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To: Members of the Executive Board
From: The Secretary
Subject: **Liquidity Management**

Attached for consideration by the Executive Directors is a paper on liquidity management, which is tentatively scheduled for discussion in an Executive Board seminar on **Wednesday, May 17, 2004**. Issues for discussion appear on pages 26 and 27.

The staff proposes publication of the paper after the Executive Board completes its discussion, together with a Public Information Notice summarizing the Board's discussion.

Questions may be referred to Mr. Desruelle, PDR (ext. 34373) and Mr. Blancher, ICM (ext. 36525).

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INTERNATIONAL MONETARY FUND

Liquidity Management

Prepared by the Policy Development and Review Department
(In Consultation with Other Departments)

Approved by Mark Allen

April 22, 2004

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EXECUTIVE SUMMARY

Building on the Fund's recent work on crisis prevention, including balance sheet analysis, this paper discusses the roles of, and interactions between reserves, public debt management and private liability management in limiting liquidity risks. It reflects on the level of reserves needed to help countries cope with external shocks taking into account both potential sources of pressures on reserves and institutional conditions that may alleviate such pressures. It also provides further considerations on sound liability management by both the public and private sectors, which can help reduce the need for foreign exchange reserves.

Reserve adequacy

From a crisis prevention perspective, the chief role of reserves is to maintain a liquidity buffer that allows time to absorb shocks. Since holding reserves is costly, reserve adequacy assessments must be based on a clear understanding of the key factors that affect the likelihood and magnitude of such shocks. Some of these factors have long been identified: imbalances in the external current account, public external debt payments in foreign currency, and an exchange rate commitment. Recent experiences show that a wider range of liabilities can also generate substantial reserve pressures including, as highlighted under the balance sheet approach, foreign currency-linked obligations between residents.

The paper proposes to enhance the Fund's approach to reserve adequacy, whose starting point is the ratio of short-term external debt to reserves. More systematic consideration of augmented ratios of foreign currency liabilities to reserves could help focus the analysis of reserve adequacy on risks stemming from these liabilities. Rolling liquidity analyses, consisting in projecting reserve coverage ratios under alternative scenarios, could also provide useful information on reserve adequacy. Lastly, reserve adequacy assessments should give explicit consideration to key policy and institutional arrangements, including the exchange rate regime, the existence and nature of capital controls, public debt management, financial sector supervision and regulation, and corporate governance.

Liability management

One important lesson from recent capital account crises is that not only the level but also the structure of public debt can create major vulnerabilities in a country's aggregate balance sheets. In practice, many countries cannot issue long-term debt in domestic currency, and are exposed to currency and maturity/rollover risk. The Fund's economic analysis and policy advice thus need to take account of the potential macroeconomic implications of public debt management and the key trade-offs involved:

- Issuing foreign currency debt is especially risky in countries where there are signs of exchange rate overvaluation, the exchange rate has been volatile, or in relatively closed economies. However, it poses less risks in countries with adequate liquidity cushions, sound debt maturity structures, and potential for long-term currency appreciation.

- Issuing short-term foreign currency debt, which combines currency and maturity risk, heightens crisis vulnerabilities and should preferably be avoided. When undertaken, it should be hedged through foreign exchange reserve backing.
- Lengthening maturities to reduce rollover risk and insulate public debt service from interest rate shocks, is in principle desirable unless there is a risk that it undermines public solvency.
- More generally, strategies to progressively improve the public debt structure, e.g., through inflation indexation or by gradually increasing the interest rate resetting periods on floating-rate debt, can help reduce liquidity risks if pursued in the context of fiscal adjustment that strengthens public solvency.

Recent crises have also demonstrated that significant private sector exposures to interest, rollover, and exchange rate risks may either result in large public liabilities or undermine the authorities' ability to implement interest and exchange rate adjustments required to respond to external shocks without large reserve losses. Here, too, the Fund's analysis and advice needs to take account of macroeconomic risks from private liability management and the benefits of appropriate buffers and hedges in private balance sheets. In particular:

- Combined maturity and currency mismatches in the banking system need to be carefully regulated and subject to strict disclosure requirements as they can generate claims on reserves.
- Indirect currency risk embedded in banks' loan portfolios requires to complement limits on banks' open currency positions with close monitoring of, or limits on, their foreign currency lending and disclosure of mismatches in the corporate sector.
- As interest rate risk is often a key source of vulnerability of the corporate sector, and indirectly the banking sector, indicators of interest coverage, capital structure, and profitability for the non-financial corporate sector warrant close monitoring.

Avenues for further work

The paper highlights the need to enhance the availability of detailed data on the structure of public debt and assets and liabilities of the banking sector. It also points to various analytical issues that may deserve further consideration, including the reconciliation of data on public debt stocks, deficits, and valuation changes, as well as further work on cost-benefit analyses of reserve accumulation.

I. INTRODUCTION

1. **Past and recent experiences across the Fund membership underscore the importance for crisis prevention of building strong liquidity cushions to withstand periods of stress.** Maintaining the ability to intervene in foreign exchange markets and to meet debt service payments in the face of various shocks, and being able to convince market participants of this ability, can indeed reduce the likelihood or severity of external crises.
2. **Country experiences also highlight the importance of assessing foreign exchange liquidity from a broad perspective.** Liquidity cushions comprise not only official foreign exchange reserves but also features of public debt structures and private liability management that help absorb, or provide protection against, shocks. More broadly, institutions, regulatory and supervisory regimes, and macroeconomic policies play a key role in external shock absorption.
3. **Seeking to provide this broad perspective, this paper discusses three related issues: reserve adequacy assessments; the role of public debt management in limiting potential liquidity pressures; and the impact of private liability management on potential liquidity drains and related policy implications.** The main objective of the paper is to help strengthen the Fund's policy advice on reserve adequacy and debt management. The paper offers further guidance on the level of reserves needed to help countries cope with external shocks, taking into account potential sources of pressures on reserves from domestic and external liabilities and institutional conditions that may alleviate such pressures. It provides further reflections on sound liability management by both the public and private sectors, which can help reduce the need for foreign exchange reserves.
4. **A key message of this paper is that foreign exchange reserve levels should reflect the state of domestic balance sheets as well as the soundness of domestic institutions—not that more reserves are always better.** Reserve adequacy assessments need to take account of the extent of maturity and currency mismatches (and especially *combined* maturity and currency mismatches) within sectoral balance sheets, and of institutional conditions that may alleviate risks arising from such mismatches (e.g., regulatory regimes that promote strong capital buffers or hedging of mismatches by private entities). Therefore, the Fund's approach to reserve adequacy can be enhanced by greater attention to measures of domestic sources of liquidity pressures and qualitative analysis of relevant institutional conditions. In addition, the focus on liquidity risk allows to draw out specific principles regarding the currency and maturity structure of public debt and private liabilities. Finally, by strengthening the analytical and empirical basis underpinning reserve adequacy analysis, the proposed approach also helps better assess the point at which reserve accumulation, which is costly, may become excessive.¹

¹ In its analysis of foreign exchange reserves, the September 2003 *World Economic Outlook* concluded that “reserves in emerging economies in Asia are now at a point where some slowdown in the rate of accumulation is desirable from both domestic and multilateral perspectives.”

5. **The paper relates to several strands of work, including the balance sheet approach to crisis prevention. As requested by the Executive Board, it also expands on previous analyses of reserve adequacy.** Reserve adequacy was discussed by the Board in 2000 and 2001.² Subsequently, the Executive Board requested that staff consider reserve adequacy in the context of a broader approach that would include management of both external and domestic debt.³ Other related topics previously discussed by the Board include the guidelines on public debt and foreign exchange reserves management, which primarily focus on institutional aspects; the balance sheet approach, which stresses the importance of balance sheet effects on macroeconomic developments; and dollarization, which highlighted the risks arising from currency mismatches in public and private balance sheets.⁴

II. RESERVE ADEQUACY

6. Following a brief review of the rationale for, and costs of, holding foreign exchange reserves, this section considers factors that may generate pressures on reserves as well as institutional conditions that may reduce the need for reserves. The section concludes with a discussion of operational implications.

A. The Rationale for, and Costs of, Holding Reserves

7. **Reserves are held by countries in order to meet a range of objectives.** These objectives vary according to each country's specific circumstances. Typically, reserves are held to limit external vulnerability by maintaining foreign currency liquidity to absorb shocks; provide a level of confidence to markets that a country can meet its external obligations, including the government's ability to repay its external debt; maintain confidence in policies for monetary and exchange rate management; and maintain a reserve for national disasters or emergencies.⁵

² See *Debt- and Reserve-Related Indicators of External Vulnerability* (SM/00/65, 3/23/00), and *Concluding Remarks by the Acting Chairman—Debt- and Reserve-Related Indicators of External Vulnerability* (BUFF/00/69, 5/9/00); and *Issues in Reserve Adequacy and Management* (SM/01/311, 10/16/01)

³ See *Summing Up by the Acting Chair—Approaches to Vulnerability Assessment for Emerging Market Economies* (BUFF/01/168, 10/22/01).

⁴ See *Guidelines for Public Debt Management* (SM/01/27, 2/1/01), and *Concluding Remarks by the Acting Chairman—Guidelines for Public Debt Management* (BUFF/01/40, 3/21/01); *Sound Practices in the Management of Foreign Exchange Reserves* (SM/00/59, 3/17/00); and *Concluding Remarks by the Acting Chairman—Sound Practices in the Management of Foreign Exchange Reserve* (BUFF/00/68, 5/8/00); *The Balance Sheet Approach and its Applications at the Fund* (SM/03/227, 7/1/03); and *Financial Stability in Dollarized Economies* (SM/03/112, 4/1/03) and *Financial Stability in Dollarized Economies—Concluding Remarks by the Acting Chairman* (BUFF/03/77, 5/29/03).

⁵ See *Guidelines for Foreign Exchange Reserve Management*, June 2001 (<http://www.imf.org/external/np/mae/ferm/eng/index.htm#1>) and *Issues in Reserve Adequacy and Management*, Box 7 (<http://www.imf.org/external/np/pdr/resad/2001/reserve.htm>).

8. **From a crisis prevention perspective, the chief role of reserves is to maintain a liquidity buffer that allows time to absorb shocks.**⁶ Throughout the Fund's membership, reserves provide confidence and help avoid surges in demand for foreign currency liquidity that may have a destabilizing macroeconomic impact. Reserves help limit the impact of shocks on the exchange rate level, the incidence of foreign exchange crises, and their usually detrimental impact on output. In countries with limited access to international capital markets, where shocks to current account flows predominate, reserves provide time to react to such events as adverse changes in the terms of trade or a fall in export capacity. In countries with significant but uncertain access to international capital markets, reserves give time to address situations where such access is curtailed or becomes very costly. In countries whose currencies play a dominant role in international transactions, reserves offer the possibility to respond to unsettled foreign exchange market conditions, which may have systemic effects, and to maintain external payment capacity under extreme events.

9. **There is ample evidence that sudden and large pressures on reserves can translate into considerable interest and exchange rate movements and severe output losses.** Capital account crises—characterized by a sudden cessation or reversal of capital inflows that forces a large and abrupt current account adjustment together with a large depreciation in the exchange rate—have been associated with severe output contractions. During the emerging market crises of the 1990s, the swing in real GDP growth averaged 10 percentage points in the most directly affected countries, reflecting capital outflows which in some cases amounted to as much as 15–20 percent of GDP (at annualized rates). The short-term adjustment took place mainly through import compression and a corresponding slump in domestic demand as well as through severe balance sheet effects stemming from corporate and financial sector exposures to exchange rate and interest rate changes.⁷

10. **Thus, *a contrario*, holding a sizeable level of reserves, which may stave off confidence crises, can yield substantial benefits.** In addition, substantial reserve holdings may help reduce spreads on foreign borrowing.

11. **Holding reserves involve costs, which are to be weighed against the benefits outlined above.** The costs of holding reserves primarily reflect the spread between the returns on foreign exchange reserves and the interest payments on government or central bank borrowing or the return on the additional investment that might be financed instead of a reserves build-up. Substantial reserve accumulation can also expose a central bank's balance

⁶ Appendix I provides a classification of cushions distinguishing between *buffers* per se (such as reserves), *hedgies* (against mismatches) and *insurance* (e.g. contingent credit lines and long-term nominal debt).

⁷ See, in particular, *IMF-Supported Programs in Capital Account Crises-Design and Experience* (SM/01/145, 8/3/01).

sheet to currency risk. Efficient reserve management can reduce the costs of holding reserves by ensuring adequate yields without compromising their quality and usability.⁸

12. **An authoritative and operational cost-benefit approach to reserve adequacy assessments is yet to be developed.** A full cost-benefit analysis would require quantified assessments of the probability and cost of crises (based, in part, on assumptions about potential future external shocks), the marginal impact of higher reserves on the likelihood and cost of crises, and the impact of reserves on spreads. Calculation of all of these elements present considerable challenges, not least due to the difficulty of specifying technical assumptions (e.g., distribution of future external shocks, post-crisis potential output level).

13. **Thus, the remainder of this section centers on a approach to reserve adequacy assessment that combines qualitative and quantitative elements.** As discussed below, it stresses potential sources of pressures on reserves and factors that may alleviate such pressures, and makes use of quantitative indicators as starting points for analysis.

B. Potential Sources of Pressures on Reserves

14. **Reserve adequacy assessments depend on whether countries have exposure to international capital markets:**

- **For countries with no or limited market exposure, the traditional focus on the size and volatility of current account flows in the assessment of reserves remains appropriate,** since changes in these flows are the key sources of pressures on reserves. Reserves will generally be expressed in months of imports of goods and services. A benchmark of three months of imports of goods and services is often used, but needs to be evaluated in terms of the past and projected volatility of current account flows. A higher level of reserves is typically sought in countries where shocks to current account flows can be particularly strong, for instance in countries where the export base is narrow and the price of the few key exports is particularly volatile or in countries where natural disasters can severely affect export capacity (e.g., tourism services) and import needs (e.g., foodstuff).
- **For countries with market exposure, the focus is on assessing reserve cushions against risks stemming from the capital account. The remainder of this section and of Section II.C focus on that second group of countries.**

15. **Reserve adequacy assessments need to be based on a clear understanding of the key factors that affect the likelihood and magnitude of pressures on reserves. Some of these factors have long been identified:**

⁸ For a detailed discussion of reserve management, see *Reserve Adequacy and Management* (SM/01/311, 10/16/01). The World Bank's *Reserve Assets Advisory Management Program* is designed to help countries manage reserves efficiently.

- **An exchange rate commitment.** Such a commitment generates large potential liabilities in foreign currency for the government, as reserves may be needed to cover all possible exchanges of domestic currency, or other domestic liabilities (including speculative positions), into foreign exchange. Controls on capital outflows may alleviate this risk. However, in most circumstances, watertight controls, which would include limits on foreign currency cash holdings, are either difficult to sustain over time or costly.⁹ Keeping open the option to adopt a floating exchange rate regime may also be seen as a means to limit potential pressures on reserves ensuing from an exchange rate commitment. However, exiting from a peg in times of stress is notoriously difficult; past experiences of both advanced and developing economies attest to that fact.
- **External imbalances.** Empirical work and practical experience underscore that external imbalances—e.g., a real exchange rate misalignment or large external current account deficit—may trigger, or amplify, capital outflows and liquidity pressures. Reserves can neither substitute for sound policies nor make up for fundamental external imbalances. They would not be adequate to fight off one-way market pressures; indeed, substantial intervention may well exacerbate such pressures by signaling an inefficient policy reaction. Rather, reserves may help absorb shocks and give time to put in place corrective policies.
- **Public obligations to non-residents (i.e. public external debt) in foreign currency.** These obligations expose sovereign borrowers to rollover risk. Under certain circumstances, for instance when access to international capital markets is severely limited or prohibitively expensive due to concerns about debt sustainability or contagion, the service of such debt may generate large calls on reserves. This is so even under floating exchange rate regimes when purchases of foreign exchange to service public external debt obligations in the foreign exchange market would require sharp exchange rate adjustment and threaten domestic stability.

16. **Country experiences over the past ten years demonstrate that a wider range of liabilities can also generate substantial reserve pressures.** External liabilities of the private sector and, as highlighted under the balance sheet approach, exposures between residents have increasingly become factors of external crises.¹⁰ As illustrated in Figure 1, this wider range of liabilities includes:

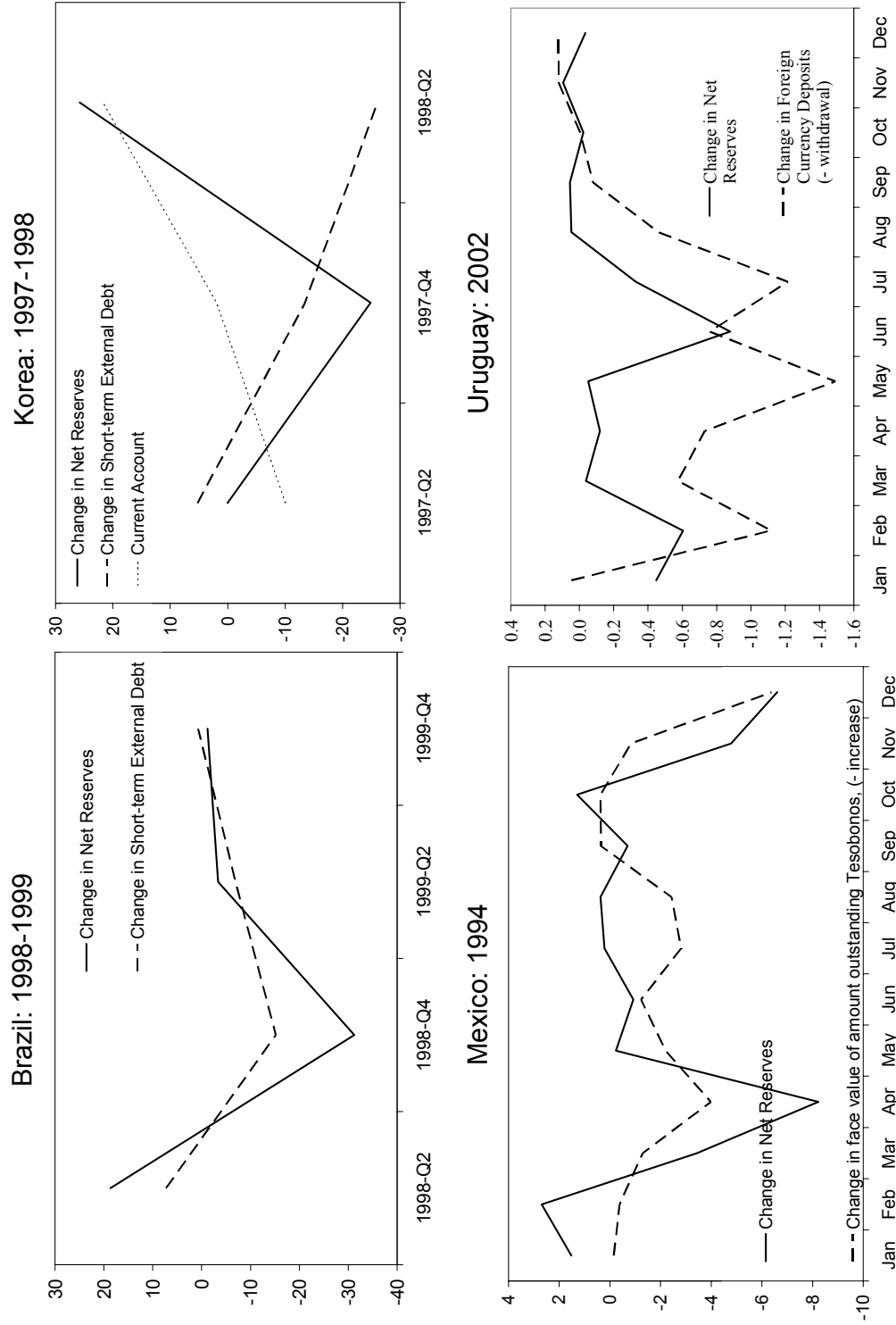
- **Public obligations to residents denominated in, or indexed to, foreign currency.** Foreign currency obligations between residents do not *per se* involve balance of payment flows. However, they may induce substantial demand for foreign exchange

⁹ See, for example, *Country Experiences with the Use and Liberalization of Capital Controls--Summing Up by the Acting Chairman* (BUFF/99/124, 09/ 23/99).

¹⁰ See *The Balance Sheet Approach and its Applications at the Fund* (SM/03/227, 7/1/03).

Figure 1. Reserves Pressures: Selected Country Cases ^{1/}
(in US\$ billions)

In Brazil and Korea reserves outflows are closely correlated with a decline in short-term external debt; in Mexico, with the stock of Tesobonos; and in Uruguay, with foreign currency deposits in the domestic banking system



Sources: IFS, Joint BIS-IMF-OECD-World Bank Statistics on External Debt and IMF staff estimates.

1/ Net reserves is reserves net of IMF disbursements.

by residents, and hence pressures on reserves, in particular circumstances. For instance, if doubts arise as to the ability of the sovereign to roll over a large volume of foreign-currency-denominated (or indexed) debt, resident investors may decide to switch out of such debt obligations and into other foreign-currency-denominated instruments perceived to be safer, including foreign currency cash. Under a fixed exchange rate regime, this sudden surge in demand for foreign exchange would automatically result in a fall in reserves. Under a flexible exchange rate regime, national authorities may well choose to intervene in the foreign exchange market rather than see the exchange rate depreciate sharply.¹¹

- **External liabilities of the private sector.** There is a risk that, in certain circumstances, such liabilities may be transferred to the public sector, creating added claims on reserves. This risk may arise not only in the case of public guarantees but also, most importantly, in cases of systemic failures that bankruptcy procedures cannot effectively address. Contrasting with a key premise of the Lawson doctrine,¹² international experience demonstrates that authorities do often back the external debts of domestic private entities—either directly through bail-outs and foreign currency liquidity support, or indirectly by intervening in the foreign exchange rate market.¹³
- **Foreign currency liabilities of the private sector to residents.** As is the case for foreign-currency-denominated public liabilities to residents, foreign-currency-denominated liabilities of the private sector to residents can be a source of pressure on reserves when creditors start questioning the quality of these domestic assets. This may occur, for instance, when systemic difficulties in the private sector cannot be effectively handled through standard bankruptcy procedures or, with an open capital account, when liquidity injections to address such difficulties result in capital outflows. In particular, in economies where dollarization in the financial sector is pronounced and maturity mismatches between foreign currency assets and liabilities

¹¹ The 1994/95 crisis in Mexico offered a telling example of pressures on reserves stemming from short-term foreign currency-indexed public debt (*tesobonos*), in addition to pressures arising from a large current account deficit: "By end-1994 almost 60 percent of domestic debt was maturing in less than 12 months. In particular, the share of *tesobonos* in total domestic securitized debt increased from less than 1 percent in 1992 to 55 percent in 1994. Thus, even though the level of domestic debt was not particularly high, the need to roll over a large share of total debt stock exerted almost continuous pressure on the financial markets." (see *Mexico—Recent Economics Developments*, SM/95/153).

¹² The Lawson doctrine envisages institutional arrangements in which the private sector is fully responsible for the consequences of its financing decisions, so that there is no need for the government to cover private foreign exchange exposures.

¹³ During the crises in Indonesia and Korea, the introduction of blanket public guarantees of private external debts were aimed at securing their roll-over by foreign creditors (see Lindgren and al. 1999). In Turkey, the central bank was reluctant to raise interest rates, and instead drew on its reserves to inject liquidity in the banking sector (see *Turkey—Third and Fourth Review Under the Stand By Arrangement and Use of Fund Resources—Supplemental Reserve Facility*, EBS/00/273, 12/18/00). In Uruguay, more recently, the monetary authorities countered bank runs through liquidity injections once the banks' foreign assets were depleted (see *Uruguay—Request for Augmentation of Stand By Arrangement*, EBS /02/108, 6/20/02).

are pervasive, runs on foreign currency deposits in domestic banks can trigger external difficulties.¹⁴

C. Institutions and Reserve Adequacy

17. **Reserve adequacy assessments also need to rely on a lucid analysis of institutional arrangements and practices, given their key role in alleviating (or exacerbating) risks.** Sound institutional arrangements and practices help minimize a variety of risks, such as debt rollover and currency risk, that directly relate to the potential sources of pressure on reserves discussed above. They also reduce the likelihood that addressing private sector imbalances requires financial support from the authorities, including use of foreign exchange reserves.¹⁵

18. In light of the sources of pressure on reserves discussed above, **key institutional arrangements and practices relevant to reserve adequacy assessments include:**

- **Public debt management.** The structure of public debt can have a direct and strong impact on public solvency and liquidity, hence on investors' willingness to roll over their holdings of public debt, and ultimately on the likelihood that servicing public debt could result in calls on foreign exchange reserves.
- **Supervision and regulations of financial institutions.** Strong supervision and regulation of financial institutions, particularly banks, helps minimize risks embedded in these institutions' balance sheets, including exchange rate risk and credit risk stemming from the exchange rate exposure of their borrowers. In turn, they reduce the risk of a sudden call on financial institutions' foreign currency liabilities (e.g., a run on foreign currency deposits, unwillingness of external creditors to roll over short-term credit lines) and a concomitant demand on the central bank's foreign currency assets.
- **Corporate governance and insolvency regime.** Sound corporate governance helps strengthen market discipline and risk management in the corporate sector, and thus contributes to reducing the risk that macroeconomic shocks (e.g., a sharp exchange rate depreciation, a substantial interest rate increase) may undermine the health of a broad segment of the corporate sector. Coupled with an efficient insolvency regime, it makes credible the notion that failures of private institutions will be handled through bankruptcy procedures rather than through public action.
- **Financial market development.** Deeper and more sophisticated financial markets can help address some of the sources of vulnerability identified above. For both the

¹⁴ See *Financial Stability in Dollarized Economies* (SM/03/112, 4/1/03); and *Financial Stability in Dollarized Economies—Concluding Remarks by the Acting Chairman* (BUFF/03/77, 5/29/03).

¹⁵ This paper however does not focus *per se* on an analysis of moral hazard risks associated with the possible transfer of foreign exchange-linked liabilities from the private sector to the public sector.

public and private sectors, the possibility to issue debt on the domestic market may offer an alternative to foreign currency debt, as well as facilitate strategies to increase average debt maturity and stem rollover risk. Similarly, the availability of derivative instruments may allow to hedge against interest rate or exchange rate risk, thereby reducing balance sheet vulnerabilities.

D. Operational Implications

19. **The Fund's current approach to reserve adequacy is based on the following elements:**¹⁶

- **The ratio of short-term external debt to reserves is seen as a particularly useful indicator**, especially for countries with significant access to international capital markets; **and a benchmark value of one for this ratio can serve as a starting point of analysis.** The short-term external debt to reserves ratio emphasizes external short-term obligations of both the public and private sectors as a key risk. The benchmark value of one, which received some support from empirical studies of crisis vulnerabilities, has an easy interpretation: if reserves equal, or exceed, short-term external debt by remaining maturity, a country can be expected to meet its external debt servicing needs for the forthcoming year, even if market access is curtailed.
- **Traditional reserve-related ratios, such as the ratios of reserve to imports, remain useful information under certain circumstances.** In particular, as discussed above, the ratio of reserves to imports can be particularly meaningful for countries without access to international capital markets. In contrast, the ratio of reserves to broad money, which is traditionally thought of as an indicator of the potential magnitude of capital flight, has not been shown to be that valuable. One possible explanation is that the greater the degree of economic stability, the larger money demand, and thus, everything else equal, the lower the ratio of reserves to broad money.
- **Country-specific factors need to be fully taken into account**, including the choice of exchange rate regime, the extent of external imbalances, the degree of openness of the capital account (including the existence and effectiveness of capital controls in containing liquidity pressures), the regulatory regime, the extent to which debt is denominated in local currency, hedged, or offset by private entities' external assets and foreign currency cash flows, and the derivative exposure of the public sector.¹⁷

20. **This paper's discussion of reserve adequacy confirms that the ratio of short-term external debt to reserves remains a particularly useful indicator, and the**

¹⁶ See *Concluding Remarks by the Acting Chairman—Debt- and Reserve-Related Indicators of External Vulnerability*(BUFF/00/69, 5/9/00).

¹⁷ See *Debt- and Reserve-Related Indicators of External Vulnerability* (SM/00/65, 3/23/00) for an extensive discussion of country-specific factors.

benchmark value of one can continue to serve as a starting point of analysis.¹⁸ This ratio provides information on two of the main potential sources of pressure on reserves identified in paragraphs 15 and 16, namely external debt repayments of the public and private sectors. In addition, developments over the past three years confirm the empirical significance of this ratio: As shown in Figure 2, the ratio of short-term external debt to reserves remains a significant explanatory variable of external volatility, as measured by a typical “crisis index” that combines changes in the exchange rate level and reserves.

21. **The paper’s discussion of reserve adequacy also suggests enhancements to the above approach along the following lines:**

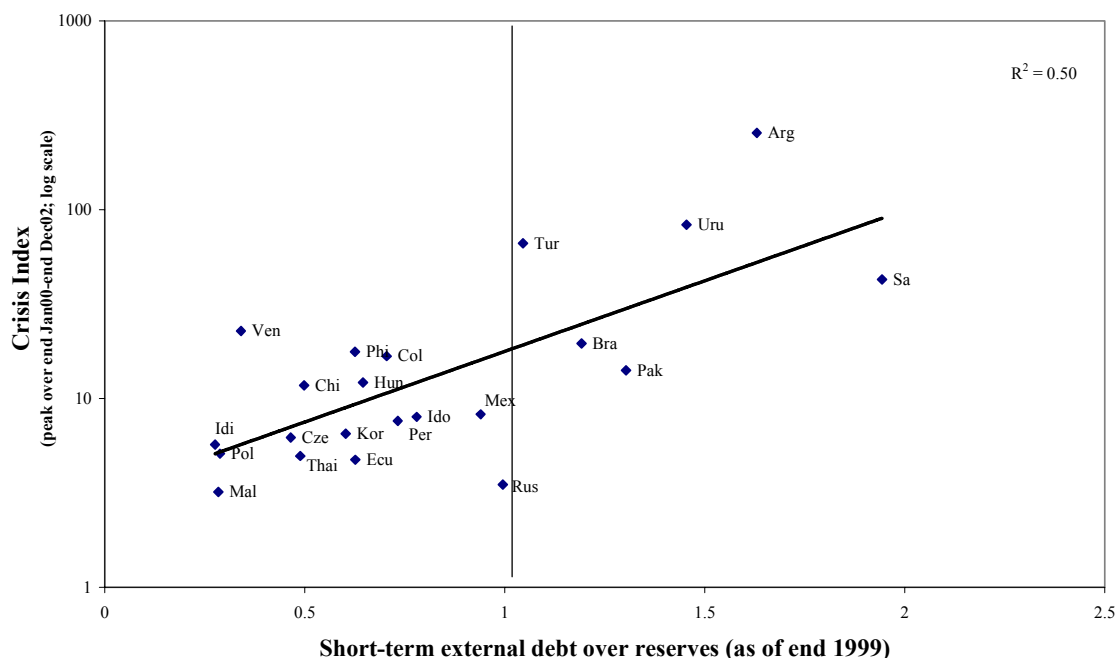
- **Augmented ratios of debt liabilities to reserves can usefully complement the ratio of short-term external debt to reserves.** While quantitative guidance (“rules of thumb” or single benchmarks) for these ratios has not yet been developed, they can flag potential risks—particularly, when the augmented ratios differ substantially from the baseline short-term external debt to reserves ratio—and focus the analysis of reserve adequacy on these risks. Like the baseline ratio, these extended ratios would be a starting point for further analysis, which would take account of country-specific factors (as discussed below). **In particular**, two augmented ratios can help reflect the risks associated with foreign currency liabilities to residents, which were discussed in paragraph 16:
 - **the ratio of short-term external debt plus short-term foreign currency-linked public domestic debt (by residual maturity) to reserves;**¹⁹ and
 - **the ratio of short-term external debt plus residents’ foreign currency deposits in domestic banks net of domestic banks’ liquid foreign currency assets to reserves.**²⁰

¹⁸ The ratio of short-term external debt (on a remaining maturity basis) to reserves has been a standard component of vulnerability indicators table included in Article IV staff reports for a number of years (see <http://www-int.imf.org/depts/pdr/MemosAndGuidanceNotes/fischer43099.pdf>). It is also part of the standard set of data used in quarterly vulnerability assessments (see *Approaches to Vulnerability Assessments for Emerging Market Economies*, SM/01/301, 10/3/2001).

¹⁹ The definition of short-term foreign currency-linked debt includes foreign currency-denominated and foreign currency-indexed securities, loans, deposits (and other instruments committing to foreign currency or foreign currency-indexed payments).

²⁰ Non-residents’ deposits in domestic banks are included in external debt. See *External Debt Statistics: Guide for Compilers and Users*, Chapter 2.

Figure 2. Short-Term Debt Over Reserves as a Crisis Indicator¹
(January 2000 – December 2002)



¹ The crisis index is a weighted average of changes in reserves and in the exchange rate level, with weights inversely correlated to past variable (see Appendix II for details). The crisis index is measured on the basis of data up to 2 ½ years more recent than reserve data to avoid reverse causality.

- **Rolling liquidity analyses**, which consist in projecting reserve coverage ratios (e.g., the short-term external debt to reserve ratio, the above augmented ratios) under a baseline scenario over the short to medium-term and assessing the potential use of reserves under alternative scenarios (e.g., scenarios reflecting lower export prices, higher interest rates, or loss of market access), **can provide significant additional information**. They could complement the projections and stress testing made in the context of the debt sustainability framework, and underpin the discussions of short-to medium-term reserve targets.
- **Additional country-specific, institutional factors that are of key importance for reserve adequacy assessments** need to be considered. As discussed in paragraph 18, they include institutional arrangements and practices that relate to public debt management, financial sector supervision and regulation, corporate governance and financial market development. All these elements set rules and incentives that have an impact on the potential extent of currency and maturity mismatches in public and

private sector balance sheets, as well as on the availability of hedges to protect against risks stemming from these mismatches.

22. **Data availability may constrain assessments of reserve adequacy.** The recent review of data provision to the Fund for surveillance purposes indicated that balance sheet analysis is generally hampered by lack of availability of key breakdowns and other data gaps, particularly on public debt and assets and liabilities of the non-financial private sector.²¹ These data constraints matter for reserve adequacy assessments. To alleviate these data limitations, the Executive Board has endorsed an action plan to improve data availability to serve the needs of the various balance sheet initiatives, including work on liquidity management.²²

III. LIABILITY MANAGEMENT

23. **This section focuses on the role of liability management in improving a country's public and private balance sheets, and reducing the risk of liquidity crises.** The paper's previous section established clear links between, on the one hand, the structure of public debt and the composition of private liabilities and, on the other hand, the nature and magnitude of potential pressures on reserves. It concluded that public debt management and policies and practices affecting private liability management need to be carefully considered when assessing reserve adequacy. These two issues are given further consideration below.

24. **At the outset, it is worth emphasizing that the overall policy and institutional environment plays an essential role in the promotion of sound liability management.** The *Guidelines for Public Debt Management* highlight key principles in this regard, including that prudent debt management, fiscal and monetary policies can reinforce one another. In particular, low inflation is critical for the development of bond markets in local currency, while exchange rate flexibility stimulates risk management.²³ A prudent fiscal stance can support lower interest rates and longer debt maturities, and may generate a virtuous circle in which interest payment reductions are either saved or used to extend maturities. Stronger market discipline in all sectors, including through the promotion of transparency and sound institutions, contributes to improve risk management and foster the development of financial markets (e.g., derivative markets that allow corporations and banks to share risks better).²⁴ Trade openness can also help reduce vulnerability to currency risk,

²¹ See *Review of Data Provision to the Fund for Surveillance Purposes*, Section III (SM/04/56, 2/24/2004).

²² See *Summing Up by the Acting Chair—Review of Data Provision to the Fund for Surveillance Purposes* (BUFF/04/53, 3/22/2004).

²³ See *Financial Stability in Dollarized Economies* (SM/03/112, 4/1/03) for measures to promote the acceptance of local currency and Goldstein (2001).

²⁴ Coordination between reserves and public debt management from an institutional perspective is addressed in *Guidelines for Foreign Exchange Reserve Management – Accompanying Document* (SM/03/103, 3/26/2003).

since the greater the degree of openness the smaller the exchange rate adjustment needed to correct given external imbalances.²⁵

A. Public Debt Management

Analytical considerations and country experiences

25. **One important lesson from recent capital account crises is that not only the level but also the structure of public debt can create major vulnerabilities in a country's aggregate balance sheets.** Public exposure to refinancing and interest risks, or exchange rate movements, can cause or exacerbate liquidity crises. The currency composition of public debt can have a very large impact on debt developments, as illustrated in Figure 3. The maturity profile, price indexation, and interest characteristics of public debt are other key factors.

26. **From a liquidity perspective, the key features of a sound public debt structure are well identified.** Public debt should ideally be mainly denominated in domestic currency—in line with government revenues—and be of long average maturity without any marked lumpiness in the repayment schedule. These characteristics would limit rollover needs and provide sufficient room for monetary and fiscal policies to offset shocks without threatening public liquidity or solvency.²⁶

27. **In practice, many countries have not established the monetary and fiscal policy credibility needed to issue long-term debt in domestic currency.** In fact, many developing countries can only choose between borrowing short-term in domestic currency or borrowing in foreign currency to finance long-term projects.²⁷

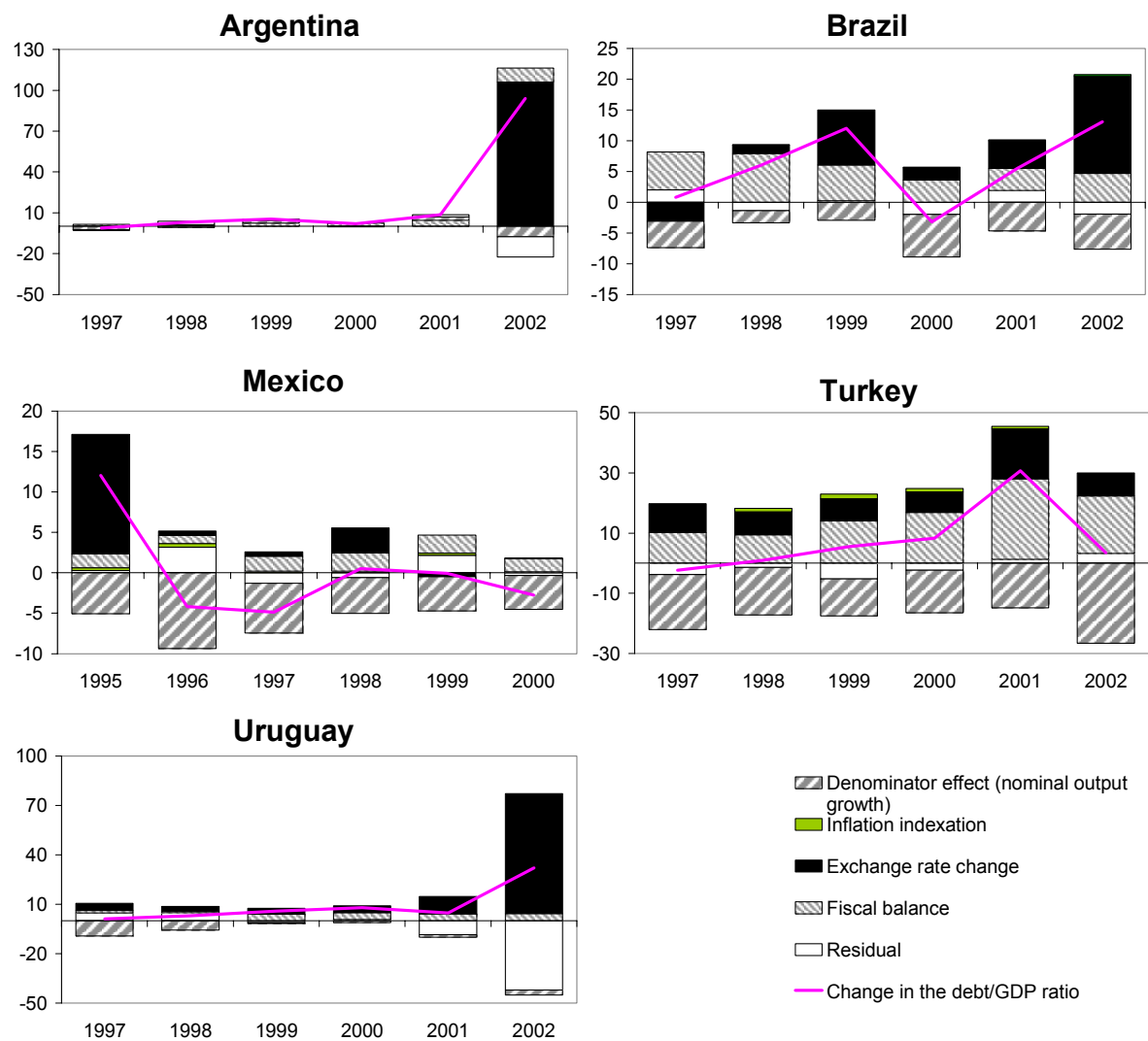
28. **Many countries, including many emerging market countries, are thus exposed to significant currency and maturity/rollover risk.** Experience suggests that the risks associated with public debt exposures to shocks, especially exchange rate shocks, have often been underestimated.

²⁵ Openness to foreign direct investment also plays a role in transferring part of the aggregate currency risk to non-residents, as “repayments” are contingent on the realization of profits.

²⁶ See Appendix III for a review of the literature on public debt management.

²⁷ The so-called “original sin” affecting emerging and developing countries (Eichengreen & Hausmann, 1999). Indeed, dollarization is on the rise, with 50 percent of developing countries having at least 10 percent of broad money or domestic debt denominated in (or linked to) foreign currency in recent years, against 10 percent of these countries in 1980-85. See *Macroeconomic Policies in Dollarized Economies* (SM/03/126, 4/8/03). On the composition of public debt of advanced and emerging market countries, see also *Sovereign Debt Structure for Crisis Prevention*, Chapter II (forthcoming).

Figure 3. Change in Public Debt to GDP Ratio: Component Contribution ¹



Sources: Country authorities and IMF staff estimates

¹ See Appendix IV for details on the decomposition of changes in public to GDP.

- The real value of foreign currency-linked debt can increase rapidly during crises—or steadily in countries with an overvalued exchange rate—raising concerns about public debt sustainability. Such risks have been particularly high for economies with a fixed exchange rate, low openness to international trade, or substantial stocks of foreign currency debt.
- During crises, real interest rates may increase rapidly and lead to vicious circles with regard to fiscal sustainability in countries with large stocks of short-term or floating-rate debt. Such risks are particularly substantial when interest rates need to be raised to defend the currency (i.e., due to the presence of a peg or to “fear of floating”) and liquidity is not “trapped” in the country by effective capital controls.
- In the countries studied (Figure 3), the cumulative surge in domestic prices during and post-crisis was much smaller than the depreciation in the exchange rate—a phenomenon generally observed during external crises.²⁸ Thus, in proportion to initial stocks, the impact of price indexation on the stock of debt was much smaller than that of exchange rate indexation.²⁹

29. **Some emerging market countries have had success in progressively hedging their public debt structure against currency and rollover risk.** In these countries, a strong record of sound macroeconomic policies helped promote public debt instruments with longer maturity, or facilitate the issuance of inflation-indexed debt in domestic currency as an alternative to foreign currency-linked debt:

- Some countries in Asia and Central Europe have made significant strides in developing markets for domestic bonds in domestic currency at longer maturities. In South Africa, stronger investor confidence associated with improved policy environment and debt management strategy, and a decrease in inflation, supported the demand for domestic conventional (i.e., non-indexed) bonds.
- Mexico has been pursuing a long-term strategy to reduce its dependence on foreign-currency-linked debt and on external debt. The authorities have been able to extend the range of domestically-issued debt instruments, issuing longer-term (up to 20 years) fixed, floating-rate, and inflation-indexed bonds. Since 1997, all publicly-traded domestic debt has been peso-denominated, and none of it has been indexed to a foreign currency. The share of peso-denominated domestic debt has risen from about 20 percent of total government debt at end-1995 to more than 50 percent in 2003.

²⁸ See, in particular, Burstein, Eichenbaum and Rebelo (2002).

²⁹ In a related vein, *Sovereign Debt Structure for Crisis Prevention* (forthcoming) reports that the volatility of GDP is smallest when GDP is expressed in CPI-indexed units, compared to GDP expressed in local-currency or foreign-currency terms.

- Chile succeeded in making inflation-indexed debt attractive to (mostly domestic) investors in the 1990s following a long period of financial stability and structural innovations (e.g., development and use of an inflation index prepared by a credible, independent entity). Such debt became a significant component of public debt and provides today a benchmark for home mortgages and other private instruments. In recent years, authorities have successfully issued medium-term non-indexed local-currency bonds.

Policy advice

30. In light of the above, **the following considerations**, which complement the key principles laid out in the *Guidelines for Public Debt Management*, **could help focus the Fund's policy advice on public debt management**:

31. On currency composition, **the risks associated with foreign-currency-denominated debt are especially significant in countries where there are signs of exchange rate overvaluation, in countries where the exchange rate has been volatile, or in relatively closed economies**. The potential costs associated with such debt should be thoroughly assessed to reflect risks of extreme pressures, and weighed against the cost of paying higher real interest rates on domestic currency debt, which provides a hedge against currency devaluations. Specifically:

- Issuing foreign-currency-denominated debt can be costly when the exchange rate is overvalued, as repayment is likely to take place when foreign currency is dearer. The debt issuance may itself exacerbate the problem by driving up the exchange rate further in the short term.
- High exchange rate volatility—induced, for instance, by swings in the terms of trade—increases the risk that debt service may become particularly burdensome at a time when the economy is already suffering from the impact of negative external shocks. Put otherwise, high exchange rate volatility points to the risk of a substantial negative correlation between debt service falling due and the capacity to generate government revenue.
- Issuing foreign currency debt is especially risky for relatively closed economies: to offset any shock to the capital account will require a substantial adjustment of the current account—when measured in proportion to existing trade flows—and, thus, a very large exchange rate movement. The combination of a large stock of foreign-currency-denominated debt and limited openness to external trade increases the likelihood of a vicious circle whereby a cut-off in access to international capital markets (for one reason or another) precipitates a steep increase in public debt ratios and debt service burden, which further undermines market access.

32. However, **issuing a portion of public debt in foreign currency may be appropriate for countries whose current debt stock is low, that have no external imbalances, and whose currency is expected to appreciate over the long run**—as is the

case for countries with high potential output growth—as long as an appropriate cushion of foreign exchange reserves is in place to absorb liquidity risk.

33. **On maturity structure, lengthening the maturity of public debt is in principle desirable from a liquidity perspective.** Section II highlighted the risks associated with short-term debt. For fixed-rate debt, a longer maturity structure reduces rollover risk, helps insulate public debt service from an interest rate shock (for instance, a rise in interest rate triggered by an attack on the domestic currency), and thus provides a cushion in case of concerns about government solvency.

34. **However, lengthening average debt maturity should not be undertaken irrespective of cost, lest public solvency be threatened.** Increases in interest rates associated with lengthening maturity can be high, particularly for countries with relatively weak policy track records or countries where concerns about public solvency already exist. In such countries, one possible approach could be to combine debt management operations designed to lengthen debt maturity with immediate fiscal adjustment to pay for the higher interest costs.³⁰ Generally, cost-effective strategies to lengthen maturities can consist of (i) gradually increasing the interest rate resetting periods on floating-rate debt to reduce rollover and interest risk, while limiting inflationary incentives, or (ii) issuing inflation-indexed debt.³¹

35. **Several other key trade-offs also need to be explicitly considered in the design of a public debt management strategy:**

- *Combining currency and maturity risk* leads to vulnerabilities that should be hedged through reserve backing of the short-term, foreign-currency-denominated public debt. Issuing short-term domestic currency debt or reducing the level of borrowing altogether (and undertaking the associated fiscal adjustment) may be preferable options.
- *Inflation indexation* is especially useful where the main obstacle to lengthening maturities is inflation risk and the associated risk premium.³² However, it entails the risk that introduction of inflation-indexed instruments may be interpreted as a signal of a weaker resolve to fight inflation—i.e. a signal that authorities are putting efforts into living with the effects of inflation rather than fighting inflation itself, which might induce adverse phenomena such as widespread inflation indexation.³³

³⁰ Other ways to reduce immediate borrowing costs include offering some form of creditor protection, such as embedded put options. However, some of these mechanisms may also entail significant liquidity risks (see for example *Global Financial Stability Report*, 2002a).

³¹ Floating rate debt is akin to nominal debt of maturity equal to the indexation lag (on sequencing issues and dilemmas involved in improving debt structure, see Turner, 2002).

³² As indicated in paragraph 28 and as discussed in *Sovereign Debt Structure for Crisis Prevention* (forthcoming), inflation-indexed debt exposes the borrower to less uncertainty than does foreign-currency debt.

³³ Conversely, introduction of inflation-indexed public debt instruments might also be seen as a sign that the authorities are prepared to “bet” on their inflation performance—i.e. that they are convinced that inflation will

Accordingly, inflation indexation of public debt is best used in conjunction with a credible program to stabilize or lower inflation (e.g., under an inflation targeting framework). In addition, it is facilitated by the existence of an independent statistical agency that enhances trust in the inflation index.

- *Inflation versus exchange rate indexation.* Compared with exchange rate indexation, inflation indexation is particularly recommended in relatively closed economies. In these economies, the impact of exchange rate fluctuations on domestic prices should be weaker and, thus, country authorities should be better able to control inflation and, by extension, the cost of indexation on public debt service.³⁴
- *Debt buy-backs* should reflect an assessment of the trade-off between increasing reserves and reducing debt stocks. They can be risky operations from a liquidity perspective as they tend to reduce reserve coverage. Accordingly, when there are concerns about liquidity, priority should be given to buy-backs of debt at shorter remaining maturities in order not to weaken reserve adequacy.³⁵

B. Private Liability Management

Analytical considerations

36. **Recent capital account crises have demonstrated that private sector exposures to interest, rollover, and exchange rate risk can generate great pressures on foreign exchange reserves, damage public liquidity and solvency, undermine the authorities' ability to respond effectively to external shocks, and, generally, trigger or exacerbate external crises.**³⁶ During capital account crises, private sector entities are likely to seek to hedge previously unhedged foreign exchange positions, to compensate for the loss of access to foreign credits, and to diversify away from domestic assets, with attendant consequences on foreign exchange demand, reserves, and/or exchange rates. Private sector liabilities can be transferred to the public sector through explicit or implicit guarantees, including the lender-of-last-resort function. More insidiously, interest and exchange rate mismatches in private balance sheets can undermine the authorities' ability to implement the exchange rate and monetary policy adjustments required to respond to external shocks (e.g., the “fear of

be lower than the forecasts priced in by markets. In advanced economies, introduction of inflation-indexed instruments has not resulted in higher inflation.

³⁴ In principle, GDP indexed debt allows debtors to insure against liquidity and solvency risks resulting from sharp economic slowdowns (see for example Borensztein and Mauro, 2002). However, in practice, there may be considerable hurdles, such as the need to ensure the reliability of the index (GDP data). See *Sovereign Debt Structure for Crisis Prevention* (forthcoming).

³⁵ When concerns about liquidity risk are moderate, it may be preferable to buy back more expensive longer-term debt (for instance, when the yield curve rises steeply), which would have a larger beneficial impact on solvency.

³⁶ This role is well documented (e.g., Lane, 1999) and also highlighted in the balance sheet approach.

floating”), as such adjustments could have severe repercussions on the health of private sector balance sheets and, by extension, public liabilities and the overall economy.

37. **Ideally, the private sector would minimize liquidity risk by hedging most exposures against interest and exchange rate shocks, and building adequate liquidity buffers against rollover risk.**³⁷ In such an ideal situation, hedges and buffers against a great variety of shocks would be easily available, and conditions conducive to long-term domestic borrowing and access to equity finance by the private sector would have been established. The scope for banks and non-financial corporations to employ hedges and buffers is discussed in Box 1.

38. **In practice, significant exposures to interest, rollover, and exchange rate risks exist in many countries** because, *inter alia*, long-term financing in domestic currency is unavailable, hedging instruments are perceived to be prohibitively expensive, or foreign currency loans are seen to be cheaper due to explicit or implicit public exchange rate guarantees.

39. **The private sector’s incentives—and ability—to hedge and build buffers against a variety of risks largely depend upon macroeconomic policies and institutional conditions and practices.** For example, corporations may not always hedge their foreign currency exposures because a long-standing fixed exchange rate has eroded their perceptions of the exchange rate risk.³⁸ Corporations may be induced to take interest rate risk (or currency risk or both) because of the lack of long-term financing in domestic currency at fixed rates; this, in turn, may result from a track record of macroeconomic instability and limited development of domestic capital markets. Banks may bear large (indirect) exposures to currency risk if lending in foreign currency is prevalent and the regulatory and supervisory regime does not cover assessments of borrowers’ ability to service foreign currency debt.

³⁷ In practice, some risks are rarely hedged and create the need for a greater capital buffer. This is the case for risks taken by banks in their trading portfolios. Also, most non-financial corporations that undertake foreign direct investment do not fully hedge the resulting foreign exchange exposures, although they may benefit from natural hedges by investing in tradable sectors or diversifying their investments across a wide range of countries (see, for example, *Foreign Direct Investment in Emerging Market Countries—Report of the Working Group of the Capital Markets Consultative Group* (SM/03/319, 9/16/03)).

³⁸ Indeed, evidence has been found that the degree of foreign exchange risk hedging is greater under a floating exchange rate regime (see Werner, 2002).

Box 1—Private Sector Hedges and Buffers

Interest rate risk

Banks can, and usually do limit their direct exposure to interest rate risk. Since financial intermediation involves maturity transformation, banks are by their very nature exposed to maturity mismatches. Nevertheless, by matching closely the expected interest structures on the asset and liability sides of their balance sheets, they can maintain their interest rate risk within limits normally imposed by the supervisory authorities.

Corporate sectors are generally vulnerable to interest rate risk. Corporations in emerging market countries often cannot obtain loans at maturities comparable to the lifetime of their assets, and resort to rolling credit lines or floating rate debt. In addition, working capital is often financed by short-term loans (backed by short-term collateral such as receivables) that are continuously rolled over. With imperfect financial markets, liquidity issues can become solvency issues.

Maturity/roll-over risk

Being in the business of maturity transformation, banks do not hedge their rollover risk but rely instead on liquidity buffers and on the domestic lender of last resort for extreme situations (bank runs). Under a fixed exchange rate (and in the absence of binding capital controls), or as a result of foreign currency maturity mismatches, bank runs can thus have considerable implications for the official reserves buffer.

In principle, corporations can manage their rollover risk well by (i) matching short-term liabilities (payables) with short-term assets (receivables) and (ii) maintaining a cushion in the form of a stock of financial assets and credit lines, and positive operational cash flow.

Currency risk

While supervisors normally impose limits on open foreign currency positions, banks are often exposed to currency risk through their lending to the corporate sector. Corporations can be hedged naturally, but may also be exposed to exchange rate movements. Corporate currency risk is relatively difficult to gauge and rarely monitored quantitatively, including in dollarized economies where banks have difficulty in applying rules-based lending to limit indirect foreign currency risk. For example, dynamic hedging used to hedge each year the payments falling due in the coming year should be treated with circumspection as it only modestly reduces balance sheet risks. Furthermore, such hedging often intensifies in times of currency pressures, thereby exacerbating these pressures further.

The extension of credit in foreign currency to corporations in the non-tradable sector can thus be a key source of risk. This is a particular source of concern when the currency is overvalued or volatile.

General risk

The private sector also has general buffers against various risks, including capital and positive profits or cash flow. Capital buffers help improve solvency and market access conditions, but do not constitute liquidity buffers *per se*. In this regard, liquid assets and positive (operational) cash flow are essential. For banks, supervisors generally impose capital requirements in line with the Basel Accord. For corporations, capital requirements are difficult to regulate in light of diverse exposure to risks, but authorities can still monitor overall capital adequacy in the non-financial private sector (e.g., by main sub-sectors) and avoid perverse incentives (e.g., tax treatment).

Policy advice

40. **In light of the above, the following considerations could help focus the Fund's analysis of private liability management and its policy advice on promotion of appropriate buffers and hedges in the private sector:**³⁹

- *Interest rate exposure* is often a key source of vulnerability of the corporate sector, especially where its access to long-term, fixed-rate financing is limited. Interest coverage ratios, as well as other indicators on the capital structure—e.g., debt-equity ratios—profitability, or cash-flow buffers warrant close monitoring.⁴⁰
- *Maturity mismatches in foreign currency* in the banking system can generate substantial rollover risk and reserve pressures, and need to be carefully regulated. Limits on maturity mismatches in foreign currency can be imposed in relation to capital, or through reserve requirements and/or more limited insurance for foreign currency deposits. In general, both a stronger regulatory environment and disclosure requirements on maturity mismatches should be seen as key factors in the promotion of market discipline and financial stability.⁴¹
- Regarding *currency risk*, standard limits on banks' open foreign currency positions do not capture the indirect currency risk embedded in the banks' loan portfolios. These limits could thus be complemented with close reviews of, and/or limits on bank's foreign currency lending practices; monitoring and disclosure of mismatches in the corporate sector; and, disclosure requirements on interest and exchange rate exposures by corporations in the context of bond and stock listing and external borrowing operations. Such monitoring is especially important in the presence of strong incentives for mismatches (e.g., fixed exchange rate regimes and large interest differentials). In the absence of adequate data for monitoring purposes, there is a case for closely regulating these bank exposures given the risks involved. This is *a fortiori* also the case for lending extended to households that most often do not have foreign currency earnings.⁴²

³⁹ Several of these considerations would be expected to be covered under the FSAP, as one objective of the FSAP is to assess liquidity risks in the banking and corporate sector that could affect macroeconomic developments.

⁴⁰ Balance sheet indicators for the corporate sector need to focus on flows given that many assets are not easy to price and real assets have fundamentally no currency denomination. Interest coverage ratios, that help assess how high interest rates can move before available cash flow is exhausted, are a standard measure of corporate financial distress (see *Macprudential Analysis—Selected Aspects*, SM/01/159, Supplement 1, 6/7/01).

⁴¹ See *Financial Stability in Dollarized Economies* (SM/03/112, 4/1/03) for a detailed discussion of related measures.

⁴² The development of *Financial Soundness Indicators* (SM/03/175, 5/14/03) helps address data issues on the banking and corporate sectors. Continued refinement of the core and encouraged sets of FSIs will be needed to reflect the increased recognition of the importance of these mismatches for financial stability.

IV. ISSUES FOR DISCUSSION AND AVENUES FOR FURTHER WORK

41. Sound liquidity management is a key component of crisis prevention and, generally, promotion of economic stability, as amply demonstrated by international experience. This paper focuses on three elements of liquidity management, namely reserves adequacy, public debt management, and private liability management, and on the strong inter-relations between these elements.

42. The paper's analysis of reserve adequacy considers the costs and benefits of holding reserves, the degree of access to international capital markets, the potential sources of pressures on reserves, and the role of institutional arrangements and practices. In particular, it stresses that foreign-currency-denominated claims among residents can be an important source of pressures on reserves; and that institutional conditions—such as the financial supervisory and regulatory regime, corporate governance, and public debt management—have an essential influence on the need for reserves.

Do Directors agree?

43. The paper takes the view that the Fund's current operational approach to reserve adequacy, while still broadly appropriate, would benefit from some enhancements that could be used in both bilateral and multilateral surveillance. In particular, as discussed in paragraph 21, the paper proposes (i) to complement the short-term external debt to reserves ratio with two augmented ratios that reflect risks associated with foreign currency liabilities to residents; (ii) to make use of rolling liquidity analyses; and (iii) to place greater emphasis in reserve adequacy assessments on key institutional arrangements and practices that influence the degree of currency and maturity mismatches in public and private sector balance sheets, as well as the availability of hedges to protect against risks stemming from these mismatches. In selected multilateral surveillance exercises, it could be useful to present cross-country tables displaying the short-term external debt to reserves ratio as well as the augmented ratios.

Do Directors agree?

44. The paper reviews the currency and maturity/rollover risks associated with public debt structures, and presents a number of considerations that, in complement with the *Guidelines for Public Debt Management*, could help focus the Fund's policy advice on public debt management. As discussed in paragraphs 31-35, these considerations cover the currency composition of public debt, its maturity structure, indexation, and debt buy-backs.

What are Directors' views on public debt management?

45. The paper reviews the exposures to interest rate, currency, and rollover risks that may be embedded in the structure of private balance sheets and the impact of macroeconomic policies and institutional conditions on incentives to hedge and build buffers against these risks. It offers various considerations that could help focus the Fund's analysis of, and advice on, these matters (paragraph 40).

What are Directors' views on promotion of sound private liability management?

46. The paper confirms the importance of key balance sheet data for external vulnerability assessments in countries with access to international capital markets.⁴³ In particular, it highlights the need for sufficiently detailed data on the structure of public debt and assets and liabilities of the banking sector, including their currency, residency and maturity compositions. This issue was addressed in the recent review of data provision to the Fund. The 2004 biennial surveillance review will provide an opportunity to reflect on current practices regarding balance sheet analysis in Article IV consultations, including coverage of public debt management.

47. The paper points to various analytical issues that may deserve further consideration. They include:

- *Reconciliation of data on public debt stocks, deficits, and valuation changes* (due, for instance, to exchange rate movements). As illustrated by the size of residuals in Figure 3, experience with such data reconciliation suggests that further efforts would be worthwhile.
- *Tools for debt sustainability analysis*. Usual fiscal concepts, such as the overall or primary public deficits, do not capture well the potential fiscal consequences of poor debt management. The stress tests included in the Fund's strengthened framework for debt sustainability go some way toward meeting that need, but more might possibly be done. For instance, consideration could be given to deficit or debt indicators that reflect the potential costs of price or exchange rate indexation or to the calibration of stress tests that best reflect debt structure.
- *Cost-benefit analysis of reserve accumulation*. As noted, a full cost-benefit analysis would require to take into account a number of factors, such as the precise identification of the cost and probability of crises, or the impact of reserves on spreads. Work on some of these issues is being pursued.
- *Funding increases in reserves*. An increase in foreign exchange reserves, when needed, can be achieved in a variety of ways. Possibilities include tightening macroeconomic policies, external borrowing, or "taxing" private holdings of foreign exchange—for instance, increasing reserve requirements on short-term foreign currency deposits. Policy advice could be developed on best ways of funding increases in reserves in particular circumstances.

Do Directors see merit in pursuing these analytical issues? Are there other analytical topics that deserve to be considered further?

⁴³ See *Data Provision to the Fund for Surveillance Purposes* (SM/02/126, 4/26/02) and *Approaches to Vulnerability Assessment for Emerging Market Economies* (SM/01/301, 10/3/01).

Sectoral Buffers, Hedges and Insurance ⁴⁴

The table below provides a general characterization of instruments that cushion against shocks across the various economic sectors:

1. **Buffers** offer a general cushion against, in principle, *any shock*. They generally consist of liquid assets (reserves), capital and free cash flow (e.g., budget surplus). For comprehensiveness, the table distinguishes between buffers that are primarily relevant from a solvency perspective from those that are primarily relevant from a liquidity perspective.
2. **Hedges and insurance** provide protection against *specific shocks*. **Hedges** are asset and liability structures whose gains and losses are automatically matched in the event of shocks. For example, a forward contract to purchase foreign exchange can hedge a future foreign currency repayment obligation. More generally, hedging can help avoid currency and maturity mismatches and limit rollover risks. Hedges in principle have symmetric pay-offs (i.e. they offset gains as well as losses). In contrast, **insurance** provides pay-offs that *can* be invoked and are asymmetric, as they do not systematically offset gains. Such characteristics come at a (time-dependent) cost.⁴⁵ Insurance can supplement buffers and complement hedges, which are often imperfect or incomplete. While hedges are usually desirable as part of good business practice, insurance generally has more complex cost-benefit implications, which require careful consideration.

⁴⁴ On hedges, capital cushions, and insurance, see Robert Merton, *A Model of Contract Guarantees for Credit-Sensitive, Opaque Financial Intermediaries*, European Finance Review, Vol. 1, 1997.

⁴⁵ Insurance encompasses (i) traditional insurance, credit lines and guarantees, which usually involve complex clauses limiting their pay-offs, and (ii) more standardized, marketable instruments such as options and credit derivatives.

Buffers			
Sector	Public sector	Banks and Other Financial Intermediaries	Corporate sector
Shocks affecting:			
Solvency/ sustainability	Reserves, other marketable assets, budget surplus, the ability to raise net revenue	Capital and free cash flow	Capital (equity/debt) and free cash flow (interest coverage)
Liquidity	Official reserves (R/STD)	Liquid assets	Liquid assets

Hedges against shocks			
Sector	Public sector	Banks and Other Financial Intermediaries	Corporate sector
Shocks			
Interest risk	Fixed interest debt 1/	Matched duration	Fixed interest debt 3/
Currency risk	Debt in domestic currency, foreign currency reserves 2/	Limits on open currency positions	Natural/ derivative hedges
Rollover risk	Longer maturity structure	Matched expected cash flow, maturity structure matched to asset life collateral 3/	Longer maturity structure

Insurance against shocks			
Sector	Public sector	Banks and Other Financial Intermediaries	Corporate sector
Shocks			
Roll-over and credit risk	Fixed interest debt, 1/ debt with embedded options to lengthen maturity, credit lines and guarantees, IMF.	Credit lines, LOLR, options, guarantees, credit derivatives (and other emulated insurance).	Credit lines, LOLR, options, guarantees, credit derivatives (and other emulated insurance).

1/ The pay-off of debt in terms of government revenue usually depends on policy reaction (allowing depreciation, inflationary financing), which implies that it can be regarded as insurance as well.

2/ The principle is to match the currency of debt to the underlying currency of revenue. For most countries this means that debt should nearly all be denominated in domestic currency.

3/ Under collateral based lending practices corporations can match loans to the life of the asset, and limit nominal interest risk. However, they would not be covered for interest or rollover risk on liabilities that are constantly renewed (e.g. working capital).

Reserve-Related Indicators of External Vulnerability

1. In complement to Figure 2, this Appendix presents further evidence on the relationship between various reserves-related indicators and depth of crises, as proxied by a “crisis index”, across a range of market-access economies. The focus is on the relationship between the level of reserves at end-1999 and the maximum crisis index during the subsequent two years, so as to limit possible reverse causality (i.e., that crises explain low reserve ratios).

Methodology and Data Sources

2. The *crisis index* used for this paper is a standard index in the literature, also used in the Fund’s Early Warning System models. It is a weighted average of the changes in the exchange rate and in the reserve level over a 5-month period. Weights are determined by the variation in the exchange rate vis-à-vis the change in the level of reserves over the previous ten years; the higher the variation of the exchange rate (or reserves), the lower the weight on the exchange rate (or reserves). The specific formula used to calculate the crisis index is as follows:

$$CI = \frac{ER * Var(R)}{Var(R) + Var(ER)} - \frac{R * Var(ER)}{Var(R) + Var(ER)}$$

where CI is the crisis index, ER is the change in the exchange rate and R the change in the level of reserves over a 5-month period, Var(R) is the variance of reserves and Var(ER) the variance of the exchange rate over the previous ten years. The peak crisis index indicates the height of the crisis over the specified period (a number of Early Warning Systems models use similar indices).

3. *Reserves, imports and broad money* data are obtained from the IMF’s *International Financial Statistics*. Reserves data include gold valued at the London fixing price. For reasons of data availability and uniformity, *short-term external debt* is based on the Joint BIS-IMF-OECD-World Bank Statistics on External Debt.^{46, 47}

⁴⁶ Specifically, it sums lines G (Liabilities to banks from the consolidated BIS statistics), H (debt securities issued abroad) and I (nonbank trade credits, official and officially guaranteed by 25 OECD countries). For more detailed information on these data, see <http://www1.oecd.org/dac/debt/>.

⁴⁷ Country abbreviations are: Arg for Argentina, Bra for Brazil, Chi for Chile, Col for Colombia, Cze for the Czech Republic, Ecu for Ecuador, Hun for Hungary, Idi for India, Ido for Indonesia, Kor for Korea, Mal for Malaysia, Mex for Mexico, Pak for Pakistan, Per for Peru, Phi for Philippines, Pol for Poland, Rus for Russia, Sa for South Africa, Thai for Thailand, Tur for Turkey, Uru for Uruguay and Ven for Venezuela.

Results

4. **Countries with high STD/R ratios are more likely to suffer deeper crises in subsequent periods.** This result presented in Figure 2 (page 16) is robust over different timeframes (e.g., R^2 of 0.56 for the relationship between the STD/R ratio at end-2000 and the peak crisis index in the subsequent year);⁴⁸
5. **There is some evidence in favor of augmenting the reserve adequacy framework to account for weak macroeconomic fundamentals--the potential for an increasing current account deficit (Figure II.1) and the extent to which the real effective exchange rate has been appreciating (Figure II.2).**⁴⁹ The reserve adequacy indicator augmented for macroeconomic fundamentals and utilized in Figure II.2 is based on the econometric results in Bussière and Mulder (1999). It is calculated as follows: $STD/R - 5*CA/GDP + 1.2*REER$, where CA/GDP is the current account as a percentage of GDP and $REER$ is the appreciation of the real effective exchange rate over the previous 4 years. A relatively simple rule of thumb that follows is that reserves should cover short-term debt plus 5 percent for every percentage point of current account deficit/GDP and an additional 1 percent for every percentage point of real effective exchange rate appreciation over the preceding 4 years.
6. **The ratios of reserves to imports and reserves to broad money perform weakly** (Figures II.3 and II.4);
7. **Preliminary results point to the ratio of reserves to short-term external and short-term domestic foreign-currency linked public debt (by residual maturity) as improving upon the performance of the standard STD/R ratio as an indicator of liquidity risk.** Figures II.5 and II.6 present the same sample results for the standard STD/R ratio and this augmented ratio respectively.

⁴⁸ Outliers such as Mexico and Russia have improved private debt management. In Mexico, private external debt has shifted from banks to corporations with external revenues. Russia is recovering from a crisis period, and building up its reserves. Argentina, Turkey and Uruguay suffer from domestic liquidity and fiscal problems.

⁴⁹ Previous empirical studies have suggested that reserves should cover short-term external debt with a mark-up for weak macroeconomic fundamentals. (See Bussiere and Mulder, 1999).

Figure II.1: Augmenting Short-Term External Debt with the Current Account Deficit and Net Errors and Omissions

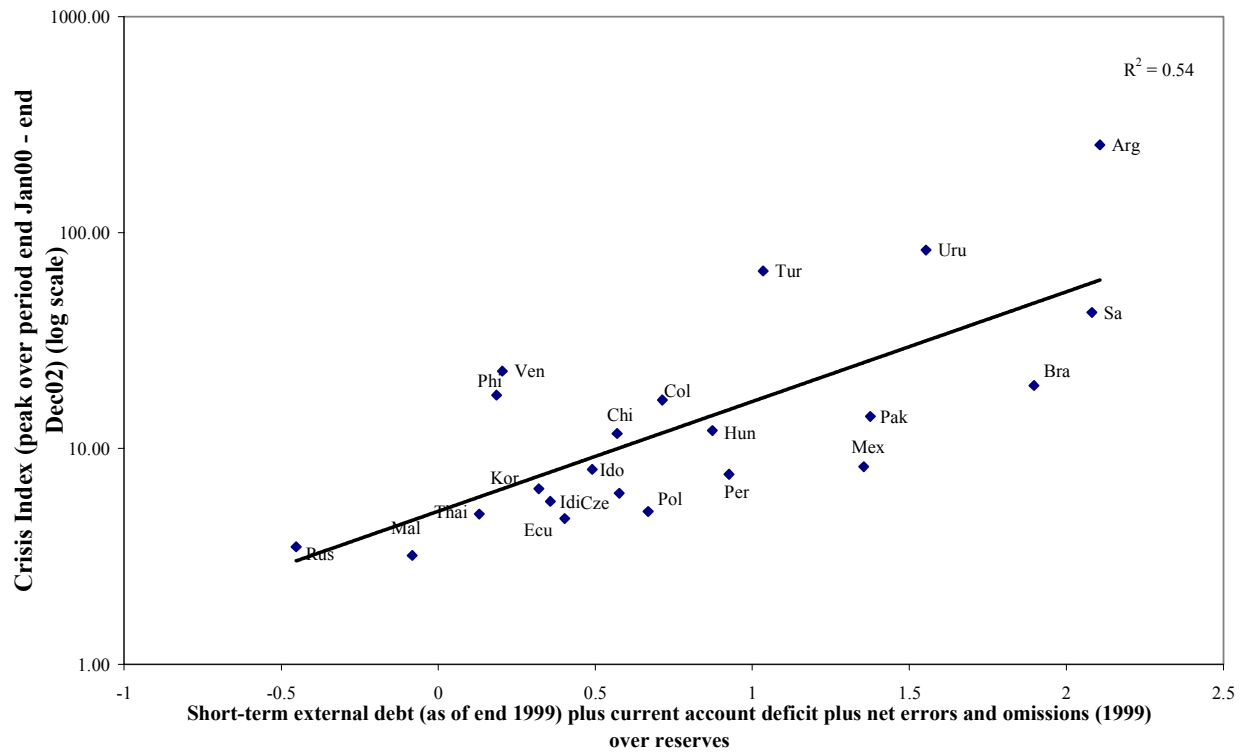


Figure II.2: Augmenting Short-Term External Debt with the Current Account Deficit/GDP and the Real Effective Exchange Rate (January 2000-December 2002)

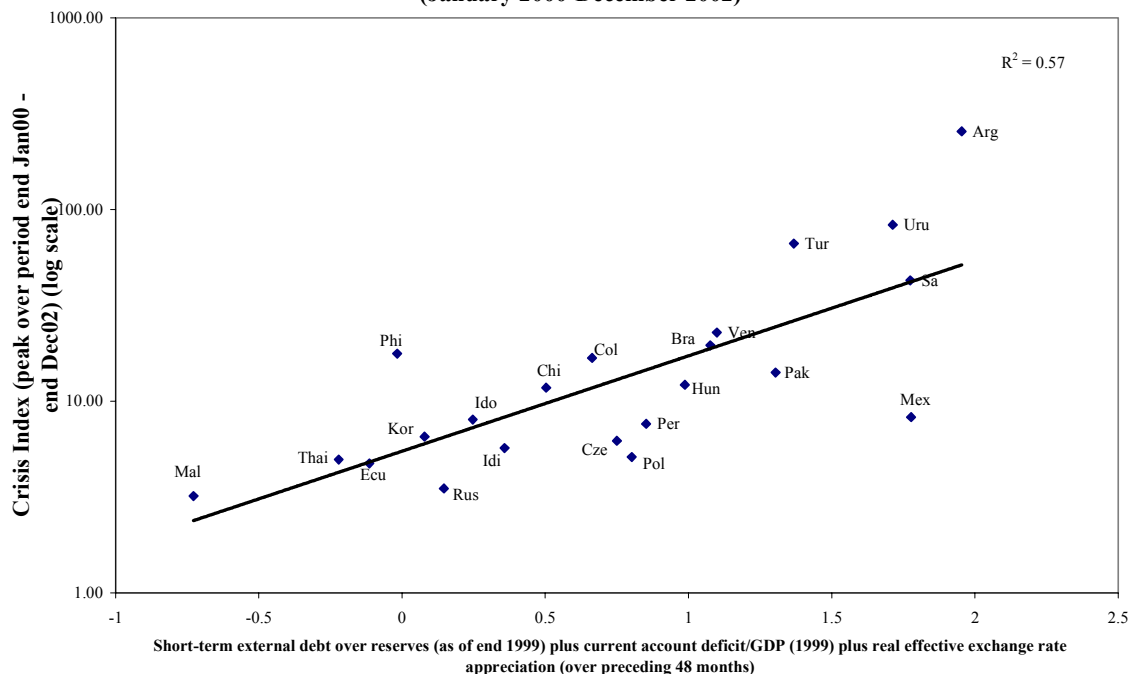
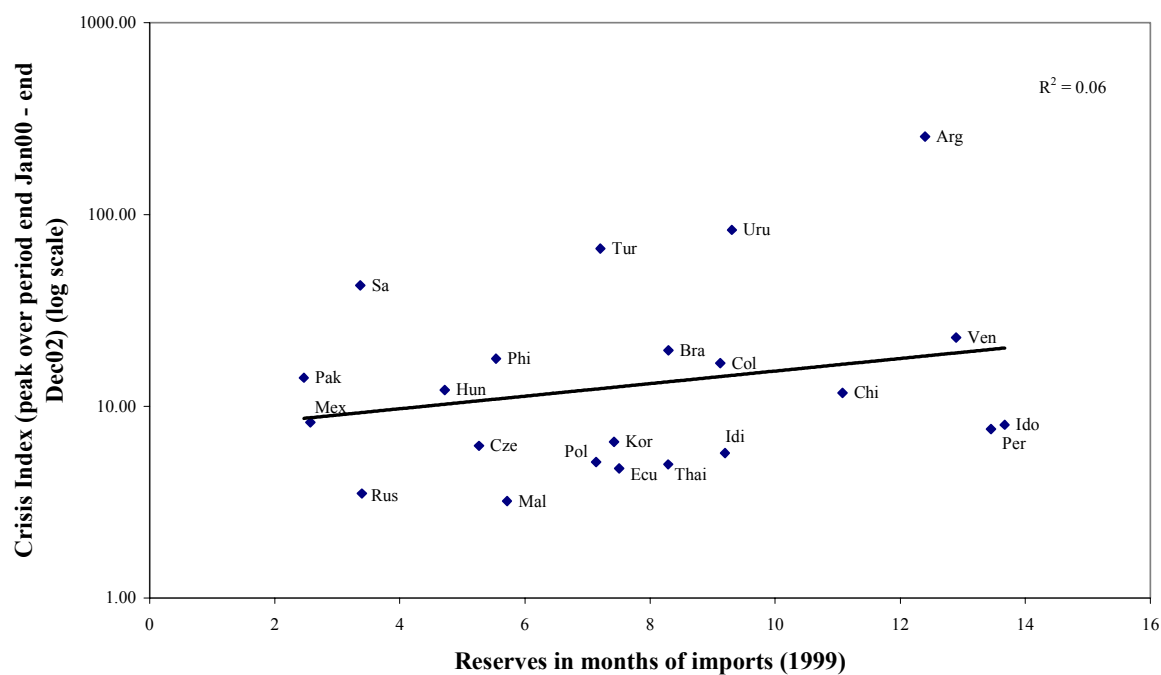
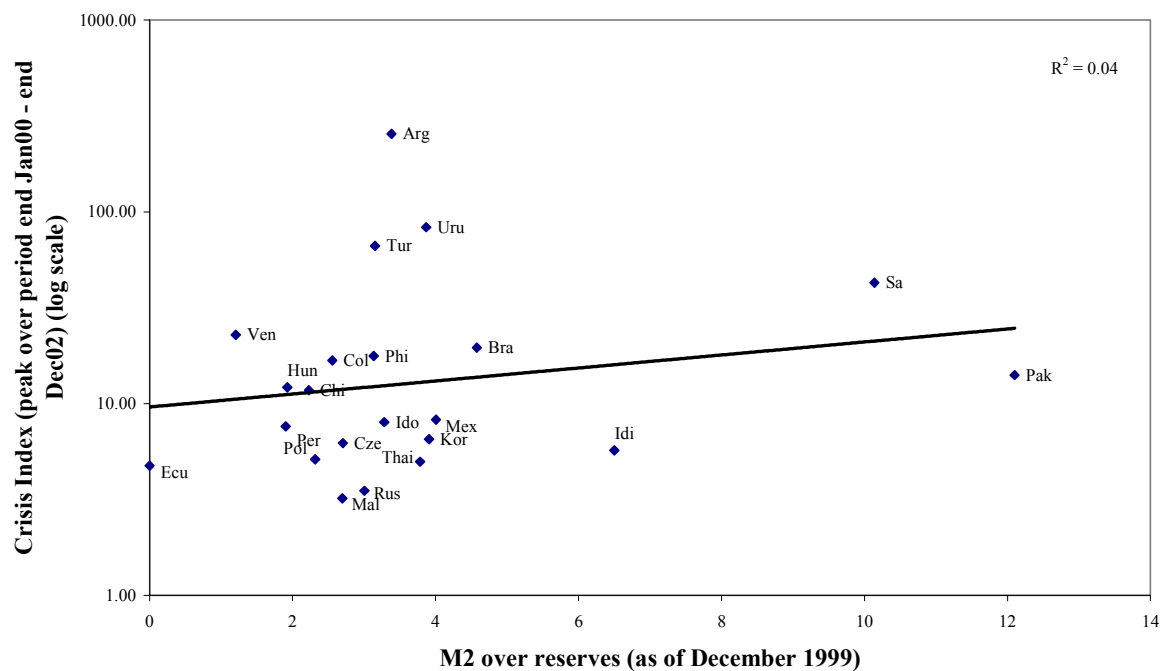


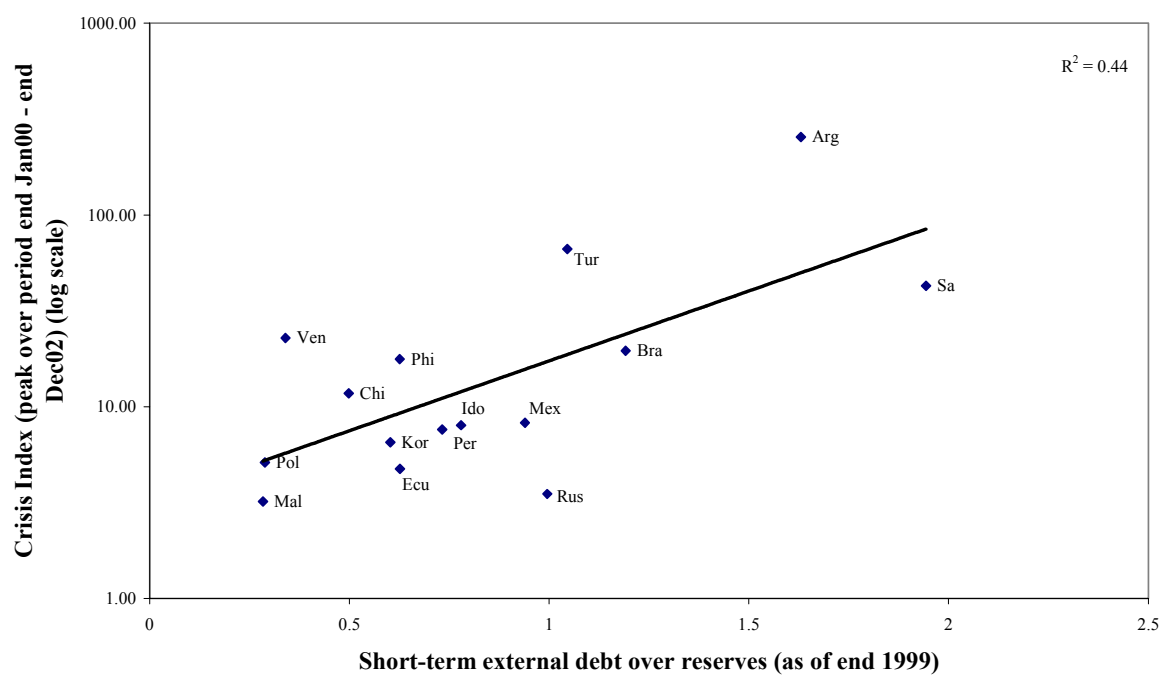
Figure II.3: Reserves over Imports as a Crisis Indicator (January 2000-December 2002)



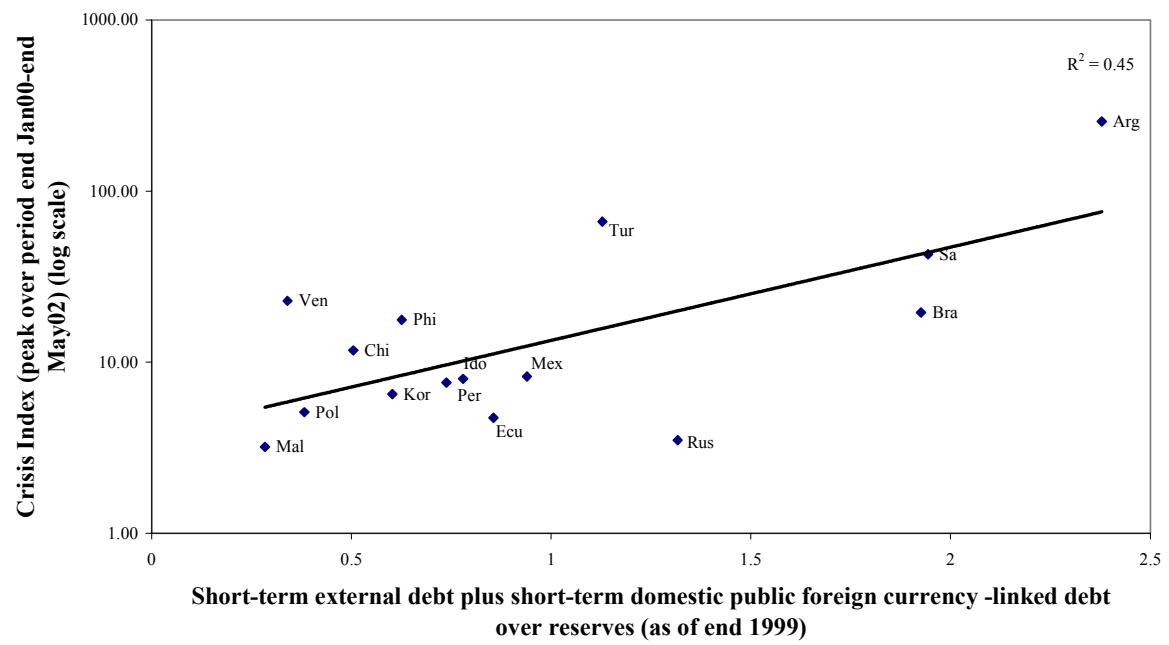
**Figure II.4: Reserves over Broad Money as a Crisis Indicator
(January 2000-December 2002)**



**Figure II.5: Short-Term External Debt over Reserves as a Crisis Indicator
(January 2000-December 2002)**



**Figure 11.6: Short-Term External Debt plus Short-Term Domestic Public Foreign Currency-Linked Debt over Reserves as a Crisis Indicator
(January 2000-December 2002)**



PUBLIC DEBT MANAGEMENT—A LITERATURE REVIEW

Renewed interest in public debt management in the late 20th century was spurred in part by the unprecedented increase in public debt in several advanced countries. The corresponding literature presents debt management as a way to insulate the budget from macroeconomic shocks and allow for a smooth adjustment in tax rates. Key related issues include policy credibility, the nature of shocks to the budget, political economy and balance of payments considerations (see Missale's 1999 overview of this literature).

Financial crises in emerging market countries also have highlighted the unique challenges of managing balance sheets in these countries (BIS 2000, Pettis 2001, Allen et al 2002, Jeanne and Zettelmeyer 2002, Rogoff 2003). In particular, investors are generally unwilling to hold domestic currency and long-term debt of such countries (the 'original sin' problem—Eichengreen and Hausman 1999), prompting emerging market sovereign to rely on riskier debt structures. A number of policy initiatives have been suggested to address this problem (Tirole 2001, Eichengreen et al 2002, Roubini and Valdes 2002). However, the debate on the justification for such initiatives is still ongoing, with some arguing that by ignoring the asset side of the balance sheets, they are based on overly optimistic conclusions (see for example Goldstein and Turner, 2003). In any case, this debate brings again to the fore complex trade-offs involved in managing public exposure to exchange rate, interest rate, roll-over and other risks, while minimizing debt costs.

Key conclusions from the literature on public debt management on currency denomination, maturity structure, and indexation are presented below.

Currency denomination

Domestic currency debt exposes the government to exchange rate risk – a key advantage in countries where the exchange rate is volatile or overvalued (Bohn 1990a, de Fontenay et al 1995, Sims 2001). The credit risk premium on domestic currency debt may also be lower as a result (Gray and Woo 2000).

However, foreign currency debt typically is associated with lower borrowing costs (Bohn 1990b). Given the risk of monetization of domestic currency debt (or a large depreciation of domestic currency), investors demand higher interest rates to hold such debt.

The issuance of public debt in foreign currency may also facilitate the domestic private sector's access to international capital markets or diversification of domestic private investors' portfolios in countries where domestic markets are not well developed (Guidotti 2000, Gray and Woo 2000).

Choosing currency denomination involves complex trade-offs in aiming at sound risk management of external public liabilities. A transparent institutional framework for debt management is crucial in this regard (Cassard and Folkerts-Landau 1997). Matching debt and

output composition may also help neutralize effects of real exchange rate depreciation on the debt-to-GDP ratio (Calvo et al 2002).

Maturity structure

Longer term, balanced debt maturity structure helps reduce the government's exposure to interest rate and roll-over risks and, as a result, helps prevent self-fulfilling liquidity crises (Alesina et al 1990, Giavazzi and Pagano 1990, Cole and Kehoe 1996; also see Obstfeld 1994, Sachs et al 1998, Jeanne and Wyplosz 2001).

Long term domestic debt can encourage national saving and foster market development. Issuance of long term, indexed government securities may make private saving attractive, promote development of domestic capital markets, and facilitate private sector access to longer term financing (Feldstein 1999, Calvo and Guidotti 1992, G-22 1998).

Short term debt has advantages as well. Decreasing debt maturity may help the government keep its no-inflation pledge credible as the stock of nominal debt rises with inflation (Missale and Blanchard 1994) and have positive disciplining effects on fiscal policy (Jeanne 2001). Borrowing at shorter maturities is also cheaper (Campbell 1995).

From a hedging perspective, the choice of public debt maturity should reflect the nature of shocks affecting the budget. If interest rates tend to be positively correlated with output (for example, reflecting productivity growth), short-term, variable-rate debt is preferable (Gale 1990, Missale 1999).

Indexation

Indexed debt may be desirable to the extent that it lowers inflationary expectations by reducing the incentive to inflate debt away, provided it is supplemented by a credible anti-inflationary policy (Calvo 1988). Indexation can also help reduce debt servicing costs if markets overestimate future inflation (Guidotti and Kumar 1991).

Indexed bonds could also help promote private saving and financial market development by improving attractiveness of government debt instruments, especially in countries with persistently high inflation rates and/or missing markets (Bach and Musgrave 1941, Feldstein 1999, BIS 2002).

If not supported by a credible macroeconomic policy, however, indexation may signal the government's lack of commitment to price stability and may exacerbate inflation under inflationary shocks (Fischer 1983, Lucas-Stokey 1983, Persson et al 1984, 1987; Calvo 1988). When the central bank is independent, indexed debt may no longer be needed to control inflationary expectations and to ensure policy credibility (Missale 1999). Overall, indexed debt had been rarely issued in practice (Price 1997), but seems to have generated growing interest in recent years.

Whether nominal or inflation-indexed debt is optimal also depends on the nature of shocks prevailing in the economy. Supply shocks favor nominal debt, while demand and monetary shocks favor indexed debt (Bohn 1988, 1990b; Calvo-Guidotti 1990a, Barro 1995, 1997).

Embedded features in debt instruments (collateralization, warrants, put options, etc.) **may help reduce borrowing costs and improve the structure of public debt but also pose substantial risks** (BIS 2000, GFSR 2002a, 2002b; Borensztein and Mauro 2002).

Decomposition of Change in Public Debt to GDP Ratio—Methodology

This appendix presents the methodology used to derive the data needed for Figure 3 in the main text.

Consider a government that has the following types of debt: i) foreign currency denominated or foreign currency linked debt (measured in dollars), ii) domestic currency denominated inflation indexed debt, and iii) regular domestic currency denominated debt. The debt dynamics then follows the equation:

$$D_{t+1} = (1 + r_{t+1}^F)(1 + e_{t+1})E_t D_t^F + (1 + r_{t+1}^{\pi i})(1 + \pi_{t+1})D_t^{\pi i} + (1 + r_{t+1}^N)D_t^N - PS_{t+1} - NDF_{t+1}$$

where PS_t – nominal fiscal primary surplus at time t in domestic currency dollars, NDF_{t+1} – non-debt creating financing (e.g. privatization receipts), $r_t^F, r_t^{\pi i}, r_t^N$ – interest rates on foreign currency linked, inflation indexed and nominal debt respectively, E_t, e_t – exchange rate level and depreciation at time t. The equation can be rewritten as:

$$D_{t+1} = (1 + e_{t+1})E_t D_t^F + (1 + \pi_{t+1})D_t^{\pi i} + D_t^N - FB_{t+1} - NDF_{t+1}$$

where

$$FB_{t+1} = PS_{t+1} - r_{t+1}^F(1 + e_{t+1})E_t D_t^F - r_{t+1}^{\pi i}(1 + \pi_{t+1})D_t^{\pi i} - r_{t+1}^N D_t^N - \text{overall fiscal balance.}$$

Denote g_{t+1} – real GDP growth rate and ρ_{t+1} – GDP deflator and

$$d_t^F = \frac{E_t D_t^F}{GDP_t}, d_t^{\pi i} = \frac{D_t^{\pi i}}{GDP_t}, d_t^N = \frac{D_t^N}{GDP_t}, fb_t = \frac{FB_t}{GDP_t}, ndf_t = \frac{NDF_t}{GDP_t} - \text{ratios to GDP. Then}$$

$$d_{t+1} = \frac{(1 + e_{t+1})}{(1 + \alpha_{t+1})} d_t^F + \frac{(1 + \pi_{t+1})}{(1 + \alpha_{t+1})} d_t^{\pi i} + \frac{1}{(1 + \alpha_{t+1})} d_t^N - fb_{t+1} - ndf_{t+1}, \text{ where } \alpha_{t+1} = g_{t+1} + \rho_{t+1} + g_{t+1}\rho_{t+1}.$$

Substituting $\frac{1}{(1 + \alpha_{t+1})} = 1 - \frac{\alpha_{t+1}}{(1 + \alpha_{t+1})}$ yields (after some algebraic transformations the following equations for the dynamics of debt to GDP ratio:

$$d_{t+1} = (1 + e_{t+1})d_t^F - \frac{(1 + e_{t+1})\alpha_{t+1}}{(1 + \alpha_{t+1})} d_t^F + (1 + \pi_{t+1})d_t^{\pi i} - \frac{(1 + \pi_{t+1})\alpha_{t+1}}{(1 + \alpha_{t+1})} d_t^{\pi i} + d_t^N - \frac{\alpha_{t+1}}{(1 + \alpha_{t+1})} d_t^N - fb_{t+1} - ndf_{t+1}$$

in addition, for the dynamics of change in debt to GDP ratio:

$$d_{t+1} - d_t = (e_{t+1}d_t^F - \frac{\alpha_{t+1}}{(1 + \alpha_{t+1})} e_{t+1}d_t^F) + (\pi_{t+1}d_t^{\pi i} - \frac{\alpha_{t+1}}{(1 + \alpha_{t+1})} \pi_{t+1}d_t^{\pi i}) - fb_{t+1} - \frac{\alpha_{t+1}}{(1 + \alpha_{t+1})} [d_t^F + d_t^{\pi i} + d_t^N] - ndf_{t+1}$$

The first two terms in the decomposition are impacts of exchange rate depreciation and inflation on the debt to GDP ratio through FX denominated (linked), and inflation linked debt respectively. The term $-\frac{\alpha_{t+1}}{(1 + \alpha_{t+1})} [d_t^F + d_t^{\pi i} + d_t^N]$ can be interpreted as the direct impact of the nominal GDP growth on the debt to GDP ratio.

REFERENCES

- Alesina, A., A. Prati, and G. Tabellini, 1990, *Public Confidence and Debt Management: A Model and a Case Study of Italy*, R. Dornbusch and M. Draghi, eds., *Public Debt Management: Theory and History*, (Cambridge: Cambridge University Press).
- Allen, M., C. Rosenberg, C. Keller, B. Setser, and N. Roubini, 2002, "A Balance Sheet Approach to Financial Crisis," IMF Working Paper 02/210, (Washington: International Monetary Fund).
- Bach, G.L. and R.A. Musgrave, 1941, A Stable Purchasing Power Bond, *American Economic Review*, 31, pp. 823–25.
- Bank for International Settlements, 2000, *Managing Foreign Debt and Liquidity Risks*, *BIS Policy Papers*, No. 8, (September).
- Bank for International Settlements, 2002, *The Development of Bond Markets in Developing Countries*, *BIS Policy Papers*, No. 11, (June).
- Barro, R.J., 1995, "Optimal Debt Management," NBER Working Paper No. 5327.
- , 1997, "Optimal Management of Indexed and Nominal Debt," NBER Working Paper No. 6197.
- Bohn, H., 1988, "Why Do We Have Nominal Government Debt," *Journal of Monetary Economics*, 21, pp. 127–40.
- Bohn, H., 1990a, Tax Smoothing with Financial Instruments, *American Economic Review*, 80(5), 1217–30.
- , 1990b, "A Positive Theory of Foreign Currency Debt," *Journal of International Economics*, 29, pp. 273–92.
- Borenstein, E., and P. Mauro, 2002, "Reviving the Case for GDP-Indexed Bonds," IMF Policy Discussion Paper 02/10, (September), (Washington: International Monetary Fund).
- Burstein, Ariel, Martin Eichenbaum, and Sergio Rebelo, 2002, "Why Are Rates of Inflation So Low After Large Devaluations," NBER Working Paper No. 8748.
- Bussiere, Matthieu and Christian Mulder, 1999, "External Vulnerability in Emerging Market Economies: How High Liquidity Can Offset Weak Fundamentals and the Effects of Contagion," International Monetary Fund Working Paper No. 99/88.
- Calvo, G.A., 1988, "Servicing the Public Debt: The Role of Expectations," *American Economic Review*, 78(4), pp. 647–61.
- Calvo, G.A. and P.E. Guidotti, 1990a, *Indexation and Maturity Structure of Government Bonds: An Exploratory Model*, in R. Dornbusch and M. Draghi, eds., *Public Debt Management: Theory and History*, (Cambridge: Cambridge University Press).
- , 1990b, "Credibility and Nominal Debt," *IMF Staff Papers*, 37, (September), pp. 612–35, (Washington: International Monetary Fund).
- , 1992, "Optimal Maturity of Nominal Government Debt: An Infinite-Horizon Model," *International Economic Review*, 33(4), pp. 895–919.
- Calvo, G.A., A. Izquierdo, and E. Talvi, 2002, "Sudden Stops, The Real Exchange Rate and Fiscal Sustainability: Argentina's Lessons," a background paper for the seminar "The Resurgence of

- Macro Crises: Causes and Implications for Latin America,” Inter-American Development Bank.
- Campbell, J., 1995, “Some Lessons from the Yield Curve,” *Journal of Economic Perspectives*, 9 (Summer), pp. 129–152.
- Cassard, M., and D. Folkerts-Landau, 1997, “Risk Management of Sovereign Assets and Liabilities,” IMF Working Paper 97/166, (Washington: International Monetary Fund), (December).
- Cole, H., and T. Kehoe, 1996, “A Self-Fulfilling Model of Mexico’s 1994-95 Debt Crisis,” *Journal of International Economics*, 41(3/4), pp. 309–330.
- De Fontenay, P., G.M. Milesi-Ferretti and H. Pill, 1995, “The Role of Foreign Currency Debt in Public Debt Management,” IMF Working Paper 95/21, (Washington: International Monetary Fund).
- Dornbusch and M. Draghi, eds., *Public Debt Management: Theory and History*, (Cambridge: Cambridge University Press).
- Eichengreen, B., and R. Hausman, 1999, “Exchange Rates and Financial Fragility,” in *New Challenges for Monetary Policy*, pp. 329-68, (Kansas City: Federal Reserve Bank of Kansas City).
- Eichengreen, B., R. Hausman, and U. Panizza, 2002, “Original Sin: The Pain, The Mystery, and The Road to Redemption,” a paper prepared for the conference “Currency and Maturity Matchmaking: Redeeming Debt from Original Sin,” (Washington: Inter-American Development Bank), (November).
- Feldstein, M., 1999, “Public Policies and Private Saving in Mexico,” NBER Working Paper No. 6930.
- Fischer, S., 1983, “Welfare Aspects of Government Issue of Indexed Bonds,” in R. Dornbusch and M.H. Simonsen, eds., *Inflation Debt and Indexation*, (Cambridge MA: MIT Press).
- Gale, D., 1990, “The Efficient Design of Public Debt,” in R. Dornbusch and M. Draghi, eds., *Public Debt Management: Theory and History*, (Cambridge: Cambridge University Press).
- Giavazzi, F. and M. Pagano, 1990, “Confidence Crises and Public Debt Management,” R. Dornbusch and M. Draghi, eds., *Public Debt Management: Theory and History*, (Cambridge: Cambridge University Press).
- Global Financial Stability Report (GFSR), 2002a, *Alternative Financial Instruments and Access to Capital Markets*, Chapter V, (March).
- Global Financial Stability Report (GFSR), 2002b, *Selected Topic: Emerging Local Bond Markets*, Chapter IV, (September).
- Global Financial Stability Report (GFSR), 2003, *Local Securities and Derivatives Markets in Emerging Markets: Selected Policy Issues*, Chapter IV, (March).
- Goldstein, M., and P. Turner, 2003, *Controlling Currency Mismatches in Emerging Economies: An Alternative to the Original Sin Hypothesis*, Institute of International Economics, Mimeo.
- Goldstein, M., 2001, Managed Floating Plus.
- Gray, S., and D. Woo, 2000, “Reconsidering External Financing of Domestic Budget Deficits: Debunking Some Received Wisdom,” *IMF Policy Discussion Paper* 00/8, (July).

- Group of Twenty Two, 1998, *Report of the Working Group on Strengthening Financial Systems*, (October).
- Guidotti, P., 2000, *Toward a Liquidity Risk Management Strategy for Emerging Market Economies*, mimeo, School of Government, Universidad Torcuato Di Tella, (October).
- Guidotti, P. E., and M. S. Kumar, 1991, "Domestic Public Debt of Externally Indebted Countries," *IMF Occasional Paper* 80, (Washington: International Monetary Fund).
- Jeanne, Olivier, 2001, "Sovereign Debt Crises and the International Financial Architecture," unpublished manuscript, (Washington: International Monetary Fund).
- Jeanne, O. and C. Wyplosz, 2001, "The International Lender of Last Resort: How Large is Large Enough?," NBER Working Paper 8381, (Cambridge, Massachusetts, National Bureau of Economic Research).
- Lane, T. and al., 1999, "IMF-Supported Programs in Indonesia, Korea, and Thailand—A Preliminary Assessment," *IMF Occasional Paper* No.178.
- Lindgren and al., 1999, *Financial Sector crisis and Restructuring—Lessons from Asia*, IMF, Occasional paper No. 188.
- Lucas, R.E. and N.L. Stokey, 1983, "Optimal Fiscal and Monetary Policy in an Economy Without Capital," *Journal of Monetary Economics*, 12, pp. 55–94.
- Missale, A., 1999, *Public Debt Management*, (Oxford: Oxford University Press).
- , 1999, "Tax Smoothing and Policy Credibility: Evidence and Policy Implications, Survey of the Theoretical Literature," in *Second Sovereign Debt Management Forum*, Compilation of Presentations from a Conference Held at the World Bank in Washington, DC. November 1–3.
- Missale, A., and O.J. Blanchard, 1994, "The Debt Burden and Debt Maturity," *American Economic Review*, 84(1), pp. 309–19.
- Moreno-Badia, M., 2002, "Confidence Crises Revisited: Is Short-Term Debt a Curse or a Blessing?" unpublished manuscript, (Washington: International Monetary Fund).
- Obstfeld, M., 1994, "The Logic of Currency Crises," NBER Working Paper 4640, (February).
- Persson, T., and L. Svensson, 1984, "Time-Consistent Fiscal Policy and Government Cash Flow," *Journal of Monetary Economics*, 14, pp. 365–74.
- Persson, M., T. Persson, and L. Svensson, 1987, "Time Consistency of Fiscal and Monetary Policy," *Econometrica*, 55, pp. 1419–31.
- Pettis, Michael, 2001, *The Volatility Machine: Emerging Economies and the Threat of Financial Collapse*, Oxford University Press.
- Price, R., 1997, "The Rationale and Design of Inflation-Indexed Bonds," *IMF WP* 97/12, (January).
- Rogoff, K., 2003, *Emerging Market Debt: What is the Problem?*, a speech given at the Sovereign Debt Restructuring Mechanism Conference, Washington, DC, January 22.
- Roubini, N., and R. Valdes, 2002, "Redemption Through Indexation," a paper prepared for the conference "Currency and Maturity Matchmaking: Redeeming Debt from Original Sin," (Washington: Inter-American Development Bank), November 21-22.
- Sachs, J., A. Tornell, and A. Velasco, 1996, "The Mexican Peso Crisis: Sudden Death or Death Foretold," *Journal of International Economics*, 41 (3/4), pp. 265–83.

- Sims, C., 2001, "Fiscal Consequences for Mexico of Adopting the Dollar," *Journal of Money, Credit, and Banking*, 33(2), (May), Part 2.
- Tirole, J., 2002, *Financial Crises, Liquidity, and the International Monetary System*, (Princeton University Press).
- Turner, P., 2002, *Bond Markets in Emerging Economies—An Overview of Policy Issues*, BIS Papers No.11, (June).
- Werner, A., 2002, "Currency and Maturity Matchmaking—Redeeming Debt from Original Sin," (Washington: Inter-American Development Bank), November 21-22.