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An Institutional Framework for Comparing Emerging Market Currency Boards

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Monetary and Financial Systems Department

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Abstract

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This paper offers an in-depth review of the institutional arrangements underlying existing currency boards (CBAs) in Argentina (until 2001), Eastern Europe, and Asia. An index of precommitment is derived from an analysis of legislative frameworks and monetary policy operations. The index covers features associated with monetary and exchange rate credibility such as: (i) clarity of legal basis, (ii) quality of reserve coverage, (iii) coverage of monetary aggregates, (iv) claims on reserves, (v) operational autonomy, (vi) transparency and accountability, and (vii) escape clauses. The paper concludes with a discussion of flexibility and credibility trade-offs and exit issues.

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I. INTRODUCTION

The objective of this paper is to derive an index of precommitment to stress the differences between various exchange rate pegs arranged under the heading of a currency board arrangement (CBA).² The analysis notes that there are substantial cross-country differences within the sample of emerging market CBAs,³ owing to policy needs and constraints prevailing at the time of their establishment. An attempt is made to quantify these differences in institutional design, both with reference to a theoretical benchmark drawn from the literature⁴ and in terms of a synthetic index of precommitment derived from a review of legislation and operating procedures. The index covers issues relating to CBA institutional design, encompassing features of autonomy and transparency, and examining the adequacy of reserves with respect to monetary aggregates and exchange rate convertibility.

The mechanisms by which CBAs impart credibility are reviewed so as to gain insight into the importance of carefully designing monetary institutions. The country case studies reveal that credible signals of political commitment to a fixed exchange rate peg may, in some instances, be equivalent to a legally binding arrangement. Public endorsement, political consensus, and the adequacy of accompanying policies are highly relevant to markets' assessment of credibility. Underlying these factors is the sensitivity of exchange rate credibility to the perceived sustainability of the peg and its supporting policies.

This paper suggests that CBAs are favored by policymakers seeking to safeguard or recover credibility under exceptional circumstances. As with other variants of fixed exchange rate regimes, the establishment of CBAs must be accompanied by the adoption of sustainable economic policies and structural reforms. Typically, the CBA is an option for countries that have sought to put their economy in order (within the context of an IMF-sponsored stabilization policy, for instance), yet require a credibility boost in order to avert pressures of contagion.

If establishment of a CBA is considered a means of resolving a crisis, however, a distinction must be drawn as to the nature of the crisis. If, on the one hand, its source lies in a loss of confidence resulting from a history of discretion in fiscal expansion or credit

² The analysis does not attempt to analyze the link between the design of monetary institutions and actual macroeconomic performance. The appropriateness of the CBA for the six emerging markets under study and the alternative exchange rate regime that might be prescribed for ex-CBA countries such as Argentina are outside the scope of this study.

³ Argentina (from 1991 to 2001), Bosnia and Herzegovina, Bulgaria, Estonia, Hong Kong SAR, and Lithuania. The Hong Kong SAR CBA, in its twenty-first year of operation, is the longest-standing CBA of the emerging markets under study. It is followed by Estonia and Lithuania, in their twelfth and tenth years of operation, respectively, while the CBAs in Bulgaria and Bosnia and Herzegovina are in their seventh year of operation.

⁴ References may be made to Schwartz (1992), Liviatan (1992), Williamson (1995), Bennett (1994), Judy (1995), Enoch and Gulde (1997), and Ghosh, Gulde and Wolf (1998). Country studies are referred to in the appendix.

creation, a CBA may enhance policymakers' credibility, provided that monetary authorities invest in building a reputation for inflation aversion. Market expectations would subsequently converge on a reputational disinflation equilibrium with lower associated output losses. If, on the other hand, the domestic crisis has originated in broader financial market turmoil, the extent of real exchange rate misalignment may undermine the sustainability of a CBA. Setting the initial peg at the appropriate level is crucial in this case.

Although, *de jure*, CBAs do not irrevocably fix exchange rates, the operational difficulties of exit may render them so. Legally, the longevity of a CBA falls short of that of dollarization or the adoption of a common currency by the legislative procedure required for its statutory amendment. An exit from a CBA framework could be envisaged when sufficient credibility is deemed to have been achieved and the policy focus shifts to regaining flexibility.⁵ The policy switch must be very carefully designed however, since a suboptimal escape clause may dissipate any credibility gains.⁶ Thus, the establishment of a CBA must be carefully considered. Indeed, even without longer-term commitment, moving to a peg or a fixed exchange rate may confer sufficient short-term confidence to bring real interest rates down and reduce the cost of stabilization. Either way, fundamental disequilibria will need to be addressed at the very outset.⁷

The paper starts by discussing the motivating factors for adopting a CBA and the prerequisites for its effective functioning. It assesses the merits and drawbacks of this particular type of fixed exchange rate regime. After deriving a framework for comparing actual CBAs with the theoretical benchmark, it stresses the differences between CBAs in six countries by means of an index of precommitment. The index is derived from an analysis of the legislative framework and monetary policy operations in these CBAs. It arranges features associated with credibility under seven headings: (i) clarity of legal basis, (ii) quality of reserve coverage, (iii) coverage of monetary aggregates, (iv) claims on reserves, (v) operational autonomy, (vi) transparency and accountability, and (vii) escape clauses. The paper concludes with a discussion of flexibility and credibility trade-offs and exit issues. In the appendix, operational issues in CBAs and central banks are compared with reference to balance sheet issues. The conditions for an orderly exit are discussed toward the end of the paper.

⁵ The discussion of Eichengreen and Masson (1998) on the adoption of greater exchange rate flexibility may be applied to the exit issues faced by currency boards.

⁶ In the Baltic countries, accession to the European Union (EU) provided the escape clause.

⁷ In the floating-versus-fixed debate, the choice is between adjusting now and adjusting later, since the adoption of an exchange rate peg may confer a temporary credibility boost on monetary institutions. Fundamental problems will need to be addressed sooner or later, however, as the fiscal vulnerabilities in the Argentine provinces attest.

II. MOTIVATIONS FOR ESTABLISHMENT OF CURRENCY BOARD ARRANGEMENTS (CBAS)

Historically, CBAs were set up in small open economies with limited expertise in monetary management, little experience in central banking, or weak financial systems.⁸ The smaller the economy and the higher its degree of openness, the lower is the cost of foregoing the exchange rate as an instrument of monetary policy.⁹ Central banks in emerging markets and transition economies may lack the credibility to achieve price stability by simultaneously managing exchange rates, domestic liquidity and the capital account. Under these circumstances, the bias is toward tightening monetary policy or imposing capital controls in the event of pressure on the peg, thereby hampering growth prospects. In CBA-based stabilization policies, economic recovery is facilitated by the convergence of interest rates to lower international levels, while enhanced credibility and the elimination of exchange rate uncertainty serve to attract additional capital inflows. The commitment to offer convertibility on demand also helps reduce transaction costs in foreign trade and investment.

The establishment of a CBA in the emerging markets under review sought to address an economic crisis or support a stabilization program. While the former applied to the case of Argentina and Hong Kong SAR, Bulgaria and Bosnia and Herzegovina were motivated by the latter. In the absence of credible public institutions, as was the case for post-conflict Bosnia and Herzegovina, discretion is ineffective for monetary stabilization. In this case, stringent rules-based frameworks are more likely to be adopted for the conduct of monetary and exchange rate policy. In Estonia and Lithuania, the CBA also served to facilitate a smooth transition out of the ruble zone. More often than not, the creation of a currency board is considered to be a remedial action to counter speculative pressures when a lack of credibility constrains the effective conduct of monetary policy. Credibility problems are particularly acute in post-crisis countries, under circumstances of exceptional hyperinflation, or when financial stability is still at an uncertain stage.

Theoretically, the case for adopting a CBA is built on issues relating to the time inconsistency of optimal discretionary policies. The difficulties of sustaining a pegged but adjustable exchange rate regime in the presence of multiple equilibria underlie a preference for either extreme of the spectrum between fixed and floating. Credibility of emerging

⁸ Small open economies such as Brunei Darussalam (in 1967), Djibouti (in 1949), and the Eastern Caribbean Central Bank (in 1965) are examples. See Schwartz (1992) for the discussion of CBAs set up in Anglophone Africa during colonial times. The economic rationale for adopting a CBA is discussed in Santiprabhob (1997).

⁹ The theory of optimal currency areas (OCA) for common currencies may be extended to support the adoption of fixed exchange rates under CBAs. Frankel (1999) points out that OCA criteria were not met in Argentina, in spite of the fact that, in the early years, the CBA appeared to have worked rather well. He suggests the inclusion of six additional criteria highlighting the importance of fairly close correlation with the anchor currency in the case of an exogenous shock. These are as follows: (i) a strong need to impart monetary stability (owing to a history of hyperinflation, the absence of credible public institutions, and/or the exposure to nervous international investors); (ii) a desire for closer integration (enhancing the political credibility of the commitment); (iii) liability dollarization; (iv) access to an adequate level of foreign reserves; (v) enforcement of the rule of law; and (vi) high standards of financial sector prudential regulation and supervision.

market institutions is not dependent only on time inconsistency, nor only on the incentives for monetary authorities to deviate from their announcements ex post. Much also depends on the expected ability to implement the policy strategy, which is a function of the reform stage reached and the overall consistency of the policy framework.

Any discussion of flexibility and precommitment trade-offs must address causality and circularity issues. It may be argued that the stability, sensibility, and credibility of underlying economic policies are of greater importance than the actual setting up of the CBA. A strong commitment to a peg is only credible if prior signals have been sent as to consistent economic policies and, in particular, to a sustainable course for fiscal policy. Some analysts, including Berengaut and others (1998), thus question the extent to which the choice of the exchange rate regime depends on certain fiscal and financial preconditions being fulfilled. An element of circularity arises from institutional and environmental contributions toward the perceived feasibility of monetary reform. The issue is whether fiscal discipline makes it easier to uphold a peg, or whether it is by fixing the exchange rate that fiscal discipline may effectively be achieved. Insights from game-theoretic approaches suggest that these elements feed into one another, which makes it difficult to distinguish the marginal contribution of the exchange rate regime.¹⁰

Insight into regime endogeneity issues may also explain why monetary authorities choose to precommit themselves in a CBA. This is the self-selection bias discussed by Gulde and others (2000), since a government that is more willing to bear the cost of tighter policies is more likely to implement the required reforms. Without the political will and the ability to implement related policies, an exchange rate peg is ineffective in generating discipline.¹¹ Moreover, a credible signal of fiscal reform accompanying the adoption of a currency peg may convey sufficient weight to anchor expectations. One could then question whether monetary institutions work effectively only if they are for all practical purposes redundant.¹² If a government is in a position to implement appropriate economic policies, it

¹⁰ The game theory dynamics underlying signaling, cheap talk, and reputational issues are developed in Gibbons (1992). Walsh (1999) applies a game-theoretic framework to monetary policy to illustrate how information on credibility is derived from policy targets and announcements. If CBA operations were to be formalized in a game-theoretic framework, signaling would need to be examined in a dynamic game between the government and economic agents. Information would be derived from given statutory provisions and any subsequent policy announcements, whether in conformity with or in contradiction of preannounced policy commitments. The literature on credibility refers to a Nash equilibrium outcome, where the policymaker takes the forward-looking private sector expectations as given, under incentive constraints on optimal and consistent policymaking.

¹¹ Gulde, Kahkonen, and Keller (2000) review the performance of the Baltic states and Bulgaria. They state (on p. 2) that it is unclear whether higher output growth under a currency board is due to this bias or to a rebound effect, since the regime is established after a period of crisis. This implies that countries (e.g., Latvia) that are willing to adopt strict policies would do well, regardless of the exchange rate regime.

¹² This refers to a question raised by Cottarelli and Giannini (1997), p. 64. A related question is whether price stability is pursued as an economic policy objective because it is economically meaningful, or whether it is justified by technical feasibility and political legitimacy. Cottarelli and Giannini (1997) argue that as a result of

(continued)

may not need to precommit, thereby avoiding unnecessary exposure to exogenous shocks requiring an adjustment of the nominal exchange rate parity.

A. Fiscal Issues and Overall Policy Consistency

A CBA safeguards currency convertibility by removing alternative claims on reserves arising from direct or indirect credit to government. The CBA board must be given complete independence from fiscal financing requirements (or the obligation to extend liquidity to banks) since this amounts to additional claims on reserves undermining the backing of monetary liabilities. Policymakers seeking alternative means to adjust to exogenous shocks are thus subject to a hard budget constraint. This is reinforced by the fact that Treasury securities may only be purchased by the private sector at market rates. The literature on central bank independence¹³ also suggests that an institutional framework based on improved transparency would weaken the incentive for ministries to bid for increased budgets.

CBAs enhance policy transparency by placing an upper limit on base money supply determined by net capital inflows and trade balance surplus. The strength of the CBA is derived from the simplicity of its fixed rules which simplify the public's monitoring task and send clear signals, promoting price and wage discipline. Backing monetary liabilities (defined as currency in circulation plus banks' deposits at the central bank) by reserves is necessary, not sufficient, to protect a CBA peg from speculative pressure. Since domestic financial assets can be used to buy foreign currency and the entire stock of liquid monetary assets is usually a large multiple of the monetary base, the ratio of broad money to foreign reserves may be a better indicator of reserves adequacy. The balance sheet issues reviewed in the appendix also illustrate the importance of access to international credit lines in the event of a bank run, over and above the basic reserve coverage.

A signaling effect comes into play, as the peg is expected to provide the private sector with transparent information about the future inflation rate. Compared with a monetary target, the commitment may be stronger as it can be monitored daily by the general public. Wagner (1998) identifies a nominal anchor effect and a disciplinary effect. The nominal anchor effect involves the inflation rate becoming exogenous. As price increases of tradeables are brought down to the world rate, prices of nontradeables are eventually also expected to be stabilized and inflation would be lowered in the long term. The acceleration in the rate of nontradeables inflation and the real appreciation of domestic currency would become problematic, should stabilization lead to an output increase at the very outset. The disciplinary effect is exerted on fiscal and monetary policy: a higher inflation rate causes real

fostering consensus on the importance of price stability, monetary institutions seeking to obtain credibility through a rules-based approach generate institutional endogeneity.

¹³ Reviewed in Alesina and Summers (1990), Vålilä (1999), and Borrero (2001).

appreciation. By causing a demand switch away from domestically produced goods toward imports, a slowdown in economic activity and inflation inevitably results. Either way, price stability is only achieved through credible economic policies. These depend on adequate fiscal policies that reflect the inflation target and are fully supported by institutional factors.

B. Inflation Convergence

An understanding of the costs associated with inflation underlies any discussion of monetary institutional design. The short-run costs of a decline in employment and output under disinflation are smaller than the long run costs of high inflation. Besides, the relationship is somewhat asymmetric, in that excess demand is more inflationary than excess supply is disinflationary. This implies that the output and employment gains under high inflation and excess demand are more than offset by the losses necessary to reverse the rise in inflation. The high net cost of overheating thus justifies a preemptive role for monetary policy and the avoidance of a boom and bust cycle. Furthermore, there is the possibility that a liquidity trap and a floor under real interest rates might undermine the effectiveness of an expansionary monetary policy in a recession. It is thus easier to react to excess demand by tightening monetary policy than it is to boost weak demand at low levels of output, a policy option which is in any case not available under a CBA.

The benefits of establishing credibility under a CBA relate to the provision of a monetary anchor for inflationary expectations. Slower money growth rates are combined with a confidence effect which for a given money growth rate improves the demand for domestic currency. Fixing the exchange rate will not necessarily limit inflation however, particularly if the parity was set at an undervalued level or if the reserve currency depreciates relative to the CBA's other trading partners. A further consideration is the relative importance of inertia and the role of expectations in inflation dynamics. If inflation is backward looking due to indexation or overlapping contracts, disinflation would rely on the emergence of excess capacity. However, an emphasis on forward-looking expectations would imply that more irreversible forms of fixed exchange rates would carry greater disinflation credibility.

Efforts to enhance policy reputation are based on the premise that a more credible monetary authority can reduce inflation at a lower cost. The actual costs of disinflation will depend on the nature and outlook of inflation expectations, the credibility and coherence of policies and the actual speed of disinflation. The standard expectations-augmented Phillips curve hypothesis suggests that price shocks are less likely to become embedded in inflationary expectations if a central bank is a more credible inflation fighter. Credible monetary authorities have greater margin of maneuver, as well as more strategic flexibility. They may avail themselves of some discretion, adjusting operating procedures in the event of unforeseen circumstances, without generating inflationary expectations. Credibility also

gives a monetary authority the possibility of counting on public support when drastic, often unpleasant measures have to be taken.¹⁴

C. Relative Prices

Convergence in the level of inflation between the CBA and the reserve country depends on the absence of relative price adjustments. Inflation convergence in the context of fixed exchange rate regimes generally focuses on the price of tradeable goods, since the price of nontradeables is affected by relative productivity growth. To the extent that purchasing power parity holds, or that relative differentials in purchasing power remain constant, domestic inflation in the CBA country is tied to inflation in the reserve country, provided that there is no need to make relative price adjustments.¹⁵

CBA and reserve country inflation rates may diverge considerably owing to persistent structural differences. The reserve country is likely to be a mature industrial economy with productivity and income in the traded goods sector growing relatively slowly. With nontradeable goods in inelastic supply, their relative price would tend to rise faster in developing countries or emerging market economies. This is especially relevant to transition economies adjusting from artificially low prices for capital intensive services such as housing, utilities or transportation, in addition to attempting to enhance the efficiency of the public provision of services. Following the increase in income levels and the upgrade of capital stock priced below cost, prices converge upward toward the level of those in mature economies. The real exchange rate expresses the change in the ratio of domestic prices of nontradeables to domestic prices of traded goods. A relative price adjustment is equivalent to a real appreciation of domestic currency, leading to inflation in the presence of downward price rigidities.

D. Flexibility in the Real Economy

The burden of adjustment to a loss in competitiveness under a CBA must come from the real economy and not an exchange rate devaluation. Such an adjustment would be facilitated by structural policies designed to increase the flexibility of the labor market and by monetary policies which speed up the convergence of inflationary expectations, both of which are at the heart of the CBA strategy. With flexible prices and wages, a fully credible disinflationary policy would, in theory, carry no output costs.

¹⁴ This was recognized by the governor of the central bank of Estonia (Eesti Pank), as reflected in his public acknowledgment of the Estonian national support for the economic policies pursued by the currency board. (See Kraft 1997.)

¹⁵ Setting import tariffs and export subsidies may act as artificial relative price changes which create nominal price rigidity smoothening the business cycle. In the case of Argentina, such changes severely altered convertibility and led to an exchange rate spread of 8 percent. The subsequent downgrading by Standard and Poor's suggests that the benefit was expected to be modest and offset by the cost of lost transparency in the so-called rules of the game.

A distinction must be drawn between different sources of inflation, since structural reforms have a greater role to play in hyperinflation than in chronically high inflation.

The former, characterized by very high and rapidly accelerating rates of inflation, is generally short lived. The latter tends to be longer-lasting and may be self-perpetuating due to indexation mechanisms and accommodating policies. Hyperinflation would thus require an effective and discrete fiscal adjustment with an emphasis on convertibility, while policies against chronic inflation rely on nominal anchors to stabilize inflationary expectations.

E. Evaluating Costs of a CBA

Disadvantages pertaining to the adoption of CBAs are similar to those associated with fixed exchange rate regimes. They relate primarily to the loss of the exchange rate instrument for balance of payments adjustment. Net exports are the channel through which the exchange rate may smooth output over the business cycle. The higher the mobility of capital, however, the looser the link between an exchange rate depreciation and an improvement in the current account. Besides, the effect of the exchange rate depreciation on real income may offset the boost to net exports. The influence that exchange rates have on output and the business cycle depends on the elasticity of trade flows with respect to prices and the response of trade prices to the exchange rate. This is why CBA frameworks tend to be better suited to small open economies.

Whether or not relinquishing monetary policy discretion is a drawback under CBAs depends on country-specific factors. Schwartz (1992) doubts that discretionary monetary policy is effective under conditions of capital mobility and globalized financial markets. Country-specific factors must be taken into account when evaluating the need for greater flexibility. Williamson (1995), for instance, identifies a time period in which interest rates in Hong Kong SAR converged to low U.S. levels in spite of high domestic asset prices that would have required a monetary policy tightening. Berengaut and others (1998) examine whether giving up monetary flexibility is detrimental to countries in transition owing to persistent structural rigidities and imbalances. They acknowledge that fiscal and structural policies provide better instruments for addressing such issues, while monetary policy maintains its focus on price stability. In addition, there is a tendency for money supply and demand functions to be neither stable nor predictable in transition economies. This is due to policy uncertainty, ongoing financial innovation and changes in the degree of monetization.

With capital account liberalization, the limited scope for credit expansion need not represent a cost for CBAs. Monetary creation depends on prior increases in reserve holdings. The behavior of foreign reserves is, in turn, dependent on the balance of payments position¹⁶. Provided that capital flows freely and that the currency is convertible, the balance of trade should not impose strict limits on a CBA's ability to expand money supply. The

¹⁶ In the first five years of CBA operations in Bosnia and Herzegovina, a substitution effect between domestic and anchor currency led to the expansion of foreign reserves, cash in circulation and bank credit in spite of a current account deficit.

reverse is also interesting, since a trade surplus or net capital inflows will lead to an increase in money supply through an increase in reserves. Depending on the degree of openness of the economy and on terms of trade effects, some of the additional earnings from exports will be directed toward the purchase of imported goods. This may thereby limit the inflationary impact of the surplus and restore balance of payments equilibrium.

Tightening monetary policy to stabilize inflationary expectations may not necessarily be to the detriment of growth. Demand conditions tend to affect output growth in the short term only. In spite of the possibility of ongoing resource underutilization, the long run determinants of growth are related to capital, labor and productivity. This is an important factor underlying the emphasis on supportive supply-side policies under a CBA. Macroeconomic stability, credible institutional and social structures, and a sound financial market also sustain growth and the efficiency of production. Empirical evidence suggests that the current and lagged value of output gaps and the deviation of current inflation from its expected value may not always be significantly correlated,¹⁷ which suggests that an anti-inflationary stance is not detrimental to growth.

F. How CBAs May Contribute to Monetary Credibility

The mechanisms by which CBAs impart credibility are similar to those derived from the operations of an autonomous central bank. While the former is rules-based, the latter benefits from discretion, but both represent institutional measures that create a culture of stability through monetary policy delegation.¹⁸ This serves to convince economic agents that the authorities will not tolerate inflation. Schwartz (1992) draws attention to certain limiting simplifications in the discussion of rules and discretion under CBAs. There seems to be insufficient attention awarded to the negative effects which an unanticipated disturbance originating in the reserve country would have on the CBA economy. A rules-based approach ignores the effects of discretion in the reserve country. Besides, credibility is not necessarily rule-dependent if one concedes that discretion does not always result in high-inflation equilibria. This would only be the case if the policymaker recognizes the futility of trying to surprise the private sector. While exchange rate policy under a CBA is no substitute for discipline, it acts as a complementary institutional arrangement designed to insulate monetary and fiscal policies from short-term political pressures.

¹⁷ Instead, a study of Latin American economies (IMF, 1996, p. 62) confirms a significant relationship between changes in monetary aggregates and inflation.

¹⁸ Cottarelli and Giannini (1997) offer an economic history review of the notion of credibility and discuss the relative merits of exchange rate and monetary targets. They highlight the evolution of monetary frameworks in the post-Bretton Woods era and the switch toward greater discretion. As authorities invested in anti-inflationary reputations, they combined instrument flexibility and long-run goal credibility. This was supported by delegating monetary policy to an independent institution, backed by measures to guarantee transparency. It is suggested that the shift toward exchange rate targets was largely due to increased capital flows and the globalization of markets.

The key to the degree of credibility which a commitment confers is customarily equated to the perceived cost of breaking it.¹⁹ Cukierman (1992) finds a correlation between the estimated cost of abandoning a peg and the perceived commitment of the government toward it. This is contested by Cottarelli and Giannini (1997) who argue that a central bank's commitment toward price stability will tend to affect public perceptions about the desirability of low inflation, especially if active public relations and information campaigns are pursued.²⁰ They suggest that arrangements that were initially intended to credibly constrain governments do not raise the cost of breaking the policy promise as much as they increase the perceived benefit of adhering to the chosen policy.

Precommitment and policy announcements help address the problems associated with informational asymmetries. In cases where the public knows and understands the policies that are followed, expectations would tend to reflect these policies. One way of consolidating credibility without relinquishing flexibility is to build an anti-inflationary reputation through deeds, revealing information about policy preferences. Vegh (1991) notes that in the event of a failed exchange rate stabilization program, inflation rates in the long term accelerate to levels higher than those which would have prevailed before the start of the stabilization policies. This underscores the importance of the consistency between policy formulation and implementation.²¹

The credibility of the stabilization policy depends on public perception that the authorities are effectively committed to following their policy announcements through. When disinflation is the sole goal of economic policy at the cost of other objectives, the output cost of the policy pursued may be so prohibitively high as to render its continued implementation politically unsustainable and therefore not credible. The case of Estonia illustrates how firm supportive policies are required to accompany a tight monetary stance within a comprehensive package designed to strengthen the exchange rate peg.

Country-specific factors will ultimately determine a monetary framework's precise combination of statutory and political commitment. At the basis of the CBA strategy is the recognition that an exchange rate peg signals stronger commitment if there are institutional hurdles to changing the regime. The advantages of being able to pull out of the peg in the event of adverse circumstances would be dissipated by the loss of transparency inherent in the withdrawal from the commitment. This is particularly the case in transition

¹⁹ The higher the cost of renegeing, the stronger the commitment and the greater its credibility. However, the greater the loss of flexibility (as devaluation is not permitted in adjustment to an external shock), the greater the cost of achieving disinflation.

²⁰ They refer to the Bank of Finland's practice of distributing monetary policy pamphlets to schools, as one way in which a central bank can instill an anti-inflationary culture.

²¹ Blinder (1999) affirms that "in the real world, [credibility] is not normally created by incentive-compatible compensation schemes nor by rigid pre-commitment. Rather it is painstakingly built up by a history of matching deeds to words. A central bank that consistently does what it says will acquire credibility almost regardless of the institutional structure." (p. 64)

economies, where ambitious stabilization programs within fragile socio-political systems require reforms to be institutionalized.²² However, in the absence of political consensus on the necessity of the chosen policy, the enforcement of discipline through institutional means is unlikely to succeed. Publicizing strong political consensus on the desirability of the fixed exchange rate is thus another way of dealing with commitment uncertainty.²³ The relative ranking of a commitment strategy based on tying one's hands and the alternative of fostering widespread public endorsement of the stabilization policy is difficult to quantify. This is, therefore, fertile ground to examine the reputational effects of variants of CBA frameworks.

III. STATUTORY FEATURES ASSOCIATED WITH CREDIBILITY

The following sections compare the statutory features of precommitment in the CBAs of Argentina (up to 2001), Bulgaria, Bosnia and Herzegovina, Estonia, Hong Kong SAR, and Lithuania. For frameworks that deviate considerably from the theoretical norm, the analysis highlights the particularities of their operating procedures.²⁴

The CBAs are compared with a theoretical benchmark drawn from the literature and ranked according to a synthetic index of precommitment. The index quantifies variations in institutional design covering elements of autonomy and transparency. It assesses the adequacy of reserves, both with respect to the coverage of monetary aggregates and to the quality of currency convertibility. Alternative claims on reserves are highlighted since they represent a potential source of vulnerability. Payment arrangements and systemic liquidity management are reviewed, as well as banks' access to international credit lines. References to data dissemination standards are included as a proxy for operational transparency and public awareness of currency board issues. Finally, the analysis also describes the possibility for the revocation of the exchange rate regime, examining exit issues and the design of any escape clause.

A. Methodological Issues Underlying Assessment of Precommitment

It is important to analyze the statutes because they directly impinge upon the degree of precommitment, they reinforce transparency, and they help channel expectations. The extent of political commitment and public endorsement are also considered as determinant factors in the choice of legal basis and institutional design, together with the circumstances in which the CBA was initially established. In Bosnia and Herzegovina, for instance, the legal framework is highly formalized, owing to the pressing need for imparting credibility to

²² This is particularly well illustrated in the strict CBA framework adopted by Bosnia and Herzegovina.

²³ The Hong Kong Monetary Authority regularly reaffirms its support for the dollar link— for instance, making statutory commitments less relevant in the enforcement of discipline. Hansson (1997) refers to the importance of policy announcements in the Baltic countries.

²⁴ The statute and accompanying legal texts are the main sources of information. For exact legal and regulatory references see the box in the appendix.

monetary policy. In terms of credibility, however, a regulatory framework with monetary rules ill-suited to the fundamentals of the economy would not be an improvement over discretion. What is at stake, therefore, is the suitability of the exchange rate regime.

It is worth noting that two main weaknesses tend to afflict any political economy analysis that relies on index values, the first of which is the sensitivity of results to the selected weighting scheme. This issue is addressed in this analysis by selecting the index components on the basis of the literature on CBA credibility. The weighting scheme that is chosen is generally neutral as all components are attributed equal weight. The only idiosyncrasy is the relative emphasis on reserve coverage in two components of the index. Indeed, it is assessed both qualitatively, with reference to the liquidity and denomination of reserves, and quantitatively, with reference to the monetary aggregate. This is supported by the literature, however, since it is the principal feature that distinguishes a CBA from other exchange rate regimes.

The second weakness of analyses based on indices relates to the loss of information when various elements are combined in a composite indicator. The conclusions derived from these results could be both simplistic and misleading. This is why the overall index value, attributed to each of the CBAs in the sample, is essentially used to obtain an idea of ranking. The focus of the analysis must remain on the individual components of the index and the relative deviation of each of the CBAs in the sample vis-à-vis the theoretical benchmark²⁵.

B. Defining the Index of Statutory Precommitment

The synthetic index of statutory precommitment arranges the CBA features which are associated with credibility under seven headings: (1) clarity of legal basis; (2) quality of reserve backing in terms of denomination and liquidity; (3) coverage of the monetary rule; (4) vulnerability to alternative claims on reserves; (5) operational autonomy; (6) transparency and accountability provisions and (7) regime revocation arrangements. In reviewing the statutory frameworks, the index captures whether the reference to the board is explicit or implied in the description of central bank legislative framework. It highlights the exact reference to the quantity and quality of backing examining the level and eligibility of assets and the definition of monetary aggregates. The convertibility undertaking is also detailed according to its legal specification—whether it is one- or two-way, with or without restrictions on access, and whether or not subject to a spread. The index notes whether the objective of currency stability is legally enshrined, and whether the statute directly refers to operational autonomy and the prohibition of credit to government. It also examines freedom in determining interest rates charged on facilities, and provisions on profit allocation. The index highlights appointment, dismissal and accountability procedures, and reviews bank supervision responsibilities.

²⁵ The theoretical benchmark is described in further detail in the appendix.

C. Quantifying CBA Deviation from Theoretical Benchmark

The following tables elaborate the range of possibilities, from the theoretical benchmark to the minimum requirement for the arrangement to be considered as a CBA. Under each of the headings defined above, the theoretical benchmark is assigned a maximum value of $1/n$ where n is the number of subcriteria in each of the seven sets of CBA features. The minimum requirement, which is still stricter than other fixed exchange rate arrangements, is assigned a value of zero. The weighting issue is simplified by assigning each of the criteria composing the index an equal weight. As an exception, the feature on reserve adequacy is disaggregated into coverage and quality thus emphasizing the central aspect of CBA operations.

Table 1. Clarity of Legal Basis

1. Clarity of Legal Basis	Theoretical Benchmark	Minimum Requirement
1.a Reference to CBA	Clear and explicit definition of a CBA = $\frac{1}{4}$	Indirectly inferred from monetary policy description = 0
1.b Currency stability objective	Primary objective enshrined in legislation = $\frac{1}{4}$	No direct reference, but among other economic policy objectives = 0
1.c Backing commitment	Clearly specified type of reserves and target aggregates = $\frac{1}{4}$	Briefly referred to without defining reserves or money explicitly = 0
1.d Convertibility undertaking	Two-way convertibility, full access, no transaction costs or spread = $\frac{1}{4}$	Limited convertibility / access, presence of transaction costs or spread = 0
Range of values for criterion	1	0

While all the statutes specify the reserve backing of monetary liabilities, there is only one explicit reference to a CBA and the extent of convertibility varies from country to country. As regards subcriterion 1.a, the CBA in Bosnia and Herzegovina is the only regime which is explicitly referred to as such in the legislation. All the others are implied from the description of the monetary rule and exchange rate regimes contained in the statutes. Under 1.b, the only CBA statute which does not explicitly feature currency stability as a primary objective in the statute is that of Hong Kong SAR. Policy statements in support of the dollar link and disclosure of government support through various channels compensate for this lack of formal commitment. Under 1.c, all statutes without exception refer directly to the reserve backing of monetary liabilities in the basic provisions.

The index adopts a binary approach to convertibility since it is the nature of the commitment which is of relevance rather than the range of possibilities. The range of possibilities is still worth examining for evidence of transaction costs or the direction of convertibility. One way or restricted convertibility undertakings are assigned values of zero since in absolute terms they both fall short of the theoretical benchmark. The extent of the convertibility undertaking varies from country to country, with full two-way convertibility guaranteed in Bosnia and Herzegovina and Bulgaria. This is also the case in Lithuania, where

in addition charges imposed by banks are subject to a ceiling. In Argentina, convertibility was statutorily guaranteed one way, although it would also have been operationally two-way. The same applies to Estonia, subject to an exchange rate spread. In Hong Kong SAR, access to convertibility is limited to note-issuing banks and subject to a narrow spread.

Table 2. Quality of Reserve Backing

2. Quality of Reserve Backing	Theoretical Benchmark	Minimum Requirement
2.a Denomination of eligible assets	Reserve currency = ½	Other convertible currencies = 0
2.b Liquidity of reserve asset holdings	Foreign currency reserves or short-term interest-bearing assets = ½	Government paper and less liquid securities = 0
Range of values for criterion	1	0

Only three of the six statutes specify that monetary liabilities should be backed by assets denominated in the reserve currency. Although theoretically monetary liabilities should be backed by reserve currency, to limit exchange rate instability in relation to third currencies, modern CBAs may opt for a mixed portfolio of reserve assets. The composition of this should reflect the currencies of the country's main trading partners. The statutes which allow assets in denominations other than the reserve currency yet impose restrictions on the third currency component, may thus be attributed a value of ½ under criterion 2.a. Examples of this include Bosnia and Herzegovina, where reserves are largely held in euros (previously in German marks) and other currencies are subject to a ceiling. In Bulgaria, the statute specifically calls for reserves to be restructured in line with the exchange rate peg. In Estonia, the statutory reference was to the bulk of reserve assets being denominated in German marks, and subsequently amended to provide for the introduction of the euro. In contrast, according to their statutes, CBA reserves in Hong Kong SAR and Lithuania may be held in unspecified foreign or convertible currency, not necessarily the reserve currency. This was also the case in Argentina. These three countries are therefore assigned a value of zero. Since the issue here is that the statutory requirement for CBA assets to be held in the reserve currency would greatly facilitate the public's assessment of reserve adequacy.

Similarly, three of the six statutes do not impose liquidity considerations on the reserve backing. The theoretical benchmark provides for reserves to be held other than in cash form, due to the need to optimize interest earnings on the CBA reserve portfolio. The statutes which stipulate that reserves must be highly liquid and risk-free are thus attributed higher values in the satisfaction of subcriterion 2.b, as compared with those containing no such reference. The former comprise Bosnia and Herzegovina, Bulgaria and Estonia, while Argentina, Hong Kong SAR and Lithuania fall in the latter category. The Estonian statute authorizes the CBA to engage in asset management, subject to the satisfaction of a number of conditions. They are, in order of importance: the maintenance of value, of liquidity, the diversification of risks and the optimization of profit. Particularly noteworthy is the fact that the legal framework applicable to Argentina imposed no liquidity and risk consideration, notwithstanding the practice for BCRA reserve management to be conducted with reference to a benchmark portfolio. Argentina would also have been assigned the value of zero on the

liquidity subcriterion because its central bank (the BCRA) was entitled to hold public bonds in breach of basic CBA requirements (even though they were subject to a ceiling and an annual growth rate). The aforementioned binary approach is maintained.

The index values assigned to reserve holdings may seem to penalize a CBA that is effective in portfolio management. However, the strict statutory features remain relevant. This is because in the event of a crisis, the CBA would require immediate access to its liquid and freely convertible reserves. Such features were designed to limit mismanagement of asset holdings, particularly since currency boards were often established because of limited experience in monetary policy. With expertise in portfolio management, a CBA can engage in maturity matching. Thus, perfectly liquid and risk-free assets would be held in amounts equivalent to cash in circulation, while the excess covering broader monetary aggregates could be invested in interest-bearing assets.

Table 3. Coverage of Monetary Aggregates

3. Monetary Aggregates	Theoretical Benchmark	Minimum Requirement
Selected monetary aggregate	Broad money = 1	Narrow or base money = 0
Range of values for criterion	1	0

Due to financial innovation, broader monetary aggregates are set as the benchmark, rather than base money, leading to the satisfaction of this criterion by only two of the CBAs in the sample. Coverage should be extended to deposits that may be converted into cash upon demand, due to financial innovation and the declining importance of bank settlement balances. An alternative is to cover base money and to broaden coverage as the exchange rate regime strengthens, or to announce at regular intervals that the bulk of a broader aggregate is adequately covered. The statutes providing for backing beyond base money refer to national particularities in the monetary framework. The CBA in Bosnia and Herzegovina includes residents' accounts on its books, while the Estonian CBA, within the central bank, backs all liabilities including any collateral extended. These two countries are awarded a full value on criterion 3, whereas the other four are awarded the value of zero.

Table 4. Claims on Reserves

4. Claims on Reserves	Theoretical Benchmark	Minimum Requirement
4.a Bank supervision role and lender-of-last-resort (LOLR) responsibilities	CBA supervisory role only, separate authority with LOLR responsibilities = 1/3	Bailout of banks in the event of systemic risk, using excess margin of reserve holdings = 0
4.b Clearing / payment arrangements and liquidity management	No rediscounting facilities or liquidity management, banks to establish international credit lines = 1/3	Temporary and exceptional provision of end-of-day liquidity to solvent banks at penal rates = 0
4.c Credit to the government	Clear and explicit statutory prohibition of credit to government = 1/3	Purchase of government paper at market rates subject to a ceiling = 0
Range of values for criterion	1	0

Three of the CBAs are charged with safeguarding the stability of the banking system and have not relinquished LOLR facilities. The statutes of Bosnia and Herzegovina and Estonia satisfy the subcriterion of bank supervision and LOLR since these CBAs are entrusted with monitoring the adherence of financial institutions to prudential requirements, without any provisions for bailing them out in a crisis, as was also the case in Argentina. In Estonia, loans may be extended to banks under systemic and emergency circumstances, provided that there are excess reserves in relation to the backing requirement. For 4.a, or the category of bank supervision and LOLR responsibilities, these three countries are thus assigned the full value of $\frac{1}{3}$, while the other three CBAs obtain the value of zero. Indeed, the Bulgarian CBA is charged with the stability of the banking system and the protection of depositors. The Lithuanian CBA may extend credit to banks up to 60 percent of the value of their liabilities. The statute governing the Hong Kong SAR monetary authority (HKMA) refers to the requirement to ensure the stability and integrity of the monetary and financial system.

As regards the involvement of the CBA in liquidity management and clearing and payment systems, the sample is divided along the same lines. The strictest is the statute found in Bosnia and Herzegovina which does not provide for any money market operations. Argentina and Estonia satisfy subcriterion 4.b, and may be attributed the value $\frac{1}{3}$. In the case of Argentina, rediscounting was temporary and banks were encouraged to establish their own international credit lines. As regards the third alternative claim on reserves, in criterion 4.c, the statutes of the CBAs in Hong Kong SAR and Lithuania are the only ones that do not explicitly prohibit the provision of credit to government. They are therefore assigned a value of zero while the other four CBAs obtain a value of $\frac{1}{3}$.

Table 5. Operational Autonomy

5. CBA Autonomy	Theoretical Benchmark	Minimum Requirement
5.a Regulatory autonomy	CBA autonomy clearly established in legal basis = ¼	No direct references to autonomy in the statute = 0
5.b Appointment / dismissal provisions	Clear contract terms and conditions of dismissal = ¼	Short term appointment, unclear dismissal procedures = 0
5.c Policymaking authority instrument autonomy	Sole responsibility of CBA = ¼	Subject to government approval = 0
5.d Profit allocation	Retained to supplement reserves = ¼	Mostly transferred to government = 0
Range of values for criterion	1	0

All statutes bar one affirm CBA autonomy from the government and most reinforce this with policymaking authority. The exception is that of Hong Kong SAR, which thus obtains the value of zero for subcriterion 5.a and 5.c. All the statutes include detailed appointment provisions, and procedures for the dismissal of the governor and members of the board. This makes 5.b, on appointment and dismissal provisions, another subcriterion, in addition to that of backing commitment under 1.c, where all the CBAs are assigned a full value. The arrangement in Bosnia is the strictest at the time of the establishment of the CBA. Initially, no national could be appointed to head the CBA, the procedure being in the hands of the IMF to remove all objective forms of government involvement in appointment and dismissal. The transition to the local appointment of a governor with Bosnian citizenship was smoothly effected in 2004 with the consolidation of autonomy and credibility. Some statutes specify the attributes of candidates to the post and refer to more detailed provisions regarding breach of contract as grounds for dismissal. Accordingly, most statutes also reinforce CBA autonomy with provisions relating to policymaking authority in interest rate policy. In Hong Kong SAR, the CBA statute is unclear as to instrument autonomy, and may thus be assigned the value of zero, while the other four CBAs obtain a value of ¼ in policymaking authority under 5.c.

The sample is split over CBA discretion in managing its budget and allocating profit. The theoretical benchmark provides for the retention of earnings on reserves so that the CBA may supplement its reserve account. At the other extreme, earnings are transferred to the government and only a minimal fraction is retained by the CBA. The exact proportion of earnings transferred to the government may also depend on the net worth of the CBA at the start of its operations, as was the case in Bosnia and Herzegovina. There, profit may only be transferred to the government provided that the capital to liabilities ratio reaches 10 percent. The HKMA, on the other hand, may transfer part of its earnings, without being required to do so. In Lithuania, most of the reserves are retained for various funds and only the excess is transferred as in Estonia, where distributable profits are determined after increases to statutory and reserve capital. These four countries, Bosnia and Herzegovina, Estonia, Hong Kong SAR, and Lithuania, are assigned a value of ¼ on subcriterion 5.d. The other two countries, Argentina, and Bulgaria, obtain a score of zero.

Table 6. Accountability and Transparency

6. Accountability and Transparency	THEORETICAL BENCHMARK	MINIMUM REQUIREMENT
6.a Accountability	Required and detailed in statute = ½	No statutory reference = 0
6.b Transparency	Detailed data disclosure = ½	Publications of a general nature = 0
Range of values for criterion	1	0

All the CBAs except for one satisfy the accountability and transparency criteria when proxied by reporting requirements and data dissemination. All the statutes require the publication of economic data on a timely basis, and some even set out reporting procedures. The notable exception is Hong Kong SAR, although it is the CBA with the most information on monetary and financial policies made readily available to the public. Since the index examines statutory features, Hong Kong SAR is attributed the value of zero while the other frameworks obtain the full value of ½ under criterion 6.a, accountability. Transparency standards are observed by all the CBAs in the sample. Where CBAs have adhered to Fund standards of data dissemination and codes of good practice, they may be judged to be in conformity with subcriterion 6.b. The only exception in this respect is Bosnia and Herzegovina, but extensive disclosure of monthly financial statements in the press, the presentation of quarterly accounts to the Presidency and detailed annual reports also justify a full value on this criterion.

Table 7. Escape Clauses

7. Escape Clauses	THEORETICAL BENCHMARK	MINIMUM REQUIREMENT
7.a Regime revocation arrangements	No discretion, strict requirement of parliamentary ruling = ½	No direct reference = 0
7.b Exit issues and escape clauses	Clear or implied time horizon and specified contingencies = ½	Open-ended commitment without exit details = 0
Range of values for criterion	1	0

Regime revocation arrangements are specified in three of the statutes, but none of the CBAs include a clear escape clause. The review of the revocation and escape clause provisions implies that CBAs in this evaluation fall short of a permanent arrangement in the emerging markets under study. Indeed, Estonia and Lithuania have explicitly adopted the CBA in the process of their transition out of the ruble zone and toward EMU, while Argentina had originally sought to address a period of hyperinflation and limit contagion from regional spillovers. In Hong Kong SAR, in view of the uncertainty surrounding the return of the province to Chinese sovereignty, the CBA was also a product of its time. The conditions under which the exchange rate regime can be revoked are central to the credibility of the CBA, particularly in times of crisis. Most of the statutes limit the discretion of government to opt out of the CBA, by imposing a parliamentary ruling for any amendments except in Hong Kong SAR. The case of Lithuania is ambiguous as the statute provides for the exchange rate regime to be changed by the government in consultation with the central

bank. There are no detailed provisions relating to conflict resolution procedures. Accordingly, these two countries are awarded the value of zero with respect to feature 7.a, regime revocation arrangements. In Bulgaria on the other hand, only an Act of Congress or National Assembly could change the regime. The same applied to the legal framework previously in place in Argentina. In Bosnia and Herzegovina, although the CBA statute contains no such reference, Article IV. 4.a) of the Constitution sets out the legal basis for the responsibility of the Parliamentary Assembly for amending the statute. In Estonia, it is clearly stated that the CBA has no right to devalue the exchange rate. As regards the final subcriterion, none of the statutes specify clear escape clauses, and they are thus all assigned the value of zero. It may be noted, however, that exit issues feature in CBA discussions for the Baltic countries and Bulgaria, with reference to European Union accession, or in the case of Bosnia and Herzegovina, the eventual adoption of the anchor currency.

D. Discussion of Results

The table below shows the value attributed to each country according to the various subcriteria of statutory precommitment. It concludes with the overall value of the index obtained by each of the six CBAs.

Table 8. Results

Criterion	Argentina	Bosnia/ Herzegovina	Bulgaria	Estonia	Hong Kong SAR	Lithuania
1.a	0	¼	0	0	0	0
1.b	¼	¼	¼	¼	0	¼
1.c	¼	¼	¼	¼	¼	¼
1.d	0	¼	¼	0	0	¼
2.a	0	½	½	½	0	0
2.b	0	½	½	½	0	0
3	0	1	0	1	0	0
4.a	⅓	⅓	0	⅓	0	0
4.b	⅓	⅓	0	⅓	0	0
4.c	⅓	⅓	⅓	⅓	0	0
5.a	¼	¼	¼	¼	0	¼
5.b	¼	¼	¼	¼	¼	¼
5.c	¼	¼	¼	¼	0	¼
5.d	0	¼	0	¼	¼	¼
6.a	½	½	½	½	0	½
6.b	½	½	½	½	½	½
7.a	½	½	½	½	0	0
7.b	0	0	0	0	0	0
Index	0.54	0.93	0.62	0.86	0.18	0.39

Notes: Normalized value of the index defined as $\sum \omega_i \delta_{ij}$ where the weight ω assigned to each of the seven criteria i is equal to $1/7$ and the value assigned to each of the subcriteria j is binary, that is zero or $1/n$, n being the number of subcriteria in each of the seven criteria (as set out in Tables 1 to 7).

The range of normalized index values is a clear numerical illustration of prevailing cross-country differences in the statutory features underlying CBAs. The index values obtained by the CBA frameworks under study are interesting on a number of accounts, especially given the breadth of 0.75 between the minimum and maximum values obtained. Yet all the emerging markets under study are referred to as CBA countries in publications which classify economies according to their exchange rate regime. Studies which compare credibility issues across exchange rate regimes may thus lead to misleading conclusions if no account is taken of these differences. This is one reason why the analysis of this paper placed considerable emphasis on determining which statutory features are particularly relevant for exchange rate credibility (e.g., the quality of backing, alternative claims on reserves, autonomy in policymaking and revocation clauses).

The ranking of the index values highlights the incidence of country-specific factors in the choice between statutory and political commitment. The actual index value obtained by a particular CBA is of limited significance, other than in providing a quantitative measure to express its deviation from the theoretical benchmark. What is also interesting is that it provides information on how strict the CBA is, relative to the institutional framework adopted in the other countries. In this analysis, it was noted that CBAs serve to enhance the transparency of monetary and exchange rate policies. This may also be achieved through regular disclosure of data on monetary and reserve aggregates. It was also suggested that monetary authorities might reinforce public consensus on the suitability of the exchange rate peg through ongoing information campaigns, strengthening the credibility of the CBA through firm reiteration of their policy commitment. This may provide an alternative to the adoption of the strict CBA framework described in the literature.

The results may illustrate the premise that the stronger the need to impart credibility to exchange rate policy, the greater the likelihood of opting for a strict CBA framework. The example of Hong Kong SAR is particularly interesting in this respect. It is therefore not surprising that the index value which the HKMA obtains is the lowest of the sample. At the other end of the spectrum, the finding that the CBA in Bosnia and Herzegovina obtains the highest index value is consistent with expectations of this analysis regarding the tendency to opt for a stricter statutory framework for monetary stabilization in the context of post-conflict institution-building.

The results obtained on the individual components of the index also illustrate the source of various impediments to the automatic CBA adjustment mechanism. In spite of the focus on stabilization policy in Bulgaria, the index value is lower than that of Bosnia and Herzegovina and Estonia. This is principally on account of the fact that the nature of the CBA adjustment mechanism is not strictly automatic, as it would be under the theoretical benchmark. The overall index value for the CBA which was in place in Argentina until recently is also downgraded, due to the inclusion of domestic government securities within reserve assets. Finally, the score of the Lithuanian CBA is lower since it is penalized for not excluding the possibility of extending credit to banks and government, according to the present definition of the index.

IV. EXIT ISSUES

It is noteworthy that none of the CBAs under study explicitly resolve the uncertainty surrounding escape clauses. While the legislative review of the six emerging markets confirms that most of the statutes feature direct or indirect references to the basic provisions of CBAs, none of them clearly sets out how to exit from the regime. The lack of an escape clause is inherent in the objective underlying the establishment of CBAs, namely to achieve reputational gains and address the problem of dynamic inconsistency. Indeed, a CBA statute which ties the hands of the monetary authorities while providing them with a loophole is unlikely to impart credibility. The following paragraphs examine the dynamics of monetary policy credibility over the lifetime of the CBA to recommend the timing and procedures for an orderly exit.

The way in which the economy of an emerging market country evolves following the establishment of the CBA will impinge upon the circumstances in which the arrangement may be abandoned. In the best-case scenario, with market expectations converging on an equilibrium of noninflationary growth, the discipline enforced by the CBA may appear to be unnecessary. Furthermore, once financial markets and institutions are consolidated, constraints may not be as relevant since discretionary policy will tend to be less harmful. Indeed, the lower the effects of a devaluation on inflationary expectations, the higher the credibility of monetary policy.

The dynamics of exchange rate credibility suggest that the probability of a devaluation is at its lowest in the early phase of a CBA. This corresponds to a “honeymoon” period, provided the statutory framework is robust and the underlying economic policies are supportive. The market recognizes that the monetary authorities, having invested in a reputation-enhancing institutional framework, have a strong incentive to sustain it. Should a speculative attack be successfully averted by the CBA, its credibility will be further strengthened. The credibility of a commitment to a fixed exchange rate is greater, the higher the cost of abandoning the peg. Since small open economies would tend to have a rapid pass-through of a nominal devaluation to domestic prices, the market perceives the government’s willingness to defend the peg, over an above signals conveyed by statutory precommitment.

In a worst case scenario, the weaknesses of the CBA economy might become increasingly apparent once the honeymoon period comes to an end. Yet, the longer a currency stays on an inappropriate peg, the more costly it is to devalue. Furthermore, if the burden of adjustment imposed on the real economy is perceived as being too high a price to pay for exchange rate stability, the currency risk would be so high as to become self-validating.²⁶ In this case, should the monetary authorities wish to pursue their quest for exchange rate stability, they have no other option but to raise the stakes and adopt

²⁶ The literature on speculative attack models suggests that if the perceived cost of adhering to a fixed exchange rate is prohibitive, expectations of a devaluation may become self-fulfilling, particularly in the absence of a sustainable fiscal policy and a sound banking system.

dollarization or a common currency. A shift to a weaker reserve currency might also temporarily address exchange rate misalignment and reverse capital outflows. Such a change in reserve currency would need to be properly designed to avoid further undermining credibility further, since it is essentially a breach of the CBA provisions.

Even in a best case scenario of supportive fundamentals, adopting greater exchange rate flexibility may provide a trigger point for a speculative attack. Monetary authorities may wish to seize the window of opportunity provided by expectations of an exchange rate appreciation, and engineer the transition to a more flexible exchange rate regime. However, the exit from a CBA cannot be thrust upon the public by surprise, due to the legal constraints on amending the statutory framework. A transition period, with a known trigger point for the repeal of the convertibility provisions, might provide for capital gains in the foreign exchange market. The currency crisis literature suggests that this would lead to a run on domestic assets.

Whether or not it is contained depends on the efficiency of the financial intermediation process and the adequacy of foreign reserves. The authorities can prepare for this eventuality by limiting the monetization of reserve inflows through, for instance, higher reserve requirements in the months preceding the exit. Combined with the establishment of contingent credit lines, the additional reserve holdings thereby generated may serve to avert the run on the currency.

A number of conditions must be satisfied in the financial system and the real economy prior to an orderly exit from the CBA. The financial sector must be able to cope with the prospect of a temporary liquidity crunch, the buoyancy of economic activity must not be undermined by high interest rates, domestic savings ratios should be high enough to compensate for limited access to international finance, and unit labor costs must be low enough to uphold competitiveness in the face of an appreciating real exchange rate. Even if economic conditions such as these were to be satisfied for a period long enough to allow for a repeal of the CBA statute, there still remains the possibility of an adverse exogenous shock. A devaluation of the currency of a major trading partner, or a shift in investor perceptions regarding emerging markets' outlook, would clearly exacerbate the operational difficulties of a smooth exit.

The difficulty of upholding pegged but adjustable regimes suggests that post-CBA monetary and exchange rate policy would need to provide alternative anchors for expectations. Monetary and inflation targets may be adopted instead, provided certain institutional prerequisites are met. The latter include the achievement of a sound central banking experience, with in particular, stable and effective monetary policy instruments, an in-depth knowledge of the monetary transmission mechanism, and an efficient system of financial intermediation with sound reserve and liquidity management.

V. CONCLUDING REMARKS

This paper has discussed the workings of CBAs, placing an emphasis on the implications of institutional design for the achievement and maintenance of credibility. It suggests that it is beneficial for policymakers seeking to avert currency or financial market pressure to pay particular attention to details of the institutional design at the basis of exchange rate stability. It appears from the review of statutory frameworks in the six countries under study, that the automatic nature of the adjustment mechanism at the heart of CBA is not always allowed to operate. Indeed, an in-depth examination of the supporting legislation and the operating procedures for monetary and exchange rate policies reveals that the regimes adopted by sample emerging markets deviate considerably from the theoretical blueprint for a CBA.

A number of policy insights may be derived from a review of CBA institutional design. Emerging markets may wish to strengthen the resilience of their economies to external shocks by striving to enhance the credibility of monetary and exchange rate policies. CBAs may be one way of achieving this, since they are institutional frameworks exclusively directed toward safeguarding the value of their currencies. Throughout the discussion, a strong emphasis was placed on the overall consistency of the underlying economic policy framework, without which any fixed exchange rate regime would soon become unsustainable. Indeed, clear signals of political commitment to a CBA might boost credibility and provide some breathing space in a crisis situation. In the absence of fiscal consolidation and structural reforms, however, fixing the exchange rate may impose a prohibitive cost on the real economy. This would render the peg inappropriate, thereby dissipating any credibility gains. In this case, there is a need for pragmatism in determining the optimal degree of precommitment to a fixed exchange rate regime. Indeed, successive attempts to create excessive credibility by increasing commitment to an inappropriate peg may turn out to be very costly if the strategy ultimately fails.

WORKINGS OF A CURRENCY BOARD: THE THEORETICAL BENCHMARK

Definition

At the basis of a currency board arrangement is a legislative commitment to exchange domestic currency for a specified foreign asset (currency or commodity) at a predetermined fixed exchange rate, on demand.

Basic features

The choice of the reserve asset backing monetary liabilities is determined according to a number of country-specific factors. A currency board may opt for a peg to a single currency, preferably a strong or reserve currency, the currency most used for international transactions or that of its main trading partner. In determining the reserve asset at the basis of the arrangement, the authorities may select a commodity, such as gold, or a basket of currencies or commodities, instead of choosing to peg to a single foreign currency. Of course, the more complex the arrangement, the less transparent it will be. The choice will depend on the structure of the country's economy, its patterns of trade, and its degree of openness. The currency to which the CBA is linked tends to be issued by a country with which there is substantial foreign trade, as emphasized by Schwartz (1992). The currency board also gains from being linked to a stable reserve currency. Had Estonia chosen to tie its kroon to the Swedish krona, as was initially suggested, it would probably have been to the detriment of economic stability, in view of the subsequent turmoil in the exchange rate mechanism (ERM). The deutsche mark turned out to be a much more stable option for the Estonian currency board at that time.

The dual currency board proposal

Pegs to a single currency may not be a viable solution for economies with a number of major trading partners. This is especially the case if the reserve currency tends to fluctuate in relation to that of the other trading partners of the CBA country. The issue of diversified external trade patterns is addressed in the dual currency board proposal of Oppers (2000). The use of a trade-weighted basket, however, apart from the implied loss of transparency, would render the management of convertibility more complex since it lacks a clear benchmark. A procedure would be required to review the weights of the basket over time, in line with the evolution of cross rates. In Oppers's example, the dollar and the euro are combined as reserve currencies. When the former currency appreciates above a certain level, convertibility is based on the latter instead. This may circumvent a loss of competitiveness when the currency board currency is pegged to an appreciating reserve currency.²⁷

²⁷ The downgrading of Argentine credit ratings subsequent to the shift to a dual peg is suggestive of a cost associated with adjusting the institutional framework in terms of lost simplicity and transparency.

Both appreciating and depreciating reserve currencies impose a cost on the CBA. The primary cost of an appreciating reserve currency is the overvaluation of the currency board real exchange rate. It may be noted however, that pegging to a depreciating reserve currency is not without its drawbacks. A lower real exchange rate is not necessarily less volatile, since this would depend on trade shares of various currencies and their covariances. Two additional drawbacks relate to interest rate and inflation dynamics associated with depreciating currencies. In a dual currency board, the convergence of interest rates would shift from one currency to the other, and display dynamics comparable to those of a target zone.²⁸ Oppers claims that higher interest rates obtained from pegging to a more depreciated reserve currency would be offset by lower risk premia, compared to those associated with an overvalued real exchange rate.

The backing provided by reserve assets

The form and extent of asset backing required is a determinant factor in the effectiveness of a currency board. The monetary authority is bound to back any domestic currency issues with holdings of reserves or short-term interest-bearing assets, denominated in the currency to which the exchange rate is pegged. Although this represents a departure from the strict CBA model, where domestic issues are to be converted into foreign currency on demand, foreign currency-denominated bonds may be accepted and paid out instead of hard currency notes and coins. If the initial holding of foreign currency-denominated reserves so permits, and there is a perceived need to impart full credibility to the currency board arrangement, the degree of backing of domestic currency will be at least one hundred percent. It is to uphold the convertibility commitment that the degree of backing by reserves should cover a substantial value of the outstanding liabilities (notes and coins in circulation).

In order to guard against contingencies such as bank failures, holding surplus reserves is also beneficial. When the exchange rate is set above market-clearing levels (i.e., it is undervalued), the required foreign reserve backing is reduced. In addition, a margin for future real exchange rate appreciation is provided for, avoiding the need to resort to inflation as a mechanism for achieving the required real appreciation.

Monetary authorities wishing to set up a currency board must consider the possibility of startup problems and the constraints imposed on the financial system. This situation arises from gathering sufficiently hard currency to back the entire money supply. In spite of providing the assurance of convertibility at a fixed rate, a crisis might erupt in the financial system if reserves are insufficient to cover a broader monetary aggregate. Banks are then called upon to ensure the convertibility of their demand deposits. If credit lines prove inadequate, the fact that the currency board is unable to intervene may exacerbate the

²⁸ Reference is made to the Krugman (1979) smooth pasting effect as the exchange rate approaches the boundaries, since economic agents know when the shift from one reserve currency to the other will take place.

difficulties of the financial sector. The loss of the lender-of-last-resort function may thus be an acute drawback in the event of a liquidity crisis.

Currency board profit considerations

CBA profits are derived from the difference between the interest on the securities that it holds and any expenses incurred in the issue and management of domestic currency.²⁹ These profits are usually transferred to government, in excess of the level required to build up foreign reserves to the required proportion of backing by the board. A margin of profits may also be maintained by the currency board in the form of an equity reserve to cover possible losses in the value of its reserve asset holdings. In principle, handling costs can be kept low if the board chooses to establish a minimum amount for transactions, thereby restricting dealings to large amounts of foreign exchange while allowing smaller amounts to be transacted through the banks. None of the currency boards surveyed, however, have established such arrangements. Estimates of the running costs of a CBA generally approximate 1 percent of CBA assets.³⁰

Money dynamics under currency boards

Market forces essentially dictate the amount of notes and coins issued. The supply of reserves is determined either by the reserve country or by the producers of the commodity to which the exchange rate is pegged. The currency board acts only as a warehouse, and the only way of obtaining additional reserves is to run a trade surplus. The distribution and demand for reserves is determined by the nature of competition between banks within the currency board setup. Changes in money demand are accommodated by endogenous changes in international reserves instead of variations in net domestic assets, as would be the case in a central banking framework. Thus, domestic interest rates are determined by local market adjustments to monetary conditions prevailing in the reserve currency country. In cases where the credibility of the currency board arrangement is at stake, due to the danger of political interference, there is a distinct possibility of an in-built risk premium in local interest rates. Interest rates can also be subject to a differential as a result of bank inefficiency or credit risk.

Setting the exchange rate peg

The level at which the exchange rate is fixed has important implications for the operations of a CBA. This is particularly the case for an undervalued currency. It may have inflationary consequences that undermine any associated gains in export competitiveness.

²⁹ Profits may also be computed as a product of the money base and the rate of inflation. Since the monetary aggregate depends on the required reserve deposit ratio, currency board profits may be increased by adjusting the ratio upwards.

³⁰ Estimate drawn up by Hanke and Schuler (1991).

Operational difficulties may also arise if the CBA country is at a different business cycle stage relative to the reserve country, bringing timing issues to the forefront. If a currency board is introduced to limit exchange rate depreciation in a context of crisis, pressures induced by a speculative attack may have resolved any prior overvaluation. Nominal depreciation is not permissible within the parameters of the currency board, which results in slower convergence of domestic and international price levels. Overvaluation must therefore be addressed (correcting misalignment by devaluing at a rate consistent with market forces) prior to the establishment of the peg, especially under high inflation.

Various methods for identifying the equilibrium real exchange rate are advocated in the literature. One may consider the purchasing power parity approach, the estimated structural monetary and portfolio balance models, the underlying balance approach, or a “consensus” based on estimates derived from various models. In the absence of a devaluation, severe exchange rate misalignment may tend to be remedied by tight liquidity. A tight policy stance can exacerbate unemployment and undermine the very sustainability of the exchange rate regime. The appropriateness of the currency board arrangement will, therefore, also depend on measures such as the degree of wage and price flexibility, and the sustainability of government finances. For example, the choice of the exchange rate peg set in Estonia and Lithuania was determined by the pressing need to impart credibility to the currency board arrangement.³¹ An undervalued real exchange rate was likely to cause a disequilibrium in the goods market during the transition period preceding convergence to European levels of inflation. In the Baltic countries, however, overvaluation was limited due to high rates of productivity which maintained domestic competitiveness and facilitated relative price adjustment while foreign direct investment continued.³² The manner in which public perceptions of economic policies evolve, following the establishment of the peg, is critical for the duration of the transition period. Convergence may be slowed down if the government’s resolve to cut budgetary expenditure is perceived to weaken, leading to wage claims, premia on domestic prices and interest rates, as well as reduced demand for domestic currency.

The price-specie flow adjustment mechanism

The CBA provides for payments adjustment in the same manner as a gold standard price-specie-flow mechanism. In the event of a balance of payments deficit and a fixed exchange rate, money supply declines as the private sector converts its domestic currency holdings into foreign reserves so as to settle import transactions. The resulting rise in interest rates serves to attract capital inflows. The higher interest rates also exert deflationary pressures by reducing domestic absorption, which improves the current account. Another way to address the deficit and avoid a contractionary effect is to tap sources of foreign

³¹ The issues faced by the currency boards in the Baltic countries are discussed in Berengaut and others (1998).

³² The absence of indexation mechanisms, flexible labor markets and low labor costs were also determinant factors in this case.

reserves such as FDI or portfolio investment, and thus rely on growth to equilibrate the balance of payments. In the original adjustment mechanism, however, if prices are downwards flexible in responding to reduced domestic demand, export competitiveness will also be improved. This allows output to reach a full employment level, resolving the balance of payments deficit through deflation³³.

Such an adjustment hinges upon two additional features of currency board systems.

The first is the automatic reduction in money supply when the balance of payments is in deficit. This does not hold true when monetary authorities attempt to sterilize the reserve outflow. The second is the underlying assumption of wage and price flexibility. If this is absent, the (nominally) fixed exchange rate will be overvalued in real terms. As a result of tighter money supply, interest rates rise, forcing a contraction in the economy. The larger the price fall to restore equilibrium, the smaller the fall in output. Labor market flexibility is also important in the event of an external shock such as, for instance, an increase in the price of a vital imported commodity. This is due to the absence of an exchange rate depreciation as a mechanism for adjusting relative prices. If the government's commitment to the fixed exchange rate is fully credible, wage and price setters would eventually adjust their strategies to incorporate expectations of low inflation in order to remain competitive. Inflation persistence might still arise due to the prevalence of overlapping contracts or forms of indexation.³⁴

Balance sheet issues

The CBA balance sheet is that of “an institution that issues base money solely in exchange for foreign assets, specifically the reserve currency.”³⁵ The excess of highly liquid and interest bearing reserve holdings of the currency board over its issues of non-interest-bearing liabilities constitutes its net worth, as indicated in Figure 1 below. Base money consists of notes and coins (“cash”) and may also include part, or all of, the reserves held by commercial banks. In a ‘pure’ currency board, unlike a central banking system, commercial banks may be required to hold their reserves (other than vault cash) in foreign currency. When the banks face a shortage of vault cash, they would sell some of their foreign currency holdings to the currency board.

Central banks differ from the “pure” currency board in that part of their assets is domestic, including government debt. This implies that central banks tend to have higher ratios of broad money to foreign reserves because of this partly domestic backing of base

³³ Prolonged deflation is not without costs however, in view of its effects on the real value of debt, and the vulnerability of the banking system to corporate bankruptcies. Deflation under a currency peg may not be easier to achieve than a real exchange rate depreciation would be under floating.

³⁴ The extent of inflation inertia may be illustrated by examining the time it takes inflationary expectations to converge to the credible fixed exchange rate equilibrium.

³⁵ Williamson (1995), p. 2.

money. In addition, central banks can discount commercial bank assets, and in so doing expand the monetary base, in the same manner as when reserves are purchased. Purchasing domestic assets in the course of a sterilization effort is intended to offset the decline in base money as a result of the sale of reserve assets in support of the exchange rate.

The monetary policy pursued by the currency board is automated. Base money increases when the commercial banks wish to convert their reserve holdings into cash, either as a result of changes in money demand or in a situation of a trade surplus. Conversely, the monetary base shrinks when banks exchange their cash for foreign reserves so that their clients may finance their imports in the event of a trade deficit. Money supply is therefore exogenous under a currency board as opposed to it being a policy instrument in the hands of the central bank.

Table A1. Comparison of Currency Board and Central Bank Balance Sheets

i. Currency Board balance sheet		
<u>Assets</u>	<u>Liabilities</u>	
Liquid reserve currency assets	Cash	} = M0 /
	(Deposits of commercial banks)	} Base money
	Net worth	
ii. Central Bank balance sheet		
<u>Assets</u>	<u>Liabilities</u>	
Liquid reserve currency assets	Cash	} = M0 /
Domestic assets (including government debt)	Deposits of commercial banks	} Base money
	Net worth	

Convertibility is guaranteed since the CBA should always be in a position to meet foreign exchange requirements when the private sector wishes to convert its cash holdings. A central bank, on the other hand, may be unable to immediately convert its entire holdings of domestic assets, be they claims on commercial banks or government paper. In practice, coverage of base money alone is insufficient to stem a bank run. In the event of a loss of confidence, depositors will seek to convert their demand deposits into the reserve currency so as to guard against any financial loss. It follows that it is up to the commercial banks to ensure the convertibility of demand deposits, either by holding sufficient foreign reserves or by establishing credit lines with international banks. Since the reserve currency and the domestic currency are for all intents and purposes substitutes, the government could encourage banks from the reserve country to set up branches or affiliates in the domestic banking sector, provided that the regulatory framework is compatible. Prudential supervision and licensing requirements enforced in the home country would thus have to be brought in line with those of the reserve country. Under a “pure” CBA, banks would be required to draw on their deposits at the currency board. Otherwise, a financial crisis could escalate since the currency board is not in a position to bail the banks out in the manner of a lender of last resort.

Even in its pure variant, the currency board can still experience severe pressure in the event of a bank run. This is due to the fact that as banks run down their currency board

deposits to meet their depositors' requirements, they are constrained to replenish their reserves by liquidating assets and cashing in their outstanding loans. At higher levels of interest rates such actions carry the risk of a credit crunch. Since the currency board as such is unable to provide the required liquidity, it may limit the damage by temporarily relaxing commercial banks' reserve requirements or turning to the international money markets in the event of financial market pressure. Convertibility may thus turn out to be quite costly for the currency board unless special arrangements are instituted. These include the holding of excess reserves earmarked for this purpose or the imposition of additional discipline on commercial banks. An independent monetary agency may also be set up to provide discount facilities for banks. Provided that the latter does not hold domestic assets the convertibility upheld by the currency board will not be undermined by the provision of emergency liquidity to the financial sector. This is illustrated below with reference to the balance sheets and money multipliers of a currency board with and without a monetary agency.

Money multipliers

Osband and Villanueva (1993) illustrate the workings of a currency board balance sheet. They assume that the introduction of a monetary agency is designed to respond to the market's need for liquidity. Figure 2 below illustrates the balance sheet of the banking system both with and without the monetary agency.

Table A2. Banking System Balance Sheet With and Without a Monetary Agency

i. Banking system balance sheet under a Currency Board	
<u>Assets</u>	<u>Liabilities</u>
Liquid holdings of reserve currency	Deposits
Deposits at the Currency Board	
Vault cash	
Loans and Securities	
ii. Banking system balance sheet with the introduction of a Monetary Agency	
- Monetary Agency -	
<u>Assets</u>	<u>Liabilities</u>
Cash holdings	Reserves deposited by banks
Net foreign assets	
Reserves borrowed by banks	
- Commercial Bankis -	
<u>Assets</u>	<u>Liabilities</u>
Vault cash	Deposits
Net foreign assets	Reserves borrowed from Monetary Agency
Loans and securities	
Reserves deposited at Monetary Agency	

The creation of a monetary agency does not affect the ratio of broad money to the monetary base since the agency does not hold domestic debt and government paper. As in the case of a

currency board, the money multiplier, as derived below, will be lower than that of a central bank. In order to define the money multiplier, base money is defined as:³⁶

$$M0 = CH_{nbp} + RES_{bks}^{cb} \quad (1)$$

That is the sum of currency holdings (CH) of the nonbank public (nbp) and reserves (RES) of the commercial banks (bks) held at the currency board (cb). The latter can be expressed in terms of deposits (DEP) with reference to a required reserve ratio denoted rr :

$$RES_{bks}^{cb} = rr(DEP) \quad (2)$$

Broad money is:

$$M1 = CH_{npb} + DEP \quad (3)$$

If $M1$ is expressed in terms of deposits, and a ratio c is set as the proportion of money held in cash, the following identity is obtained:

$$DEP = M1 - c(M1) \quad (4)$$

In the definition of $M0$ currency holdings are re-expressed as the proportion of $M1$ money not held in deposits, and replaced in (2) to obtain:

$$M0 = c(M1) + rr(DEP) \quad (5)$$

The money multiplier is given by:

$$mm = M1/M0$$

Substituting from (5) yields:

$$mm = 1 / (c + rr(1-c)) \quad (6)$$

The larger the nonbank private sector's holdings of currency,³⁷ or the higher the share of c in $M1$, the less reserves available to the banking system. The limited availability of reserves restricts banks' advances to its client base. As a result, the money multiplier is smaller. Similarly, the higher the required reserve ratio, the tighter is liquidity and the smaller is the money multiplier. Deriving the balance sheet identities so as to re-express the money supply in terms of credit created and reserve backing highlights the potential for greater monetary expansion by central banks, as against strict CBA frameworks. This is due to the inclusion of net domestic assets (NDA), as illustrated in Figure 3.

³⁶ Superscript denotes 'at' and subscript denotes 'of.'

³⁷ As a result of financial innovation, a smaller proportion of money is held in cash.

Table A3. Balance Sheet Identities 1/

<p><u>i. Currency boards (with bank required reserves)</u> CBA: $FR = CH_p + CH_{bks} (+ RES^{cba}_{bks})$ Bks: $(RES^{cba}_{bks} +) L\&S + CH_{bks} + NFA_{bks} = DEP$</p> <p><u>ii. Banking system with a monetary agency</u> MA: $CH_{ma} + NFA_{ma} + BOR^{ma}_{bks} = DEP^{ma}_{bks}$ Bks: $DEP^{ma}_{bks} + L\&S + CH_{bks} + NFA_{bks} + RES^{cb}_{bks} = DEP + BOR^{ma}_{bks}$</p> <p><u>iii. Central bank with holdings of domestic assets and monetary agency functions</u> CB: $FR + NFA_{ma} + NDA_{ma} + BOR^{ma}_{bks} = CH_p + CH_{bks} + RES^{cb}_{bks}$ Bks: $RES^{cb}_{bks} + L\&S + CH_{bks} + NFA_{bks} = DEP + BOR^{ma}_{bks}$</p> <p>1/ As above, superscript denotes 'at' and subscript denotes 'of'. Abbreviations are as follows: <i>FR</i> is foreign reserves, <i>NFA</i> is net foreign assets, <i>L&S</i> is loans and savings, <i>BOR</i> is borrowing, <i>cba</i> is currency board arrangement, <i>ma</i> is monetary agency and <i>p</i> is public.</p>
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In a CBA framework with a monetary agency, money supply is $M = CH_{nbp} + DEP$. If the balance sheet identities of Figure 3 (i) and (ii) are consolidated, the liabilities side expressed in terms of ratios to deposits (in lower case), while retaining the components of the money base, money supply under a currency board and a monetary agency can be re-expressed as follows: $[(ch_{nbp} + 1) / (ch_{nbp} + ch_{bks} + res - bor)] * (FR + NFA_{ma})$ (7)

Monetary expansion is likely to be smaller under a currency board, contributing to its credibility and to the stabilization of inflation expectations. This is shown in the expressions for the money multiplier and the money supply and may be illustrated with reference to the CBA money supply expressed in (7). For a central bank, reserve backing increases with the addition of NDA_{ma} to the last term from the right. Hence a central bank would possess a greater capacity to expand the money supply on the basis of its net assets. Furthermore, the exclusion of domestic asset holdings from the balance sheet of a currency board imposes a tighter financing constraint on the government. Indeed, monetary liabilities can only be issued on the basis of increased foreign reserve holdings. Only foreign reserves are included in assessing the credibility of a currency board, since the liquidation of domestic assets may be problematic during a balance of payments crisis.

Including a monetary agency under a currency board does not alter its expansionary capacity. The extension of credit remains backed by foreign assets, while it may ease temporary liquidity constraints faced by the banking system. Otherwise, the principal monetary policy instrument at the hands of the currency board is the required reserve ratio. It would, therefore, also be relevant to examine domestic credit creation in assessing currency board credibility. Since base money growth is constrained by increases in reserves, bank credit would provide additional information on monetary dynamics under a currency board.

Liquidity management and the clearing system

In the day-to-day liquidity management by banks, automation in clearinghouse activity and the advent of RTGS (real-time gross settlement systems) reduces the importance of the market for settlement funds. Henckel, Ize, and Kovanen (1999) discuss the implications for the operations of currency boards, of the declining proportion of central bank settlement balances in total payment transactions. As currency and settlement balances shrink, their coverage by reserve currency holdings becomes largely irrelevant, and broader monetary aggregates must be considered. Economists have suggested that interest rate instability in the currency board systems which refrain from lending operations may increase as a result of clearinghouse participants borrowing intraday and leaving the market short. This is especially acute in the absence of foreign interest rate arbitrage acting smoothly enough to reverse such activities.³⁸ The establishment of end-of-day liquidity support or the use of repurchase facilities for banks would, therefore, be recommended. This option is reflected in technical measures adopted by the Hong Kong Monetary Authority (HKMA). The issue is the correct setting of a repurchase rate in the interest of the international reserves position. In this case, the definition of the monetary base may be broadened to include fully backed commercial bank required reserves with the currency board, or bills issued by the board to provide additional settlement balances for banks.

The broader is the definition of monetary liabilities, the stronger the undertaking of convertibility. The HKMA³⁹ recommends that the definition of money be comprehensive (so as to cover all forms of payment that can be used to settle transactions), that it be practical (so as to enable the authorities to exercise effective control over the quantity or price of money), and that it be featured on the balance sheet of the monetary authority. It also suggests a revision of the traditional currency boards' focus on currency notes. This is due to the fact that large transactions are increasingly effected through electronic means, involving payments between banks on behalf of their customers and the clearing of checks. Yet, the backing of currency in circulation remains central to the maintenance of confidence for the general public. When the monetary base comprises balances held in the banks' clearing accounts at the CBA, the latter would also be responsible for the interbank clearing system. The HKMA also recommends real-time settlement to minimize the need for end-of-day liquidity support from the currency board. It suggests that the board be responsible for clearing and that liquidity be provided only against collateral and at penalty rates; otherwise base money might be created without an increase in reserves.

³⁸ Reference may be made to the events of 1998 in Hong Kong SAR when speculators affected stock prices by inducing money market rates to rise and the HKMA intervened in clear breach of its proclaimed laissez faire approach.

³⁹ In its website and the information leaflets it provides on the CBA.

If the financial system is efficient, the balances held at the currency board are likely to be small, and the resulting leverage may lead to unnecessarily sharp fluctuations in interest rates which would put undue pressure on banks. There are opportunities for arbitrage when market rates deviate from the parity through deposits and withdrawals of currency notes against credits and debits of the clearing accounts of banks, unless the convertibility undertaking extends also to currency notes. This is a particularity in the form and extent of convertibility upheld in Hong Kong SAR's CBA. Indeed, the HKMA suggests that banks could also provide for the convertibility of their customers' deposits since they have clearing accounts at the currency board which are fully backed by foreign reserves. The extent to which banks will allow their customers to withdraw large amounts of currency notes against their deposit balances is limited. This is particularly the case if the exchange rate is weaker than parity. In obtaining currency notes for their customers in exchange for foreign reserves the banks may consequently have to impose a fee reflecting this exchange rate differential.

Table A4. Legislative and Regulatory References

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