

IMF Working Paper

© 1998 International Monetary Fund

This is a *Working Paper* and the author(s) would welcome any comments on the present text. Citations should refer to a *Working Paper of the International Monetary Fund*. The views expressed are those of the author(s) and do not necessarily represent those of the Fund.

WP/98/8

INTERNATIONAL MONETARY FUND

Policy Development and Review Department
Monetary and Exchange Affairs Department

Currency Boards: The Ultimate Fix?

Prepared by

Atish R. Ghosh, Anne-Marie Gulde, and Holger C. Wolf¹

Authorized for distribution by Hugh Bredenkamp and Charles Enoch

January 1998

Abstract

The growing integration of world capital markets has made it fashionable to argue that only extreme exchange rate regimes are sustainable. Short of adopting a common currency, currency board arrangements represent the most extreme form of exchange rate peg. This paper compares the macroeconomic performance of countries with currency boards to those with other forms of pegged exchange rate regime. Currency boards are indeed associated with better inflation performance, even allowing for potential endogeneity of the choice of regime. Perhaps more surprisingly, this better inflation performance is accompanied by higher output growth.

JEL Classification Numbers: JEL F33, F41, F43.

Keywords: Currency Boards, Fixed Exchange Rates, Inflation, Growth

Author's E-Mail Address: aghosh@imf.org; aguldewolf@imf.org; and hwolf@stern.nyu.edu

¹Policy Development and Review Department; Monetary and Exchange Affairs Department; New York University, Princeton University, and NBER, respectively. We would like to thank Kadima Kalonji for his assistance, as well as Helge Berger, Hugh Bredenkamp, Charles Enoch, Paul Masson, Steven Phillips, Christopher Ryan, Jeffrey Sachs and seminar participants at Georgetown University for helpful comments.

Contents	Page
Summary	3
I. Introduction	4
II. Data	8
III. Inflation Effects of Currency Boards	10
IV. Growth Effects of Currency Boards	17
V. Conclusions	18
Tables	
1. Principal Characteristics of Presently Operating Currency Boards	9
2. Macroeconomic Performance Across Exchange Rate Regimes	11
3. Inflation Regressions	13
Bibliography	20

SUMMARY

In recent years, currency board arrangements have gained increasing popularity. Yet, relatively little is known about their macroeconomic performance. This paper compares inflation and output growth in countries with currency boards to countries with other, less extreme forms of exchange rate peg.

Compared to other pegged exchange rates, average inflation under currency boards is about 4 percentage points lower. Some of this may be attributed to the greater monetary discipline under such arrangements. The bulk of the difference, however, is explained by the greater confidence engendered by adopting a currency board. This confidence effect raises money demand, and results in lower inflation for a *given* growth rate of the money supply. The findings are robust to potential endogeneity of the regime choice, whereby countries with a greater proclivity toward low inflation may be more likely to adopt a currency board.

On average, countries with currency boards actually grew faster than countries with either pegged exchange rates or floating exchange rates. While it is unlikely that this growth performance can be explained by the exchange rate regime alone, the opposite proposition—that currency boards lead to more sluggish growth—receives no support from the data.

“Even if we only have eight Kroons in circulation, we will have a D-Mark in our vaults to back them” (Siim Kallas, President of the Estonian Central Bank, upon launching the currency board).

I. INTRODUCTION

Currency boards are back in fashion. Fifty years ago, currency boards were a common monetary arrangement, most notably in the British dominions, where they served to provide both fiscal revenues and monetary stability.² Partly because such arrangements smacked of colonialism, however, many of these countries abandoned their currency boards once they attained independence, and greater confidence in their ability to conduct their own monetary policy. Indeed, with the exception of a handful of small, and very open economies, currency boards generally fell into disuse.

Yet, more recent years have seen a revival in the popularity of currency boards, with such arrangements being advocated not only for small open economies, but also for mid-sized and even large countries.³ Two arguments are typically cited in favor of adopting currency boards. First, they may help solve the time consistency problems stressed by Kydland and Prescott (1977) and Barro and Gordon (1983). Second, following the recent literature on currency crises, currency boards may deter self-fulfilling runs and other undesirable multiple equilibria (Davies and Vines (1995)).⁴ Growing theoretical interest in the properties of currency boards (Schwartz (1993), Eichengreen (1994), Williamson (1995), *inter alia*) has coincided with a more frequent use of such arrangements, including recent adoptions by Argentina (1991), Estonia (1992), Lithuania (1994), Bosnia (1997) and Bulgaria (1997).⁵

The case for currency boards is essentially an extension of the case for pegged exchange rate regimes. Pegging the exchange rate constrains the scope for excessive monetary expansion. The monetary discipline necessary for pegged rates is likely to engender confidence in the domestic currency and, in turn, to lower inflation for a *given* rate of monetary

²The first British currency board (CB) arrangement was Mauritius in 1849. For historical analysis and descriptions, see Collins (1983), Hanke and Schuler (1991), Schwartz (1993) and Williamson (1995). Somalia and the Philippines operated under CB arrangements under Italian and US administration respectively, while most French colonies had a weaker arrangement with partial backing in domestic assets.

³Balino, Enoch, Ize, Santiprabhob and Stella (1997) provide a recent analytical survey.

⁴See Walters (1992), Hanke, and Schuler (1991), Hanke, Jonung, Schuler (1993), Schwartz (1993), Zarazaga (1995), Hanke (1996).

⁵The bibliography contains references to the individual country experiences.

expansion. In addition, greater confidence may be expected to lower real interest rates and promote faster output growth.

A currency board, by removing—or at least severely limiting—the scope for discretionary credit policy, should result in even greater discipline and confidence than simply pegging the exchange rate. Of course, the difference between a currency board and a pegged exchange rate is largely one of degree: a currency board can be abandoned just as a pegged exchange rate can. Institutional arrangements, however, typically make the abolition of a currency board considerably more difficult, thus providing additional credibility at the margin.

This extra credibility comes at a price.⁶ Compared to other pegged regimes, currency boards are more constraining on credit policy and on the ability of the authorities to alter the exchange rate parity. (It is, of course, precisely the surrender of this option which—by reducing the scope for mischief—is supposed to provide the additional credibility.) The cost of this foregone option depends on several factors. Thus, currency boards are often argued to be less desirable for “large” countries (Williamson (1995), Corden (1996)), since a country sufficiently large to affect “world” interest rates would be giving up the possibility of an independent monetary policy were it to adopt a currency board.⁷ But few countries are in this position, and the growing integration of financial markets makes an independent monetary policy under *any* form of fixed exchange rate regime largely illusory.

More generally, the cost depends on the susceptibility of the economy to aggregate shocks, and the absence or ineffectiveness of alternative policy instruments. Here, in fact, the “size” argument against currency boards may be turned on its head. Economically *large* countries, by virtue of being more diversified across sectors and regions, face fewer aggregate real shocks that could be offset by a change in the exchange rate (even assuming that nominal exchange rate adjustments translate into desired real exchange rate movements).

A somewhat different cost is the reduced ability of the central bank to act as a lender of last resort in the face of system-wide liquidity crunches. Ancillary reforms, such as measures to enhance labor market and wage flexibility, the buildup of excess coverage to allow limited purchases of domestic assets in times of liquidity crunches, and permitting

⁶It is sometimes argued that adopting a currency board entails forgoing seignorage revenues. This is incorrect since the central bank continues to earn interest on its foreign assets, while paying none on most of its domestic liabilities (mainly base money). Moreover, a central bank with a pegged exchange rate will also be limited in its ability to expand domestic credit, at least if it wants to sustain the peg for long. Thus seignorage arguments are largely irrelevant in any comparison *within* the set of pegged exchange rate systems.

⁷It is worth emphasizing that it is economic, not geographic or population size which matters in this respect.

foreign branch banking, can help address these issues.⁸ Yet, even with such reforms, there is a general presumption that adopting a currency board is likely to create, at least in the short run, a trade-off between lower inflation and an increased risk of real exchange rate misalignments and financial distress.⁹

Ultimately, the relative merits of currency boards versus other forms of exchange rate peg cannot be resolved by theory alone. In this paper, therefore, we take an unabashedly empirical approach to examining the performance of currency board regimes. There is already a substantial body of literature attesting to the lower inflation achieved under fixed exchange rates compared to floating rates—even allowing for the possibility that countries with a preference for low inflation are more likely to adopt an exchange rate peg.¹⁰

But, for currency boards to be justified, they must deliver *better* inflation performance than other pegged exchange rate regimes.¹¹ Here, the empirical evidence is more scant. McCarthy and Zanalda (1996) compare the inflation and growth performances of Caribbean countries, finding that the subgroup of countries operating under a currency board arrangement had lower inflation and higher growth than other comparable Caribbean economies, though they attribute at least part of this to the greater concessionary flows to the currency board members. Kwan and Lui (1996) compare the performance of Hong Kong (China) under its currency board arrangement (October 1983 onwards) to its previous regime (1973–83). Based on a counterfactual simulation, they conclude that inflation would have been lower during the floating period had Hong Kong (China) operated under a currency board arrangement. Their comparison, however, is between a currency board and a float, and thus less exacting than the comparison between currency boards and other fixed exchange rate regimes, on which we focus here.¹²

⁸Foreign branch banking was a common feature of most colonial CB systems, perhaps contributing to their durability.

⁹Osband and Villanueva (1992), Schwartz (1993), Bennett (1994) and Williamson (1995) provide more detailed discussions of the advantages and disadvantages of currency boards. Fischer (1992) and Eichengreen (1994) provide alternative views on the case for national moneys and the sustainability of fixed exchange rates.

¹⁰See Ghosh, Gulde, Ostry and Wolf (1997), and other references therein.

¹¹The literature to date has not yet provided a clear answer regarding the “best” inflation rate. In this paper we will thus focus on the deviation from zero, rather than the deviation from some optimal rate.

¹²See Collins (1983) and Khatkhate and Short (1980) for discussion of a broader set of arrangements.

Some of the more recently created currency boards have been in existence for only a few months, so data on their performance are still unavailable. This makes it difficult to determine whether the observed differences in performance between existing currency board arrangements and other pegged exchange rate regimes result from the regime itself or from some peculiarity specific to the countries, be it hyperinflation (Argentina), transition from socialism (Estonia, Bulgaria), volatile terms of trade (Caribbean CB), war (Bosnia), or the presence of a global financial center (Hong Kong, China). Conversely, the very differences between countries' operating currency boards provides some hope of isolating the common effect of the regimes, and the number of observations available suffices for at least a simple econometric analysis.

Our main results may be summarized briefly. We find that, on average, inflation under currency board arrangements was about 4 percentage points lower than under other pegged exchange rate regimes. In part, this lower inflation was achieved by having lower money growth rates (a *discipline* effect). But the difference in money growth rates is not sufficient to explain the inflation differential, suggesting an additional *confidence* effect whereby higher money demand results in lower inflation, for a *given* money growth rate. Numerically, this confidence effect is substantially larger than the discipline effect, accounting for 3.5 percentage points out of the 4.0 percentage point differential.¹³

This finding inevitably raises the question of causality: countries with a lower proclivity to inflation may be more likely to adopt a currency board. Controlling for such regime choice endogeneity, however, does not alter the basic result that currency boards are associated with lower inflation than corresponding pegged exchange rate regimes. Moreover, the volatility of inflation is also lower under currency board arrangements.

Turning to the effects on growth, countries with currency boards actually grew faster than the average of all countries with pegged exchange rate regimes. While one might hesitate to ascribe the better growth performance to the exchange rate regime, the argument that the adoption of currency boards invariably entails lower growth (perhaps through real overvaluation, or a general "straitjacketing" of credit policy) receives no support from the data.

Finally, we examine whether the adoption of a strict monetary regime is reflected in better fiscal performance. Indeed, this turns out to be the case: the currency board countries

¹³ While the group of currency board countries does include a number of small economies (with population ranging from 0.1 million inhabitants for St. Vincent and the Grenadines to 35 million for Argentina), our principal results are not attributable to this factor. In regressions restricting the sample to include only countries with 5 million inhabitants or fewer, the results for inflation remain highly significant. The results for growth, while pointing into the same direction, lose their statistical significance in the full regression with all explanatory variables included.

ran an average fiscal deficit of 2.8 percent, compared to 4.2 percent under other pegged exchange rate regimes and 4.4 under floating exchange rate regimes.

In spite of the evidence in support of currency boards, interpretation of the results needs to remain mindful of the constraints imposed by the generally small sample size. The main intention of this paper therefore is to report the facts on actual outcomes, rather than supporting normative policy advice, in particular for larger countries. Such advice would, at the very least, have to await a final judgement on the resilience of the Argentinean and the Hong Kong Currency Boards--the two currency boards in our sample that have large domestic financial sectors--in light of the Asian currency crisis of Fall 1997

The remainder of this paper is organized as follows. Section 2 describes our data and some of the institutional background of existing arrangements. Sections 3 and 4 present our empirical evidence on the effects of currency boards on inflation and growth; section 5 concludes.

II. DATA AND INSTITUTIONAL CHARACTERISTICS

Our study is based on an comprehensive annual data set of all Fund members covering the period 1970–96. There are 2,386 observations in all, of which almost 70 percent are some form of pegged exchange rate regime (the float category consists of target zones as well as pure floats). Of the 1,691 pegged exchange rate observations, 115 represent currency boards.

Certain currency board countries are excluded, either because they have been put in place only very recently (e.g., Bosnia and Bulgaria) or because adequate data are not available. Only countries with at least fifty percent cover requirement are classified as currency boards here.¹⁴ Our full sample consists of Antigua and Barbuda (1981–96), Argentina (1991–96), Dominica (1978–96), Djibouti (1978–96), Estonia (1992–96), Grenada (1977–96), Hong Kong (China) (1983–96), Lithuania (1994–96), St. Lucia (1980–96), and St. Vincent and the Grenadines (1980–96), yielding 136 observations. In the empirical work below, we drop the year of the regime change (since the precise timing varies) and the year following any exchange rate regime change, to avoid the contamination problems discussed in Ghosh, Gulde, Ostry and Wolf (1997); this reduces the sample to 115 observations. When the central bank turnover rate is included, the number of observations available falls to 111.

¹⁴In particular, this means that countries within the CFA zone are excluded, since the CFA requires only 20 percent cover and has other features, including access to automatic overdraft with the French treasury, which make it rather different from the currency boards considered here. A reclassification (i.e. their inclusion in the currency board sample) of the CFA countries—which account for about 15 percent of observations in the group of pegged exchange rates—would not, however, alter our basic findings below that currency boards are associated with lower inflation. It would, however, reduce the average GDP growth rate of the currency board sample to (slightly) below the average of pegged exchange rate regimes.

Table 1: Principal Characteristics of Presently Operating Currency Boards

Country	Years in Operation	Peg Currency	Permissible Reserve Assets	Minimum Cover 1/	Latest Actual Cover	Public Access to Exchange at Central Bank	Power of CB to Change the Arrangement
Argentina	6 years	US dollar	2/3 forex and gold, 1/3 US\$ denominated Arg. Gov Bonds	M0	105 percent of M0, 21.3 percent of M2	No	None
Antigua and Barbuda (ECCB)	32 years	US dollar	Foreign assets and gold	60 percent of M0	81.7 percent of M0, 12 percent of M2	No	N.A.
Brunei-Daressalam	30 years	Singapore dollar	Liquid foreign assets, liquid foreign securities and accrued interest	70 percent of the Central Bank's demand liabilities	Around 80 percent of the Central Bank's demand liabilities	No	None
Bosnia	3 months	Deutschemark	With the exception of 50 percent of Central Bank capital, only DM assets	100 percent of monetary liabilities of the Central Bank	100 percent of monetary liabilities of the Central Bank	No	None
Bulgaria	5 months	Deutschemark	Foreign assets and gold	M0 plus some desired excess coverage	134 percent of M0 40.5 percent of M2	Yes	None
Djibouti	48 years	US dollar	Foreign assets	100 percent of currency in circulation	125 percent of M0, 22.5 percent of M2	No	None
Dominica (ECCB)	32 years	US dollar	Foreign assets and gold	60 percent of M0	84 percent of M0, 14.7 percent of M2	No	N.A.
Estonia	5.5 years	Deutschemark	Foreign assets and gold	100 percent of M0 (excluding central bank certificates)	118 percent of M0, 43.5 percent of M2	Initially yes, later abandoned	N.A.
Grenada (ECCB)	32 years	US dollar	Foreign assets and gold	60 percent of M0	85 percent of M0, 15.6 percent of M2	No	N.A.
St. Kitts and Nevis (ECCB)	32 years	US dollar	Foreign assets and gold	60 percent of M0	99 percent of M0, 19.8 percent of M2	No	N.A.
St. Lucia (ECCB)	32 years	US dollar	Foreign assets and gold	60 percent of M0	95 percent of M0, 16 percent of M2	No	N.A.
St. Vincent and the Grenadines (ECCB)	32 years	US dollar	Foreign assets and gold	60 percent of M0	88 percent of M0, 15.3 percent of M2	No	N.A.
Hong Kong (China)	14 years	US dollar	Foreign assets	105 percent of notes and coins	408 percent of M0, 22.4 percent of M2	No	Some
Lithuania	3.5 years	US dollar	Foreign assets and gold	100 percent of M0 + liquid central bank liabilities 2/	91.8 percent of M0, 41.1 percent of M2 3/	No	CB can appreciate the rate

Sources: MAE, Balino, Enoch, Ize, Santiprabhob and Stella (1997), and authors' calculations.

1/ M0 equals reserve money, i.e., the sum of currency in circulation plus non-government demand liabilities.

2/ To be covered initially by gross reserves, with the aim of building up further cover in terms of net reserves.

3/ In terms of net reserves.

Table 1 describes some of the most important characteristics of the currency boards now in existence.¹⁵ In principle, a currency board is defined by two key characteristics: backing of the domestic currency by a foreign currency, and free conversion of domestic currency into the backing currency at a fixed rate. In practice, currency boards often go beyond, or fall short of, this theoretical ideal. For instance, as long as the rule is public, the conversion rate between the domestic and the backing currency could be crawling over time. Indeed, the conversion rate could be determined by a (verifiable) rule which depends, for example, on the terms of trade (Osband and Villanueva (1992)). In practice, all the currency boards in the sample are based on a simple “irrevocably” fixed conversion rate. In principle, there is also no need to use a single currency, rather than a basket, as the reserve unit. In the sample, this is not the case; all arrangements are single currency pegs, mostly to the US dollar (9 cases) and more recently the Deutschemark (3 cases). As Table 1 suggests, even among currency boards, there are substantial differences in the rigor of the arrangement, ranging from the fairly soft conditions of the Argentinean board, which allows partial cover in domestic assets, to the hard arrangement of Estonia.

III. INFLATION EFFECTS OF CURRENCY BOARDS

Inflation averaged 6 percent per year under currency boards, substantially lower than under floating exchange rates (almost 50 percent per year) or other pegged exchange rates (about 20 percent per year), as indicated in Table 2. The average inflation rate (π), however, tends to be distorted by a few high inflation observations. Therefore, in what follows, we use the scaled measure $\pi/(1+\pi)$ (see also Cukierman, Webb and Neyapti (1992), Ghosh, Gulde, Ostry, and Wolf (1997)). This is very close to the inflation rate at low levels of inflation, while sharply reducing the effects of outliers. It turns out that using this scaled measure, or the median inflation rate, does not affect the relative rankings of the different regimes (Table 2).

Looking across the various subsamples, currency boards result in lower inflation (with the difference statistically significant) than other pegged exchange rate regimes, except when the subset of countries without capital controls is considered. This matches the findings of Ghosh, Gulde, Ostry and Wolf (1997), who argue that the abolition of capital controls exerts an independent effect on the monetary authorities, curtailing their ability to conduct inflationary policies regardless of the exchange rate regime. The small number of observations in this subsample, however, cautions against placing too much importance on this result.

Not only do currency boards result in a lower *average* rate of inflation, they are also associated with a lower *volatility* of inflation. Inasmuch as the welfare effects of inflation depend upon unanticipated price movements, this lower volatility may be an important property. We use a three-year centered standard deviation of inflation as our measure of inflation volatility. Under currency boards, this standard deviation is between 7 and

¹⁵See also Balino, Enoch, Ize, Santiprabhob and Stella (1997).

Table 2: Macroeconomic Performance Across Exchange Rate Regimes

	Nobs	Average π	Median π	Average $\pi/(1+\pi)$	Std. Dev. π	Average Money Growth	Average Gov. Bal./GDP	Average GDP Growth
(in percent)								
All Observations								
Full Sample	2386	27.4	7.8	10.2	18.4	33.9	-4.2	1.5
Pegged	1691	18.0	7.2	8.3	9.6	22.2	-4.1	1.5
Float	695	48.3	9.1	14.4	38.2	62.3	-4.4	1.6
Currency Board	115	5.6	4.0	5.0	2.6	11.9	-2.8	3.2
Pegged excl. Currency Board	1576	19.0	7.6	8.5	10.1	23.0	-4.2	1.3
Upper and Upper Middle Income Countries								
Full Sample	984	21.1	6.1	9.1	10.0	26.7	-2.6	2.2
Pegged	530	8.3	6.1	7.0	3.9	15.7	-1.5	2.4
Float	454	35.1	6.3	11.5	16.7	39.6	-3.9	1.9
Currency Board	45	4.7	4.0	4.4	2.0	14.1	-1.4	4.5
Pegged excl. Currency Board	485	8.7	6.3	7.3	4.1	15.9	-1.6	2.2
Lower and Lower Middle Income Countries								
Full Sample	1402	32.1	9.1	10.9	24.7	38.9	-5.3	1.0
Pegged	1161	22.6	8.1	8.9	12.3	25.2	-5.3	1.0
Float	241	73.9	15.7	20.1	78.6	104.9	-5.5	1.1
Currency Board	70	6.2	4.0	5.4	3.0	10.5	-3.9	2.3
Pegged excl. Currency Board	1091	23.8	8.4	9.1	13.0	26.1	-5.3	1.0
No Capital Controls								
Full Sample	552	14.7	5.2	8.1	11.3	36.1	-4.0	1.9
Pegged	230	8.8	5.6	7.6	4.1	18.3	-3.7	2.6
Float	322	18.4	4.9	8.5	15.9	48.7	-4.2	1.5
Currency Board	21	10.4	6.0	8.6	4.5	15.4	-0.9	3.1
Pegged excl. Currency Board	209	8.7	5.5	7.5	4.1	18.6	-4.0	2.5

Source: authors' calculations based on IFS, WEO and AREAR databases.

10 percentage points lower than under pegged exchange rate regimes (again, with the differences statistically significant).

A formal test of whether currency boards are associated with lower average inflation is given in the first row of Table 3.¹⁶ Here β_1 is the coefficient on a dummy variable which is equal to unity for a currency board in a regression across all pegged exchange rate observations only, thus measuring the difference between inflation under pegged exchange rates generally and currency boards. As indicated, inflation was about 4 percentage points lower under currency boards compared to other pegged exchange rates, with the effect statistically highly significant.

What accounts for the better inflation performance under currency boards? In part, it may be spurious, reflecting other macroeconomic shocks to, or properties of, the countries in question. As a first step towards allowing for this possibility, we include annual dummies to control for global inflation shocks in the regression. If the introduction of currency boards happens to be correlated with other shocks that lower inflation across regimes, the inclusion of annual dummies would purge this effect. The coefficient for the full sample is hardly changed, falling from 3.9 percentage points to 3.2 percentage points, and remaining statistically highly significant. It is noteworthy, however, that the coefficient for the upper and upper middle income country subsample falls to -0.5 percentage points and is no longer statistically significant.

More generally, inflation is likely to be a function of a variety of explanatory variables. To see this, it is useful to consider a simple money demand function of the form:¹⁷

$$MV/P = Y^\alpha \quad (1)$$

Taking logs (denoted by lower case letters) and first differences (denoted by Δ) gives an expression for the inflation rate:

$$\pi = \Delta p = \Delta m - \alpha \Delta y + \Delta v \quad (2)$$

¹⁶Corresponding results for the breakdowns by per capita income level, and the absence of capital controls, are given in the first row of the succeeding blocks.

¹⁷The money demand function simply provides a convenient analytical framework for discussing the results. It bears emphasizing, however, that none of the results depends upon the adoption of a particular form of the money demand function.

Table 3: Inflation Regressions

	β_0		β_1		R^2
	Coef.	t-stat.	Coef.	t-stat.	
Full sample					
[1] Const.	0.083	36.09	-0.039	-9.90	0.02
[2] Annual dummies	0.084	35.36	-0.032	-6.78	0.13
[3] Indep. excl. Δm	0.084	28.16	-0.039	-2.49	0.16
[4] All indep. vars.	0.089	31.66	-0.034	-2.93	0.33
Upper and Upper Middle Income Countries					
[1] Const.	0.073	21.39	-0.029	-5.51	0.02
[2] Annual dummies	0.069	23.19	-0.002	-0.33	0.23
[3] Indep. excl. Δm	0.079	16.65	-0.007	-0.56	0.38
[4] All indep. vars.	0.083	18.79	-0.011	-1.04	0.50
Lower and Lower Middle Income Countries					
[1] Const.	0.088	29.49	-0.045	-7.97	0.02
[2] Annual dummies	0.088	29.47	-0.045	-6.94	0.14
[3] Indep. excl. Δm	0.091	23.39	-0.053	-4.83	0.17
[4] All indep. vars.	0.094	27.95	-0.042	-4.66	0.32
No Capital Controls					
[1] Const.	0.067	13.98	-0.016	-1.81	0.01
[2] Annual dummies	0.056	10.29	0.029	2.44	0.45
[3] Indep. excl. Δm	0.053	10.24	0.050	2.81	0.48
[4] All indep. vars.	0.056	9.89	0.050	2.75	0.50

Source: authors' calculations

[1] $\pi = \beta_0 + \beta_1 \text{ CBRD}$

[2] $\pi = \beta_0 + \beta_1 \text{ CBRD} + \beta_2 (\text{Annual dummies})$

[3] $\pi = \beta_0 + \beta_1 \text{ CBRD} + \beta_2 (\text{Annual dummies}) + \beta_3 (x+m)/\text{GDP} + \beta_4 \text{ Turn} + \beta_5 \Delta \text{GDP}$

[4] $\pi = \beta_0 + \beta_1 \text{ CBRD} + \beta_2 (\text{Annual dummies}) + \beta_3 (x+m)/\text{GDP} + \beta_4 \text{ Turn} + \beta_5 \Delta \text{GDP} + \beta_6 \Delta M$

According to (2), inflation will be lower in a cross-section of countries with lower money supply growth (termed the “discipline effect”), faster income growth (other things equal) and slower velocity growth. Controlling for the money supply and real income, residual shocks to velocity can be interpreted as a “confidence effect.”¹⁸

In a regression which *excludes* the growth rate of the money supply, the coefficient on the currency board dummy captures *both* the confidence effect and, to the extent that adopting a currency board results in lower money growth rates, the discipline effect.¹⁹

Of course, confidence in the domestic currency may depend on factors other than the exchange rate regime. Two variables are typically cited in the literature: the independence of the central bank (Cukierman, Webb and Neyapti (1992)), and the degree of openness of the economy (Romer (1993)). Therefore, in addition to the GDP growth rate as suggested by (2), we include the rate of turnover of the central bank governor (with a higher turnover rate associated with less central bank independence) and the ratio of the sum of exports and imports to GDP.

The third row in each block of Table 3 (marked [3]) reports the constant β_0 and the coefficient on the currency board dummy β_1 when these additional variables are included, but omitting the money supply growth rate. The negative association between operating on a currency board and inflation remains, the estimated inflation differential widens to 3.9 percentage points (5.3 percentage points for the lower and lower-middle income countries) and remains highly significant.²⁰

Once the growth rate of the money supply is included in the regression (rows [4] of Table 3), the coefficient falls to 3.4 percentage points. In other words, the discipline effect of a currency board (operating through a reduced rate of money supply growth), accounts for only 0.5 percentage points of the lower inflation under currency boards, while the confidence effect accounts for the remaining 3.4 percentage points.

¹⁸These changes could, theoretically also reflect financial deepening and financial innovation. However, as is shown below, this effect is significantly larger under currency board regimes. As there is no reason to assume a higher degree of financial sector innovation under this regime, it seems natural to interpret Δv as “confidence” in the domestic currency.

¹⁹Essentially, the coefficient is subject to an “omitted variable bias,” but this bias is precisely the effect of money growth on inflation, weighted by the correlation between the exchange rate regime and the rate of money growth, i.e., the discipline effect.

²⁰The coefficients on the central banker turnover rate is 0.05 (t-statistic: 2.57**) and on GDP growth is -0.21 (t-statistic: 3.79**). Thus lower central bank independence is associated with higher inflation, while higher GDP growth is associated with greater money demand and lower inflation, in accordance with (2). The openness variable is insignificant.

Therefore, the anti-inflationary benefit of currency boards (relative to other pegged exchange rate regimes) arises mainly from the greater confidence in the domestic currency that these arrangements instill.²¹

The results presented thus far imply a firm association between the adoption of a currency board and better inflation performance, relative to other pegged exchange rate arrangements. Yet it is possible that the results reflect nothing more than a greater anti-inflation proclivity among countries that choose a currency board over a simple exchange rate peg.

Controlling for the potential simultaneity bias requires endogenizing the choice of a currency board. Suppose the decision to adopt a currency board depends upon some set of variables, X_2 as well as on the inflation rate, π .

$$C = X_2\alpha_2 + \beta_2\pi + \varepsilon_2$$

Here C^* is an unobserved "desire" to adopt a currency board. Let C denote the observed indicator variable designating whether the country has in fact adopted a currency board. The structural equation determining inflation is given by:

$$\pi = X_1\alpha_1 + \beta_1C^* + \varepsilon_1$$

where X_1 is a vector of exogenous variables and where the hypothesis of interest is $\beta_1 < 0$: currency boards result in lower inflation. The simultaneity implies that the negative coefficient on the currency board dummy obtained above could be spurious. As the endogenous variable (the decision to adopt a currency board) is dichotomous, standard 2SLS is not feasible, and a method proposed by Maddala (1983) is used instead.

Suppose that the reduced form of the model is given by:

$$\pi = X\lambda_1 + v_1$$

²¹On theoretical grounds, the case for greater credibility is ambiguous as a system with well-designed escape clauses may dominate a currency board system, which may result in extreme obstacles to adjustment (Persson and Tabellini (1990)).

$$C^* = X\lambda_2 + v_2$$

where X includes both X_1 and X_2 . Since C is observed dichotomously, we can only estimate

$$\lambda_2^* = \frac{\lambda_2}{\sigma_{v_2}}$$

Defining

$$C^{**} = X\lambda_2^* + \frac{v_2}{\sigma_{v_2}}$$

the structural inflation equation may be written:

$$\pi = X_1\alpha_1 + \beta_1\sigma_{v_2}C^{**} + \varepsilon$$

The two-stage procedure consists of estimating λ_2 by probit maximum likelihood, taking the fitted value of C^{**} and substituting it into the inflation structural equation which can then be estimated by OLS.²² Identification of the inflation structural equation actually does not require that some exogenous variables be omitted from it, although, in practice we include the country's population in the probit regression and exclude it from the OLS inflation

²²An adjustment to the standard errors is required. Corrected standard errors are given by:

$$V = \sigma_1^2(H'X'XH)^{-1} + (\beta_1\sigma_2)^2(H'X'XH)^{-1}H'X'X\Sigma X'XH(H'X'XH)^{-1}$$

where Σ denotes the variance-covariance matrix of the first-stage probit maximum likelihood parameter estimates, and

$$H = (\lambda_2 | J)$$

where J is a matrix of 1's and 0's such that $XJ = X_1$.

equation. Other variables used in the first-stage probit include the legal definitions of central bank independence developed by Cukierman, Webb and Neyapti (1992), lagged money growth rates, the central bank turnover rate (*Turn*), the indicator of capital controls, and the openness of the economy.²³ In general, a smaller population, and a greater degree of openness of the economy are (highly) significantly correlated with the adoption of a currency board. The resulting structural inflation equation then becomes:

$$\pi = 0.083 - 0.02C + 0.32\Delta m + 0.025(x+m)/GDP$$

(2.27**) (5.96**) (0.700)

$$+ 0.053Turn - 0.200\Delta GDP \quad R^2 = 0.25$$

(2.71**) (3.62**)

Thus, even taking account of the simultaneity bias, the adoption of a currency board is associated with lower inflation. Re-estimating the regression using lagged money growth as an instrument for Δm does not materially alter the results.

Underlying the greater monetary discipline (which, in turn, gives rise to the confidence effect) is better fiscal discipline. As Table 2 shows, budget deficits have been substantially smaller under currency boards than without. This is a striking, but not unexpected, property of currency boards: with the scope for credit expansion limited, budget deficits will generally need to be smaller. Whether one would say that currency boards “cause” better fiscal discipline is largely a matter of semantics: clearly countries that are sufficiently serious about pegging their exchange rate that they adopt a currency board, must put their fiscal position in order as well.

IV. GROWTH EFFECTS OF CURRENCY BOARDS

The last column of Table 2 reveals another striking feature of the data: far from having lower growth, average annual per capita growth was almost twice as high under currency boards than under floating or pegged exchange rates. This finding holds across the various per capita income categories, and when annual dummies are included in the regression.

In a more typical “growth regression,” which controls for physical and human capital accumulation (I/GDP , HK), the initial level of per capita income, relative to the US, $\log(Y^{US}/Y)$, terms of trade variability σ_{TT} , population growth, Δpop , and indicators for

²³The central bank independence variables are assumed to be constant beyond 1990 where the data do not exist. The definition of capital controls follows the IMF’s Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER).

cataclysmic events such as drought or war, there is still a positive differential in favor of currency board countries, to the tune of 1.8 percentage points per year, although the effect is barely significant statistically.²⁴

$\Delta y =$	0.083	+0.018 <i>C</i> (1.68*)	+0.1 ln (Y^{US}/Y) (3.51**)	+0.11(I/GDP) (4.31**)
	+0.0004 σ_{TT} (0.22)	+0.010 ($x+m$)/ GDP (1.55)	-0.020 <i>Drought</i> (5.06**)	
	-0.311 Δpop (1.57)	-0.01 <i>War</i> (1.59)	+0.0011 <i>HK</i> (3.13**)	
				$R^2 = 0.19$

There are two important caveats to these results. First, many of the currency board countries in the sample are small, island economies, subject to specific shocks, and with particular economic structures which makes their experience perhaps less relevant to other countries. Second, there may be a “peso problem.” One criticism of currency boards is that, in times of crisis, they do not permit sufficient flexibility of credit policy. If the sample does not include instances of extreme economic disruption, currency board arrangements may appear better for economic growth than they really are. There is essentially no way around this problem, especially given the relatively small sample of currency board countries. Nonetheless, it is worth noting that at least some of the currency board countries in the sample have been subject to extraordinary shocks—and weathered them with their currency boards intact.

Thus, one would certainly hesitate to ascribe the better growth performance of currency board countries to their exchange rate regime alone. Suffice it to say, however, that the opposite proposition—currency boards result in more sluggish economic growth—receives no support from the data. Nor, in fact, are they associated with a greater volatility of GDP growth.²⁵

V. CONCLUSIONS

After falling into disfavor during much of the post-war period, currency boards have, in recent years, staged a remarkable comeback. They have been used successfully in attempts

²⁴ Some of the variables in this regression, such as the investment ratio, might themselves be affected by the choice of the exchange rate regime.

²⁵ The standard deviation of GDP growth under currency boards is about 0.7 percentage points lower than under other pegged exchange rate regimes.

to break inflationary inertia, and to bolster the credibility of the monetary authorities who might, otherwise, experience difficulty in maintaining an exchange rate peg.

Since currency boards are more restrictive than other pegged exchange rate regimes, they must deliver better inflation performance if they are to be justified. This turns out to be the case. Pitting them against other pegged exchange rates suggests an inflation differential in the order of 4 percent per year. This difference stems mainly from lower growth (or sharper declines) of velocity, rather than lower money supply growth. As such, the anti-inflationary benefits of currency boards appear to derive primarily from expectational (credibility) effects regarding future monetary policy.

Our findings are generally robust, even when the possibility of endogenous regime choice is considered. Moreover, we find little evidence that currency boards result in more sluggish economic growth; on the contrary, countries with currency boards enjoyed significantly higher growth rates. That said, it bears emphasizing that currency boards are no “quick fix.” Indeed, many countries would be hard pressed to undertake the necessary fiscal adjustment which underlies the solid macroeconomic performance enjoyed by currency board countries. Nonetheless, within the limitations imposed by the relatively small and specific sample of countries with currency boards, the evidence in their favor appears unequivocal.

BIBLIOGRAPHY

- Auernheimer, Leonardo (1993), "Currency Boards and Policy Rules," in Nissan Liviatan (ed.) *Proceedings of a Conference on Currency Substitution and Currency Boards*, World Bank Discussion Paper 207.
- Balino, Tomas, Charles Enoch, Alain Ize, Veerathai Santiprabhob and Peter Stella (1997), "Currency Board Arrangements: Issues and Experiences," IMF Occasional Paper No. 151, August.
- Barro, Robert and David Gordon (1983), "Rules, Discretion, and Reputation in a Model of Monetary Policy," *Journal of Monetary Policy*, 12:101-121.
- Bennett, Adam (1992), "The Operation of the Estonian Currency Board," IMF Staff Papers, 40(2), June, pp. 451-70.
- Bennett, Adam (1994), "Currency Boards: Issues and Experiences," IMF PPAA 94/18.
- Bordo, Michael and Finn Kydland (1990), "The Gold Standard as A Rule," NBER Working Paper No. 3367.
- Camard, Wayne (1996), "Discretion with Rules? Lessons from the Currency Board Arrangement in Lithuania," IMF PPAA 96/1.
- Collins, Charles (1983), "Alternatives to the Central Bank in the Developing World," Occasional Paper No. 20, Washington, IMF.
- Corden, Max (1996), "The Dilemmas of Currency Boards," Mimeo.
- Cukierman, Alex, Miguel Kiguel and Nissan Liviatan (1992), "How much to Commit to an Exchange Rate Rule?," *Revista De Analisis Economico*, 7:73-90.
- 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.
- Davies, Gareth and David Vines (1995), "Equilibrium Currency Crisis," CEPR Discussion Paper No. 1239.
- De Loynes, John Barraclough (1974), "A History of the West African Currency Boards," London, Crown Agents, 2nd ed.

- Drazen, Allan and Paul Masson (1994), "Credibility of Policies Versus Credibility of Policymakers," *Quarterly Journal of Economics*, Vol. 109, pp. 735–54.
- Economist, The (1997), "The Great Escape," May 3rd, p. 69.
- Eichengreen, Barry (1994), *International Monetary Arrangements for the 21st Century*, Brookings.
- Enoch, Charles and Anne-Marie Gulde (1997), "Making A Currency Board Operational," IMF PPAA *forthcoming*.
- Fischer, Stanley (1992), "Seignorage and the Case for A National Money," *Journal of Political Economy*, Vol. 90, 295–313.
- Ghosh, Atish, Anne-Marie Gulde, Jonathan Ostry, and Holger Wolf (1997), "Does the Nominal Exchange Rate Regime Matter?," NBER Working Paper 5874.
- Gulde, Anne-Marie (1997), "The Bulgarian Currency Board Stabilization," Mimeo, IMF.
- Hanke, Steven and Kurt Schuler (1991), *Currency Boards for Eastern Europe*, Heritage Foundation, Washington.
- Hanke, Steven and Alan Walters (1992), "Currency Boards," in the *New Palgrave Dictionary of Money and Finance*, London, Macmillan.
- Hanke, Steven, Lars Jonung and Kurt Schuler (1993), *Russian Currency and Finance*, London, Routledge.
- Hanke, Steven (1996), "Currency Board for Mexico," *Central Banking*, 6:84–90.
- Honohan, Patrick (1994), "Currency Board or Central Bank?," CEPR Discussion Paper No. 1040.
- Johnson, Harry and Alexandre Swoboda (1973) (eds.), *The Economics of Common Currencies*, Harvard University Press, Cambridge, Massachusetts.
- Khatkhate, Deena and Brock Short (1980), "Monetary and Central Banking Problems of Ministates," *World Development*, Vol. 8 (December), 1017–25.
- Kwan, Yum and Francis Lui (1996), "Hong Kong's Currency Board and Changing Monetary Regimes," NBER Working Paper No. 5723.
- Kydland, Finn and Edward Prescott (1977), "Rules Rather than Discretion: the Inconsistency of Optimal Plans," *Journal of Political Economy*, Vol. 85: 3:473–91.

- Liviatan, Nissan (1992), *Proceedings of A Conference on Currency Substitution and Currency Boards*, the World Bank.
- Maddala, G. S. (1989), "Limited Dependent and Qualitative Variables in Econometrics," Cambridge, Cambridge University Press.
- Masson, Paul and Mark Taylor (1996), "Common Currency Areas and Currency Unions: A Survey of the Issues," in *Policy Options in the Operation of Currency Unions*, Cambridge, Cambridge University Press.
- McCarthy, Desmond and Giovanni Zanalda (1996), "Economic Performance in Small Open Economies: the Caribbean Experience 1980–92," Centro Studi Luca d'Agliano Working Paper No.102.
- Monetary Authority of Singapore, *The Financial Structure of Singapore*, MAS, Singapore.
- Nascimento, Jean–Claude (1994), "Monetary Policy in Unified Currency Areas: the Cases of the CAMA and ECCA During 1976-90."
- Obstfeld, Maurice and Kenneth Rogoff (1995), "The Mirage of Fixed Exchange Rates," NBER Working Paper No. 5191.
- Osband, Kent and Delano Villanueva (1992), "Independent Currency Authorities," IMF Working Paper No. 92/50.
- Persson, T. and Guido Tabellini (1990), *Macroeconomic Policy, Credibility and Politics*, Chur: Harwood Academic Publishers.
- Romer, David (1993), "Openness and Inflation: Theory and Evidence," *Quarterly Journal of Economics*, Vol. CVIII:869–903.
- Schwartz, Anna (1993), "Currency Boards: Their Past, Present and Possible Future Role," *Carnegie–Rochester Conference Series on Public Policy*, 39:147–87.
- Walters, Alan (1992), "A Hard Ruble for the New Republics," *National Review*, Vol. 44:2 (February 3rd).
- Williamson, John (1995), "What Role for Currency Boards?," *Washington Institute for International Economics*.
- Zarazaga, Carlos (1995), "Argentina, Mexico and Currency Boards: Another Case of Rules Versus Discretion," *Economic Review*, Federal Reserve Bank of Dallas, Fourth Quarter, pp. 14–24.

10 percentage points lower than under pegged exchange rate regimes (again, with the differences statistically significant).

A formal test of whether currency boards are associated with lower average inflation is given in the first row of Table 3.¹⁶ Here β_1 is the coefficient on a dummy variable which is equal to unity for a currency board in a regression across all pegged exchange rate observations only, thus measuring the difference between inflation under pegged exchange rates generally and currency boards. As indicated, inflation was about 4 percentage points lower under currency boards compared to other pegged exchange rates, with the effect statistically highly significant.

What accounts for the better inflation performance under currency boards? In part, it may be spurious, reflecting other macroeconomic shocks to, or properties of, the countries in question. As a first step towards allowing for this possibility, we include annual dummies to control for global inflation shocks in the regression. If the introduction of currency boards happens to be correlated with other shocks that lower inflation across regimes, the inclusion of annual dummies would purge this effect. The coefficient for the full sample is hardly changed, falling from 3.9 percentage points to 3.2 percentage points, and remaining statistically highly significant. It is noteworthy, however, that the coefficient for the upper and upper middle income country subsample falls to -0.5 percentage points and is no longer statistically significant.

More generally, inflation is likely to be a function of a variety of explanatory variables. To see this, it is useful to consider a simple money demand function of the form:¹⁷

$$MV/P = Y^\alpha \quad (1)$$

Taking logs (denoted by lower case letters) and first differences (denoted by Δ) gives an expression for the inflation rate:

$$\pi = \Delta p = \Delta m - \alpha \Delta y + \Delta v \quad (2)$$

¹⁶Corresponding results for the breakdowns by per capita income level, and the absence of capital controls, are given in the first row of the succeeding blocks.

¹⁷The money demand function simply provides a convenient analytical framework for discussing the results. It bears emphasizing, however, that none of the results depends upon the adoption of a particular form of the money demand function.