Baldwin, Richard E., Skudelny, Frauke and Daria Taglioni, 2005, Trade Effects of the Euro-Evidence from Sectoral Data" Working Paper Series 446, European Central Bank.

Baldwin, Richard E., 2006, The Euro's Trade Effect, Working Paper Series 594, European Central Bank.

Baldwin, Richard E. and Virginia Di Nino, 2006, "Euros and Zeros: The Common Currency Effect on Trade in New Goods," NBER Working Paper No. 12673 (Cambridge, Massachusetts: National Bureau of Economic Research).

Baldwin, Richard E., and Daria Taglioni, 2006, "Gravity for Dummies and Dummies for Gravity Equations," NBER Working Paper No. 12516 (Cambridge, Massachusetts: National Bureau of Economic Research).

Barro, Robert and David Gordon, 1983a, "Rules, Discretion, and Reputation in a Model of Monetary Policy," *Journal of Monetary Policy*, Vol. 12, pp. 101-121.

Barro, Robert, and David Gordon, 1983b, "Positive Theory of Monetary Policy in a Natural Rate Model," *Journal of Political Economy*, Vol. 91, pp. 589–610.

Baxter, M. and A. Stockman, 1989, "Business Cycles and the Exchange–Rate Regime: Some International Evidence," *Journal of Monetary Economics*, Vol. 23 (May), pp 377-400.

Baxter, Marianne and Alan Stockman, 1989, "Business Cycles and the Exchange Rate Regime: Some International Evidence," *Journal of Monetary Economics*, Vol. 23, pp 377-400.

Bordo, Michael and Anna Schwartz, 1996, Why Clashes Between Internal and External Stability Goals End in Currency Crises, 1797-1994, Open Economies Review, Vol. 7, pp. 437-468, December.

Bordo, Michael D., and Ronald MacDonald, 1987, "Violations of the Rules of the Game and the Credibility of the Classical Gold Standard, 1880-1914," NBER Working Paper 6115 (Cambridge, Massachusetts: National Bureau of Economic Research).

Brada, Josef and Jose Mendez, 1988, "Exchange Rate Risk, Exchange Rate Regime and the Volume of International Trade" Kyklos 41, pp. 263-80.

Bubula, Andrea and Inci Otker-Robe, 2002, "The Evolution of Exchange Rate Regimes Since 1990: Evidence from De Facto Policies," IMF Working Paper 02/155 (Washington: International Monetary Fund).

Bubula, Andrea and Inci Otker-Robe, 2003, "Are Pegged and Intermediate Exchange Rate Regimes More Crisis Prone?" IMF Working Paper 03/223 (Washington: International Monetary Fund).

Caballero, Ricardo, 1991, "On the sign of the Investment-Uncertainty Relationship," *American Economic Review*, Vol. 81, pp. 279-288.

Calvo, Guillermo and Carmen Reinhart, 2002, "Fear of Floating," *Quarterly Journal of Economics*, Vol. 117, pp. 379-408.

Calvo, Guillermo 1999, "Argentina's Dollarization Project: A Primer", www.bsos.umd.edu/econ/ciecalvo.htm.

Caporale, G. and N. Pitis, 1995, "Nominal Exchange Rate Regimes and the Stochastic Behavior of Real Variables," *Journal of International Money and Finance*, Vol. 14, No. 3, pp 395-415.

Chinn, Menzie and Sahng-Jin Wei, 2008, "A Faith-based Initiative: Do We Really Know that a Flexible Exchange Rate Regime Facilitates Current Account Adjustment?" Manuscript.

Clark, Peter B., Natalia T. Tamirisa, Shang-Jin, Azim M.Sadikov, Azim M. and Li Zeng, 2004, *A New Look at Exchange Rate Volatility and Trade Flows*, IMF Occasional Paper No. 235 (Washington: International Monetary Fund).

Cooper, Richard, 1971, "Currency Devaluation in Developing Countries," Essays in International Finance, No. 86 (Princeton, New Jersey: Princeton University International Finance Section).

Cukierman, Alex, 1992, "Central Bank Strategy, Credibility, and Independence" (Cambridge, Massachusetts: MIT Press).

Cukierman, Alex, Steven Webb, and Bilin Neyapti, 1992, Measuring the Independence of Central Banks and its Effect on Policy Outcomes," World Bank Economic Review, Vol. 6, pp. 353-398.

Cushman, David O., 1983, "The Effects of Real Exchange Rate Risk on International Trade," Journal of International Economics Vol. 15, pp. 45-63.

Cushman, David O., 1986, "Has Exchange Rate Risk Depressed International Trade? The Impact of Third-Country Exchange Risk," *Journal of International Money and Finance* Vol. 5, pp. 361-379.

Cushman, David O., 1988, "U.S. Bilateral Trade Flows and Exchange Rate Risk During the Floating Period," *Journal of International Economics* Vol. 24, pp. 317-330.

de Haan, Jakob, Helge Berger, and Erik van Fraassen, 2001, How to Reduce Inflation: an Independent Central Bank or a Currency Board? The Experience of the Baltic Countries, Emerging Markets Review, 2 3, 218-43, September.

Di Giovanni, Julian and Jay C. Shambaugh, 2008, "The Impact of Foreign Interest Rates on the Economy: The Role of the Exchange Rate Regime," *Journal of International Economics*, Forthcoming.

Dornbusch, Rudiger, 2001, "Fewer Monies, Better Monies," *American Economic Review*, 2001, 91, No. 2, pp. 238-42, May.

Edwards, Sebastian, 2007, "On Current Account Surpluses and the Correction of Global Imbalances," NBER Working Paper 12904. (Cambridge, Massachusetts: National Bureau of Economic Research).

Edwards, Sebastian and Eduardo Levy Yeyati, 2005, "Flexible Exchange Rate as Shock Absorbers," *European Economic Review*, Vol. 49, pp. 2079-2105.

Edwards, Sebastian, 2004a, "Thirty Years of Current Account Imbalances, Current Account Reversals, and Sudden Stops," IMF *Staff Papers*, International Monetary Fund, Vol. 51, pp. 1-49.

Edwards, Sebastian, 2004b, "Financial Openness, Sudden Stops, and Current Account Reversals," NBER Working Paper No. 10277 (Cambridge, Massachusetts: National Bureau of Economic Research).

Edwards, Sebastian (2007). "On Current Account Surpluses and the Correction of Global Imbalances." NBER Working Paper, 12904(Cambridge, Massachusetts: National Bureau of Economic Research).

Edwards, Sebastian and Eduardo Levy Yeyati, 2005, "Flexible Exchange Rate as Shock Absorbers," *European Economic Review*, Vol. 49 pp. 2079-2105.

Eichengreen, Barry and Muge Adalet, 2005, "Current Account Reversals: Always a Problem?" NBER Working Paper 11634(Cambridge, Massachusetts: National Bureau of Economic Research).

Eichengreen, B., 1994, *International Monetary Arrangements for the 21st Century* (Washington: Brookings Institution).

Fischer S., 2001, "Exchange Rate Regimes: Is the Bipolar View Correct?" Distinguished Lecture on Economics in Government, *Journal of Economic Perspectives*, Vol. 15, No. 2, pp 3-24.

Fleming, J. Marcus, 1962, "Domestic Financial Policies Under Fixed and Under Floating Exchange Rates," *Staff Papers*, International Monetary Fund, Vol. 9, pp. 369-79.

Flood R. and A. Rose, 1995, "Fixing Exchange Rates: A Virtual Quest for Fundamentals," *Journal of Monetary Economics*, Vol. 36 (August), pp. 3-37.

Frankel, Jeffrey and Andrew K. Rose, 2002, "An Estimate of the Effect of Common Currencies on Trade and Income," *Quarterly Journal of Economics* Vol. 117:2, pp. 437-466.

Frankel, Jeffrey, Sergio Schmukler and Luis Serven, 2000, "Global Transmission of Interest Rates: Monetary Independence and Currency Regime," World Bank Working Paper.

Frankel, Jeffrey, Sergio Schmukler and Luis Serven, 2002, "Global Transmission of Interest Rates: Monetary Independence and Currency Regime," NBER Working Paper No. 8828 (Cambridge, Massachusetts: National Bureau of Economic Research).

Frankel, Jeffrey, 2005, Contractionary Currency Crashes in Developing Countries, Mundell Fleming lecture, Staff Papers, International Monetary Fund, Vol. 52, No.2, pp. 149-192.

Friedman, Milton, 1953, "The Case For Flexible Exchange Rates," in Milton Friedman Essays in Positive Economics Chicago: University of Chicago Press, pp. 157-203.

Ghosh, Atish, Anne-Marie Gulde, and Holger Wolf, 2000, "Currency Boards: More Than a Quick Fix?" Economic Policy, Vol. 15, No. 31 (Oct., 2000), pp. 269-335.

Ghosh Atish, Anne-Marie Gulde, and Holger Wolf, 2003, *Exchange Rate Regime: Choices and Consequences*, (Cambridge and London : MIT Press).

Ghosh Atish, Anne-Marie Gulde, Jonathan Ostry and Holger Wolf, 1995, "Does the Nominal Exchange Rate Matter?" IMF Working Paper WP/95/121 (Washington D.C.: International Monetary Fund).

Ghosh Atish, Anne-Marie Gulde, Jonathan Ostry and Holger Wolf, 1997, "Does the Nominal Exchange Rate Matter for Inflation and Growth?" IMF Economic Issues no. 2, (Washington D.C.: International Monetary Fund).

Giannone, Domenico and Lucrezia Reichlin, 2004, "Trends and Cycles in the Euro Area: How Much Heterogeneity and Should We Worry About It?" European Central Bank, Working Paper No. 595.

Hausmann, Ricardo and Andres Velasco, 2002, "The Argentine Collapse: Hard Money's Soft Underbelly", Brookings Trade Forum, pp. 1-62.

Hausman, Ricardo, Michael Gavin, Carmen Pages, and Eduardo Stein, 1999, "Financial Turmoil and the Choice of Exchange Rate Regime," Inter-American Development Bank, Research Department Working Paper 400.

Husain, A., A. Mody, and K. Rogoff, 2005, "Exchange Rate Regime Durability and Performance in Developing Versus Advanced Economies," *Journal of Monetary Economics*, Vol. 52, pp 35-64.

Kiguel, Miguel and Nissan Liviatan, 1991, "Lessons from the Heterodox Stabilization Programs," Working Paper 671, Country Economics Department, World Bank.

Krugman, Paul, 1979, "A Model of Balance-of-Payment Crises," *Journal of Money, Credit and Banking*, Vol. 11, pp. 311-25.

Lane, Philip R. and Roberto Perotti, 2003, "The Importance of Composition of Fiscal Policy: Evidence from Different Exchange Rate Regimes," *Journal of Public Economics,* Vol. 87 (9-10), pp. 2253-79.

Larrain F. and A. Velasco, 2001, "Exchange Rate Policy in Emerging Market Economies: The Case for Floating," *Essays in International Economics*, No. 224 (Princeton, New Jersey: Princeton University).

Levy-Yeyati, E., and F. Sturzenegger, 2003, "To Float or to Trail: Evidence on the Impact of Exchange Rate Regimes" *American Economic Review*, Vol. 93, pp. 1173–1193.

Levy Yeyati, Eduardo and Frederico Sturzenegger 2003, Dollarization: A Primer, in: Eduardo Levy Yeyati and Frederico Sturzenegger eds., Dollarization: Debates and Policy Alternatives (Cambridge, Massachusetts: The MIT Press).

Masson, P., "Exchange Rate Regime Transitions,"*Journal of Development Economics*, Vol. 64, 0pp. 571-586.

Mundell, R., 1961, "A Theory of Optimum Currency Areas," *American Economic Review*, Vol. 51, pp. 657–65.

Mundell, Robert, 1962, "The Appropriate Use of Monetary and Fiscal Policy for Internal and External Balance," *Staff Papers*, International Monetary Fund, pp. 70–79.

Mundell, Robert A., 1963, "Capital Mobility and Stabilization Policy Under Fixed and Flexible Exchange Rates," *Canadian Journal of Economics and Political Science*, Vol. 29, November, pp.475–85.

Mundell, Robert A., 1960, "The Monetary Dynamics of International Adjustment under Fixed and Flexible Exchange Rates," *Quarterly Journal of Economics* Vol. 74, pp. 227-57.

Mundell, Robert A., 1963, "Capital Mobility and Stabilization Policy Under Fixed and Flexible Exchange Rates," *Canadian Journal of Economics and Political Science* Vol. 29, pp. 475-85.

Mussa, M., 1986, "Nominal Exchange Rate Regimes and the Behavior of Real Exchange Rates: Evidence and Implications," Carnegie-Rochester Conference Series on Public Policy, Vol. 25 (Fall), pp. 117-214.

Obstfeld, Maurice and Kenneth Rogoff, 1995, "Exchange Rate Dynamics Redux," *Journal of Political Economy* Vol. 103 (3), pp. 624-60.

Ramcharan, R., 2007, "Does the Exchange Rate Regime Matter for Real Shocks? Evidence from Windstorms and Earthquakes," *Journal of International Economics*, Vol. 73, pp 31-47.

Rogoff, K., A. Husain, A. Mody, R. Brooks, and N. Oomes, 2004, *Evolution and Performance of Exchange Rate Regimes*, IMF Occasional Paper 229 (Washington D.C.: International Monetary Fund).

Schuler, Kurt 1992, Currency Boards, Dissertation, George Mason University. Online at www.erols.com/Kurrency/Webdiss1.htmand webdiss2.htm.

Schuler, Kurt 1996, Should Developing Countries Have Central Banks? Currency Quality and Monetary Systems in 155 Countries, London: Institute of Economic Affairs.

Velasco, Andres, 2001, "Argentina's Bankruptcy Foretold", Time, Latin American Edition, July 23rd, 2001.

Williamson, John 1995, What Role for Currency Boards?, Washington Institute for International Economics.

Wolf, Holger, Atish Ghosh, Helge Berger, and Anne-Marie Gulde 2008,*Currency Boards in Retrospect and Prospect* (Cambridge MA: The MIT Press).