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I. Introduction

The long lasting debate on exchange rate regimes has taken a new turn in recent economic literature with regimes moving away from the middle ground of pegged but adjustable fixed exchange rates towards the two poles: flexible exchange rates and fixed exchange rates. In general, the tradeoff in moving from a floating exchange rate to a pegged rate manifests in reduced exchange rate volatility at the cost of an independent monetary policy. Pegged regimes provide superior insulation of output against monetary shocks and are deemed to reduce both exchange rate uncertainty and transaction costs; thus, greater trade and investment results (Ghosh, Gulde and Wolf 2002). In contrast, floating regimes efficiently absorb real shocks and enable countries to retain an independent monetary policy as a macroeconomic stabilization tool. The impossible trinity of a fixed exchange rate, capital mobility, and an independent domestic monetary policy presents a strong case against traditional pegged regimes. Support for such a regime will not be viable in the long run unless the regime is really hard[1] and supported by a credible commitment, since domestic monetary policy would undoubtedly be tempted to address exchange rate volatilities. One primary attraction of pegged regimes, the removal of the nominal exchange rate as an adjustment mechanism, is also their principal drawback, since adjustment to domestic or international shocks is slower via differential domestic inflation than that via the nominal exchange rate (Ghosh, Gulde Wolf 2002).

Currency board arrangements have gained increased popularity in recent years attributable to their success in addressing objectives such as facilitating the transition from a centrally planned to a market economy, arresting hyperinflation, restoring exchange rate stability after a period of political and economic turmoil, and providing a trustworthy and stable institutional framework. A currency board can allow a developing economy to establish its domestic currency relatively promptly and efficiently by fixing the exchange rate between the domestic currency and the reserve currency at a predetermined level and by guaranteeing that the domestic currency is backed by sufficient foreign exchange reserves. Though currency boards are generally associated with outstanding inflation and interest rate performance, they are hardly a panacea. The arrangement of this most extreme form of exchange rate peg imposes restrictions on the central bank's ability to employ monetary policy, diminishes its role as a lender of last resort and inhibits the creation of domestic credit. The stringent institutional arrangements required to initiate a currency board aim to make its abolition a daunting task. These limitations, on the other hand, tend to heighten confidence in the domestic monetary authority and financial institutions due to enhanced monetary discipline and restrictive fiscal policy (Gulde, Kahkonen, Keller, 2000).

[1] Hard pegged regimes denote currency board arrangements, dollarization and monetary unions.

Thesis

This paper builds upon the study by Ghosh, Gulde and Wolf (2002) by examining the inflation and output performance of currency boards and other hard pegged regimes (such as dollarization and monetary unions) as well as of soft pegged and floating regimes. The impossible trinity suggests that in countries with open capital accounts, traditional soft pegs have proved to be unsustainable in the long run and crisis prone (Obstfeld and Rogoff 1995). The choice between a hard peg and a floating rate depends on numerous factors including the unique characteristics of an economy: level of income, degree of openness of capital accounts, and the country's inflationary and monetary policy history. The choice of a hard peg is justifiable for countries with a history of monetary instability and countries whose capital and current account transactions are closely integrated with a group of other economies (Fischer 2001). Also, countries implementing hard pegged regimes are usually small both in terms of GDP and population and are highly open to trade.

This paper seeks to employ regression analysis to empirically estimate the crisis proneness and the differences for the levels of inflation and per capita GDP growth among countries with floating exchange rates, those with pegged exchange rates, and finally, those with currency board arrangements or dollarization. Specifically, we expect the inflation levels for countries implementing currency boards to be significantly lower than those for countries having pegged, intermediate floating and floating exchange rates. Although we do not anticipate hard pegged regimes to exhibit exceptional output growth, we conjecture that the superior inflation performance of the regime is not gained in a tradeoff between inflation and growth. The assumed inflation performance advantage of hard pegged regimes inevitably raises the question of endogeneity of regime choice since countries with a low propensity of inflation are prone to adopt relatively restrictive monetary regimes. Since in real economies we often observe that monetary instability or hyperinflation predates arrangements of currency boards, we anticipate the reverse causality bias to be unsubstantiated. Finally, with an eye towards improved stability, we expect to find support for the bipolar view that countries will eventually abandon the crisis prone adjustable pegs and intermediate floats for the corner solutions of free floats and hard pegs.

II. Literature Review

The theoretical literature on the choice and consequences of exchange rate regime adoption is expansive and ever-growing. Essentially, the choice between adopting pegged or floating regimes represents a tradeoff between restricted exchange rate volatility and the benefit of monetary policy as a stabilization tool. Following Ghosh, Gulde and Wolf, one can claim, at the risk of oversimplification, that the influential theoretical literature on the objectives of exchange rate regimes can be divided into three broad categories: insulating the domestic economy, integrating economically with one or more countries, and maintaining policy credibility towards macroeconomic goals.

Studies by Fleming (1962) and Mundell (1963) on the insulating properties of exchange rate regimes with highly mobile capital, focus on the prominent differences in the conduct of stabilization policy between pegged and floating regimes. Interpreting monetary and fiscal policies as nominal and real shocks, respectively, fixed exchange rates provide greater insulation of output in the face of nominal shocks, while floating exchange rates excel at absorbing real shocks (Ghosh, Gulde and Wolf 23). Under a pegged regime, a monetary expansion lowers interest rates, which leads to capital outflows, reduced reserves and money stock contraction. In this case monetary policy is rendered completely ineffective if perfect capital mobility is assumed. On the other hand, under a floating regime, the capital outflows lead to depreciation of the exchange rate which, subsequently, stimulates output. Fiscal expansions under a floating regime raise interest rates, which lead to capital inflows, an appreciated exchange rate and a weakened trade balance. Under perfect capital mobility, fiscal policy is rendered completely ineffective. In contrast, under a pegged regime, the capital inflow will force automatic monetary expansion augmenting the effect of the fiscal expansions because of the central bank's commitment to uphold the peg. These considerations reinforce the impossible trinity of independent monetary policy, open capital accounts and fixed exchange rate.

Implementation of an exchange rate peg translates to abandoning the nominal exchange rate as an adjustment tool which can adversely affect the potency of stabilization policy if alternative adjustment mechanisms such as wage and price flexibility and factor mobility are unavailable. It is widely recognized that reduced exchange rate variability lowers uncertainty and risk premiums, and thereby encourages cross border trade and trade integration which, in turn, may reduce the correlation of shocks in the given region. While increased trade integration leads to superior specialization and diminishes the correlation of supply shocks, it also facilitates the transition of demand shocks, which renders the net effect of increased trade on business cycle correlations ambiguous.

The third major exchange literature strand is pioneered by the Barro and Gordon (1983) theoretical framework, which emphasizes how credibility affects central banks' decision-making in setting monetary policy. Exchange rate regimes can theoretically be proposed as a potential nominal anchor aimed at lowering inflation expectations and, thus, at aiding the central bank in the difficult task of lowering not only inflation but unemployment. Central banks face the credibility problem associated with the incentive of generating surprise inflation in order to arrest unemployment. With wages being set before monetary policy is altered, the workers can successfully factor such incentives into wage demands inducing unchanged unemployment and increased inflation. In a closed economy such forward looking wage-setting can be rectified by conducting extremely restrictive monetary policy in order to regain credibility. For open economies a stringent peg regime such as a currency board can provide a strong pre-commitment and subsequent credibility boost given that the abolition of the pegged regime comes at a significant political cost.

Exchange rate regimes are theoretically constrained by the monetary policy trinity, which represent stark tradeoffs among the three goals of policymakers in open economies: (1) exchange rate stability, (2) monetary policy autonomy, and (3) freedom of capital movement (Refer to figure 6). Unfortunately since only two of these beneficial objectives can mutually coexist, policymakers are forced to choose which one they wish to give up. Obstfeld, Shambaugh and Taylor (2004) claim that if domestic monetary authority activism (2) means the ability to influence interest rates away from the world rate, then arbitrage in open capital markets (3) and interest parity under a credibly fixed exchange rate (1) markedly defeat the purpose. Using a measure of monetary independence based on short-term market interest rates, the authors estimate whether exchange rate regimes influence the extent to which local interest rates diverge from the world rate. They find compelling historical evidence in favor of the trinity, which, thus, emerges as a relevant and long enduring policy constraint. Furthermore, while some countries adopt flexible or fixed exchange rates with respect to monetary independence preferences, "others have endured crises and confusion in vacillating between these two corner solutions" (Obstfeld, Shambaugh and Taylor 4).

In the past decade, pegged exchange rates, especially adjustable pegs, have emerged as culprits in the major financial crises from the European exchange rate mechanism turmoil of 1992-93 to the crises in Mexico (1994); Thailand, Indonesia, and Korea (1997); Russia and Brazil (1998); Ecuador (1999); Argentina and Turkey (2000); and Turkey again (2001). The severity of the ensuing crises, many of which turned into banking system and economic activity collapses, have rendered many policymakers wary of exchange rate regimes between the corner solutions of hard pegs and free floats. Apart from the impossible trinity, intermediate regimes are affected by political incentives to tamper with the exchange rate whenever the short-term benefits outweigh the costs. Policymaker's concerns with nominal and real exchange rates are fueled by their effects on inflation, and allocation of resources and wealth of domestic citizens, respectively (Fischer 2001). Furthermore, emerging market economies are averse to both substantial exchange rate appreciation and depreciation due to loss of export competitiveness, and pervasive government and private sector foreign denominated debt, respectively (Reinhart 2000). On the other hand, the increased capital mobility, due to the lifting of capital controls and improved communications technology, has made pegs extremely vulnerable to speculation and thus unsustainable in the long run without an irrevocable official commitment to upholding the peg. The "fear of floating," prevalent both today and in the past, coupled with the aforementioned policymaker credibility concerns, gives the upper hand to hard pegged regimes which simultaneously tackle both issues (Reinhart 2000). Both Fischer (2001), and Bubula and Otker-Robe (2004) employ a *de facto* exchange rate regime classification and find that while the proportion of IMF members with intermediate exchange rates fell during the 1990's, the proportion using hard pegs and free floats rose markedly, corroborating the bipolar view (Refer to figures 1 and 2).

The bipolar theory, however, has been contested on a number of grounds such as Argentina's currency board collapse, "fear of floating," differences in exchange rate regime classification, and lack of solid empirical evidence (Bubula and Otker-

Robe 2004). Many theorists have pledged support to Frankel's claim that "no single currency regime is right for all countries at all times" (Frankel 1999). Fischer, a key proponent, admits that the bipolar view may have been exaggerated for "dramatic effect," but insists that while a variety of flexible arrangements exist, adjustable pegs are unsustainable in the long run since exchange rate movements profoundly influence most countries' policy (Fisher 2001). Rogoff and others (2003) employ a new classification of exchange rate regimes and find that the bipolar view is an inaccurate historical description and an unlikely scenario for the future. The authors attribute these innovative results to the specifics of the *natural*[2] classification, which differs substantially from the IMF's *de jure* and *de facto* classifications and reveals no "hollowing out of the middle" (Refer to figure 5) They argue that intermediate regimes have shown remarkable durability by taking account of the tendency of countries to allow less flexibility in practice than in policy, or the "fear of floating" theory by Calvo and Reinhart (2002). Countries' reluctance to permit unfettered fluctuation of their exchange rates can be attributed to policy credibility concerns, loss of trade competitiveness due to large potential appreciation, inflationary pressures and currency mismatches of foreign currency denominated liabilities. Furthermore, the authors argue that as an economy matures, the value of exchange rate flexibility rises notably, and flexible exchange rate regimes offer developed countries high growth performance without any loss in credibility (Reinhart 2000). They, however, acknowledge that rigid exchange rate regimes are relatively impervious to speculative attacks and offer anti-inflationary credibility gain without compromising growth or volatility.

Bubula and Otker-Robe (2004) evaluate the bipolar view and the potential for crisis proneness of exchange rate regimes on a large sample of countries in the 90's using the IMF's *de facto* classification. Similar to Fischer (2001), the authors claim that the number of hard pegged and floating regimes have increased substantially while the number of intermediate regimes has declined (Refer to Figure 2). They find that the frequency of crises associated with pegged regimes is greater than under floating regimes for all countries, but about the same for developing countries with relatively closed capital markets. Intermediate regimes emerge, however, as considerably more crisis prone compared to the polar alternatives across country groups. Hard pegs consistently exhibit the lowest crisis incidence rate, which is about a third of intermediate regimes' rate. Furthermore, the authors provide evidence that their results are not driven by an endogeneity bias, namely that a move to an intermediate regime signals an imminent crisis. In general, the study presents broad support for the bipolar view and demonstrates the flight from the more susceptible to crises intermediate regimes but warns that there is no substantial evidence of their future disappearance.

Ghosh, Gulde and Wolf (2002) estimate that countries under pegged exchange rate regimes average 10.5 percentage points lower inflation rates than those with floating exchange rates over the period from 1970 to 1999. While they attribute slightly less than half of the differential to greater regime confidence engendered by adoption of a pegged regime, the major

[2] Refer to Reinhart and Rogoff (2004) and Rogoff and others (2003).

portion of the rest represents consequent monetary and fiscal discipline. Furthermore, the authors determine that heightened credibility of the domestic financial institutions encourages money holding and thus results in lower inflation for given money growth. Using a six part classification of exchange rate regimes, the authors report that hard pegged regimes offer significantly better performance than either soft pegged or intermediate regimes. The study finds negligible endogeneity effects of current inflation performance on regime choice by employing a two stage probit procedure. Furthermore, since money growth is an independent variable in the inflation regression specification, the indirect effects of pegged exchange rate regimes are not accounted for. Thus, controlling for pegged exchange rate regimes' indirect effect on inflation operating through circumscribed money growth, the study estimates a notably higher coefficient for the pegged exchange rate regime variable. This clearly shows that exchange rate regimes have a significantly stronger effect on inflation when one accounts for the money policy conducted under pegged regimes.

Ghosh, Gulde, and Wolf also consider the effects of exchange rate regime choice on output growth and find that both pegged and intermediate regimes are associated with better growth performance than floats. "The differences in growth performance [of pegged regimes] are neither paltry nor spectacular" with respect to floating rates regimes since results are found to be insignificant for pegged regimes and not robust across sub-samples (Ghosh, Gulde, Wolf, 93). Similar to the inflation regression, the authors estimate the indirect effect on output of exchange rate regime choice through trade openness and investment but fail to find substantiated evidence of endogeneity. Disaggregation of the exchange rate regime classification into a more detailed one suggests that the relationship between exchange rate flexibility and output performance is not linear. Hard pegged regimes fare no worse than pure floats, and basket pegs coupled with hard floats emerge as the best performers. Ghosh, Gulde and Wolf note that their findings, consistent with the theoretical literature, fail to identify a significant relationship between exchange rate regimes and real output growth. Overall, Ghosh, Gulde and Wolf find compelling evidence that pegged regimes offer superior inflation and competitive real output growth performances compared with floating regimes.

III. Exchange Rate Regime Classification

Intuitively, one could lump exchange rate regimes into two main categories: fixed and floating. A pegged exchange rate operates similarl to an exchange rate anchored to another currency or commodity. Further, unlike a floating rate, a peg signifies a formal commitment by the central bank to subject its monetary policy to meeting the exchange rate's targets and to maintaining parity through specified foreign exchange interventions. In reality, however, a plethora of arrangements in terms of peg rigidity exist (See Table 1), and "no single currency regime is right for all countries at all times" (Frankel 1999).

Since every IMF member country's central bank is required to submit a formal yearly statement of its intentions on exchange rate policy a *de jure* classification of exchange rate regimes can be plausibly formed. *De jure* classifications strongly support the bipolar view (Refer to figure 4). In general, a formal announcement of future exchange rate regime change reflects the policy of the domestic monetary authority and is bound to affect the economy and popular expectations in a most profound way. Though such an approach is forward looking and emphasizes the importance of pronounced policy signals, the *de jure* classification has a crucial drawback: intentions do not necessarily coincide with actions. Some countries with declared fixed exchange rates do not take sufficient action to defend their pegs and devalue frequently. Others abuse the pegged exchange rate regime's credibility and implement markedly expansionary policy. Additionally, countries under a floating exchange rate often administer substantial interventions in the foreign exchange market in order to keep the exchange rate within a tight band. Thus *de jure* classifications are prone to regime misalignments, and due primarily to the "fear of floating," could significantly misstate the number of intermediate regimes.

Given the difficulty of differentiating between the actual and announced regimes, a number of *de facto* classification systems have been proposed. The IMF has begun publishing regime classifications that account for the actual functioning of regimes as, for example, unsuccessful pegs and tightly managed floats. The classification combines formal and informal policy declarations on exchange rates and monetary policy with actual exchange rate and reserve movements. Their findings generally support the bipolar view over the last decade (Refer to Figures 1, 2 and 3). A different approach taken by Reinhart and Rogoff's (2004) *natural* classification, relies on a broad set of descriptive statistics and detailed chronologies of exchange rate arrangements to group regimes (Rogoff 2004). Their classification uses a comprehensive dataset dating back to 1946 and shows little support for the bipolar view (Refer to Figure 5). Levy-Yeyati and Sturzenegger (1999) present yet another *de facto* classification which employs foreign exchange intervention, reserve data and interest rate movements to classify regimes. Others use actual exchange rate movements or control for country characteristics.

Regardless of the approach used, *de facto* classifications have critical conceptual and practical drawbacks. A prominent pitfall of all *de facto* classifications systems is their backward looking nature, which fails to capture the signaling function of announced policy intentions on exchange rate regime choice, which in turn markedly affects economic performance. Of course, the absence of exchange rate volatility can be due to a lack of adverse shocks rather than to foreign exchange rate market interventions. Furthermore, economists cannot easily distinguish between interventions undertaken to meet a specific exchange rate target and those designed to meet other policy objectives such as inflation targeting. Since observed exchange rate movements are affected by country-specific institutional frameworks and shocks, inferring the underlying actual exchange rate policy can be quite difficult. For instance, a small open economy with substantial exchange rate volatility can be classified as a float while a large and diversified economy with lower volatility can be described as a peg. Inferences based on interest

rate movements can also be misleading since in many developing countries interest rates differ considerably from the market clearing rate. Additionally, foreign reserves can be affected by foreign debt payments or large military or raw material purchases rather than exchange rate pressures. In summary, all classification methods are flawed to some extent, vary greatly from each other, and while there is much room for progress in the future, it is not clear that complex solutions will outperform the simple *de jure* one.

This study uses a 15 exchange rate regime, *de jure* classification monotonically arrayed in terms of peg rigidity, as compiled by Ghosh, Gulde and Wolf (2002)[3]. Fifteen regimes suggests more precision than can be justified, and as noted above, risks missing the general picture while getting bogged down with unnecessary detail. Thus, in the empirical analysis we employ a more compact four regime classification system: hard pegs, comprised of dollarization, currency boards and monetary unions; soft pegs, composed of single currency and basket pegs; hard floats, encompassing cooperative regimes, crawling pegs, target bands and managed floats; and free floats (Refer to Table 1). In order to address the aforementioned uncertainties regarding *de jure* classifications and verify the robustness of the *de jure* classification results, we use the same four way aggregation in terms of the Ghosh, Gulde and Wolf (2002) hybrid *de facto* classification. The authors' "consensus" classification removes the observations where the *de jure* classification does not match a *de facto* one based on exchange rate movements. Therefore, this classification reduces the sample by 35 percent over the 1970-1999 period and essentially eliminates a number of identified hard float and soft peg regimes. Regime classification misalignments are gravest amongst hard floats where only 30.6 percent of observations are classified as such by both *de facto* and *de jure* classifications compared to 41.5 percent and 80.3 percent for pegs and floats, respectively. Due to the rigorous adoption requirements and high exit costs, hard pegs are robust with respect to classification. The table below indicates how well the two systems match up.

Regime classification	De facto pegs	De facto hard floats	De facto floats
De jure pegs	80.3% (2265)	42.9% (378)	29.1 (178)
De jure hard floats	15.3% (432)	30.6% (270)	29.2% (179)
De jure floats	4.3% (124)	26.4 (233)	41.5% (254)

Note: numbers in parenthesis show number of observations

While a *de jure* approach has its drawbacks, often times a simpler and more intuitive approach is more compelling than a complex one that holds the promise to correct all shortcomings but generates new ones. Since most of the proposed *de facto* classifications differ from each other in significant ways as well as when pitted against a *de jure* classification, in this study we will focus mainly on the *de jure* results but will verify their robustness using the hybrid *de facto* classification proposed by Ghosh, Gulde and Wolf (2002).

[3] For classification specifics refer to Ghosh, Gulde and Wolf (2002) 40-51.

V. Data Description and Descriptive Statistics

This study employs a macroeconomic data set used by Ghosh, Gulde and Wolf (2000), which is primarily drawn from International Monetary Fund's World Economic Outlook Database and the World Bank. The complete dataset consists of 5,010 annual observations and is constructed as a balanced panel of 30 observations per country. The dataset is comprised of observations from 160 countries over the period 1970-1999. Since in many cases data are missing or invalid, a subset of 1,946 or fewer observations is employed in the regression analysis[4]. The year a regime change is initiated and the following year is left out due to unpredictable volatilities. For the regression specification using lagged growth terms additional yearly observations were dropped in order to ensure non-overlapping of county data. There are a number of drawbacks associated with using a large sample with its great heterogeneity of experience. A significantly pronounced problem is the lack of consistency and accuracy in variable measurements over different countries and time periods. A further complication is implementing functional forms which work successfully for samples consisting of large numbers of countries boasting diverse economic development patterns. Thus broad-paneled data set studies rely on the trust that strong underlying economic signals from the diversity of experiences will be able to overcome the general noise (Barro 2002).

Countries with hard pegged exchange rate regimes represent 13.2 percent of the full sample observations whereas countries with soft pegged, hard floating and floating exchange rate regimes constitute 52.2, 20.8 and 14.2 percent, respectively. The observations of countries with hard pegs in the regression analysis sample include Antigua & Barbuda (1981-1999), Argentina (1991-1999), Dominica (1978-1999), Djibouti (1978), Estonia (1992-1999), Grenada (1977-1999), Hong Kong (1983-1999), Lithuania (1980-1999), St. Lucia (1980-1999), and St. Vincent and the Grenadines (1980-1999). The number of hard peg observations are 115 and 46 for the inflation and growth regressions, respectively. Table 2 describes some of the most important characteristics of the currency boards in existence in 1997. In general, a currency board is defined by four main characteristics: sufficient backing of the domestic currency by the anchor currency, freedom of conversion of domestic currency into the reserve currency at a fixed rate, a formal institutional arrangement and restricted monetary policy. A glance at the table verifies that the rigor of arrangements vary widely in practice and inevitably fall short of the orthodox idea. Argentina was an example of a currency board with fairly flexible arrangement that allows partial cover of domestic assets while Estonia and Bulgaria boast stringent arrangements. Hanke (2002) focuses on the departures from orthodoxy of modern currency boards and finds that only Bosnia meets the required reserve requirement of 100-115%, and only Bulgaria does not regulate commercial banks. Finally, none supply just coins and notes. Hanke claims that the modern arrangements are, in fact, not

[4] Since the regression sample does not include any monetary union observations (Refer to table 1), it is safe to assume in the regression analysis that hard pegs denote just currency board and dollarization observations.

currency boards. It is, however, unlikely that any country will be willing to completely forgo a monetary authority with discretionary powers in order to be bound by the rules of orthodoxy.

Table 3 and figure 7 present the descriptive statistics for the integral variables used in this study and divide the data into specific samples for all four exchange rate regimes. Evaluating the mean and median inflation rates across regimes allows us to verify that hard pegged exchange rate regimes enjoy the best inflation performance followed by soft pegged, floating and hard floating exchange rate regimes. Hard pegs, closely followed by soft pegs, achieve the least money growth which signifies the importance of monetary discipline in order to support the peg. GDP growth summary statistics across regimes are quite similar with hard pegged regimes performing well despite their constraints of virtually nonexistent monetary policy. Pegged regimes achieve larger deficits compared to floating regimes which is theoretically sound because restrictions on monetary policy lead authorities to use fiscal policy to stabilize the economy. Hard pegs attain the lowest turnover rates for central bank directors which signify general central bank stability and independence. It is also worth noting that hard pegged regimes boast the greatest ratio of imports and exports to GDP which signifies their superior trade openness with respect to other regimes. Hard floating exchange regimes offer the worst inflation performance but competitive growth performance. This can be attributed to lower central bank credibility and inconsistent or flawed exchange rate interventions which are often associated with floating regimes implementing discretionary or rule based interventions.

Table 4 presents descriptive statistics across different sub-samples. Hard pegs consistently outperform the other regimes with respect to money growth and inflation and offer surprisingly strong growth performance. The performance of hard pegged regimes is quite comparable with floating regimes in high income and low inflation counties, which is hardly surprising since such countries generally boast strong economies capable of withstanding exchange rate and inflationary shocks and would not benefit greatly from adopting a peg for that purpose. As expected, hard pegs fare very well in the sub-samples of inflation-ridden and low income observations. One explanation for the considerable discrepancy between the inflation and growth performance of hard pegs and floats is the *de jure* regime classification where some of the reported floats in fact behave as either pegs or hard floats. A second claim is that low income or high inflation countries usually lack the appropriate institutional framework that could enable them to take full advantage of a floating exchange rate.

VI. Inflation Regression

To examine the link between the exchange rate regime and inflation, this study will employ a regression specification with scaled[5] inflation, Π, as the dependent variable:

$$\Pi = \beta_0 + \beta_1 Hardpeg + \beta_2 Softpeg + \beta_3 Hardfloat + \beta_4 MG + \beta_5 GDPG + \beta_6 Turn + \beta_7 Open + \beta_8 GovBal + \beta_9 TTG + \beta_{10} Year$$
$$(-) \quad (-) \quad (+) \quad (+) \quad (-) \quad (+) \quad (-) \quad (-) \quad (-)$$

Hardpeg: dummy variable representing currency board or dollarization; ***Softpeg:*** dummy variable representing pegs tied to a single currency or a basket of currencies; ***Hardfloat:*** dummy variable denoting floating exchange rate regimes featuring rule-based or discretionary interventions.; ***MG:*** stands for the yearly broad money growth rate; ***GDPG:*** denotes yearly real GDP growth rate; ***Turn:*** represents the five-year average turnover rate of the central bank's governor in the particular country and is used as an inverse proxy for central bank independence (Cukierman 1992); ***Open:*** stands for the ratio of exports plus imports to GDP and is used as a measure of yearly trade openness. ***GovBal:*** represents a three-year backward average of the annual governmental budget balance as a percent of GDP; ***TTG:*** accounts for a three-year backward average of the growth of terms-of-trade shocks indicating the growth rate of export prices to import prices (Fischer 1993); ***Year:*** denotes the difference between the sample end date and the year of the observation and accounts for global inflation shocks and other identified yearly effects.

Since no dummy explanatory variable is specified for floats, which are selected as the baseline exchange rate regime, the coefficients on the other exchange rate regime variables should be interpreted as the inflation differential relative to a floating exchange rate. Institution of a hard pegged regime is expected to enhance monetary discipline, further Central Bank credibility, lower insecurity, and boost overall economic stability, and thus, foster superior inflation performance relative to other regimes. Due to the credibility-raising uncertainty-lowering effects of adopting an exchange rate peg, soft pegged regimes are expected to fare better than floats with regard to inflation. Hard floats have poor inflation performance due to pressures on servicing exchange rate bands or inadequate interventions, driven by short term perspectives, associated with such regimes. Faster money growth, widely recognized as a main driver of inflation, is associated with higher inflation. By assumption, we anticipate higher real GDP growth to reduce inflation by raising money demand. A high turnover rate for the central bank governor is associated with higher inflation on grounds that governors of central banks who report to political leaders can be subjected to unsubstantiated dismissals. Economic theory and factual observation suggest that relatively independent central banks are associated with better inflation performance relative to relatively dependent banks. Greater trade openness is hypothesized to raise the cost of a monetary expansion, which implies lower inflation in more open economies

[5] Since inflation and money growth rates can be severely skewed by a small number of outliers, Ghosh, Gulde and Wolf (2002) impose the scaling given by X = X/(1+X), where X is money growth or inflation, to address outliers.

(Roemer 1993). Further, import inflows often put downward pressure on prices. Large governmental surpluses are theorized to lead to lower inflation because of reduced aggregate demand pressures and direct money financing. The higher the growth of export prices to import prices, the lower inflation rates are expected to be. Further we added lagged variables for broad money growth to account for the lag structure of monetary policy implementation which is presumed to range from roughly 18 to 24 months.

Inflation Regression Results

The first two columns of Table 5 present a summary of the inflation regression specification results using a *de jure* exchange rate classification. The signs of all the coefficients for the explanatory variables accord with this study's initial hypotheses. Further, most variables enter the equation with significant coefficients with the exception of soft pegs and money growth lagged two years. Soft peg's insignificant coefficient could be attributed to the shortcomings of the *de jure* classification, this study's sample, or the particular grouping of exchange rate regimes especially since soft pegs account for more than half of all observations. As expected, hard pegs emerge as the best inflation performer and offer a 3.5 percentage points lower inflation rate compared to floating regimes. Hard floats do considerably worse than floats; on average they generate 2.8 percentage points higher inflation than floating regimes. The money growth and lagged money growth estimates exhibit an expected very strong positive effect on the dependent variable. With the exception of the second lagged term, these variables are also strongly significant. The GDP growth rate variable boasts the largest coefficient among all variables and reflects a markedly strong negative causal relationship between output growth and inflation. The coefficient estimates of the other explanatory variables are in line with our initial hypothesis: countries with more open economies, larger positive fiscal balances, and countries with more independent central banks exhibiting lower inflation than their counterparts.

The third and fourth columns in table 5 portray the results when replacing the *de jure* classification with a *de facto* classification. There are negligible changes in the coefficients of the non-exchange rate variables. Under the *de facto* classification, the inflation performance of hard pegged regimes is estimated at 4.4 percentage points better than that of floats regardless of the fact that there are almost no classification misalignments amongst hard peg observations. The soft pegs variable endures the most substantial change across classification methods; its coefficient is found to be significant and almost three times higher than the one estimated under the *de jure* classification. Such a change can be clearly attributed to badly performing floats and hard floats classified as soft pegs by the *de jure* classification. Hard floats' coefficient loses almost half of its value relative to the *de jure* estimate but is now found to be insignificant, which can be attributed to some amount of poorly performing misclassified regimes leaving the hard float category.

Table 6 presents estimates of the inflation regression results across eight different sub samples. It is noteworthy that the exchange rate regime variables never switch coefficient signs across the two classification methods with the exception of hard floats in the capital and current account restrictions samples. But in this sub-sample neither estimate differs significantly from zero. Overall, the *de facto* and *de jure* estimations are quite comparable in terms of coefficient magnitudes, but the *de facto* variables tend to have lower standard errors (higher t-statistics). Both hard pegs and soft pegs are estimated with signs which are in reverse to the initial hypothesis only in the upper income industrialized countries. A possible explanation is that upper income countries enjoy the benefits of a strong institutional framework to begin with, and a peg will not contribute in any way to their inflation performance. Amongst the other sub-samples, the inflation premium of hard pegs ranges in between 1.3 and 12.9 percentage points. In the upper-middle income and lower income categories pegged exchange rates, especially hard pegs exhibit superior inflation performance relative to both floats and hard floats. The inflation performance of *de jure* pegged regimes is weak amongst low inflation observations but significant for *de facto* pegs. The inflation performance of hard pegs is solid and significant amongst observations featuring capital and current account restrictions but surprisingly verges on the margins of significance amongst observations of very open economies. To sum up, hard pegs exhibit very strong inflation performance which is robust across diverse samples and two classification methods.

There are certain concerns about the regression estimates which one needs to bear in mind when analyzing the results. A Durbin-Watson test statistic of 0.8 and a White test conducted on our sample data indicated autocorrected errors and heteroskedasticity problems. These shortcomings were addressed by employing a Newey-West correction of the regression equation standard errors. The possibility of a specification error was flagged by a Ramsey reset test for omitted variable bias. The introduction of lagged money growth terms is an attempt to rectify this problem. The additional variables introduced notable changes to the coefficients and standard errors of some of the other variables and slightly raised the adjusted R-squared, which is indicative of their explanatory power. Due to unavailable data, we are unable to include certain variables pertaining to country specific institutional frameworks such as proxies for a democratic political system, pervasiveness of corruption, and legal system efficiency, amongst others. Nevertheless, given confidence in the theoretical soundness and the functional form of the proposed specification, this study is willing to trade meeting the first classical assumption for simplicity of interpretation by not expanding the list of explanatory variables further.

Exchange Rate Regime Unconditional on Money Growth

Guided by Ghosh, Gulde and Wolf, one needs to take account of the possibility of money growth being endogenous to the exchange rate regime. Because money growth is one of the explanatory variables in the regression specification, any indirect effects of the exchange rate regime set forth by money growth will not be accounted for by the coefficients of the exchange

regime variables. Assume that money growth is dependent on the exchange rate dummies and inflation depends on money growth:

$$MG = \alpha_0 + \alpha_1 Hardpeg + \alpha_2 Softpeg + \alpha_3 Hardfloat + e$$

$$\Pi = \beta_0 + \beta_1 Hardpeg + \beta_2 Softpeg + \beta_3 Hardfloat + \beta_4 MG + \beta_5 GDPG + \beta_6 Turn + \beta_7 Open + \beta_8 GovBal + \beta_9 TTG + \beta_{10} Year$$

The *confidence* effect of instituting a hard pegged exchange rate regime, which is the direct effect of the regime on inflation of holding money growth constant, is given by the β_1 coefficient. The *discipline* effect, which is the indirect effect of the exchange rate institution on inflation through a money growth channel, is supplied by $\beta_4 \alpha_1$. Since ***Hardpeg*** is a dichotomous variable an estimate of α_1 can be obtained from the difference in the average growth rates of the money supply under hard pegged and floating regimes (likewise for the other regimes) . Thus the full effect of the hard pegged exchange rate regime on inflation is given by combining the *confidence* and *discipline* effects (likewise for the other regimes). If this method is applied to results from inflation regression and the descriptive statistics (Tables 3 and 5) we obtain:

Regime	Confidence effect	Discipline effect	Full effect
Hardpeg	-0.035	-0.011	-0.046
Softpeg	-0.008	-0.006	-0.014
Hardfloat	0.028	0.017	0.045

Therefore correcting for the endogeneity of money growth to the exchange rate regime and considering the indirect *discipline* effect, the variables for pegged regimes become larger negatives, with hard pegs offering a 4.6 percentage points lower inflation relative to floats, whereas the variable for hard floats becomes a larger positive climbing to 4.5 percentage points higher inflation relative to floats. This result shows that the inflation performance of pegged regimes is significantly stronger than it appears and more than half of the full inflation premium can be attributed to the *discipline* effect of restricted monetary policy set forth by the exchange rate regime adoption.

Endogeneity of Regime Choice

The decision to adopt a specific exchange rate regime can depend on a variety of factors such as inflation preferences, optimal response to shocks, and economic integration with other countries. This raises the question of causality: countries with a low proclivity to inflation may be more likely to adopt hard pegged regimes. We employ a Granger causality test on hard pegs and inflation and find that we cannot reject the null hypothesis that hard pegs do not Granger-cause inflation but can reject the opposite null hypothesis; thus we have little evidence of reverse causality. The table below presents the results of the Granger causality test using five lagged terms. The result is robust to changing the lagged terms and while the probabilities change slightly, we can never reject the first hypothesis or fail to reject the second one.

Null Hypothesis	F-Statistic	Probability
Hard Pegs does not Granger Cause Inflation	8.323	0.001
Inflation does not Granger Cause Hard Pegs	0.106	0.990

In order to empirically address endogeneity concerns, we employ a simultaneous equation model with a dichotomous regime classification. Hard pegs are the only explanatory regime variable, and the others are assumed to be part of the constant term because it is difficult to find plausible instruments that can correctly distinguish between different exchange rate regimes. Such a specification can be useful for conducting a two stage simultaneous equation framework that estimates the residual effect of a hard pegged exchange rate regime on inflation filtering out the endogeneity of regime choice. The results of the proposed two-stage estimation, however, will not be comparable to the baseline inflation OLS results, where the rest of the exchange rate regimes were not grouped together. Thus we estimate an OLS for this dichotomous classification in order to provide a suitable benchmark. We propose a first stage probit binary estimation where a hard peg depends on the inflation rate and a vector of other characteristics. The instruments include the exogenous variables from the baseline specification plus population size. Exchange rate theory suggests that countries with small populations are more likely to adopt pegged exchange rates, thus rendering population size a good predictor of regime choice changes since there is little reason to believe that country size influences inflation.

The results of the first stage probit are presented in the left panel of Table 7, where population exhibits the expected strong negative effect on hard pegged exchange regime adoption. The results of the two stage simultaneous equation procedure do not differ substantially from the dichotomous classification OLS results (Refer to the right panel of Table 7). The two-stage process estimates hard pegs with a greater standard error (lower t-statistic) and a coefficient lower by one percentage point compared with the OLS estimate. Nonetheless, the coefficient has the anticipated sign and is strongly significant. None of the other variables registers noteworthy changes in their coefficients and standard errors (t-statistics). Thus, stripping away the endogeneity of regime choice does not affect hard pegged exchange rate regimes' competitiveness in inflation performance in relation to the other regimes. These findings suggest that the superior inflation performance of hard pegs compared to the other regimes can be attributed to the specific operation, confidence and discipline effects of the hard pegs, rather than to the county's lower propensity to inflation which leads to adopting a stringent exchange peg.

VII. Growth Regression

The exemplary inflation performance of hard pegged regimes shown in the previous section, along with monetary discipline, policy credibility effects and the creation of a trustworthy institutional framework associated with them, suggests that hard pegs may also engender remarkable growth performance. Growth, however, much more so than inflation, is bound to depend on

factors other than the exchange rate regimes as a plethora of determinants have been proposed in the growth literature (Barro 2002). The second set of regressions in this study attempt to find whether the rigidity associated with hard peg institutions lead to superior inflation performance at the cost of economic growth. We employ a regression specification with GDP per capita growth, Δy^{pc} as the dependent variable.

$$\Delta y^{pc} = \beta_0 + \underset{(+)}{\beta_1 Hardpeg} + \underset{(-)}{\beta_2 Softpeg} + \underset{(+)}{\beta_3 Hardfloat} + \underset{(+)}{\beta_4 Educ} + \underset{(-)}{\beta_5 \Pi} + \underset{(+)}{\beta_6 I} +$$
$$\underset{(-)}{\beta_7 Tax} + \underset{(-)}{\beta_8 GovBal} + \underset{(+)}{\beta_9 TTG} + \underset{(-)}{\beta_{10} Open} + \underset{(+)}{\beta_{11} Popg} + \underset{(+)}{\beta_{12} Poplog} + \underset{(-)}{\beta_{13} Gap} + \beta_{14} Year$$

Hardpeg: is a dummy variable representing a currency board or dollarization; ***Softpeg:*** is a dummy variable representing adjustable pegs such as single currency or a basket pegs; ***Hardfloat:*** the final dummy variable, denotes floating exchange rate regimes featuring rule-based or discretionary interventions; ***Educ:*** represents the average educational attainment of males over 25 years of age; ***Π:*** stands for the level of inflation; ***I:*** represents the investment to GDP ratio for a given country in a given year; ***Tax:*** stands for the country's budget revenue as a percentage of GDP; ***GovBal:*** represents a three-year backward average of the annual governmental balance as a percent of GDP; ***TTG:*** accounts for a three-year backward average of the growth of inflationary terms-of-trade shocks indicating the growth rate of export prices to import prices; ***Open:*** represents the ratio of exports plus imports to GDP as measure of the yearly trade openness of the particular country; ***Pop:*** represents current year's population growth. ***Poplog:*** stands for the log of the level of population in the given country. ***Gap:*** the log of the ratio of the country's initial per capita GDP to that of the United States, both based on international prices in 1970; ***Year*** denotes the difference between the sample end date and the year of the observation and accounts for global inflation shocks and other identified yearly volatilities.

Since no dummy explanatory variable is specified for floats, which are selected as the baseline exchange rate regime, the coefficients on the other exchange rate regime variables should be interpreted as the growth differential relative to that for a floating exchange rate. Mainly due to credibility effects and the promise of a credible and reliable institutional framework which is theorized to foster economic integration and growth, hard pegs are expected to be conducive to higher growth relative to floats. Given the negatives associated with exchange rate pegging, consistent with the impossible trinity, we expect soft pegs to fare worse than floats with regard to output growth. We expect strong growth performance from hard floating regimes, since they can employ discretionary policies to stabilize or stimulate the economy and generally boast lower exchange rate volatility than floats. Human capital accumulation is a necessary neoclassical ingredient for growth, and educational attainment is expected to be highly conducive to growth. Further, we expect countries with low inflation, low tax burden, large budget surpluses and high investment rates to be conducive to high economic growth. A rise in the terms of trade shocks, or the

growth of export prices to import prices, can be associated with increases in productivity and factor utilization which have a positive impact on output growth. Trade openness reflects classical comparative advantage and tends to accelerate international specialization, production efficiency and the transfer of technical knowledge. The openness measure employed in this study, however, tends to be highly sensitive and inversely related to population size since larger economies rely significantly more on domestic trade. Increased workforce growth reduces the capital and output per worker, and as the number of children per person rises, output growth is expected to fall. Increased population size is expected to be conducive to growth since the domestic market will be larger and the country will be less dependent on trade for generating output growth. The log is imposed to counter the effects of size for the two recent prominent outliers: India and China. Initial income accounts for convergence or "catch-up" effects. We expect conditional convergence of income with higher growth in response to lower initial GDP per capita provided that all other structural variables that are highly correlated with per capita GDP variables are held constant. We anticipate a negative sign for this variable since initial income accounts for the hypothesis that the growth rate of an economy is positively related to the distance between the economy's level of income and its long term steady state income.

Growth Regression Results

The first two columns of Table 8 present the results of the growth regression results using a *de jure* classification. Hard pegs are estimated to have 0.1 percentage point growth premium relative to floats, but the variable has an insignificant coefficient. Since hard pegged regimes showed strong growth performance in the descriptive statistics, one may question the insignificance of this coefficient. Compared with the inflation regression, the growth regression was run with a smaller sample due mainly to missing educational attainment observations. Although the sample size diminished by only 164 observations, the number of hard pegged regime observations have been reduced by more than half to 46 observations compared to the inflation regression's 119. This result, however, is consistent with the theoretical literature which suggests that the exchange rate regimes, in general, do not exhibit a strong relationship with per capita output growth. Calvo and Mishkin (2003) claim that the choice of exchange rate regime is likely to be of second order importance to the development of good fiscal, financial, and monetary institutions in producing macroeconomic success in developing market economies.

Ghosh, Gulde and Wolf (2002) present an additional reason behind the poor performance. Since trade openness, inflation and the investment rate are present as variables in the specification, the indirect effects of the hard pegged exchange rate regime on growth operating through the channel of these variables will not be fully accounted for by its coefficient. Following the computation technique presented in the inflation regression, we find that combining these indirect effects results in hard pegs gaining a 5 percent growth premium over floats. The bulk of this change comes from the difference in openness

between hard pegs and floats since the investment and inflation rate differentials are small and cancel each other out (Refer to table 3). The measure of openness, as noted above, used in this study heavily over-represents small, reliant on trade, countries. Since the entire set of hard peg observations is essentially composed of small open economies, the validity of this result is highly questionable.

The coefficients for soft pegs and hard floats are negative and positive, respectively, as predicted, but only that for hard floats is found to be significant. As reinforced by the impossible trinity, soft pegs are not particularly conducive to growth; furthermore, the statistical significance is not particularly strong in the negative direction. The significant performance of hard floats can be attributed to the intermediate nature of the regime which allows fine tuning with response to shocks and a full arsenal of stabilization and stimulation tools. With exception of insignificant coefficients on the taxation and terms of trade variables, all other explanatory variables are estimated with the expected signs and are significant. The considerably strong negative impact of population growth can be attributed to the sample period where almost all high growth and income countries exhibited very low population growth. The rapidly declining population growth in the developed world, positive due mostly to rising immigration, generates a serious problem in the future when the retirement age population will be large compared to the working age population. As a result, the benefits offered under current social security and retirement funds may not be sustainable.

Estimating the robustness of the *de jure* classification findings we re-estimate the regression employing the hybrid *de facto* one. Minimal changes result from the elimination of misaligned exchange rate regimes. Except for the soft pegs variable, whose coefficient changes sign but remains insignificant, there are no noteworthy changes amongst the exchange rate regime variables. The budget balance variable's coefficient registers a modest gain of about 2.5 percentage points, and the investment rate variable's coefficient falls by about 2.3 percentage point while trade openness variable losses its significance.

Table 9 presents an attempt to estimate whether the growth regression results are robust across a number different sub-samples. It is noteworthy that the exchange rate regime coefficients are not only prone to switching coefficient signs across sub-samples but also with respect to classification method. Across classification methods, both hard floats and soft pegs variables benefit form the removal of misaligning regimes in terms of both coefficient magnitude and t-statistic significance. Similar to the results presented in the inflation section, hard pegs are found to be a significant negative contributor to growth in the low inflation and high income sub-samples. The growth performance of hard pegs is surprisingly weak in the low and low-middle income segment, but quite strong in the upper-middle income sample (*de facto* classification). These results can be attributed to the fact that hard pegged regimes require the suitable base of a functioning market economy and solid financial framework in order for the regime to be successful. The growth performance of countries under capital and current account restrictions appears to benefit from the institution of a hard peg. To sum up, exchange rate regimes fail to exhibit any particular

strong causal link with output growth and the results are not spectacular. Thus, hard pegs fare no worse that floats or adjustable pegs, but hard floats appear to provide the strongest growth performance, especially under the *de facto* classification.

Due to dataset constraints, the growth regression lacks certain variables that have a noteworthy potential for explaining output growth. The validity of this claim is reinforced by a Ramsey reset test which signified possible omitted variable bias. Gallup, Sachs and Mellinger (1999) suggest that a large share of variation in output growth can be explained by inclusion of geographical variables such as tropical geography and the proportion of the population living within 100 kilometers of the sea coast. Further potential explanatory variables, suggested by Barro (2004), include proxies for a democratic political system, predominance of Islam, a colonial past, population fragmentation, the pervasiveness of corruption, legal system efficiency and healthcare quality. Although the inclusion of meaningful extra variables would most definitely raise the explanatory power of the regression, we believe that it is unlikely to alter the primary findings of this study since exchange rate regime choice acts independently of such variables. Possible problems of autocorrected errors and heteroskedasticity were addressed by employing a Newey-West correction of the regression equation standard errors.

Initially we hypothesized that hard pegs would offer growth performance comparable to that of floats. Hence the aforementioned results do not come as a great surprise since the stringent nature of a hard pegged regime severely restricts monetary policy. Nonetheless, hard pegs' outstanding inflation performance and satisfactory growth performance propels them as the more attractive corner exchange rate solution relative to floats.

VIII. Stability

In the last decade developed countries have witnessed historically unusual stability. The British have named the last ten years the "nice" decade of **n**on-**i**nflationary **c**onsistent **e**xpansion, while Americans speak of the "Great Modernization" (Martin and Rowthorn 2004). Stability is of considerable importance because it affects the behavior of securities markets and reduces uncertainties plaguing citizens, corporate planners and policymakers. Yet, there exists considerable disagreement among theorists on the causes and effects of stability. Some economists believe that economies have made significant progress towards natural self-stabilization; others claim that it is improvements in handling of inflation pressures and monetary policy that have been primary contributors to economic stability (Martin and Rowthorn 2004). In contrast, pessimists like James Stock and Mark Watson, economics professors at Harvard and Princeton, play down developmental achievements and successful policy and claim that recent stability was due to sheer luck (Martin and Rowthorn 2004).

Due to the recent controversy related to the bipolar view of exchange rates and the impossible trinity, it is of particular interest to investigate whether these corner exchange rate regimes stand out as defenders of stability compared to intermediate solutions. The crisis episodes in Mexico (1994), Thailand, Indonesia, and Korea (1997), Russia and Brazil (1998), Ecuador

(1999), and Turkey (2000) have led to the perception that adjustable fixed exchange rate regimes are inherently fragile and crisis prone (Fischer 2001; Ghosh, Gulde and Wolf 2002). Following the collapse of Argentina's currency board, the stability of hard pegs has been questioned as well. Currency crises under pegged regimes are quite apparent since they often culminate in an exit from the peg. On the other hand, a currency crisis under a floating regime can yield a sharp depreciation from credit expansions and short turn stimulus to the economy (Ghosh, Gulde and Wolf 2002). Pegged exchange rate regimes are theorized to be more prone to banking crises since they are associated with unlimited foreign currency exposure and restrict the ability of the central bank to act as a lender of last resort. Excessive borrowing can, however, be counteracted by prudential measures, and the absence of lender of last resort functions implies low moral hazard risks (Ghosh, Gulde and Wolf 2002).

In this study we employ four measures of stability in order to determine which exchange rate regime is least crisis prone: volatility of inflation and growth, likelihood of banking and currency crises episodes, and the likelihood of severe recessions. We use the standard deviation to estimate the volatility of inflation and growth rates around their averages. Martin and Rowthorn (2004) claim that using other measures is likely to affect unimportant details and detract focus from the broad picture. For measures of currency and banking crises, we employ data established by Glick and Hutchison (1999). Banking crises are defined as a combination of measures of non-performing assets and institutional events such as: forced closures, mergers, governmental intervention in the operations of financial institutions, and runs on banks. Currency crises are defined as large changes in an index of currency pressure, defined as a weighted average of monthly real exchange rate changes and monthly reserve losses. Consistent with Eichengreen's argument that a typical financial crisis claims about 9 percent of GDP, we define recession episodes as observations with growth rates 1.5 standard deviations below the general sample mean or close to a negative 10 percent growth.

Table 10 and Figures 8 and 9 reveal the individual exchange rate regime inflation and growth volatilities under both classification methods. Using the *de jure* classification, pegged exchange rate regimes exhibit markedly lower inflation and money growth volatilities than hard floats and free floats. Hard pegs offer the best performance while free floats fare the worst. The *de facto* classification reveals a comparatively lower volatility for adjustable pegs and notably higher volatility associated with hard and pure floating regimes. Due to the irrevocable commitment of hard pegs and the lack of classification misalignments, their performance stays the same across classification methods. Under the *de jure* classification hard pegs and hard floats exhibit the lowest growth volatilities. The *de facto* classification reveals that hard floats and soft pegs appear to benefit from the removal of misaligned regimes, while free floats are associated with even higher growth volatility. Overall, hard pegs offer strong stability performance while free floats trail considerably behind the other regimes.

Table 11 and Figure 10 present the individual exchange rate regimes performance with respect to several instability measures under the *de jure* classification method. Amongst pegged regimes just 2% of observations reflect the beginning of

banking crises compared to hard floats and pure floats which average 4% and 7%, respectively. Considering all banking crisis observations (not just beginnings), hard pegs offer the least ratio of crises to non-crises episodes while floats offer the worst. Hard pegs stand out with particularly low currency crisis occurrences and total currency crisis episodes, which can be attributed to the monetary stability and abundant foreign currency reserves associated with the regime. Hard floats register about twice as many crisis episodes as soft pegs and free floats fare even worse. With respect to severe recession episodes of less than minus 10 percent growth, hard floats offer the best performance, followed closely by both hard and soft pegged regimes. Table 12 and Figure 11 present the crisis performance of exchange rate regimes under the *de facto* classification method. The results for hard pegged regimes do not change, while soft pegs and hard floats register consistently better results. Similar to the volatility results, removing misaligned regimes results in free floats appearing significantly more crisis prone with respect to all measures of instability.

We find that hard pegged exchange rate regimes offer a very strong and consistent stability performance. While falling behind hard floating exchange rate regimes with respect to severe recessions and growth volatility, soft and hard pegged regimes appear to be considerably less crisis prone compared to both floating regimes. This finding is in stark contrast with the widespread view that fixed exchange rate regimes are fragile and prone to collapse. On the other hand, the paltry performance of free floating exchange rate regimes is rather surprising. Eliminating misaligned regimes consistently results in poorer performance of free floats which signifies that the best performing *de jure* floats are in fact intermediate or fixed exchange rate regimes. The poor performance of free floats reveals that developing countries have a very good reason to fear floating. We conclude that the flexible pole of the bipolar view is hard to recommend, which leaves hard pegs as the only viable corner solution for developing countries.

IX. Conclusion

Exchange rate regimes are theoretically constrained by the impossible trinity of exchange rate stability, monetary policy autonomy, and freedom of capital movement. Increasing capital mobility has led many economists to theorize that exchange rate regimes will eventually abandon the crisis prone intermediate regimes and move towards the two poles of hard pegs and free floats. Hard pegs have recently regained popularity as exchange rate solutions for developing countries due to the recent adoptions of currency board arrangements by Argentina (1991), Estonia (1992), Lithuania (1994), Bosnia (1997) and Bulgaria (1997). While the validity of the bipolar view and the historical accuracy of the monetary policy trilemma has been undermined by the recent collapse of Argentina's currency board and the prevalent fear of floating, even skeptics agree that hard pegs have performed quite well for developing countries. In contrast, the benefit of allowing an exchange rate to float is theorized to grow as the country's output per capita level rises (Rogoff 2004). In this study we evaluate the performance of

hard pegged regimes with respect to inflation, growth and crisis proneness by employing both *de facto* and *de jure* exchange rate classifications. The inflation levels for countries under hard pegged exchange rates are estimated by regression analysis to be 3.5% lower than those under floating exchange rates. When we incorporate the indirect effect of regime institution on inflation through money growth channels, the inflation performance premium of hard pegged exchange rate regimes increases to 4.6% lower inflation relative to floating exchange rate regimes. When we account for possible endogeneity of regime choice with respect to inflation, the regression estimates significantly better inflation performance for hard pegged regimes compared to floating exchange rate regimes. Having found no evidence of reverse causality, we theorize that the inflation performance premium of hard pegged is due to the credibility and discipline effects associated with the regime rather than the particular country's intrinsic propensity for low inflation. This study also finds significant evidence that the growth performance of pegged exchange rate regime is on par with that of floating regimes and that the outstanding performance does not come at a growth cost. Furthermore, hard pegged regimes offer outstanding stability performance with respect to measures such as inflation and growth volatilities, proneness to severe recessions, proneness to banking and financial crises. In stark contrast, floating exchange rate regimes appear particularly crisis prone. Moreover, accounting for misaligned exchange rate regimes leads to even worse performance of floating regimes which indicates pervasive fear of floating. In short, we find that hard pegged exchange rate regimes provide excellent performance for developing countries, which appear justified in fearing floating.

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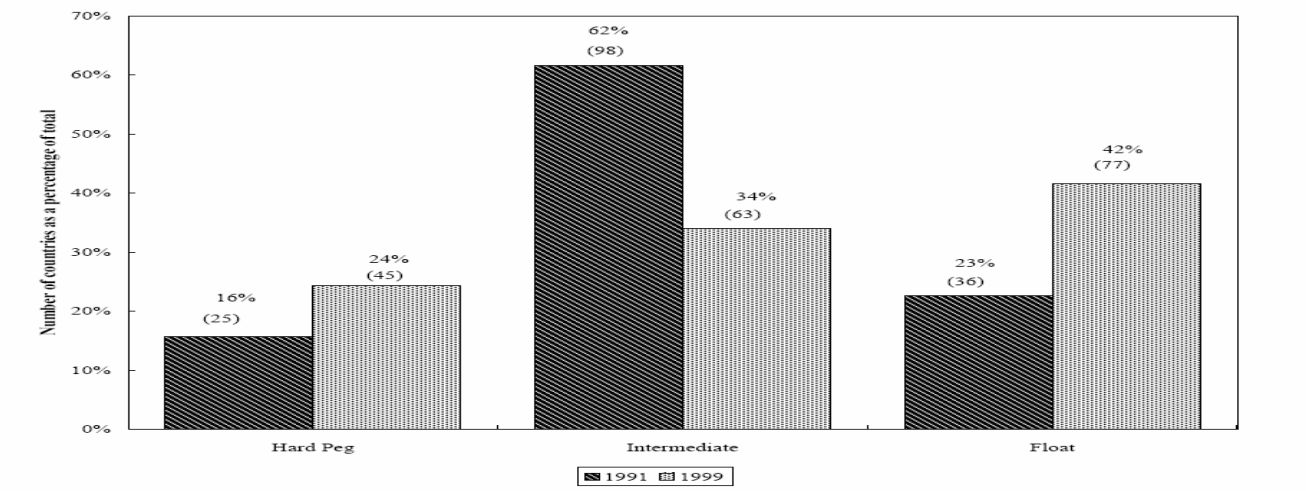
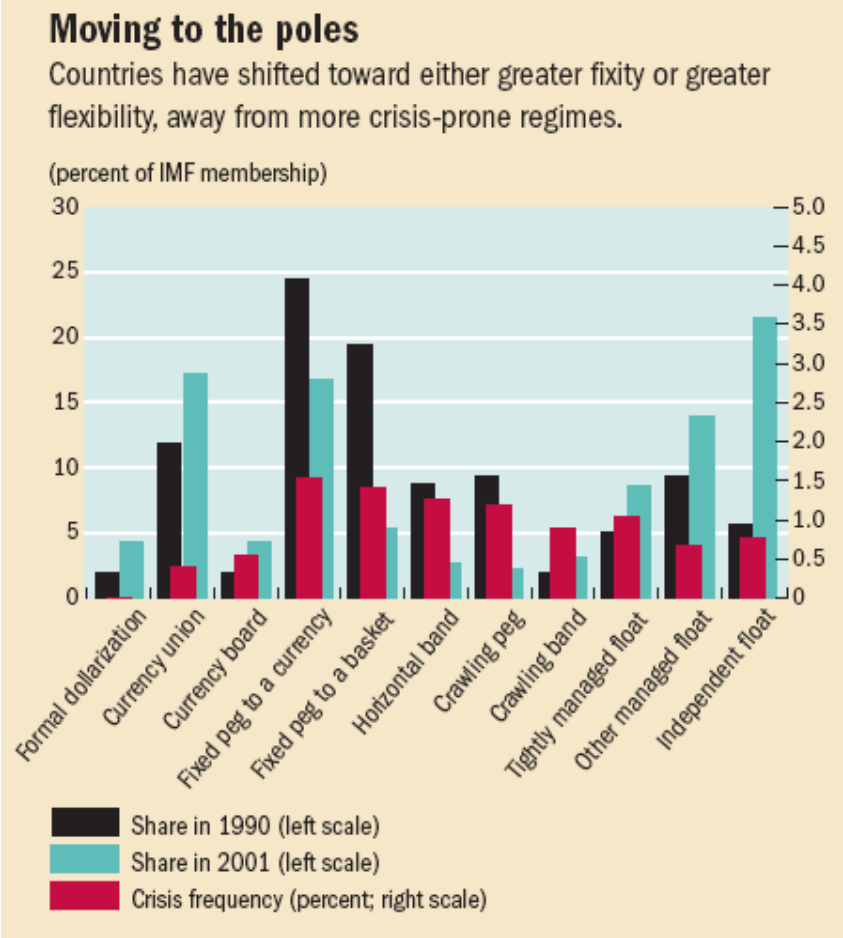
Figure 1: Exchange Rate Regimes in the 90's De Facto classification
(number of countries in parenthesis)



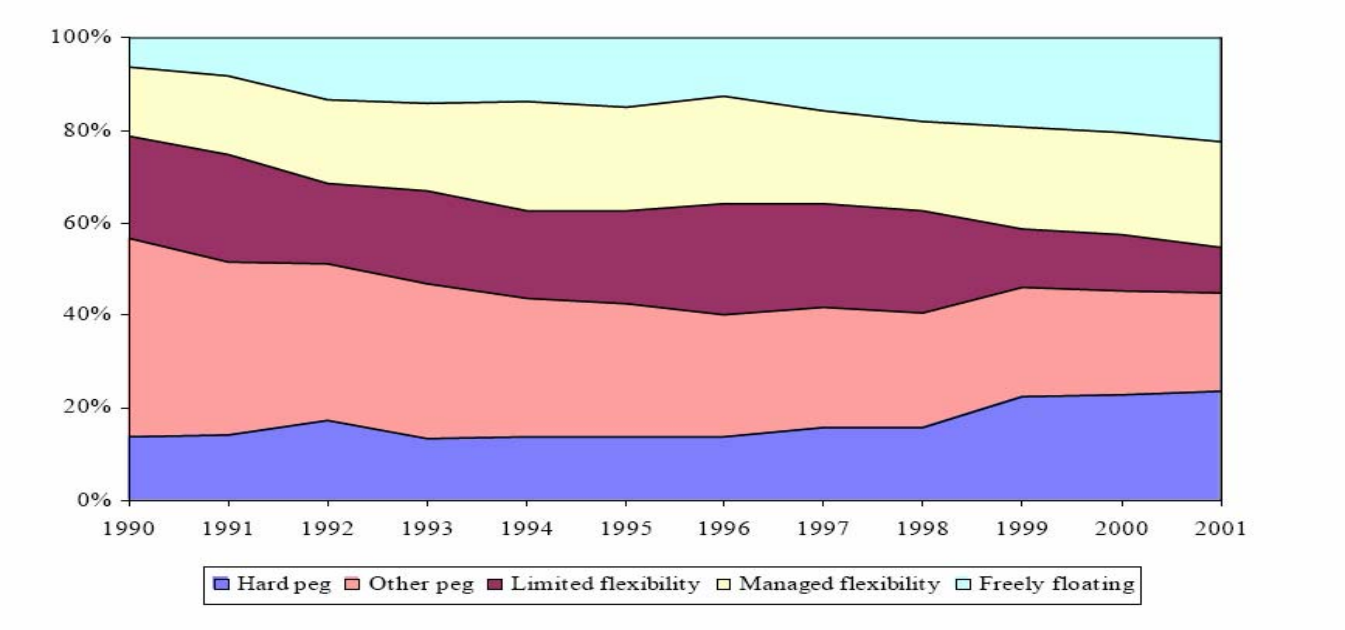
Source: IMF estimates, Fischer (2001)

Figure 2: Exchange Rate Regimes in the 90's De Facto Classification
Distribution and Crisis Proneness



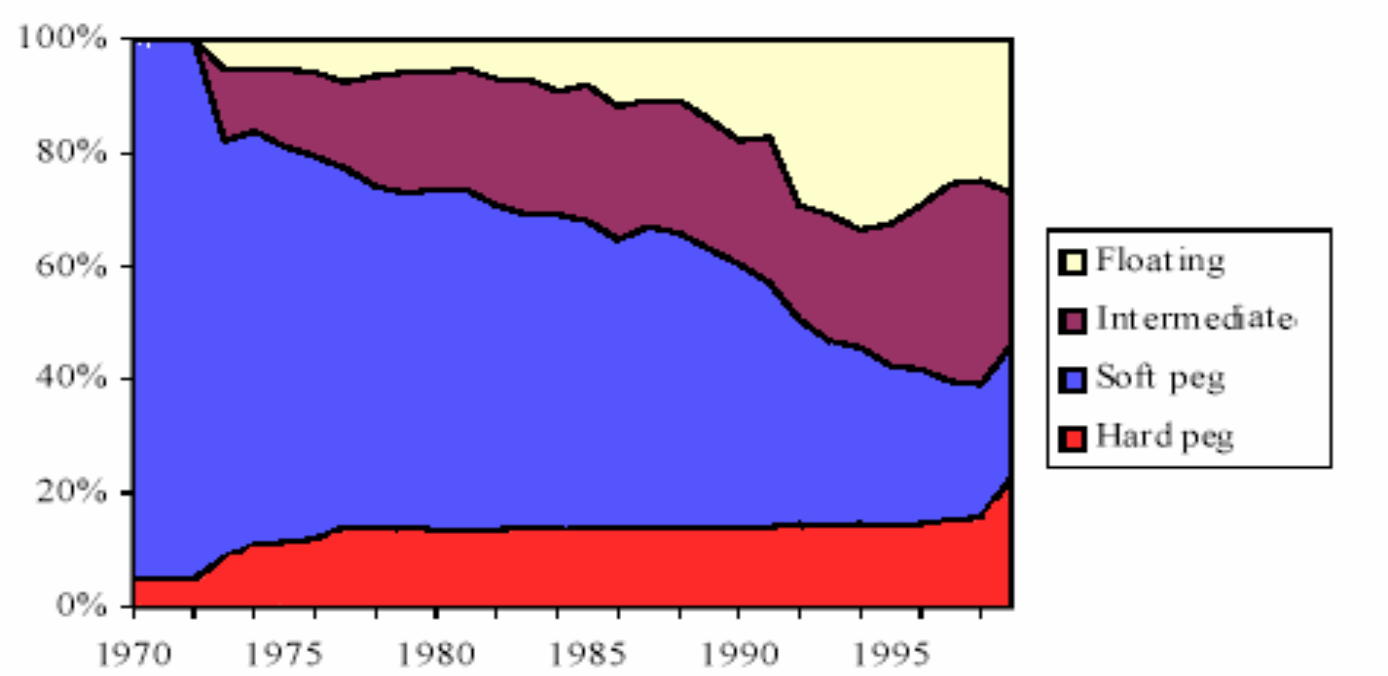
Source: Estimates by Bubula and Otrker-Robe (2004)

Figure 3: IMF De Facto Regime Distribution, 1990–2001
(in percent of annual observations)



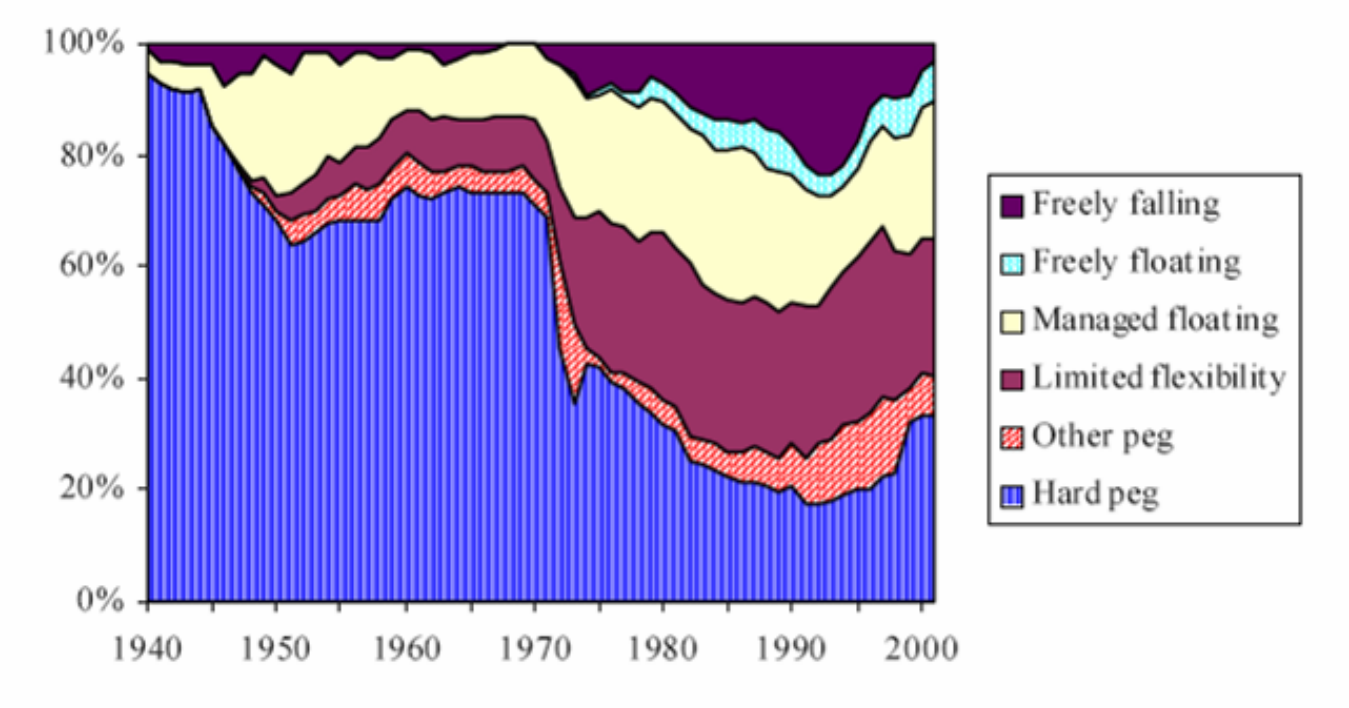
Source: Rogoff (2004)

Figure 4: De Jure Regime Distribution, 1970–1999
(in percent of annual observations)



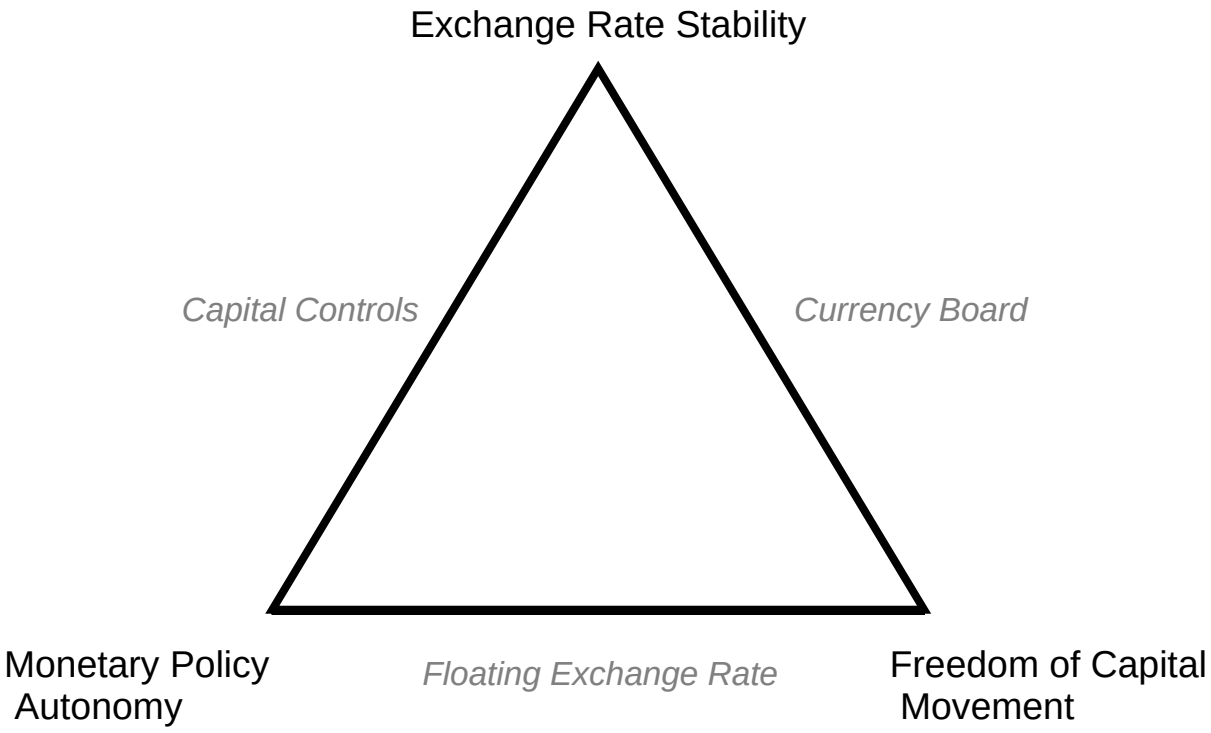
Source: Rogoff (2004); Ghosh, Gulde and Wolf (2002)

Figure 5: Natural Classification Regime Distribution, 1940–2001
(in percent of annual observations)



Source: Rogoff (2004)

Figure 6: The Impossible Trilemma



The vertices of the triangle represent the three goals that policymakers in open economies would like to achieve while the sides stand for policy regimes. Only one of the sides can be chosen and it is consistent with the goals that lie on its edges, and inconsistent with the goal lying opposite to it.

Table 1: Exchange Rate Regimes Classification in Terms of Peg Rigidity

Classification	Sub classification	Regime
Pegged (Exchange rate's value does not vary in terms of an anchor currency or commodity.)	**Hard Pegs** (Exchange rate is pegged in a manner that changes in parity or exit from the regime is costly and difficult.)	**Dollarized Regimes** (Foreign currency is used as legal tender; no domestic monetary policy.)
		Currency Boards (Exchange rate is pegged to an anchor currency; limited monetary policy; required minimum of foreign reserves; irrevocable official commitment to uphold the regime.)
		Monetary Union (A group of countries uses a common currency issued by a common regional bank; monetary policy is determined by the regional bank.)
	Adjustable Pegs/ Soft Pegs (Currency is linked to a single or currency or a basket of currencies. Cost of adjustment or exit is sufficiently lower than that of hard pegs.)	**Single Currency Pegs** (Exchange rate is pegged to a fixed par-value to a single foreign currency but is adjustable; higher reserves increase credibility.)
		Basket Pegs (Like single currency peg, except that the currency is pegged to a basket of two or more currencies.)
Hard Floats (Exchange rate floats but due to central bank interventions in the foreign exchange markets it stays within predetermined bounds.)	**Floats With rule-based intervention** (Exchange rate is not begged at a specific rate but the central bank intervenes in a predetermined level to affect exchange rate movements.)	**Cooperative Regimes** (Cooperating central banks keep the bilateral exchange rates within a preset range of each other; adjustment is done via limited monetary policy or interventions.)
		Crawling Pegs (Exchange rate is determined in a rule-based manner, adjusting at a predetermined rate or as a function of inflation differentials.)
		Target Zones and Bands (Exchange rate is allowed to fluctuate within a preset range and excess pressure at the margin is countered with interventions.)
	Floats With discretionary intervention (Exchange rate is floating but heavy official interventions are administered.)	**Managed Floats** (Exchange rates are allowed to float but authorities reserve the right to discretionary interventions; often accompanied by a separate nominal anchor such as inflation targeting.)
Floats (Exchange rate is allowed to float freely.)	**Free Floats** (Exchange rate is allowed to float freely with little or no central bank intervention.)	**Floats** (Exchange rate is determined in the foreign exchange market with little official intervention; unfettered monetary policy; no foreign reserve requirements; often accompanied by inflation targeting.)

Source: Ghosh, Gulde and Wolf (2002)

Table 2: Principal Characteristics of Currency Boards in Operation

Country	Years in operation	Peg currency	Special features	Minimum Cover	Latest Actual Cover
Antigua and Barbuda	32	U.S. dollar	Member of East Caribbean Central Bank (ECCB)	60% of M0[6]	81.7% of M0, 12% of M2
Argentina	6	U.S. dollar	One-third of coverage can be in U.S. dollar-denominated government bonds	M0	105% of M0, 21.3% of M2
Bosnia and Herzegovina	1	deutsche mark		100% of the monetary liabilities of the Central bank	100% of the monetary liabilities of the Central bank
Brunei Darussalam	30	Singapore dollar		100% of the monetary liabilities of the Central bank	80% of Central Bank's demand liabilities
Bulgaria	1	deutsche mark	Excess coverage in banking department to deal with banking sector weaknesses	M0 plus some desired excess coverage	134% of M0, 40.5% of M2
Djibouti	48	U.S. dollar	Switched peg currency from French franc to U.S. dollar	100% of currency in circulation	125% of M0, 22.5% of M2
Dominica	32	U.S. dollar	Member of ECCB	60% of M0	84% of M0, 14.7% of M2
Estonia	6	deutsche mark	Excess coverage for domestic monetary interventions	M0	118% of M0, 43.5% of M2
Grenada	32	U.S. dollar	Member of ECCB	60% of M0	85% of M0, 15.6% of M2
Hong Kong	14	U.S. dollar		105% of notes and coins	408% of M0, 22.4% of M2
Lithuania	4	U.S. dollar	Central bank has the right to appreciate the exchange rate	M0 plus liquid central bank liabilities	91.8% of M0, 41.1 % of M2
St. Kitts and Nevis	32	U.S. dollar	Member of ECCB	60% of M0	99% of M0, 19.8 % of M2
St. Lucia	32	U.S. dollar	Member of ECCB	60% of M0	95% of M0, 16% of M2
St. Vincent and the Grenadines	32	U.S. dollar	Member of ECCB	60% of M0	88% of M0, 15.3% of M2

Source: Ghosh, Gulde and Wolf (1997); MAE, Balino, Enoch, and Stella (1997)

[6] M0 equals reserve money- the sum of currency in circulation plus non-government demand liabilities.

Table 3 : Descriptive Statistics across Exchange Rate Regimes

	Full Sample		Hard pegs		Soft Pegs		Hard Floats		Floats	
	mean	median	mean	median	mean	median	mean	median	mean	median
Money Growth	0.150	0.130	0.104	0.112	0.125	0.110	0.227	0.190	0.152	0.122
Inflation	0.105	0.072	0.046	0.034	0.086	0.064	0.168	0.111	0.111	0.074
Output Growth	0.018	0.021	0.030	0.031	0.014	0.018	0.026	0.028	0.017	0.020
Investment	0.223	0.216	0.250	0.250	0.222	0.215	0.233	0.228	0.207	0.203
Budget Balance	-0.040	-0.032	-0.035	-0.022	-0.045	-0.037	-0.034	-0.031	-0.034	-0.026
Budget Revenue	0.300	0.287	0.311	0.299	0.323	0.308	0.250	0.237	0.288	0.292
Trade Openness	0.733	0.620	1.259	1.191	0.752	0.653	0.647	0.526	0.594	0.530
Population Growth	0.016	0.015	0.013	0.013	0.017	0.017	0.016	0.017	0.015	0.013
Turnover Rate	0.227	0.200	0.167	0.200	0.232	0.200	0.268	0.200	0.194	0.200
Observations	1711		115		902		345		349	

Figure 7: Inflation and Growth Performance across Exchange Rate Regimes

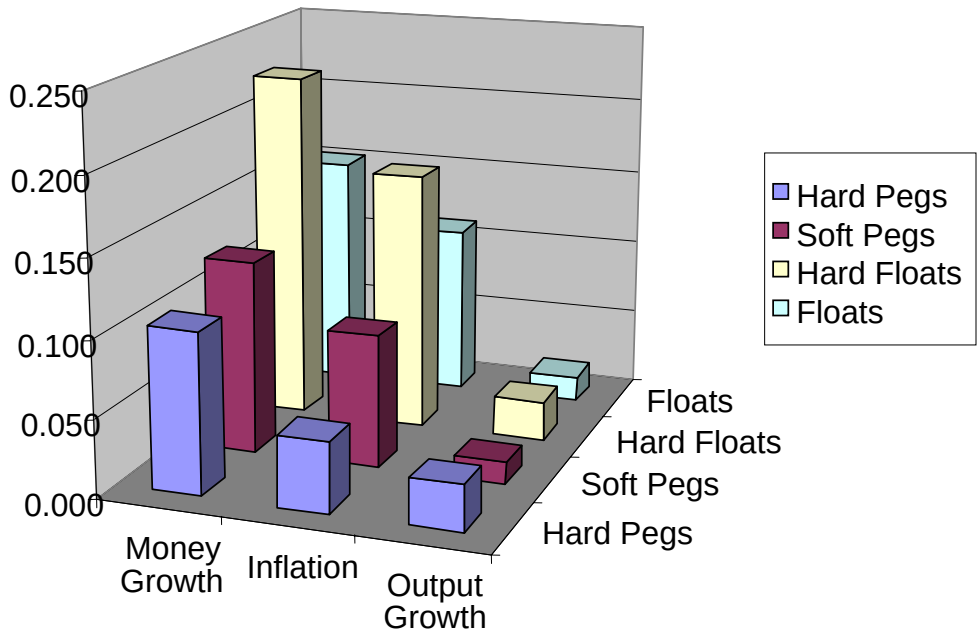


Table 4 :Descriptive Statistics across Income and Exchange Rate Regimes

	All Regimes	Hard Pegs	Soft Pegs	Hard Floats	Floats
All Observations					
Money Growth	0.156	0.104	0.132	0.235	0.162
Inflation	0.112	0.047	0.094	0.176	0.121
Output Growth	0.017	0.030	0.014	0.026	0.014
Upper and Upper-Middle Income Observations					
Money Growth	0.137	0.116	0.116	0.251	0.104
Inflation	0.092	0.045	0.074	0.200	0.068
Output Growth	0.021	0.033	0.020	0.029	0.019
Lower and Lower Middle Income Observations					
Money Growth	0.176	0.084	0.149	0.222	0.225
Inflation	0.133	0.051	0.114	0.158	0.180
Output Growth	0.013	0.025	0.008	0.028	0.008
High Inflation Observations (>10%)					
Money Growth	0.228	0.168	0.182	0.290	0.256
Inflation	0.209	0.157	0.177	0.251	0.232
Output Growth	0.009	0.050	0.004	0.018	0.004
Low Inflation Observations (<10%)					
Money Growth	0.105	0.096	0.102	0.145	0.092
Inflation	0.043	0.033	0.043	0.054	0.039
Output Growth	0.023	0.028	0.020	0.037	0.021

Table 5 : Inflation Regression Results

	De jure		De facto	
	Coefficient	t-stat	Coefficient	t-stat
Constant	1.674	3.301	2.106	3.640
Hard pegs	-0.035	-4.112	-0.044	-5.834
Soft pegs	-0.008	-1.538	-0.023	-4.872
Hard Floats	0.028	3.910	0.015	1.649
Money growth	0.221	10.460	0.233	8.484
Money growth (-1)	0.005	2.630	0.004	1.859
Money growth (-2)	0.001	0.886	0.001	0.709
Real GDP growth	-0.412	-6.539	-0.398	-5.946
Openness	-0.016	-4.210	-0.011	-2.637
Turnover rate	0.041	4.108	0.052	4.562
Terms of trade growth	-0.070	-2.687	-0.080	-2.648
Budget balance	-0.164	-3.887	-0.154	-3.363
Year	0.001	3.181	0.001	3.538
Adj R-squared	0.660		0.652	
Number observations	1401		1101	

Table 6 : Inflation Regression Results Across Samples

	De jure		*De facto*		*De jure*		*De facto*	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
	High income observations				**Low inflation observations ()**			
Constant	5.426	6.970	5.360	6.162	1.831	4.434	2.139	4.811
Hard pegs	0.070	4.804	0.050	3.787	-0.013	-1.306	-0.017	-1.927
Soft pegs	0.008	1.725	0.001	0.099	-0.001	-0.186	-0.007	-2.291
Hard Floats	0.050	2.846	0.014	1.208	0.008	1.867	0.000	0.009
Number observations, R2	509	0.764	336	0.794	885	0.285	710	0.267
	Upper-middle income observations				**Open economy observations**			
Constant	4.111	2.177	4.487	2.514	5.001	5.312	4.231	4.518
Hard pegs	-0.129	-4.419	-0.110	-6.816	-0.042	-1.777	-0.030	-1.712
Soft pegs	-0.046	-1.594	-0.044	-3.419	-0.046	-3.104	-0.036	-4.621
Hard floats	0.023	0.720	0.058	2.189	0.008	0.437	0.007	0.507
Number observations, R2	269	0.851	238	0.860	416	0.678	356	0.680
	Low and low-middle income observations				**Current account restrictions observations**			
Constant	-1.068	-1.040	0.675	0.631	1.003	0.635	0.843	0.588
Hard pegs	-0.073	-5.993	-0.083	-8.201	-0.103	-5.621	-0.100	-8.082
Soft pegs	-0.012	-1.129	-0.032	-3.900	-0.034	-2.249	-0.039	-4.594
Hard floats	-0.014	-1.418	-0.011	-0.932	-0.017	-1.064	0.001	0.056
Number observations, R2	623	0.610	497	0.616	586	0.663	469	0.681
	High inflation observations (>10%)				**Capital account restriction observations**			
Constant	-2.131	-2.776	-1.720	-2.563	1.256	1.148	1.527	1.466
Hard pegs	-0.017	-0.829	-0.020	-0.927	-0.081	-5.634	-0.078	-6.347
Soft pegs	-0.006	-0.524	-0.021	-2.530	-0.033	-3.232	-0.035	-5.291
Hard floats	0.008	0.630	0.025	1.379	-0.005	-0.422	0.008	0.547
Number observations, R2	516	0.690	391	0.702	939	0.674	336	0.794

Table 7 : Simultaneous Equation Model (Hard Pegs versus All Regimes)

First Stage Probit Estimation on Hard Pegs		
	Coefficient	**z-stat**
Constant	-10.080	-0.529
Inflation (-1)	-4.083	-3.014
inflation (-2)	1.341	1.0404
Money growth	0.075	0.1987
Money growth (-1)	0.026	1.6044
Money growth (-2)	0.038	2.1378
Output growth	1.552	0.7055
Trade openness	0.345	2.298
Turnover rate	-0.570	-1.632
Terms of trade	0.075	0.1393
Budget balance	-3.031	-2.613
Population	-0.004	-0.431
Year	-0.014	-2.837
R-Squared	0.191	
Observations	1399	

Second Stage Inflation Regression			OLS Estimates	
	Coefficient	**t-stat**	**Coefficient**	**t-stat**
Constant	1.18	2.472	1.674	3.301
Hard Pegs	-0.026	-3.11	-0.035	-4.112
Money growth	0.198	8.964	0.221	10.46
Money growth (-1)	0.006	2.448	0.005	2.063
Money growth (-2)	0.002	1.041	0.001	0.886
Output growth	-0.39	-5.995	-0.412	-6.539
Trade openness	-0.01	-2.204	-0.016	-4.21
Turnover rate	0.037	3.646	0.041	4.108
Terms of trade	-0.057	-2.279	-0.07	-2.687
Budget balance	-0.162	-3.966	-0.164	-3.887
Year	0.001	2.37	0.001	3.181
Adj. R-squared	0.656		0.66	
Observations	1399		1401	

Table 8 : Growth Regression Results

	De jure		De facto	
	Coefficient	t-stat	Coefficient	t-stat
Constant	0.308	0.961	0.828	2.573
Hard pegs	0.001	0.125	0.001	0.086
Soft pegs	-0.001	-0.237	0.002	0.845
Hard floats	0.007	2.289	0.008	2.414
Educational attainment	0.001	2.147	0.001	1.456
Inflation	-0.043	-3.727	-0.054	-4.459
Investment	0.100	4.896	0.077	3.498
Taxation	-0.017	-1.459	-0.014	-1.229
Budget balance	0.068	2.453	0.094	3.468
Terms of trade	0.017	1.169	0.009	0.565
Openness	0.008	2.682	0.006	1.801
Population growth	-0.802	-8.314	-0.773	-7.795
Population (log)	0.003	3.682	0.002	2.939
Initial income	-0.029	-5.464	-0.025	-4.994
Year	0.000	0.921	0.000	2.523
Adj R-squared	0.206		0.209	
Number observations	1237		1125	

Table 9 : Growth Regression Results across Samples

	De jure		*De facto*		*De jure*		*De facto*	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
	High income observations				**Low inflation observations**			
Constant	0.808	2.423	0.776	2.130	0.992	3.251	1.155	2.990
Hard pegs	-0.036	-2.649	-0.038	-2.541	-0.009	-1.367	-0.009	-1.448
Soft pegs	0.000	-0.073	0.004	1.245	-0.001	-0.395	-0.002	-0.746
Hard Floats	-0.001	-0.300	0.006	1.521	0.003	0.842	0.004	1.317
Number observations, R2	381	0.278	374	0.318	907	0.235	732	0.216
	Upper-middle income observations				**Open economy observations**			
Constant	0.566	0.666	-0.027	-0.031	1.464	2.065	1.521	1.927
Hard pegs	0.007	0.520	0.024	2.199	0.001	0.165	0.001	0.152
Soft pegs	-0.008	-0.772	0.007	0.820	0.004	0.666	0.004	0.835
Hard floats	0.001	0.076	0.011	1.288	0.008	1.213	0.013	2.017
Number observations, R2	274	0.214	243	0.241	421	0.271	361	0.286
	Low and low-middle income observations				**Current account restrictions observations**			
Constant	1.425	3.263	1.331	2.651	1.783	3.729	1.436	2.641
Hard pegs	0.000	-0.027	0.007	0.550	0.036	2.263	0.042	3.120
Soft pegs	-0.005	-1.044	-0.001	-0.289	0.002	0.321	0.007	1.442
Hard floats	-0.002	-0.521	0.000	0.060	0.007	1.288	0.012	2.130
Number observations, R2	643	0.256	508	0.197	598	0.278	478	0.248
	High inflation observations				**Capital account restriction observations**			
Constant	1.297	2.244	0.614	0.987	0.891	2.558	0.802	1.974
Hard pegs	0.048	2.523	0.054	2.752	0.028	1.645	0.034	2.254
Soft pegs	-0.006	-1.042	0.008	1.542	0.000	-0.024	0.003	0.940
Hard floats	0.004	0.768	0.009	1.709	0.006	1.367	0.009	2.455
Number observations, R2	518	0.172	393	0.148	953	0.229	756	0.199

Table 10: Measures of Volatility - Standard Deviation of Inflation and Growth (in percentage points)

		Hard Pegs	Soft pegs		Hard Floats		Floats	
		De jure/De facto	*De jure*	*De facto*	*De jure*	*De facto*	*De jure*	*De facto*
Inflation	Median	4.59%	7.21%	6.99%	13.73%	10.55%	9.75%	19.10%
	Std. Dev.	10.91%	11.83%	8.73%	17.85%	17.40%	21.49%	27.43%
	Observations	244	2615	1851	646	265	603	251
Growth	Median	3.17%	1.60%	1.56%	2.31%	2.42%	1.68%	0.52%
	Std. Dev.	5.92%	8.45%	7.53%	4.60%	3.66%	8.13%	10.32%
	Observations	244	2615	1851	646	265	603	251

Figure 8: Exchange Rate Regime Volatility De Facto Classification - Standard Deviation of Inflation, Money Growth and Output Growth (in percentage terms)

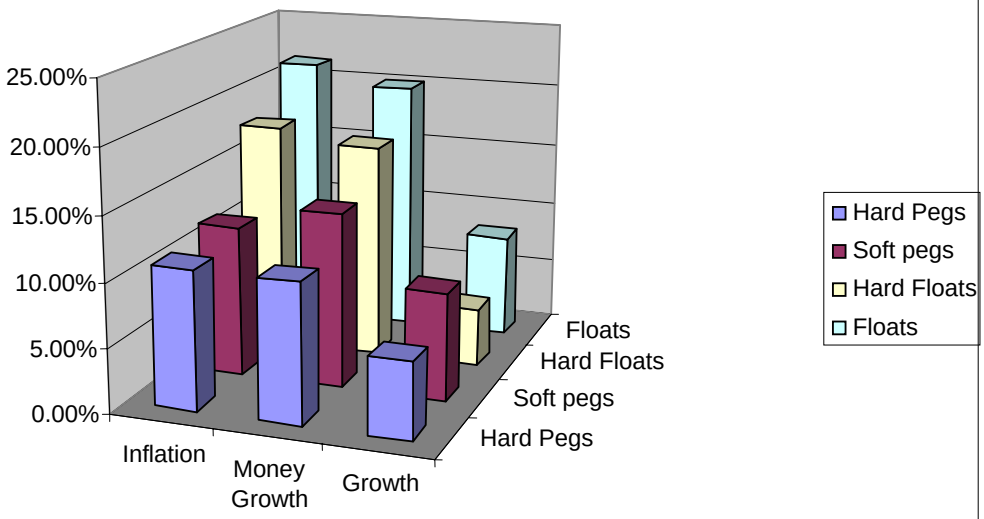


Figure 9: Exchange Rate Regime Volatility De Facto Classification - Standard Deviation of Inflation, Money Growth and Output Growth (in percentage terms)

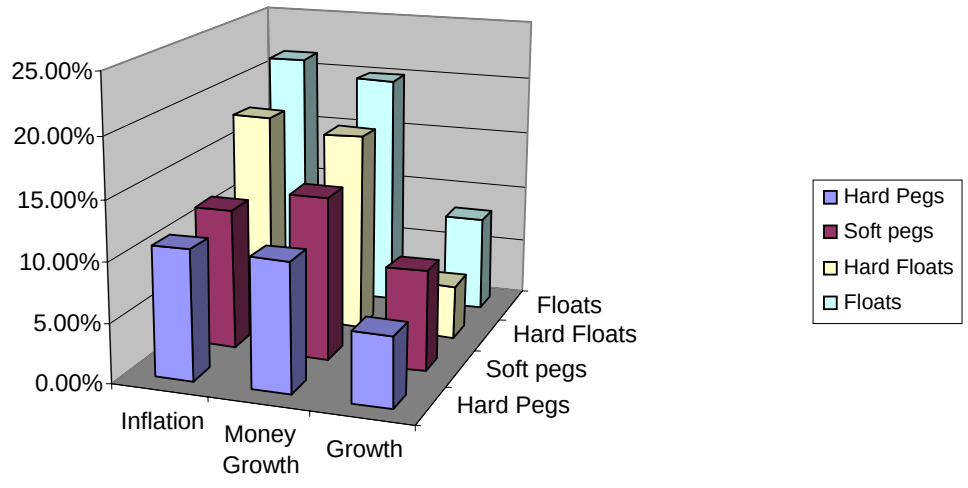
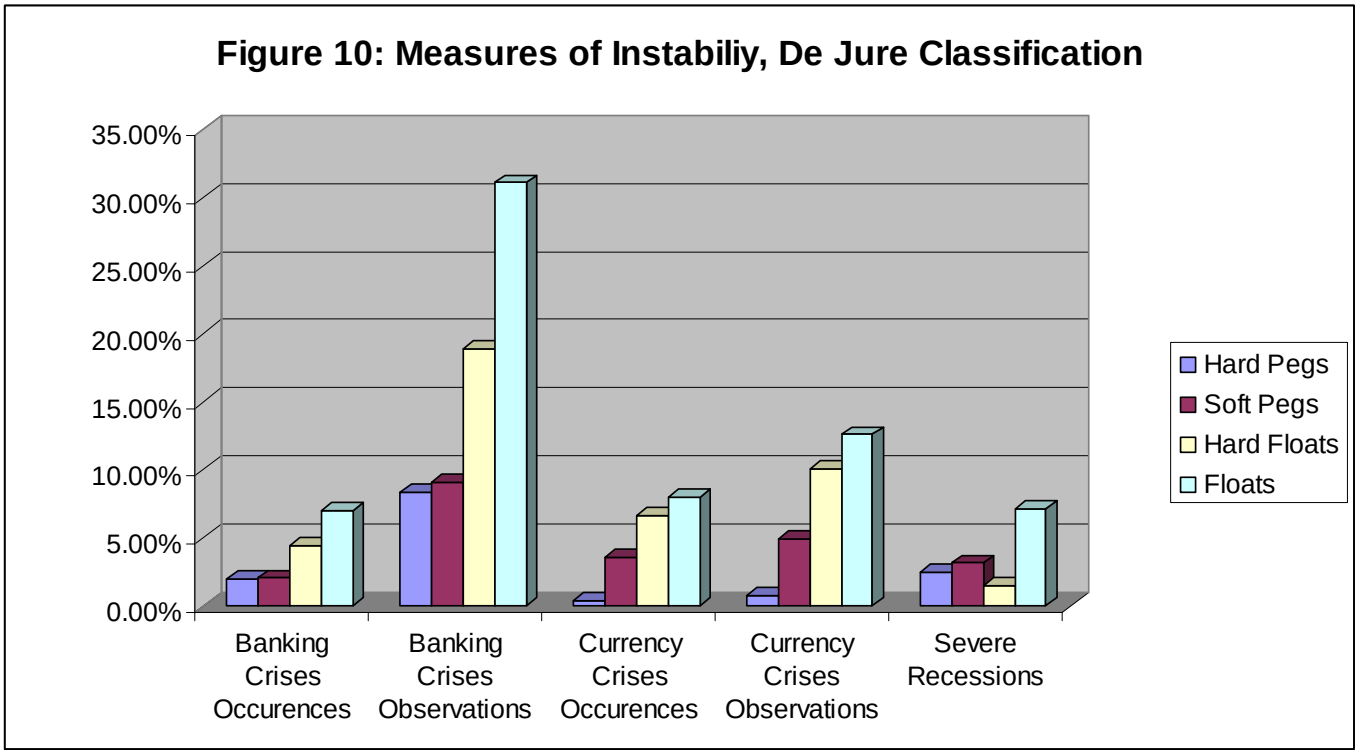


Table 11: Measures of Instability, De Jure Classification

	Banking Crises Occurrences[7]	Banking Crises Observations[8]	Currency Crises Occurrences	Currency Crises Observations	Severe Recessions[9]
All Regimes	3.22%	13.70%	4.54%	6.58%	3.91%
Hard Pegs	2.00%	8.40%	0.40%	0.80%	2.46%
Soft Pegs	2.07%	9.16%	3.65%	4.97%	3.17%
Hard Floats	4.42%	18.90%	6.71%	10.06%	1.55%
Floats	7.04%	31.10%	8.02%	12.60%	7.13%
Observations	4313	4313	4313	4313	4727

(Each entry represents the percent value of all observations of the specific exchange rate regime which are defined as crisis (or start of crisis) episodes.)



[7] Takes into account only the start year of a crisis
[8] Takes into account all years of a crisis episode
[9] Defined as observations registering an output per capita growth rate of -10%

Table 12: Measures of Instability, De Jure Classification

	Banking Crises Occurrences	Banking Crises Observations	Currency Crises Occurrences	Currency Crises Observations	Severe Recessions
All Regimes	3.22%	13.70%	4.54%	6.58%	3.91%
Hard Pegs	2.00%	8.40%	0.40%	0.80%	2.40%
Soft Pegs	1.78%	8.39%	1.18%	1.33%	2.91%
Hard Floats	2.59%	12.96%	5.19%	8.52%	1.11%
Floats	9.84%	43.70%	13.39%	21.26%	15.35%
Observations	4313	4313	4313	4313	4727

(Each entry represents the percent value of all observations of the specific exchange rate regime which are defined as crisis (or start of crisis) episodes.)

Figure 11: Measures of Instabiliy, De Facto Classification