

INTERNATIONAL MONETARY FUND

Debt- and Reserve-Related Indicators of External Vulnerability

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SUMMARY, CONCLUSIONS, AND IMPLICATIONS

1. **Improved policies for debt and liquidity management are increasingly seen as an important element of crisis prevention.** Better guidance in this area would be useful to policymakers in managing reserves and debt, to the Fund in the exercise of its surveillance responsibilities, and to market participants in assessing risks. To that effect, this paper identifies the key debt- and reserve-related indicators of a country's external vulnerability and, where possible, simple benchmarks for external sector soundness. Key economy-wide indicators, and their uses, are listed in Table 1. A number of sectoral indicators are also discussed.

Assessing the adequacy of reserves

2. **Although import- and money-based measures of reserve adequacy have not been very successful as predictors of recent crises in emerging markets, there is a role for them in certain situations:**

- The ratio of reserves to imports, as a current account based measure, is useful for countries with no or limited access to capital markets.
- The ratio of reserves to monetary aggregates can be useful as an indicator of the potential impact of capital flight, especially in countries with weak banking systems, but needs to be supplemented with an analysis of other possible sources of capital flight (including short-term government liabilities).

3. **For policymakers in countries with significant (but uncertain) access to capital markets, the ratio of reserves to short-term external debt (by remaining maturity) appears to be the single most important indicator of reserve adequacy:**

- In using this indicator, it is important for it to reflect a comprehensive measure of external debt, regardless of instrument or currency denomination. No instrument is entirely free of rollover risk; and although domestic currency external debt—in contrast to foreign-currency-denominated or -indexed debt—shrinks in real terms when the exchange rate depreciates, this does not eliminate the risk of liquidity crisis.
- A universal indicator should include the short-term external debt of both public and private sectors.

4. **There is some empirical support for a benchmark with a value of one for such a ratio of reserves to economy-wide short-term external debt, across a range of emerging market economies. But such a benchmark would only serve as a starting point for further analysis,** based on a country's macroeconomic situation (including its "fundamentals" and its exchange rate regime) and on the microeconomic conditions that

affect the functioning of the private sector (e.g., taxes, implicit and explicit guarantees, banking supervision, the bankruptcy regime). These microeconomic conditions can result in moral hazard, distort institutions' financing structure, and make sectors more vulnerable to external shocks. On the other hand, to the extent the private sector has unqualified access to international capital markets (as part of it typically does in industrialized countries), its short-term external debt can be discounted in the overall ratio.

5. **In any measure of reserve adequacy, gross reserves need to be carefully measured in line with the internationally accepted definition.** To reflect available liquidity, it is reasonable in the indicators to augment gross reserves with contingent lines of credit that are truly usable, and to subtract from them obligations of the monetary authorities that can materialize immediately, such as derivatives subject to margin calls.

6. **The impact of other potential drains on reserves needs to be carefully analyzed and monitored.** For example, the reserves to short-term external debt indicator recommended above does not include derivatives that are not subject to margin calls, nor government foreign currency debt to residents. Nevertheless, these can lead to additional drains on reserves. Short-term domestic currency liabilities of the government to residents can also become drains on reserves. It is especially important to consider short-term government liabilities to residents if there are no capital controls, or other means that create a captive market, and the exchange rate is fixed.

7. **Stress tests are closely related to indicators (a benchmark of one for the ratio of short-term external debt to reserves represents a simplified stress test in which the current account balance and access to capital markets are nil for a year), and can be used to supplement the analysis.** By allowing consideration of shorter or longer periods of limited access to capital markets, capital flight, FDI flows and the projected current account deficit, stress tests are useful in identifying major liquidity risks, as well as strategies to mitigate them.

Debt indicators

8. **Debt sustainability should be assessed in the context of medium-term scenarios:** "snapshot" indicators do not take account of the prospects for the growth of output and exports, or for fiscal performance. Differing macroeconomic prospects, as well as differences in microeconomic conditions across countries, limit the scope for cross-country benchmarks.

9. **Among debt-related indicators:**

- The paper identifies the ratio of external debt to exports as an especially useful indicator of trends in debt and repayment capacity.
- The ratio of debt to GDP is a useful supplementary indicator that takes account of the potential for switching production to exports.

- Where public debt is predominant, the ratios of debt to GDP and to tax revenue are especially useful.
- The paper cautions against putting excessive weight on debt service ratios, except as regards public sector debt.

10. **The maturity structure of debt is a critical element in crisis prevention.** It is to some extent captured in the reserves to short-term external debt ratio discussed above. It is recommended that this ratio be projected forward several years (making simple, but explicit, assumptions on maturity of new debt) to analyze the impact of the maturity structure. Indicators summarizing the maturity structure should focus on relatively homogeneous categories, such as nonconcessional public debt, rather than total debt.

11. **The effective currency composition and interest rate structure of debt (after taking derivative positions into account) are important ingredients in determining external vulnerability.** Sharp swings in exchange and interest rates can have severe cash flow and balance sheet effects. However, the importance of dispersion of debt across debtors, the impact of natural or explicit hedges, and a dearth of data on derivatives at a national level, mean that analysis of such vulnerability may need to be focused primarily at the level of sectors or even individual institutions.

12. Financial institutions are particularly vulnerable to changing exchange rates and to changes in cash flow, such as withdrawal of foreign currency deposits or credit lines by foreign banks. **Important indicators of the external vulnerability of the financial sector are gross external liabilities, open foreign currency positions (if significant), and indicators of the maturity and quality mismatch in the foreign currency position that include off balance sheet items such as derivatives.**

13. Directly relevant for the external vulnerability of the corporate sector are imbalances in companies' balance sheets and cash flow that make them vulnerable to changes in exchange rates. **Especially important indicators of such imbalances are the difference between foreign currency liabilities and liquid foreign currency assets as a ratio to equity, and the mismatch in foreign currency cash flow as a ratio to overall cash flow.** In the absence of data on such ratios, indicators such as leverage, the ratio of short-term external debt to overall debt, and the coverage of interest payments by operational cash flow can provide useful information, in conjunction with information on the composition and distribution of corporate external debt.

Follow up and data requirements

14. **The staff plans to pursue the issues raised in this paper in its discussions with country authorities.** Special attention will need to be devoted to advice on targets for reserves and the size and structure of debt. The staff plans to report the relevant indicators of vulnerability more systematically in its reports. Moreover, the staff plans to strengthen its dialogue with country authorities on the ways in which they create microeconomic conditions

conducive to sound risk management by the financial and the corporate sectors (for example, by avoiding tax or regulatory regimes that create a bias toward short-term external borrowing, or by ensuring that institutional structures—including bankruptcy regimes—support contract enforcement). The principles set forth in this paper also have an important bearing on public debt management and could be used in the development of guidelines.

15. **Data availability is critical for the analysis of vulnerability.** At present, the availability of the indicators proposed in this paper varies considerably. Some series can be derived from existing statistical methodologies, and some are commonly used in debt monitoring systems. Important steps have been taken and set in train to improve such data:

- within the SDDS, initiatives to improve data compilation and reporting on reserves, external debt, and the International Investment Position more generally;
- new international standards for the compilation of external debt and other pertinent data—to be reflected in a new international debt guide which is being prepared by the Inter-Agency Task Force on Finance Statistics; and
- improvements in the availability of creditor side external debt data.¹

16. **Other series needed to construct some of the indicators in this paper go beyond either present statistical frameworks or current common debt monitoring practice,** notably indicators that are useful for monitoring individual banks or firms. Such information, often basic, is published by individual firms in the context of listings of bonds and stocks on public stock exchanges and frequently disseminated by specialized private data providers. A first priority could be to encourage disclosure of key information and its ready availability, for example from public exchanges. Further, statistical agencies could be encouraged to (re)disseminate relevant aggregates. Supervisory regulation could also be used to ensure that the necessary information, especially on the less common currency breakdowns, is collected and disseminated by individual institutions, as a means to foster market discipline and as a basis for adequate monitoring by the appropriate supervisory authorities

¹Ongoing initiatives in the area of data, and any other improvements in data availability that may be necessary for a better assessment of vulnerability, were discussed at the conference “Capital Flows and Debt Statistics: Can We Get Better Data Faster,” hosted by the IMF and organized in cooperation with the FSF Working Group on Capital Flows (February 23-24, 2000). The background paper for this conference and a summary of the proceedings may be found on the IMF website, www.imf.org.

Table 1. Overview of Indicators 1/

Reserve-related indicators 2/	Use
1. Ratio of Reserves to Short-Term External Debt 3/	Single most important indicator of reserve adequacy in countries with significant but uncertain access to capital markets.
2. Ratio of Reserves to Imports	Useful measure for reserve needs for countries with limited access to capital markets, and comparison across a wide range of countries.
3. Ratio of Reserves to Broad Money	Measure of the potential impact of a loss of confidence in the domestic currency. Useful if banking sector is weak and risk of capital flight exists.
Debt-related indicators	Best used in the context of medium-term scenarios, tested under alternative assumptions.
1. External Debt over Exports	Useful indicator of trend in debt that is closely related to the repayment capacity of the country.
2. External Debt over GDP	Useful indicator relating debt to resource base (for the potential of shifting production to exports so as to enhance repayment capacity).
3. Average Interest Rate on External Debt	Useful indicator of terms. In conjunction with debt ratios and growth outlook, a key indicator for assessing the debt burden.
4. Average Maturity 4/	Useful for homogeneous categories such as nonconcessional public sector debt, to track shortening of maturities or efforts to limit future vulnerability.
5. Share of Foreign Currency External Debt in Total External Debt	Useful indicator of the impact of exchange rate changes on debt (balance sheet effect), especially in conjunction with information on derivatives that transform the effective currency composition.
<p>Definitions:</p> <p>Reserves are external assets readily available to and controlled by monetary authorities for direct financing of external payments imbalances. To be augmented for use in the reserve indicators by immediately usable contingent lines of credit and reduced by immediate drains. Reserves include gold at market prices.</p> <p>External debt consists of the non-equity elements of external liabilities (i.e. all debt instruments held by non-residents), regardless of currency of denomination.</p> <p>Short-term external debt is external debt with a remaining maturity of one year or less. The maturity of debt with embedded put options should be taken to be the earliest date when the creditor can demand repayment.</p> <p>Other notes:</p> <p>1/ Sectoral and institution based indicators can be found in chapter IV C, Table 2 (see also ¶75, 78 and 82-83).</p> <p>2/ The forward and short-term domestic debt position of the monetary authorities and the rest of the central government can be a source of capital flight, especially where no effective capital controls or other means to create a captive market exist, the exchange rate is fixed, and the debt is already denominated in foreign currency.</p> <p>3/ R=STD can serve as a starting point for analysis. For instance, a current account deficit and appreciated real effective exchange rate augments the need for reserves, while a flexible exchange rate regime and conditions to ensure private sector access to international capital markets reduces the need. Stress tests are particularly useful to take into account additional pressures such as capital flight, or a current deficit (before or after FDI financing) etc. The scope for such pressures can be presented in percent of reserves for easy comparison with the short-term debt over reserves indicator.</p> <p>4/ R/STD can be projected forward several years to show the impact of the maturity structure.</p>	

I. INTRODUCTION

17. **The crises in financial markets in recent years have brought to the fore the importance of sound debt and liquidity management** in helping to prevent external crises or to cushion the pace of necessary adjustment. There has been considerable discussion of these issues in recent years, both within the Fund,² and in other fora.³

18. **The increased focus on these topics reflects several motivations.** Most importantly, it is incumbent on policymakers to contain the risk of external crisis and to have in place the tools to ensure policies are appropriate. It is apparent by now that there is no simple way of resolving large-scale external crises; the process is costly, uncertain, and complex. Moreover, a crisis in one country can bring large costs in others. Hence the importance of crisis prevention through sound policies, including in the vital areas of debt and reserve management. The clearer the criteria for judging the soundness of debt and reserve management, the clearer the signals that alert policymakers to the need for adjustment.

19. **The present paper attempts to take stock of the current state of knowledge in this area** and, in particular, to answer the questions:

What sort of indicators should be used to assess the degree to which a country's debt and reserve situation makes it vulnerable to shocks? Can these indicators be compared against simple benchmarks to provide a useful test of the soundness of debt and reserve management policies?

20. **Bearing in mind that no indicator is perfect, and qualifications apply to any, the aim is to search for those indicators that are robust and relatively easy to consider.** Although the overall framework of analysis of this paper applies to all countries, the primary focus of the search for indicators lies on economies with relatively variable access to capital markets, notably emerging market economies. Indicators, because they capture only a few factors, work better for comparative analysis within groups of countries that are relatively homogenous.

21. **While keeping data availability in mind, the paper does not systematically examine whether data are universally available for the recommended indicators to be calculated.** It is evident that many countries still suffer from serious data deficiencies in the

²See, for instance, "The Management of External Debt and Reserves in Emerging Markets," FO/DIS/99/124, September 9, 1999, which also outlines the Fund's ongoing efforts to improve its analysis of these issues in individual country cases.

³Descriptions of a number of these discussions and the resulting proposals, such as those by the G-22, can be found in various reports on the "architecture" of the international financial system, on the IMF website. An earlier draft of this paper benefited from comments from the Financial Stability Forum's Working Group on Capital Flows.

area of debt and reserves. To improve this situation, support at the national level for statistical work is essential. At the international level, a number of relevant statistical initiatives have been or are being undertaken: the inclusion of the reserves template and introduction of a new external debt category in the SDDS; the work of the Inter-Agency Task Force on Finance Statistics in updating and harmonizing international guidelines for the measurement of external debt data; improvements in the availability of creditor data; and research by Fund staff into the availability of macroprudential indicators.

22. **The paper is structured as follows.** The next section lays out some key concepts, while the two subsequent chapters examine reserve adequacy and debt-related indicators, respectively. The paper concludes with issues for discussion. Several annexes containing data and figures, and elaborating on technical aspects of the discussion, are attached.

II. SOME KEY CONCEPTS

23. **This paper focuses primarily on the financial relations a country has with the rest of the world—that is, its overall “balance sheet.”** The prime focus is on *external* assets and liabilities (namely, relations between residents and nonresidents), encompassing both the public and private sector. Within this overall balance sheet, the focus is on debt-related liabilities (in contrast to equity) and on reserves.

24. **External debt and reserves affect a country’s external vulnerability through their impact on the country’s ability to discharge external obligations.** Inability to discharge obligations may result either from a *solvency* or a *liquidity* problem.

25. **Solvency can be defined as the country’s ability to meet the present value of its external obligations.**⁴ A perceived lack of solvency leads inevitably to an external crisis, as foreign creditors withdraw and domestic residents seek refuge abroad for their assets. It is relatively easy, but not very helpful, to define a country’s theoretical *ability* to pay: in theory, countries are solvent as long as the present value of net interest payments does not exceed the present value of current inflows (primarily exports) net of imported inputs.⁵ In practice, countries stop servicing their debt long before this constraint is reached, at the point where servicing that debt is perceived to be too costly in terms of the country’s economic and social objectives. Thus, the relevant constraint is generally the *willingness* to pay, rather than the theoretical macroeconomic ability to pay.

⁴See, e.g., Milesi-Ferretti and Razin, “*Current Account Sustainability: Selected East Asian and Latin American Experiences*,” IMF Working Paper 96/110, 1996.

⁵Solvency abstracts from the issue of whether debt is rolled over or not, by focusing on net flows. The formulation used in this sentence also abstracts from issues of growth. Annex V contains further analysis. See also, e.g., Calvo and Vegh, 1999, “*Inflation Stabilization and BOP Crises in Developing Countries*,” NBER Working Paper 6925, 1999.

26. **While a solvency problem almost always leads to a liquidity problem, as capital flees the country, it is also possible for a liquidity problem to arise when countries appear to be solvent.** Although a (technically) solvent country typically can service its foreign debt under normal circumstances, it can suffer a “run” on its liquidity as uncoordinated creditors rush for the exit.⁶ In any case, it is difficult in practice to determine whether the cause of illiquidity is insolvency or a coordination failure because “solvency is very much like honesty: it can never be fully certified, and proofs are slow to materialize.”⁷ Hence the importance of foreign exchange reserves and of the maturity structure of external assets and liabilities.

27. **In analyzing the impact of external obligations, a distinction should be made between the public and private sectors.** If there is a risk that the public sector will cease to discharge its external obligations, this is likely in itself to lead to a sharp curtailment of capital inflows, in part because it also casts severe doubt on the government’s commitment to allowing private sector debt repayment. By contrast, if (a part of) the private sector is unable to discharge its external obligations, this does not necessarily indicate an external crisis, and, if the problem is contained, should merely lead to lenders, whether domestic or external, carrying the burden of failing loans. However, if private defaults take place on a significant scale, this too is likely to lead to a sharp reduction in capital inflows, and government intervention may follow—in the form of exchange restrictions, a general debt moratorium, or bailouts.

28. **An important implication is that not all external obligations are equal. Relative to public obligations, the weight to be attached to private obligations in risk analysis will depend in large measure on the microeconomic conditions that determine market participants’ risk taking behavior.** Such conditions may include implicit or explicit taxes and guarantees on various forms of external borrowing, and weaknesses in institutional structures such as contract enforcement and bankruptcy procedures. These conditions can result in moral hazard, distort the financing structure, and make sectors more vulnerable.⁸ For example, taxes that favor short-term debt financing or implicit guarantees that promote foreign currency funding (be it implicit exchange rate guarantees or expected bail-outs) contribute to financing structures that reduce the ability of individual institutions to withstand shocks, including wholesale withdrawal by creditors.

⁶For a discussion of self-fulfilling crises see, e.g., Krugman, “*Are currency crises self-fulfilling?*,” NBER Macroeconomics Annual, 1996, Obstfeld, “*The logic of currency crisis*,” Cahiers Economiques et Monétaires, 1994; and Krugman, “*Balance Sheets, the Transfer Problem, and Financial Crises*,” unpublished, 1999.

⁷Calvo, Guillermo, in “*Capital Flows and Macroeconomic Management: Tequila Lessons*,” International Journal of Finance & Economics, 1996, Vol. 1, No. 3, page 208.

⁸Key micro conditions include institutions that foster wage and price flexibility. In addition, institutions such as shareholder rights, accounting standards, and ownership structure can profoundly affect the financing structure of banks and corporations and their exposure to risk (Claessens, Djankov, and Nenova, “*Corporate Risk Around the World*,” World Bank Policy Research Paper 2271, January 2000).

29. **Uncertainty about such micro conditions can also contribute to external vulnerability.** Expectations about the functioning of institutions, such as the bankruptcy regime, and government interventions (bail-outs or exchange restrictions) during crisis circumstances may be volatile and impact foreign creditors' willingness to provide capital to a country. Given conducive and stable microeconomic conditions, the overall private sector debt burden may well be high, but still not a cause for concern—as is illustrated by the history of a number of industrialized debtor countries.⁹

30. **A final point relates to the importance of the exchange rate regime.** A floating exchange rate helps both ensure greater caution in lending and borrowing decisions (as the risk of exchange rate fluctuations must explicitly be taken into account), and contain the cost of external crisis (as, under a fixed exchange rate regime, a crisis may bring an additional cost in the form of a disorderly breakdown of the regime). However, a floating exchange rate regime does not do away with the concern about external obligations. In practice, the response of inflows and outflows to an exchange rate depreciation may be weak—especially in the very short term or if confidence factors dominate—and thus the exchange rate may depreciate substantially in the event of a loss of market confidence. Such a depreciation may bring enormous costs, in terms of both import compression and potentially ruinous balance sheet effects, and would impair the country's debt-servicing capacity. Thus, even a country with a floating exchange rate should take care not to expose itself to excessive debt service obligations.

III. RESERVE ADEQUACY

31. **Reserves are held for a variety of reasons.** Chief among these are maintaining liquidity and allowing time to absorb shocks in situations where access to borrowing is curtailed or very costly. In addition, reserves provide confidence in the authorities' commitment to the timely discharge of external obligations and to supporting the value of the domestic currency.

32. **The recent financial crises have made clear the very high costs that countries bear when they run short of liquidity, and the question of what is an adequate level of reserves has acquired new prominence.** There are two separate issues here. The first is whether *indicators* of reserve adequacy can be formulated that would be a useful predictor of the incidence and severity of crises. The second is whether a rule or *benchmark* level for such an indicator can be defined, which countries (or at least some set of countries) could use as a policy guide in this area.

33. **Following a discussion of the definition of reserve assets (gross and net) to be used for indicators, this chapter discusses three types of indicators of reserve adequacy:** ratios of reserves to imports, to monetary aggregates, and to measures of external debt. It

⁹Although sound individual decisions will not eliminate the risk of a private default sufficiently widespread to cause a crisis, as large exogenous shocks may overwhelm any system, they will markedly reduce it.

then examines whether a benchmark can be established for the reserves to short-term debt ratio¹⁰ and how stress testing can be used to complement an analysis based on indicators. It concludes by reviewing the impact of derivative liabilities of the monetary authorities.

A. Defining Reserves

Assets

34. **Reserves are defined as “external assets that are readily available to and controlled by monetary authorities for direct financing of external payments imbalances, for indirectly regulating the magnitudes of such imbalances through intervention in exchange markets to affect the currency exchange rate, and/or for other purposes”** (*Balance of Payments Manual*, 5th edition—BPM5). The reserves template for the Special Data Dissemination Standard (SDDS) provides more detailed guidance on what should be included in reserves.¹¹ As detailed in the operational guidelines for the reserves template, if the authorities are to use reserve assets for the financing of payments imbalances and to support the exchange rate, the reserve assets must be *foreign currency assets*. The guidelines also call for assets to be marked-to-market in line with BPM5, and for gold to be included at market prices.

35. **Contingent lines of credit are not part of reserves,¹² but, if they are truly usable on demand, they can be used to augment the reserve number used in reserve indicators.** Such lines of credit must allow immediate drawings without material conditionality, and spreads should not effectively prohibit drawings. Very few countries, however, have such lines, and it should be borne in mind (for instance, in performing stress tests) that drawing on such lines could reduce other inflows, by inducing the providers of credit lines to reduce other exposures.

Netting drains on reserves?

36. **The crises of the last few years have shown the importance of taking account of future drains on reserves, and the question arises how to treat such drains in the “headline” reserves number for use in indicators on which policymakers should focus.**¹³

¹⁰Unless otherwise specified, references to short-term debt in this paper are to short-term debt by remaining maturity (i.e., all debt maturing within the next year).

¹¹See “Data Template on International Reserves and Foreign Currency Liquidity—Operational Guidelines,” October 1999, Statistics Department, International Monetary Fund, available on the IMF website.

¹²Contingent credit lines are separately reported in the SDDS reserves template line III.3.

¹³The SDDS reserves template provides a comprehensive listing of drains on reserves, including both predetermined and contingent drains (including short-term debt, forward liabilities, and guarantees). It provides data on short-term foreign currency outflows of the monetary authorities and other central government, whether to residents or nonresidents.

(continued...)

The idea of netting such drains from the headline reserves number raises questions related to time horizon. Just as, on the asset side, the headline number used in reserve indicators should include only liquid assets and assets immediately available, so only drains on reserves that might materialize immediately should be netted out of the headline number.¹⁴ (This would include derivatives subject to margin calls.)¹⁵ Among the drains on reserves that may materialize over a longer time horizon, the short-term external debt of the monetary authorities will be included in one of the indicators discussed below (the ratio of reserves to short-term external debt).

B. Import-Based Measures of Reserve Adequacy

37. **The traditional indicator of reserve adequacy is reserves in months of imports, and this ratio is likely to remain relevant** as a simple way of scaling the level of reserves by the size and openness of the economy. Reserves in months of imports of goods and services has a straightforward interpretation: the number of months a country can continue to support its current level of imports if all other inflows and outflows cease. This measure—focused on the current account—is of use especially in judging reserve needs for countries that have limited access and vulnerabilities to capital markets.¹⁶ In addition, import data generally suffer from relatively few measurement problems.¹⁷

¹⁴In the remainder of this paper, the word “reserves” is used to mean reserves, plus contingent lines of credit, minus immediately callable liabilities.

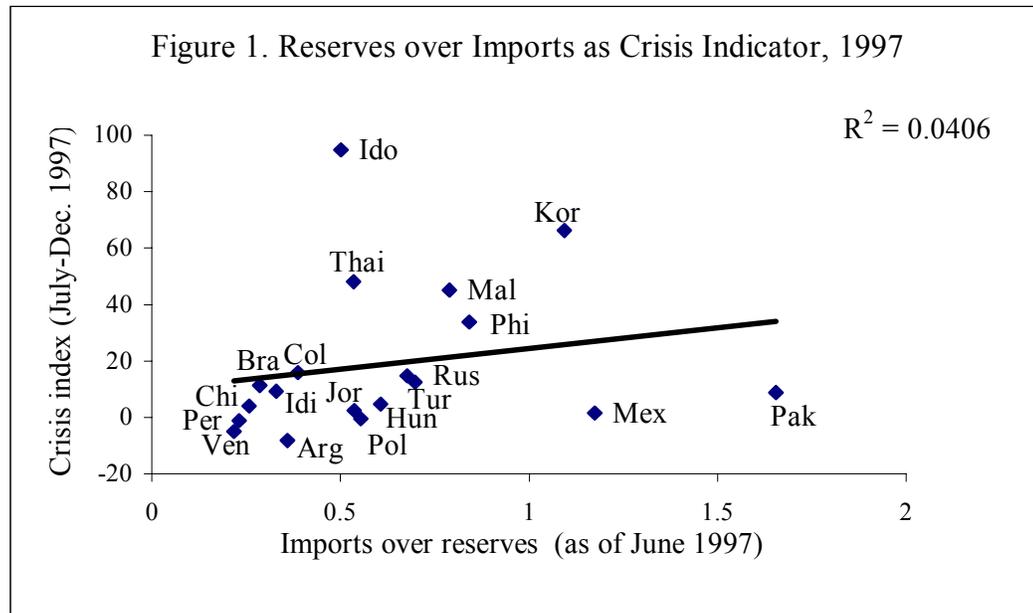
¹⁵In the SDDS reserve template this is the sum of lines IV.1.f. (derivatives that have a residual maturity greater than one year and are subject to margin calls), and of III.4.a.(ii) (written call options) and II.2.a (short positions in forwards and futures) to the extent these positions are subject to margin calls.

¹⁶These conditions make this indicator generally less suitable for analyzing vulnerability in industrialized countries. For countries with limited access to capital markets, the variability of the current account is also important, as reserves are then needed to buffer the impact of shocks to the current account.

¹⁷A uniform definition of this measure would help comparability across countries. For the Fund’s internal purposes the focus is on: (i) the prospective level of imports over the next 12 months, rather than the historical level; (ii) imports including gross services payments and aid-related imports; and (iii) imports excluding imports for transit trade, if these are sizable and the value added limited. As a rule of thumb, three months of reserve cover of imports has traditionally been seen as a minimum level for comfort, and is close to the mean and the median of the level of reserves held in member countries (those for which data are available).

Box 1. Reserves over Imports

The (weak) relation between reserves over imports and a country's performance during a period of international crisis is illustrated in Figure 1. For the second half of 1997, i.e. during the Asian crisis episode, this figure shows the relationship across a range of emerging market economies between reserves over imports before the onset of the crisis and the degree to which these countries were subsequently affected by the currency crises. As shown in Annex I, broadly similar results obtain for the crisis periods of 1994 and 1998.



Several conventions relating to these figures, such as abbreviations, the inverse relation used, and the definition of the crisis index are explained in footnote 18.

38. **It is increasingly clear, however, that the appropriate level of reserves cannot be determined without reference to the capital account.** Box 1, for instance, illustrates the weak relation between reserves over imports and the occurrence or depth of crises in a recent period of financial turmoil.¹⁸ Reflecting the main sources of possible pressure on the capital

¹⁸The figures in this paper are meant as illustrations, not as conclusive evidence (for which in many cases much more thorough econometric studies are available). In this vein the R^2 is included as a measure of goodness of fit that can be visually inferred as well. This measure is strongly affected by outliers and thus the sample used. The following conventions and definitions are used in figure 1 and the other figures in this paper: (i) **Country abbreviations:** Arg for Argentina, Bra for Brazil, Chi for Chile, Col for Colombia, Hun for Hungary, Idi for India, Ido for Indonesia, Jor for Jordan, Kor for Korea, Mal for Malaysia, Mex for Mexico, Pak for Pakistan, Per for Peru, Phi for Philippines, Pol for Poland, Rus for Russia, Sou for South Africa, Thai for Thailand, Tur for Turkey, Ven for Venezuela. (ii) **Data sources:** Unless otherwise indicated, all data are taken from the IMF's International Financial Statistics (IFS). Reserves include gold valued at the London fixing price. (iii) **Crisis index:** As in models of Early Warning Systems, a crisis index is used as an indicator of the occurrence and depth of external crises. The index is a weighted average of the *change* in the exchange rate and the *change* in the level of reserves over the indicated period. The weights are determined by the variation in the exchange rate (continued...)

account, it is generally considered useful to measure reserves against some monetary aggregate and/or some measure of external debt.

C. Money-Based Measures of Reserve Adequacy

39. **Money-based indicators of reserves provide a measure of the potential for resident-based capital flight from the currency.**¹⁹ An unstable demand for money or the presence of a weak banking system indicates a greater probability of such capital flight. In these circumstances the ratio of reserves to broad money is thus a potentially useful indicator. In addition, the ratio of reserves to base money may be especially useful for assessing reserve adequacy under fixed exchange rate regimes whose credibility needs to be established (a focus on this measure is institutionalized in the context of currency boards).

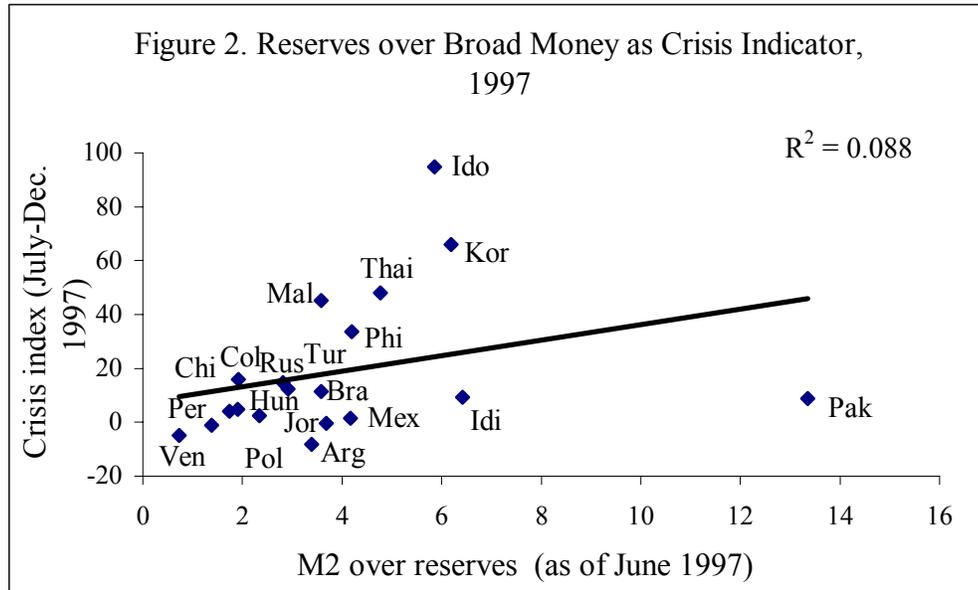
40. **Money-based indicators, however suffer from several drawbacks.** In countries where money demand is stable and confidence in the domestic currency high, domestic money demand tends to be larger and the reserves over money ratio, *ceteris paribus*, relatively small. Therefore, while a sizable money stock in relation to reserves suggests a large *potential* for capital flight out of money, it is not necessarily a good predictor of *actual* capital flight. Money-based measures also do not capture comprehensively the potential for domestic capital flight. They do not, for example, take account either of the potential for residents to shift out of short-term debt of the public sector into foreign assets, or of the potential for residents to take derivative positions in exchange rates vis-à-vis the monetary authorities. Box 2 illustrates the weak relation between reserves over broad money and the occurrence and depth of crises in a recent period of international crisis.

versus the change in the level of reserves over the forgoing ten years, with the weight lower the more variation a variable displays. Exchange rate changes feature prominently in the crisis index, in part because, the crisis index for a country with a previously fixed exchange rate primarily indicates the change in the exchange rate rather than in the level of reserves. For example, for 1997 the weight on the exchange rate change in the crisis index is on average 70 percent. (iv) The figures use **the inverse of the reserve indicators**. This improves the estimations as an increase in reserves when they are already at a high level does rather little to reduce the probability or depth of crisis further.

¹⁹Money-based measures of reserve adequacy have been in use for many decades, since well before import-based measures came into common use. Most central banks operating under the gold standard in the interwar period were required to pursue “some definite relation between the gold reserves, or the gold reserves plus foreign exchange, and the note issue, or the note issue plus other sight liabilities.” League of Nations “*International Currency Experience; Lessons of the Interwar Period*,” 1943. The historic use reflected a need to build confidence in money.

Box 2. Reserves over Broad Money

The relation between reserves over M2 and a country's performance during a period of international crisis is illustrated in Figure 2. Even if outliers are removed the relation is relatively weak. As shown in Annex I, the relation is no closer in 1994 or 1998.



D. Debt-Based Measures of Reserve Adequacy

41. In recent years there has been increasing interest in comparing the level of reserves to a measure of external debt, in particular to short-term external debt by remaining maturity.²⁰ A measure comparing reserves and short-term external debt is useful to gauge risks associated with adverse developments in international capital markets. Short-term debt by remaining maturity provides a measure of all debt repayments to nonresidents over the coming year and, as such, constitutes a useful measure of how quickly a country would be forced to adjust if it were cut off from external borrowing.

42. Empirical work both in the Fund and elsewhere²¹ suggests that the ratio of reserves to short-term external debt (R/STD), as further defined below, is indeed the

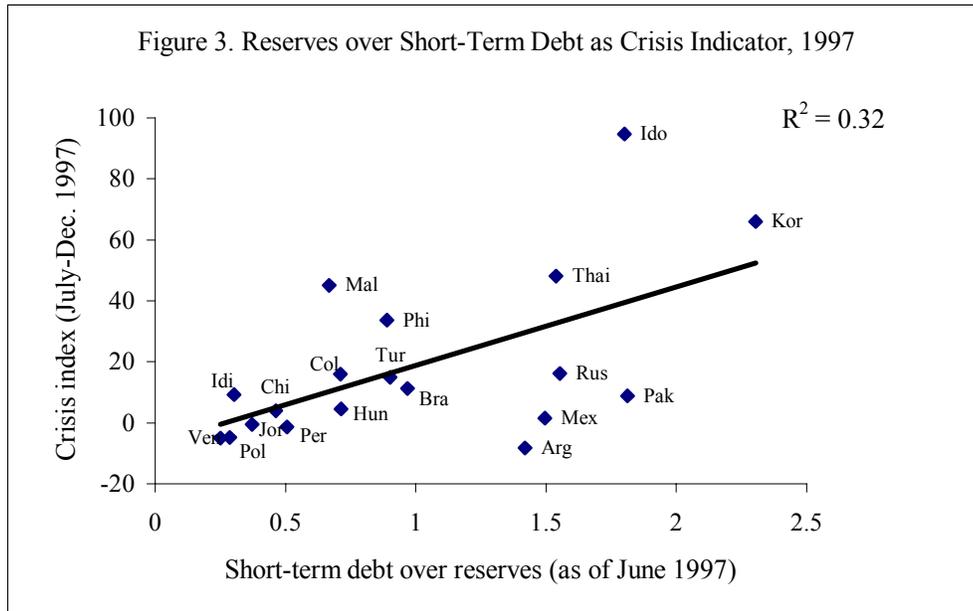
²⁰Short-term debt by remaining maturity is equivalent to short-term debt on an original maturity basis (which includes currency and deposits with a maturity of under one year) plus amortization falling due within one year on medium- and long-term loans and bonds.

²¹See, for instance, Rodrik and Velasco, "Short-Term Capital Flows," paper prepared for the 1999 ABCDE Conference at the World Bank, 1999; "Anticipating Balance of Payments Crises—The Role of Early Warning Systems," SM/98/271 (12/17/98); Furman and Stiglitz, "Economic Crises: Evidence and Insights from East Asia," 1998; and Turner, "Liquidity: Forex Reserves and the Alternatives," note prepared for the Sovereign Debt Management Forum, Washington, D.C., November 1–3, 1999.

single most important indicator of reserve adequacy in countries with significant but uncertain access to capital markets. A smaller reserves to short-term debt ratio is associated with a greater incidence and depth of crises (see also Box 3). Whether the

Box 3. Reserves over Short-Term External Debt

The relation between the reserves over short-term external debt indicator and a country's performance during a period of international crisis is illustrated in Figure 3. The reserve indicator is shown for the period before the crisis took full effect and significantly impacted reported reserve levels. See footnote 24 for the source of the short-term debt data, which are subject to significant margins of error.



For the second half of 1997 this figure shows an upward sloping relationship between short-term debt over reserves and the crisis index across a range of emerging market economies. In spite of the countries' substantial differences in various economic dimensions, the ratio of short-term debt over reserves preceding the crisis periods explains a significant part of the variation in the crisis index. This suggests that the weaker a country's liquidity position prior to the onset of the crisis, the stronger the exchange market pressure and thus potential for a crisis during the crisis period.

A Fund staff study of the Tequila, Asian, and Russian crises contains more formal tests for a similar group of countries (Bussière and Mulder, "External Vulnerability in Emerging Market Economies: How High Liquidity Can Offset Weak Fundamentals and the Effects of Contagion," Working Paper WP/99/88, July 1999, International Monetary Fund). The results point to the superiority of short-term debt over reserves as a predictor of the depth of crisis, compared to either imports over reserves or broad money over reserves, when simultaneously included as predictors. Similar results are obtained in tests of the Early Warning System model developed by Fund staff. (Borensztein, Eduardo, Andrew Berg, Gian-Maria Milesi-Ferretti, and Catherine Pattillo, "Anticipating Balance of Payments Crises—The Role of Early Warning Systems," IMF Occasional Paper, 1999).

resulting indicator is sufficiently robust that a benchmark level can be identified is a separate issue, which is discussed below.²²

Defining the relevant concept of short-term external debt

43. **A general reserves to short-term debt ratio should use a comprehensive measure of external debt (i.e., the non-equity elements of external liabilities),²³ regardless of instrument or currency denomination (Box 4).** All categories of instruments should be included: loans, debt securities (bonds and notes, and money market instruments), currency and deposits, trade credits, and the debt component of foreign direct investment (Box 4). Debt to nonresidents is included, and debt to residents excluded, regardless of the currency of denomination. In determining maturity, debt with embedded put options should be taken to be payable on the earliest date when the creditor can demand repayment.²⁴

44. **On balance it seems best to include both public and private debt for the purpose of defining a general reserves to short-term debt indicator.** Clearly, debt issued or guaranteed by the public sector should be included, and this will often encompass many of the liabilities of the banking system, which typically enjoy explicit or implicit guarantees. Beyond this, as noted above (§28-29), the degree to which (unguaranteed) private short-term external debt is of concern varies across countries—with microeconomic conditions and with the volatility of investor perceptions. However, it is possible for the private sector's access to international capital markets to be curtailed for reasons related not to its own solvency, but because of increased transfer risk (the risk that exchange rate restrictions are imposed that

²²The data problems involved in assessing short-term debt are formidable, and there are, and will remain for some time, important question marks over the comparability of data for different countries.

²³The Interagency Task Force on Finance Statistics, an interagency body chaired by the IMF, is preparing a new guide on external debt statistics. The aim is to issue a first draft of the guide to be used for seminars within the next few months. The Task Force definition of external debt, used here, is in line with the conceptual framework of the International Investment Position as elaborated in BPM5.

²⁴For reasons of data availability and uniformity, short-term debt in the figures in this paper is based on the Joint BIS-IMF-OECD-World Bank statistics on external debt and is taken to be the sum of 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 the 21 DAC member countries). These data are based on creditor side reporting and are on a remaining maturity basis. They do not include debt from bank creditors in countries that do not report to the BIS (18 countries report), official nontrade-related bilateral debt, multilateral debt, domestically issued debt acquired by nonbanks, and privately placed external debt. At the same time, the data suffer from a modest degree of double-counting, to the extent that debt securities issued abroad (line H) are held by foreign banks and included in line G. On average, Joint Table short-term debt is equivalent to about 95 percent of short-term debt shown in the World Economic Outlook (based on data collected by country teams from the authorities) for the group of countries referenced in Box 1.

Box 4. Short-Term External Debt: Coverage and Currency Denomination

External debt should include all debt instruments held by nonresidents, and thus not only foreign issued instruments, but also debt issued domestically but acquired by nonresidents (an important category because it can be especially volatile, but data are often difficult to get); debt issued offshore that is lent to residents; and deposits held by nonresidents.

Trade-related credits should be included in the definition of short-term debt. Traditionally, trade credit was thought to be relatively impervious to liquidity-related crises. Accordingly, and because short-term debt was often assumed to consist primarily of trade credit, scant attention was paid in liquidity analysis to short-term debt. The focus was instead on medium- and long-term amortization and interest payments, and this was reflected in the standard debt service ratios. However, the experience in the recent crisis periods has underscored that during severe crises all short-term lending is drastically curtailed, as banks and other investors seek to limit their overall country exposure. A comprehensive concept of debt that includes trade credits is therefore most useful as a general measure.

Debt issued by corporations that are owned by foreign investors is also included in the measure of debt. It is true that foreign debt issued by enterprises that are majority foreign-owned and guaranteed by foreign entities is less likely to contribute to a liquidity crisis, as the foreign entities' credit is less likely to be affected by the crisis. In general, however, the definition of foreign-owned is too wide for this argument to go through reliably: enterprises are generally classified under foreign direct investment if foreign ownership exceeds a threshold of about 10–20 percent (BPM5 recommends 10 percent). In addition, foreign-owned enterprises, in particular banks, may benefit from guarantees, including deposit insurance schemes, that could turn the external liabilities of these operations into liabilities of the government during a crisis period.

Short-term debt includes debt to nonresidents regardless of the currency of denomination. At least under a flexible exchange rate regime, denomination in domestic currency reduces the risk of liquidity crisis (thanks to the equilibrating mechanism whereby the real value of the debt shrinks when the exchange rate depreciates, and thanks to the ability of the domestic lender of last resort to inject liquidity). However, it does not eliminate this risk, inter alia because the liquidity injection may lead to demands on reserves or to an exchange rate depreciation, albeit one less costly than when exposure is in foreign currency (since the balance sheet effects are more limited). Also, the currency composition of the debt can be altered through swaps and other derivative contracts.

Conversely, foreign currency short-term debt that is acquired by residents should not normally be included in the short-term debt concept. In aggregate, foreign currency relations between residents cancel out, so that the concept of foreign currency debt to residents is relevant only at a sectoral level. If foreign currency claims of one sector, e.g., the public sector, on another domestic sector were to be added to the overall foreign currency external debt, this would risk significantly exaggerating the exposure. Repayments of internal debt obligations do not necessarily lead to external outflows, because capital controls may be in place and captive markets may exist (banks and pension funds may be regulated in a way that limits their transfer of investments to claims on nonresidents). However, in considering the exposure of the public sector (see below), a focus on the authorities' overall foreign currency-denominated and -indexed debt (including to other residents) and assets is important with a view to estimating the impact on debt service of changes in the exchange rate. Moreover, in the absence of capital controls or captive markets, information on all short-term domestic debt of the government is important, as its repayment can lead to capital flight and pressures on reserves, especially if the financial position of the public sector is weak. Information on floating rate domestic currency debt, whose cost can increase rapidly during periods of stress, is similarly relevant.

prevent the repayment of obligations).²⁵ Moreover, the liquidity position of particular sectors (see also chapter IV.C) could contribute to self-fulfilling expectations that affect the sector or the economy as a whole, if not compensated by liquidity at a national level. It is thus appropriate for the authorities to monitor the liquidity position of the private sector and to take private short-term debt into account in their macroeconomic policies, including their reserve policies. In parallel, arguments can be put forward for including in the numerator of the “reserves” measure the liquid foreign assets of the private sector, but on balance it seems best to exclude these (Box 5).²⁶

Box 5. The Treatment of Private Sector External Assets

Especially in industrial countries, private sector external asset positions can be significant. Such positions tend to increase with the maturity of the economy and reflect cross holdings that are beneficial from a portfolio perspective (asset holders have an incentive to spread risks). The presence of large scale non-reserve external assets generally suggests that a narrow focus on gross liabilities is unsatisfactory, and points to the need to examine different ratios which capture other assets, for example the ratio of short-term liabilities to overall non-FDI assets. However, in emerging markets, such non-reserve assets tend to be much smaller. Moreover, significant portions of them may not be available to finance liquidity imbalances—this is true, for instance, of many pension fund assets, and of those liquid foreign assets that banks hold as counterparts to liquid foreign currency claims by residents (which are not included in the measure of short-term debt). In general, private sector foreign assets may not be distributed between sectors and individual enterprises in such a way that they can be used to absorb private sector liquidity needs. The diverse nature of non-reserve assets suggests that these assets be excluded from the core reserves over short-term debt ratio; but the presence of such assets is an issue that needs to be taken into account in individual country analysis.

Augmenting short-term debt with the current account deficit

45. **There is a case for comparing reserves to a measure of short-term external debt augmented with other borrowing needs.** Analysts often use an indicator that includes the current account deficit, and Mr. Guidotti, former Deputy Finance Minister of Argentina, and others have argued that reserve adequacy should be judged based on how long a country can go without foreign borrowing. This implies that other borrowing needs—in particular the current account deficit—would be included alongside short-term debt.

46. **The ratio of reserves to short-term external debt augmented with the projected current account deficit (or another measure of expected borrowing) is useful as an additional indicator, but it is not recommended that it supersede the narrower reserves to short-term debt indicator.** Empirical studies suggest, and Annex I illustrates, that the

²⁵The sovereign ratings for external foreign currency borrowing of a country function as a cap for the ratings assigned to banks and corporations by the major rating agencies.

²⁶Bussière and Mulder, “*Which Short-Term Debt over Reserve Ratio Works Best: Operationalizing the Greenspan/Guidotti rule*,” draft Working Paper, forthcoming, International Monetary Fund, finds empirical support for including private sector debt in the ratio of reserves to short-term debt for a range of emerging market economies. This paper also finds no support for augmenting reserve assets with private assets, or netting private assets from short-term debt.

augmented ratio does not in general perform better than the basic reserves to short-term debt ratio.²⁷ They also generally find the current account deficit *in percent of GDP* to be a crucial additional variable in predicting external crisis,²⁸ so that this variable needs to be examined separately anyway (Footnote 32 contains a simple rule of thumb for taking the current account deficit, as well as the real exchange rate, when assessing the reserves to short-term debt ratio). In any case, the narrower measure is easier to judge because it does not depend on a projected current account deficit of uncertain magnitude—all the more uncertain because it may also depend directly on the availability of new funding.

E. A Simple Benchmark for Reserve Adequacy?

47. **The ratio of reserves to short-term external debt has recently received attention in attempts to find a simple benchmark that countries should satisfy in order to minimize their vulnerability.** Mr. Greenspan (Chairman of the Federal Reserve Board of the United States) has elaborated on Mr. Guidotti's proposal with suggestions that reserves should exceed official and officially-guaranteed short-term debt.²⁹

48. **The Fund staff has found some empirical support for a benchmark of one for the ratio of reserves to economy-wide short-term external debt.**³⁰ **The staff would recommend using a ratio of unity as a starting point for analysis of reserve adequacy for countries with significant but uncertain access to capital markets.** In addition, however, the above discussion points to the need to take into account various factors that serve to enhance or mitigate the need for reserves in a particular country compared to such a benchmark.³¹

²⁷In tests of the Early Warning System model developed by Fund staff (Borensztein et al., 1999, op. cit.), R/STD performs broadly the same as the ratio in which short-term debt is augmented with the current account deficit. Bussière and Mulder, op. cit. (forthcoming) find that the basic R/STD ratio outperforms the augmented ratio.

²⁸The current account deficit to GDP is an important explanatory variable in Borensztein et al., 1999, op. cit., and Bussière and Mulder, 1999, op. cit.

²⁹"*Efforts to Improve the Architecture of the International Financial System*," Testimony before the Committee on Banking and Financial Services, U.S. House of Representatives, May 20, 1999.

³⁰See a Fund staff study of the Tequila, Asian, and Russian crises by Bussière and Mulder, 1999, op. cit. The data used in this study are broadly similar to those used in this paper. The findings imply that a benchmark of one for the ratio of reserves to short-term debt is broadly appropriate. The study finds that the appropriate level of reserves for the set of countries tested depends especially also on the current account deficit and the extent to which the real effective exchange rate has been appreciating (the study uses the increase over the previous four years as a proxy). Boxes 3 and 6-7, and Annexes I-II contain further material to illustrate the relation of reserves to short-term and external vulnerability. The dispersion of ratios in Figure 3 provides a visual indication of the extent to which a single indicator can be used as a benchmark.

³¹The importance of mitigating or aggravating factors is illustrated by the fact that in most high income industrialized countries the ratio of reserves to economy-wide short-term external debt is relatively low (on

(continued...)

- the exchange rate regime (a flexible regime reduces the likelihood and costs of crisis);
- the currency denomination of external debt (ideally after hedging);
- other macro fundamentals, especially the current account deficit and the real exchange rate;³²
- the microeconomic conditions that impact the soundness of the private sector debt position. For example, to the extent a country's private sector has unqualified access to international capital markets, its short-term debt can be discounted in the overall ratio; and
- the possibility of capital flight by residents or the possibility for residents and nonresidents to take derivative positions or otherwise short the currency. Thus, close attention should also be paid to monetary aggregates (especially when the banking system is weak), and short-term public debt held by residents (especially in the absence of capital controls or captive markets, and the public sector's financial position is weak) (Box 4).

F. Derivative Liabilities of the Monetary Authorities

49. **The comparison of reserves to short-term debt, as discussed above, takes account of the short-term external debt of the monetary authorities (which is included in the denominator), but not of their notional derivative liabilities (unless subject to margin calls).** It is important to consider the impact of such liabilities separately.³³ In the recent crises, several central banks took large forward positions in support of the domestic currency. The potential for running up such positions is in general very great, since central banks may face the full force of international capital markets on the other side of the market, and since there are no natural limits on the amount of forward intervention. As a result,

average about 0.2) (Annex II), and by cases of emerging market economies in which, with hindsight, low (high) reserves should not have been taken as cause for concern (comfort) (Box 7).

³²A relatively simple rule of thumb for the reserve level would follow from the econometric results in Bussière and Mulder, op. cit.: to avoid any impact of contagion, reserves should be such that the reserves to short-term debt ratio is one plus 5 percent for every percentage point of GDP current account deficit, and an additional 1 percent for every percent the real effective exchange rate has appreciated in the previous 4 years. If, compared to the countries in the sample, the corporate sector or the banking sector is very well managed, this can be taken into account in this rule of thumb by reducing the weight of the short-term debt of these sectors.

³³The notional foreign exchange derivative liabilities cannot simply be added to short-term external debt, since this could imply double-counting (to the extent that the derivatives merely transform the currency denomination of some of the external debt and are held by residents).

forwards can be a dangerous instrument.³⁴ It is thus particularly important that the full implications of forward liabilities be understood by policy makers.

50. **As discussed in Annex III, when the central bank seeks to maintain the value of the currency, forward contracts generally presage a drain on reserves in the amount of the full notional value of the contracts.** In the absence of exchange restrictions, there is no substantial difference in this respect between outright and nondeliverable forward contracts.³⁵ These drains may be less likely to materialize to the extent that the ultimate counterparties to the forwards are residents, but this outcome depends largely on the presence of effective capital controls and the effectiveness of tax regimes. Thus, any substantial forward commitments to sell foreign currency should be taken into account in assessing reserve adequacy, and if they are of shorter maturity and no effective capital controls exist, would generally be taken to increase the need for reserves one-for-one.

G. Stress tests

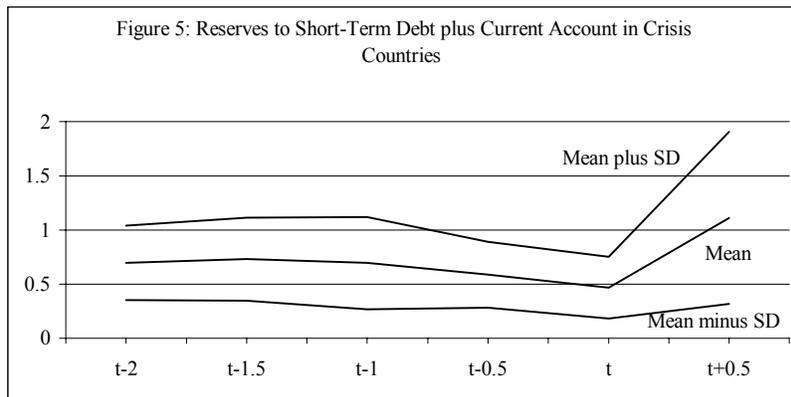
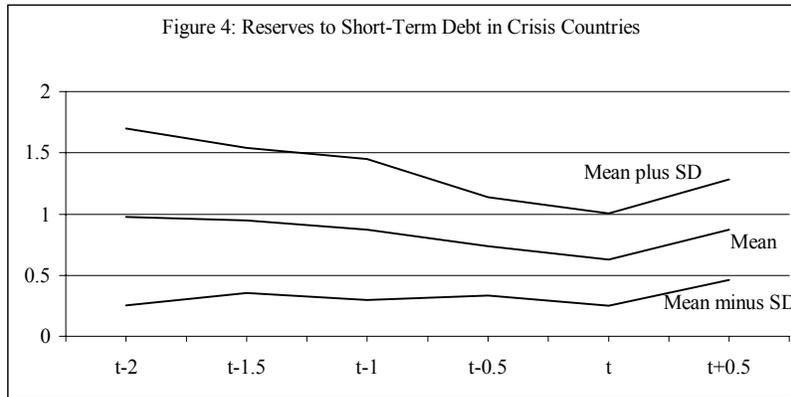
51. **A straightforward method for taking risk enhancing or mitigating factors into account in judging the level of reserves is to conduct stress tests.** Stress tests are in essence a simple and relatively uniform method of scenario analysis, and generally limit the behavioral reactions to a bare minimum to enhance comparability and increase transparency of the test. Thus a ratio of reserves to short-term debt of one means that a country can withstand a simple stress test in which the current account and access to capital markets are nil for a year: the reserve loss will be equal to short-term debt (by remaining maturity). Stress tests are particularly useful to take into account the impact of additional pressures such as capital flight or a current account deficit. If the magnitude of these pressures is expressed in percent of reserves, they can easily be taken into account in a judgment on the reserves to short-term debt ratio. For instance, a country could withstand a simplified stress test in which it faced a current account deficit equivalent to 30 percent of reserves, in addition to a complete cutoff from capital markets, only if its reserve to short-term debt ratio was at least 130 percent. (Annex IV discusses “liquidity at risk,” a special form of stress testing.)

³⁴Forward liabilities incurred in defense of the exchange rate should be distinguished from forward liabilities that result from simultaneous but opposite intervention in the spot and forward markets as a means of conducting monetary policy. The latter interventions have a neutral effect on the reserves position and are not subject to the dangers noted in the text.

³⁵Although nondeliverable forwards are typically settled in domestic currency, and the potential *direct* demands on reserves are limited by the fact that the corpus of the contract is not settled, equivalent pressure on reserves will materialize, *ceteris paribus* and in the absence of exchange restrictions, when the counterparties to nondeliverable and outright forwards unwind their positions (see Annex III).

Box 6. The Impact of the Crisis Indicators, Before and After the Crisis

As shown in Figure 4, the seven most severely affected crisis countries of the last five years displayed a gradual decline in reserves to very low levels, on average, before the crisis, and a sharp increase after the upswing.^{1/} The reserves to short-term debt ratio of these seven countries gradually weakened from an average of about 1 during the two years before the crisis, falling to the equivalent of around nine months' coverage in the semester prior to the crisis.^{2/} A broadly similar pattern emerges when the augmented reserve ratio (reserves plus current account deficit to short-term debt) is used. In contrast to the basic ratio, this ratio was well below one even two years prior to the crisis (Figure 5).



^{1/}This set includes Mexico (1994), Indonesia (1997), Korea (1997), Malaysia (1997), Thailand (1997), Brazil (1998), and Russia (1998). The data are on a semiannual basis and therefore the moment of the crisis t is chosen as the semester when the crisis index rose to its maximum. The mean plus (minus) one standard deviation (SD) refers to the sample mean plus (minus) the sample standard deviation, both of which are computed across countries for a given point in time relative to each country's crisis.

^{2/}Note that the closer one gets to the crisis point, the more likely a low reserves to short-term debt ratio is a symptom of the crisis rather than a cause. Figure 5 uses the current account deficit of the past 4 quarters as a proxy for the expected deficit absent a crisis.

Box 7. Reserves to Short-Term External Debt—Deviations from a Benchmark of Unity

Deviations in the ratio of reserves to short-term debt from a benchmark of unity do not always imply that a crisis is about to happen (low reserve ratios) or that a country is entirely safe from crisis (high reserve ratios). The table below shows the **worst cases of misprediction** selected from observations in the 1990's of a group of 25 larger emerging market economies.^{1/}

The **absence of a crisis despite low reserves** in the case of Indonesia (December 1995) and Korea (December 1996) was to some extent a matter of calm before the storm. In the cases of Brazil (December 1990), Argentina (June 1991), Mexico (June 1995), Pakistan (December 1996), and Turkey (June 1994), it reflects low reserves after a crisis period. In the case of South Africa the combination of sound solvency indicators (as evidenced by a low debt to export ratio), a relatively high level of non-reserve assets, flexibility in the exchange rate, and capital controls, appears to have been sufficient to avoid a sharp decline in the exchange rate or reserves at any one point in time. This may also need to be seen against the background of exchange market intervention through derivatives. Other cases—Philippines (December 1990)—are more difficult to explain.

At the same time, countries such as Colombia, Malaysia, and Venezuela **experienced crises while having relatively large reserves**. Political factors in some of these cases, and in the case of Malaysia an especially sharp wave of contagion, may have contributed to the relatively large swings in the exchange rate and reserves despite high levels of reserves.

	Date (Year/Month)	R/STD	Current Account	Debt/exports
No Crisis Despite Very Low Reserves to Short-Term Debt Ratio:				
Brazil	1990/12	0.12	-2.0	3.9
South Africa	1996/12	0.19	-0.1	0.9
Mexico	1995/06	0.32	0.1	2.0
Pakistan	1996/12	0.36	-7.3	3.7
Korea	1996/12	0.46	-4.5	0.5
Indonesia	1995/12	0.50	-2.4	2.5
Argentina	1991/06	0.59	1.0	4.8
Turkey	1994/06	0.60	5.3	4.6
Philippines	1990/12	0.63	-7.4	3.2
Crisis Despite Very High Reserves to Short-Term Debt Ratio:				
Venezuela	1994/05	2.50	-3.3	2.8
Malaysia	1997/07	1.50	-4.9	0.5
Colombia	1995/08	1.47	-5.7	2.4

External current account balance as percent of GDP (- is deficit).

^{1/}A crisis is defined to occur when the weighted average of monthly percentage depreciations in the exchange rate and monthly percentage declines in reserves exceeds its mean by more than three standard deviations (for further detail see Borensztein et al., 1999, op. cit.).

52. **Stress tests can be used to test a variety of scenarios**, to take account, for instance, of:

- the likelihood that access to different types of inflows (FDI, trade credit, other credits) would be affected differently in a period of turbulence;
- shorter or longer periods of limited access to capital markets than the one year implicit in the ratio of reserves to short-term debt;
- the extent to which different parts of the private sector might retain access to financial markets in a crisis;
- possible reserve losses as a result of changes in the exchange rate through the derivative positions of the monetary authorities;
- the potential for capital flight both from deposits with the domestic banking system and short-term government debt; and
- additional risks such as changes in the price level of major commodities, in the interest rates charged for floating rate loans, or large cross-currency exchange rate movements that affect the debt and current account deficit in disparate ways.

53. **This kind of analysis can usefully complement evaluations of sustainability through medium-term scenarios.** Such stress tests could prove useful in identifying the major risks facing countries, as well as strategies to mitigate such risks, such as exchange rate flexibility, entering into long-term export contracts, or enhancing the liquidity buffer by increasing reserves or by establishing private contingent credit lines.

IV. DEBT-RELATED INDICATORS

54. **Appropriately defined debt indicators are a useful tool to support sound debt management, but care is needed—especially in attempts to formulate benchmarks—to make adequate distinctions between different types of debt and their impact on external vulnerability.** As emphasized in Chapter II, private sector debt that is not based on distorted incentive structures is of less concern than private sector debt that reflects severe distortions, for example, in favor of short-term or foreign currency financing. These differences limit the usefulness of macroeconomic debt indicators as benchmarks to comparisons within fairly homogeneous groups of countries and categories of debt. This also underscores the importance of sectoral indicators.

55. **This chapter is structured as follows.** It first addresses traditional debt-related indicators and distills conclusions regarding their formulation and use as indicators and benchmarks. Implications of the structure of debt—maturity structure and exchange rate and

interest rate composition—are discussed next. The chapter concludes with a discussion of sectoral indicators.³⁶

A. The Use of Debt Indicators for Sustainability Analysis

56. **External debt sustainability analysis is generally conducted in the context of medium-term scenarios.** These scenarios allow for analysis of diverse flows such as new borrowing driven by current account deficits, of the terms at which new borrowing is conducted, and of the interaction with policies such as demand management policies affecting imports and exports. Judgment in these numerical evaluations tends to focus on the conditions under which debt and other indicators would stabilize, on major risks, and on the need and scope for policy adjustments. Macroeconomic uncertainties (such as the outlook for exports and imports) and policy uncertainties (fiscal expansion or consolidation) tend to dominate the medium term balance of payments outlook, and feature prominently in the scenarios conducted by staff in the context of Article IV consultations and program design.

57. **Within this context, the most common debt indicators scale the external debt stock by either exports, GDP, or government revenue.** In each case total outstanding debt at the end of a 12-month period is scaled by the relevant flow over that period.³⁷ A high ratio indicates a greater burden of servicing the debt, with the magnitude of the burden depending also on the difference between the interest rate and the growth rate of exports, GDP or revenue (Annex V). And a growing ratio, especially if the level of debt is already high, may suggest that a country is on an unsustainable path.

58. **Among the various indicators based on the debt stock, debt to exports is the most useful, but other ratios may also be relevant:**

- Debt to exports has the advantage that it is less volatile than debt to GDP in the presence of changes in the real exchange rate, and allows a more meaningful inference of trends.³⁸

³⁶Core concepts such as solvency and liquidity that are used in this chapter were introduced in Chapter II (¶ 25 and 26), while the definition of debt was introduced in Chapter III (¶ 43).

³⁷It is assumed here that debt data are defined on a face value basis. Current statistical guidance (BPM5) recommends the compilation of the market value for debt rather than the face value for the purpose of compiling the International Investment Position data, and such a concept is also employed on the asset side, to provide a consistent view of net wealth. Data under the two concepts converge when interest rates paid by the issuer are stable. When external vulnerability and interest rates rise, the market value of the debt will decline, unlike face value, reducing the usefulness of the market value of debt in indicators of external vulnerability.

³⁸Over- and undervaluation of the exchange rate may also distort the ratio of debt to GDP. For example, in countries with overvalued exchange rates, the observed ratio of debt to GDP underestimates the equilibrium debt ratio.

- Debt to exports also has the advantage that exports provide the basis for debt repayments.³⁹ However, the debt to GDP indicator may also provide some indication of the potential to service debt by switching resources from production of domestic goods to the production of exports
- In cases where public debt is predominant, the ratios over GDP or tax revenue may also be useful in that they relate debt to the underlying source of repayment, the country's tax base.

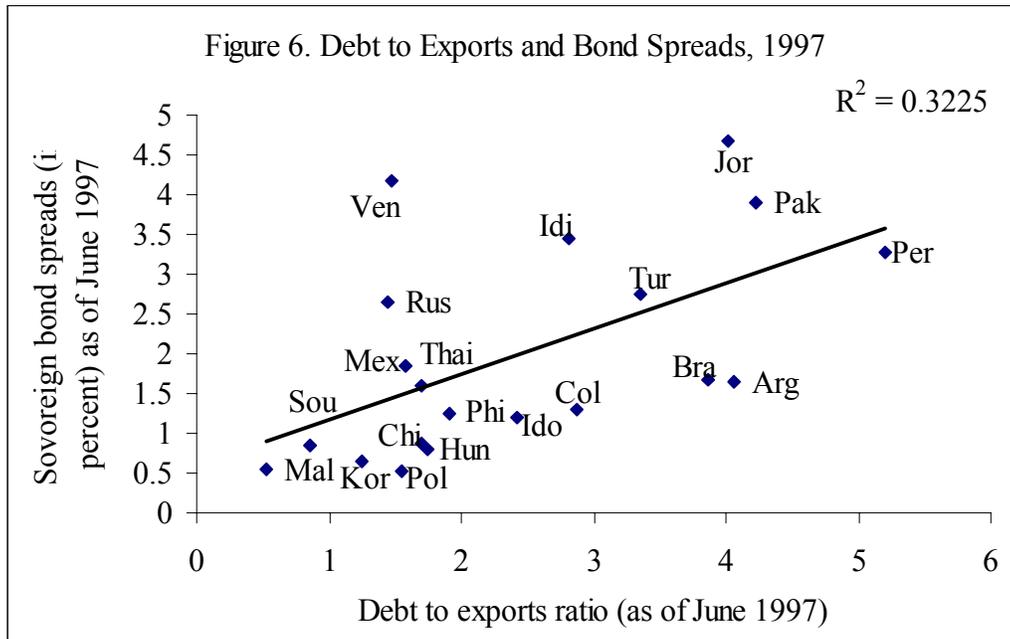
59. **At the same time, all indicators based on the stock of debt suffer from certain drawbacks, particularly if viewed only in the form of a single snapshot in time.** First, the interest burden of servicing the debt can vary widely, depending in particular on whether the debt is concessional or not. In general, it is useful to report and analyze the average interest rate on the debt alongside the debt to exports ratio, as an indicator of concessionalism of debt and to analyze the impact of changing interest rates on the real debt burden.⁴⁰ Second, the pace of output and export growth and the contribution to it of debt creating inflows differ across countries.⁴¹ These drawbacks could to some extent be addressed by focusing on the present value of debt payments rather than debt itself, by using debt over prospective exports or GDP, or by multiplying the ratios of debt to export or GDP by the nominal rate of interest minus the rate of nominal export growth (defined in the same currency)—see Annex V. These alternative constructs, however, are significantly more complicated. The difficulty of identifying “snapshot” indicators underscores the importance of examining the evolution of debt in medium-term scenarios, and of reviewing the debt ratios in conjunction with expected interest and growth rates.

60. **For the larger emerging market economies, the ratio of debt to exports does seem to positively impact interest spreads on sovereign bonds.** Since spreads are a useful proxy for the loss creditors expect, this suggests that repayment expectations are affected by the overall level of debt (illustrated in Figure 6 for a relatively tranquil period). Nevertheless, the relationship varies considerably from one year to another, implying that other factors are also important. In particular, spreads appear to be significantly affected by variations in market liquidity and by fluctuations in the markets' assessment of the government's willingness to pay.

³⁹For countries where reexports play a significant role, or, more generally, where the value added in exports is low, the ratio might be considered to overstate repayment capacity. To enhance comparability, it is then useful to use a concept of exports that nets imports for reexports.

⁴⁰Indeed, it could be argued that the best single solvency indicator is the ratio of interest payments over exports. The two-part presentation is here preferred because the ratio of debt to exports is in common use, and because the average interest rate is easily compared to benchmarks such as dollar, euro, or yen interest rates.

⁴¹To the extent that past and present debt-creating inflows will contribute to increased exports and output in the future, ideally the debt—if it is to be measured at a single point in time—should be measured against the higher exports and output that will result.



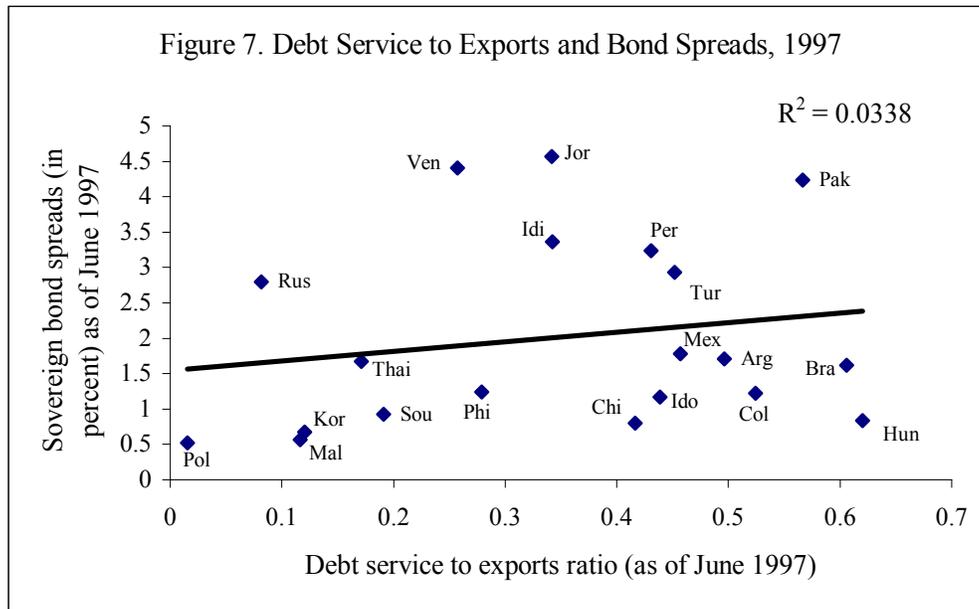
61. **The ratio of debt service to exports is another possible indicator of economy-wide debt sustainability, but care should be taken in its use.**

- In practice, an indicator that is different from the core concept is generally used. Although debt service is in principle defined including principal payments and interest paid on both long- and short-term debt, in practice amortization payments on short-term debt are usually excluded from debt service.⁴² In addition, the coverage of private sector data is often limited, either because the indicator is intentionally focused on the public sector or because data on private debt service are not available.
- The ratio of short-term debt to reserves already provides an indication of potential liquidity problems, while the ratio of interest payments to exports provides an insight into solvency problems.

These factors may contribute to the limited correlation between the debt service ratio and bond spreads for the larger emerging market economies (as illustrated in Figure 7).⁴³

⁴²This is common practice in IMF staff reports and is standard in the World Economic Outlook and in the World Bank's Global Development Report. Lack of data, as well as the assumption that short-term debt mainly constituted trade credit that was easy to roll over, contributed to this practice. As experience shows, this assumption is in some cases questionable.

⁴³The source of the debt service data in Figure 7 is the WEO. These data exclude repayment of debt with an original maturity of less than 1 year.



62. **Nonetheless, a narrow version of this ratio, focused on government and government guaranteed debt service, can be a particularly useful indicator of government debt sustainability and transfer risk, for the following reasons.**⁴⁴ If the official sector wants to offset amortization payments through new borrowing from official sources, it will in most cases need to take some action entailing financial and non-financial costs, e.g., new loans may require imports, the implementation of projects, or other conditionality, including of a political nature. In this case, interest payments and amortization are more comparable, and including both in a single measure may provide some broad indication of the overall cost to service the debt.⁴⁵

63. **The scope for identifying critical ranges for debt indicators is rather limited.** The absolute value of overall debt ratios is not very useful across heterogeneous countries, without additional information, notably on factors that affect the soundness of borrowing and lending decisions. Difficulties in comparing debt indicators across countries are also reflected in the absence of a relation between debt and crisis indicators (illustrated in Annex I), and in the unstable relation with spreads.

⁴⁴A version of this indicator, that focuses on official debt, is used, for instance, in the Heavily Indebted Poor Countries (HIPC) Initiative.

⁴⁵An alternative indicator that is more focused on resource transfer would be the public transfer ratio, the ratio of interest payments plus net debt payments over exports.

- **For more homogeneous country groupings and for debt definitions focused on the public sector, there is more potential to identify ranges for debt-related indicators** that suggest that debt or debt service is approaching dangerous levels, i.e., that these indicators are approaching levels which in other countries have resulted in suspension or renegotiations of debt service payments, or have caused official creditors to consider whether the debt burden may have reached levels that are too costly to support. For example, assistance under the HIPC Initiative is determined based on a target for the public debt to exports ratio (150 percent) or debt to tax revenue ratio (250 percent). In these ratios the net present value of debt is used, and only a subset of external debt is taken into consideration, namely medium- and long-term public and publicly guaranteed debt.⁴⁶
- **Empirical work on macro debt indicators is limited and does not provide much guidance.** Based on whether or not a country has been subject to rescheduling, Cohen estimates critical points for debt to GDP of 50 percent, debt to exports of 200 percent and debt to tax of 290 percent.⁴⁷ Above these points the risk of rescheduling exceeds 60 percent.⁴⁸ However, the estimations do not control for variables such as the composition of debt (private or public), export growth rates, international interest rates, the level of per capita income, or institutional variables, and capture only rescheduling, which is but one manifestation of external crisis.

B. The Impact of the Composition of Debt

The maturity structure

64. **The maturity structure of debt has a profound impact on liquidity, and can be tracked using the ratio of reserves to short-term debt and through stress testing.** An emphasis on the reserves over short-term debt ratio as recommended above will in itself focus attention on the maturity structure of debt, and will create, to some extent, incentives to lengthen maturities and avoid a lumpy repayment structure. Moreover, stress testing or scenario analysis, as discussed above, can be used to analyze the impact of limited access to financial flows for a period longer than a year, thus taking into account debt falling due over longer time horizons.

⁴⁶Short-term debt is included only to the extent it has been long in arrears.

⁴⁷Cohen, “*A Note on Solvency Indicators*,” Center for Economic Policy Research, July 1997, Working Paper No. 1753.

⁴⁸The results for the debt to export ratio are broadly in line with the average ratio observed for countries at the time of the first debt rescheduling—Cohen, op. cit., reports an average debt to exports ratio of 270 percent for reschedulings in the 1980s.

65. **Such stress testing can be supplemented with rolling liquidity analysis to analyze the impact of the maturity structure on future, rather than present, liquidity,** by predicting the reserves over short-term debt ratio forward in the context of medium-term scenarios. Simple and explicit assumptions need to be made to support a meaningful interpretation of such projections. For example, short-term debt by original maturity could be assumed to be rolled over (or grow in line with trade), amortization on medium- and long-term loans and bonds could be assumed to be rolled over with a specific maturity profile (such as the current maturity structure), and similar assumptions can be made for additional debt. The implications of achieving a desired reserves over short-term debt ratio for the needed maturity structure of newly contracted or rolled over debt could be highlighted. Useful maturity indicators to provide shorthand information on assumptions and prospects are the levels of medium- and long-term debt falling due over specified periods (e.g., two, three, and five years).⁴⁹

66. **While the maturity structure is important, it is difficult to capture this in a single number—such as average maturity of overall debt—that is useful, especially for comparison across countries.**⁵⁰ Short average maturity is not necessarily indicative of external vulnerability:

- average maturity masks important differences in the sectoral composition of debt. For example, countries with limited debt mostly in the form of private trade credit will show a relatively short average maturity, but will not necessarily be particularly vulnerable;
- average maturity also masks important differences in the dispersion of maturities, when it is really the whole spectrum (as analyzed in rolling liquidity analysis) that matters. For example, countries with a small fraction of very long-term concessional debt and a significant amount of short-term government debt may show a high average maturity.⁵¹

⁴⁹In a crisis, it becomes particularly important to track indicators related to rollover of credit lines and maturities on a high frequency basis. The Fund has assisted a number of countries in setting up systems for this purpose.

⁵⁰Duration is an alternative indicator that is often used in financial markets, instead of maturity, when analyzing individual instruments, as it gives weight to the impact of interest payments on cash flow. Duration is defined as the sum of the present value of debt payments (principal and interest), each multiplied by the time until these payments are due, divided by the total present value of all debt payments.

⁵¹There are similar problems with the idea that a benchmark (three years) should be established for average maturity, not only for the purpose of crisis prevention, but also as a way of ensuring that private creditors pay a price if a country goes into crisis (even if short-term debt is repaid, the holders of long-term debt would likely suffer price declines). (See Alexander, “*Liquidity and Risk Management for Emerging Market Countries*,” Background Note for G-10 Deputies, Federal Reserve Board, August 1999.) Another problem with using a simple benchmark for average maturity across countries is that it should not be considered in isolation from the magnitude of the stock of debt.

67. **Therefore, only adequately focused measures, such as average maturity by sector and by debt category, can usefully be compared over time.**⁵² Such measures can alert policy makers and market participants to maturity structures that are potentially problematic and warrant closer consideration of sectoral vulnerabilities.

Currency and Interest Rate Composition

68. **The currency and interest rate composition of debt can also have significant implications for external vulnerability, but analysis and indicators of such vulnerability may similarly need to be focused at a sectoral level or even at the level of individual institutions.**

69. **As discussed above (Box 4), there is a significant difference in implications between domestic and foreign currency external debt.** The burden imposed by the former in terms of foreign currency is eroded if the exchange rate depreciates, and the balance sheet effects of a depreciating exchange rate vary with the extent to which the debt is denominated in foreign currency. Information on the currency composition of debt at the sectoral level is particularly important, because the balance sheet effects also depend on foreign currency relations between residents (such as government foreign currency-denominated or -indexed liabilities to residents).

70. **The specific foreign currency and interest rate composition of external debt may also have significant implications.** If sharp changes occur in the exchange rates in which debt is denominated, but these are not offset by similar changes on the inflow side (for example, in exports), significant income effects can result. Similarly, sharp increases in short-term interest rates, such as those experienced in the early 1980s, can have profound implications for the real cost of debt, especially if a significant share of debt is floating rate.

71. **While the currency and interest composition of debt can be important in analyzing external vulnerability, it is necessary to take account of derivatives, as these may significantly change the effective composition of debt.** Interest derivatives can be used to swap floating rate obligations into fixed rate liabilities. Similarly, currency derivatives can be used to change the exposure from foreign to domestic currency or to a different foreign currency. In the presence of large scale derivative activities, on which available data are often limited, it is doubly difficult to assess the overall implications of private sector exposure to (cross) currency or interest fluctuations. In such a situation it is difficult to build up a picture of overall vulnerability without information at the sectoral level or at the level of individual banks and firms.

⁵²For the public sector the average maturity of nonconcessional debt would form a more adequate basis for comparison across countries.

C. The Role of Sectoral Indicators

72. **A sectoral analysis of debt is important because the sustainability of public and private sector debt is governed by different considerations.** Analysis at the level of sectors can shed light on the degree to which private debt should be of concern.⁵³

73. **The present paper has a narrow focus, and it will merely note the extensive work underway elsewhere (see below) on the general issue of risk management at the institutional or sectoral level.** The question this paper seeks to answer is whether there are simple debt-related indicators that provide insights into the external vulnerability of sectors—i.e., their vulnerability to changes in exchange rates and, consequently or in expectation thereof, to a cutoff from foreign currency lending.⁵⁴

The public sector

74. **Public debt management must seek to ensure that the public sector can service its debt while minimizing costs in the long run—which implies also minimizing the costs to the economy of crises resulting from imprudent debt management.** Debt management should thus contribute to limiting the risk of recourse to a moratorium on public debt service, and minimizing transfer risk. Careful management of *all* public debt is required both for the sake of effective stewardship of fiscal resources, and also for the sake of external stability, since external crises can have their roots in fiscal sustainability problems. These wider issues, however, are beyond the scope of this paper.⁵⁵

75. **A number of indicators can be identified that help capture the solvency and liquidity risks associated with external public debt:**

- the public sector debt service ratio, ratios of public debt to GDP and to tax revenue, the average interest rate, various maturity indicators, and indicators of the composition of debt—these have all been noted above;

⁵³The Working Group on Capital Flows of the Financial Stability Forum and others have stressed that sound risk management generally requires a different approach for the public, financial, and corporate sectors.

⁵⁴When analyzing issues at a sectoral level, foreign currency obligations and assets are a more natural focus, rather than external debt and assets. From the perspective of an individual firm, it is, at least in the absence of capital controls or other regulations that distinguish between residents and nonresidents, irrelevant whether the counterparty is a resident or a nonresident. In addition, and relatedly, data are often not available on whether counterparties to individual firms' assets and liabilities are residents or nonresidents.

⁵⁵Some of these issues will be addressed in the World Bank's forthcoming Manual on Public Debt Management.

- the share of foreign-currency-denominated or indexed debt, which provides a handle on the extent to which exchange rate depreciation may help erode away a debt problem;⁵⁶
- the share of overall short-term and longer-term floating rate debt in domestic government debt—short-term debt may be a source of capital flight in the absence of effective capital controls, and the size of interest repayments on floating rate debt may be affected by measures to defend the currency and to stem capital flight.

76. **In addition, the public sector has a special role to play in ensuring that it creates or maintains conditions for sound risk management in other sectors** (for instance, by avoiding policies that create a bias toward short-term foreign currency borrowing). The discussion that follows will provide some insight as to whether useful indicators can be developed of the extent to which the government creates conditions for sound risk management.

The financial sector

77. **Financial sector vulnerability is a particular cause for concern as regards external vulnerability.**⁵⁷ Financial institutions are especially vulnerable because they are usually highly leveraged, exposed to maturity mismatches, operate in markets where asymmetric information is important, and are subject to moral hazard through explicit or implicit deposit insurance and limited liability.⁵⁸ Reflecting these characteristics, financial institutions are vulnerable to the balance sheet effects of changing exchange rates (or interest rates), and to changes in cash flow such as withdrawal of foreign currency deposits or credit lines by foreign banks.

78. **Among aggregated microprudential indicators, two have a foreign currency dimension**—“sensitivity to foreign exchange risk” and “foreign-currency-denominated lending.”

- The *open foreign exchange position* is a key indicator of sensitivity to foreign exchange risk.⁵⁹ Because of the obvious direct risk attached to this factor, the Basel

⁵⁶Risk audits, that have been widely suggested, could be particularly useful in determining the governments’ contingent foreign currency liabilities.

⁵⁷E.g. Kaminsky and Reinhart, “*The Twin Crises: The Causes of Banking and Balance-of-Payments Problems*,” International Finance Discussion Papers 544, Board of Governors of the Federal Reserve System, 1998.

⁵⁸Overall financial sector vulnerability is beyond the scope of the present paper. Extensive work is being undertaken on it elsewhere, including in the context of Financial Sector Stability Assessments (FSSAs), and the development of aggregated microprudential indicators.

⁵⁹The open position is the most important but not the only component of foreign exchange market risk, as the latter also allows for inclusion of other direct exchange rate effects (e.g., through structured notes), and allows

(continued...)

Core Principles of Banking Supervision include limits on the open foreign currency positions of banks. In the presence of such regulatory constraints (as long as they are abided by), the open foreign currency position is typically not a prime concern.

- Also important are *foreign currency maturity mismatches*—i.e., the extent to which foreign currency liabilities are matched by foreign assets that can be liquidated in the same time frame. In the presence of capital controls, the indicator could focus on a subset, namely, the mismatch in foreign assets and liabilities (i.e., claims on and liabilities to nonresidents). In the presence of such mismatches, a cut-off from external funding can put considerable pressure on the international reserves of the central bank.
- *Foreign currency quality mismatches* (and in particular the quality of foreign currency assets) matter, for the same reasons, although here data can be very difficult to obtain. A particular concern is foreign currency-denominated credit to local borrowers without significant foreign currency cash flow, or who display other foreign currency related weaknesses discussed under the corporate sector indicators below.
- Information on *gross foreign currency liabilities* is useful to the extent assets are not usable by banks to offset withdrawals in liquidity, for example because of fiduciary or liquidity requirements.

79. **Assessment of financial sector vulnerabilities needs to take account not only of the numerical values of these indicators, but also of the quality of supervisory policies, institutions' own systems, and data availability, and efforts are underway to improve these.** Supervisory policies create rules and incentives for individual financial institutions to limit their own vulnerability, and institutions' own systems should enhance their capacity to do so. Data availability is necessary for markets to price risk adequately and for supervisors to perform adequate oversight. To support the assessment of vulnerabilities, oversight and market discipline, the staff is surveying the availability of data to devise indicators as part of the review of Macro Prudential Indicators, while the Basel Committee on Banking Supervision is reviewing the guidelines on bank liquidity.

The corporate sector

80. **In the wake of the recent crises it has become obvious that vulnerability analysis cannot ignore the corporate sector.** Although individual firm failures can and should be addressed through bankruptcy and resolution systems, it is increasingly recognized that the organization of the corporate sector, and especially its financial structure, can impact external

for different ways (e.g., stress tests) of examining the effect of non-linear instruments such as foreign currency options.

vulnerability (including indirectly through its impact on the credit risk of the financial sector).⁶⁰ Overextension of foreign currency financing to the corporate sector, combined with limited profit margins, and/or a financing structure that is highly leveraged or geared toward short-term financing, can lead to widespread corporate nonpayment. By overwhelming the legal system for contract enforcement and bankruptcy, and undermining asset prices and the value of collateral,⁶¹ this can have a domino effect. The ensuing corporate failures may contribute to a recall of foreign loans for trade and working capital and a dramatic fall-off in new capital inflows, which can precipitate or worsen an external crisis.

81. The present paper will not attempt to summarize extensive research work underway in this area, but will focus on indicators of the financial structure to the extent they provide insight into the impact of the corporate sector on external vulnerability. Some general background information is provided in Box 8.

82. Directly relevant for external vulnerability are imbalances in companies' balance sheets and cash flow that make them vulnerable to changes in exchange rates. The exchange rate can have a *balance sheet effect* by increasing the value of a firm's debts more than that of its assets, which may reduce its ability to obtain new loans. (Leverage is an important indirect factor here: leveraged companies are especially vulnerable to such imbalances as their cushions are more limited.) The exchange rate will also impact a company's *cash flow*. Corporations that borrow in foreign currency but produce few exportable goods or services (as was common, for instance, in Indonesia) are exposed to sharp cash flow (and profit) reductions as the exchange rate depreciates.⁶² Moreover, the extent to which corporations are exposed to short-term foreign debt impacts, in conjunction with their cash flows, the extent to which they are exposed to cut-offs from foreign financing. Thus, key financial indicators for the corporate sector from the standpoint of the present paper would be:

- the mismatch in foreign currency cash flow as a ratio to overall cash flow taking account of hedging and other foreign currency revenues; and

⁶⁰In a world with no fixed costs, information asymmetries, or contract enforcement problems, the financing structure of corporations should have little effect as (bankrupt) corporations could be sold and bought instantaneously, and access to finance would depend on future prospects rather than collateral. However, information costs and asymmetries and imperfect enforcement mechanisms (such as slow, unreliable, or overwhelmed bankruptcy regimes) suggest that financing structures make a difference, and also explain the important role that is often assigned to collateral in financing.

⁶¹Krugman, 1999, op. cit.

⁶²Hedging can reduce nominal exchange rate sensitivity over the horizon of the hedge. Hedges are often used for periods over which prices are fixed and companies are locked into contracts. For longer periods corporations often rely on natural hedges—prospects of future exports or other foreign currency linked revenues to offset foreign currency outflows. Even well-hedged companies will run some exchange rate risk, as the real effective exchange rate will affect some of their costs in unforeseen ways that generally cannot be hedged.

- the difference between foreign currency liabilities and liquid foreign currency assets as a ratio to equity.

83. **More traditional corporate indicators are useful as well.** Indicators to assess general profitability and vulnerability include the coverage of interest payments by operational cashflow, leverage, the ratio of short-term to overall debt (for domestic and foreign currency), and the ratio of domestic currency versus foreign currency debt. Indicators aggregated for all corporations (Box 8 includes several that are derived from a large data base on corporate data), or by type of sector (traded or nontraded sector), combined with information on dispersion, provide useful information on the overall state of the corporate sector and its contribution to external vulnerability. In addition, they provide information on interest sensitivity, which is important, as the prevention of an exchange rate crisis could call for sharply increased interest rates, while a failed defense may result in at least temporarily high interest rates.

84. **Data availability with regard to corporate indicators focused on exchange rate vulnerability—especially indicators that would require breakdowns in domestic and foreign currency—leaves much to be desired, but could be promoted using present dissemination practices as a starting point.** For large corporations, publication standards that make the relevant data available are often established as part of the conditions for stock exchange listings of equity and bonds. A first priority could be to ensure that information that individual corporations are required to publish is readily available, for example from stock exchanges. Further, statistical agencies could be encouraged to (re)disseminate relevant aggregates. Collection and publication of additional pertinent information could be promoted, as part of supervisory regulation and listing arrangements, for companies that are allowed direct access to foreign capital markets (bank or bond funding), or whose stocks and bonds are listed on the domestic exchanges. This would both foster market discipline and provide a basis for adequate monitoring by the appropriate supervisory authorities.

85. An overview of indicators that can be used at a sectoral level or at the level of an individual firms or banks is contained in Table 2.

Box 8. Impact and Causes of the Corporate Sector Financing Structure

Corporate nonpayment arises either from corporate insolvency or illiquidity, and the degree of leverage is an important variable influencing the risk of both. Companies that are highly leveraged are more vulnerable to declining values of their assets (i.e., *balance sheet effects*), as their debt to collateral ratios are higher; and an increase in the domestic currency cost of servicing of debt relative to the value of collateral can trigger financing problems, which in turn can further reduce the value of collateral if widespread. Leveraged companies are also more vulnerable to cutoffs in financing as *cash outflows* (for debt service) are larger. The same applies to corporations with a high share of short-term debt. Profits and cash flow of such companies are also more sensitive to changes in interest rates (Bernanke and Gertler, “*Inside the Black Box: the Credit Channel of Monetary Policy Transmission*,” *Journal of Economic Perspectives*, 1995).

The institutional origins of the financial structure of corporations are being investigated empirically, based on available data on corporations in centralized databases and newly developed institutional indicators. Results suggest that weak creditor rights increase the reliance on debt financing, while strong rights of (minority) equity holders lead to a more prudent debt structure. The availability of tax shields that extend to non-debt financing also contributes to a less leveraged financing structure.

Financial and Institutional Characteristics for Nine Asian Economies, Germany and the USA, 1996

Country	Financial characteristics ^{1/}		Institutional characteristics	
	Leverage	Long Term Debt Share	Creditor's Rights	Equity Rights
Hong Kong SAR	1.559	36.4	4	4
Indonesia	1.878	43.3	1	2
Japan	2.374	40.8	2	3
Korea	3.545	41.5	3	2
Malaysia	1.176	29.9	4	3
Philippines	1.285	51.4		
Singapore	1.049	41.1	3	3
Taiwan Pr. Of China	0.802	38.9		
Thailand	2.361	32.8	3	3
US	1.125	74.1	1	5
Germany	1.472	54.7		

Source: Claessens, Djankov and Xu, “*East Asian Corporations, Before and During the Recent Financial Crisis*,” World Bank, 1999.

^{1/}**Leverage** is the median ratio of debt over equity. The median share of long-term debt in total debt is reported in percent. **Leverage** is traditionally defined in a backward looking way as the value of debt over equity (where equity is measured as assets minus debt). Leverage can also be defined in a more forward looking way as the market value of equity over the market value of debt. This method is consistent with modern techniques for valuing corporations (Gray, “*Assessment of Corporate Sector Vulnerability*,” World Bank Technical Paper No. 455, 1999). It takes the value of a corporation as going concern into account (the potential to generate profits from current and future investments in physical and human capital, know how, brand recognition, etc.), something the backward looking measure does not. However, such a forward looking measure is sensitive to noise (unexplained fluctuations) in aggregate market valuation and bubbles. Both measures of leverage are generally useful and necessary to form an adequate picture of corporate finance.

Table 2. Overview of Sectoral/Institutional Indicators

	Definition	Use/Evaluation
Public sector indicators		
1. Public Sector Debt Service over Exports	Public Sector Debt Service: Sum of interest and amortization payments on public external debt.	Useful indicator of willingness to pay and transfer risk.
2. Public Debt over GDP or Tax Revenues	This indicator can be defined for total debt or for external debt.	Solvency indicator of public sector.
3. Average maturity of non-concessional debt		Measure of maturity that is not biased by long repayment terms for concessional debt.
4. Foreign Currency Debt over Total Debt	Foreign currency debt including foreign currency indexed debt.	Indicator of the impact of a change in the exchange rate on debt.
Financial sector indicators		
1. Open Foreign Exchange Position	Foreign currency assets minus liabilities plus net long positions in foreign currency stemming from off-balance sheet items.	Indicator for foreign exchange risk, but normally small because of banking regulations.
2. Foreign Currency Maturity Mismatch	Foreign currency liabilities minus foreign currency assets as percent of these foreign currency assets at given maturities.	Indicator for pressure on central bank reserves in case of a cut-off of financial sector from foreign currency funding.
3. Foreign Currency Quality Mismatches	Impact on credit and counterparty risk of changing exchange rate. 1/	Indicator for vulnerability of financial sector to a depreciation of the exchange rate.
4. Gross Foreign Currency Liabilities		Useful indicator to the extent assets are not usable to offset withdrawals in liquidity.
Corporate sector indicators		
1. Net Foreign Currency Cash Flow over Total Cash Flow	Net Foreign Currency Cash Flow: Prospective cash inflows in foreign currency minus prospective cash outflows in foreign currency.	Key indicator for unhedged foreign currency exposure.
2. Net Foreign Currency Debt over Equity	Net Foreign Currency Debt: Difference between foreign currency liabilities and assets; Equity: Assets minus debt.	Indicator for balance sheet effect of exchange rate changes.
3. Interest over Cash Flow	Total prospective interest payments over operational cash flow (i.e. before interest and taxes).	Key cash flow indicator for general financial soundness.
4. Leverage	Book value of debt over equity (assets minus debt).	Key indicator of sound financial structure. High leverage aggravates vulnerability to other risks (e.g. low profitability, high ratio of STD/TD).
5. Short-Term Debt over Total-Term Debt (both total and for foreign currency only)		In combination with leverage, indicator of vulnerability to temporary cut-off from financing.
6. Return on Assets (before Tax and Interest)	Profit before tax and interest payments over total assets.	Indicator of general profitability.
1/ No standard indicator is suggested. Lending criteria can provide important information. For bank claims on the corporate sector indicators could be formulated based on a weighted average of corporate indicators.		

V. ISSUES FOR DISCUSSION

86. The paper has reviewed a variety of reserve and debt related indicators of external vulnerability. The results are summarized in the “Summary, Conclusions and Implications.” The conclusions with regard to indicators are reflected in Tables 1 and 2, on pages 6 and 39.

- Directors may wish to comment on the recommended indicators, the characterization of the different circumstances under which these indicators would apply, and the data and conceptual issues that would arise.
- What potential would Directors see for member countries to draw upon these recommendations in the context of their efforts to monitor and limit sources of external vulnerability? Does this paper provide useful operational guidance?
- The staff intends to use the results of the paper and Executive Board discussion to further refine the presentation of vulnerability indicators in staff reports and other operational papers. The staff would also propose to draw on these results in its response (in collaboration with the World Bank staff) to the request by the IMFC to develop guidance on best practices in sovereign debt management. Do Directors agree with this approach?

Illustrative Charts of Debt- and Reserve-Related Indicators

The figures in this annex show, across a range of emerging market economies, the relationship between a number of reserve and debt indicators before the onset of crises, and the degree to which these countries were subsequently affected by currency crises (as measured by a crisis index). Footnotes 18 and 24 in the main text contain key information for interpreting the charts.

Panel 1. Reserve and Debt Indicators of Selected Emerging Market Economies in 1994

Figure 8. Short-Term Debt over Reserves, 1994

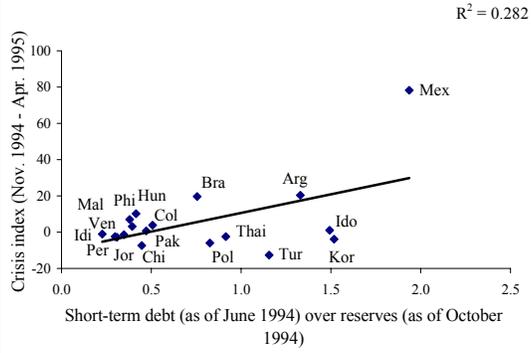


Figure 9. Augmenting Short-Term Debt with the Current Account Deficit, 1994

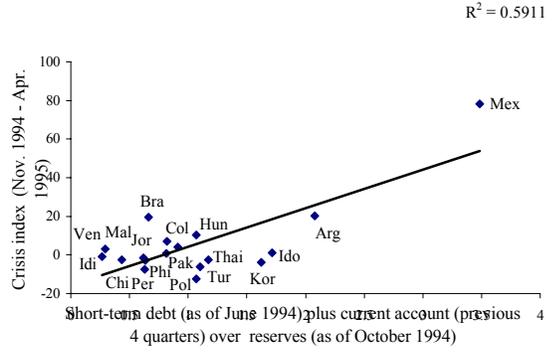


Figure 10. Broad Money over Reserves, 1994

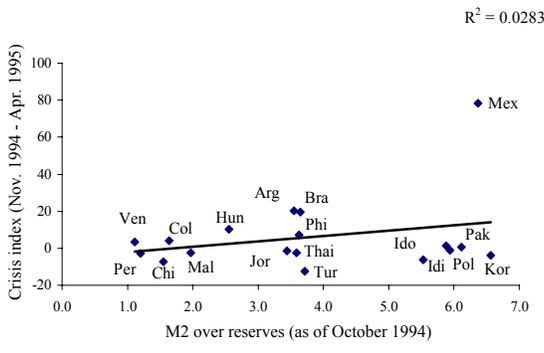


Figure 11. Imports over Reserves, 1994

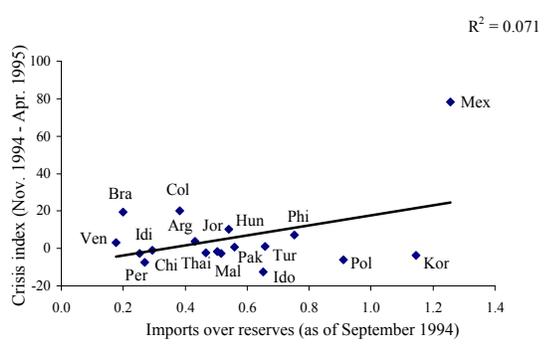


Figure 12. Total Debt over Exports, 1994

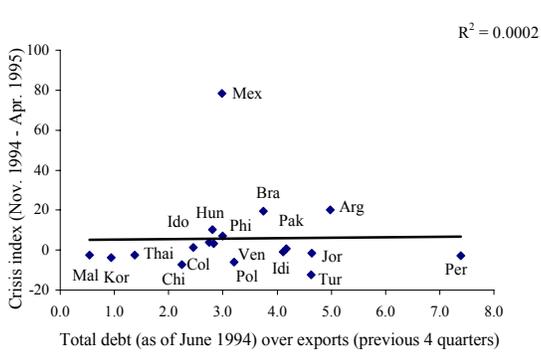
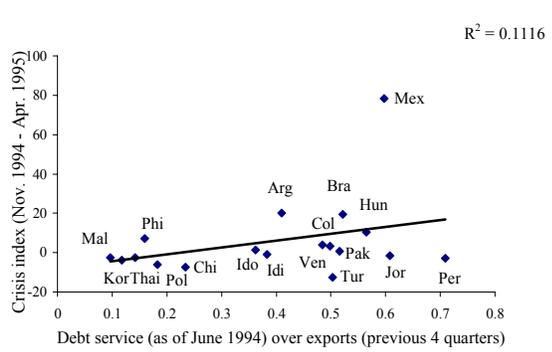


Figure 13. Debt Service over Exports, 1994



Panel 2. Reserve and Debt Indicators of Selected Emerging Market Economies in 1997

Figure 14. Short-Term Debt over Reserves, 1997

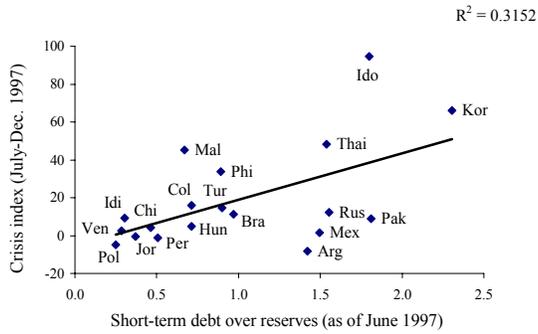


Figure 15. Augmenting Short-term debt with the Current Account Deficit, 1997

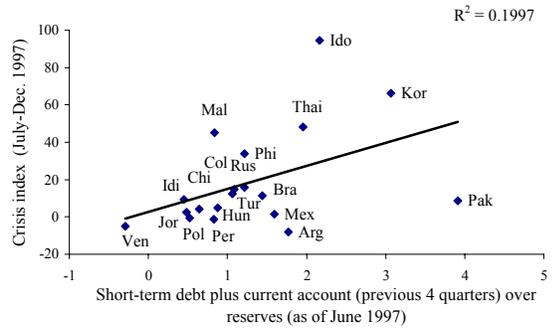


Figure 16. Broad Money over Reserves, 1997

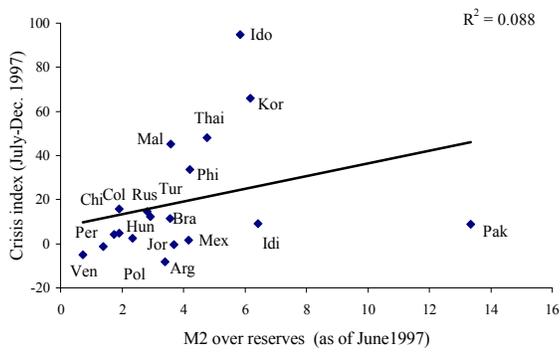


Figure 17. Imports over Reserves, 1997

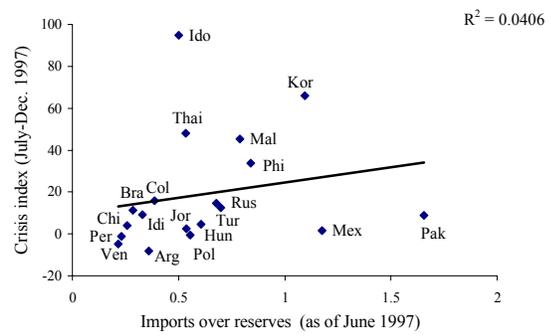


Figure 18. Total Debt over Exports, 1997

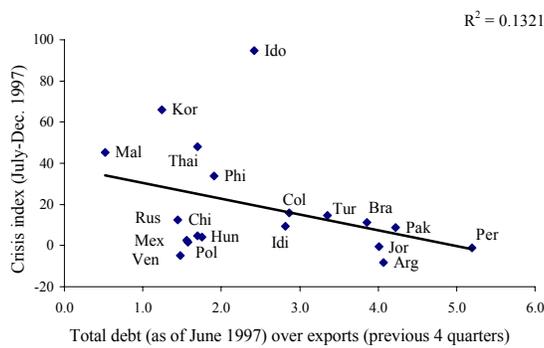
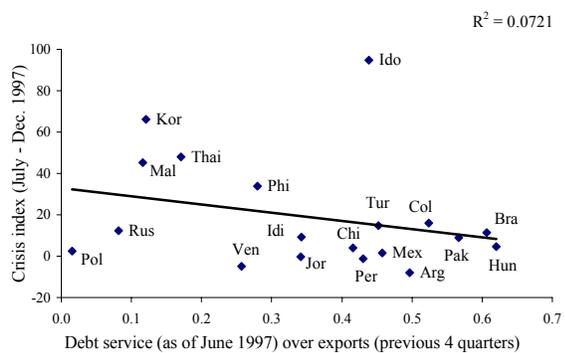
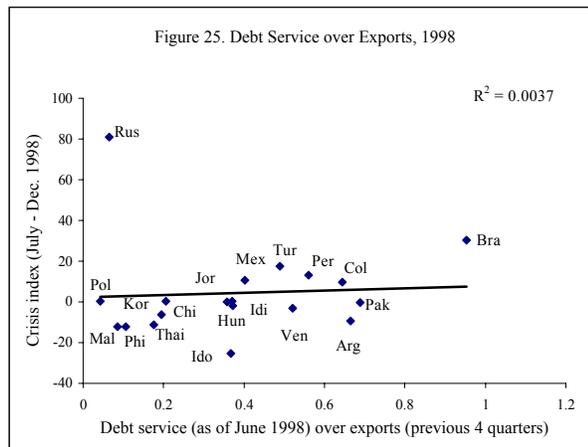
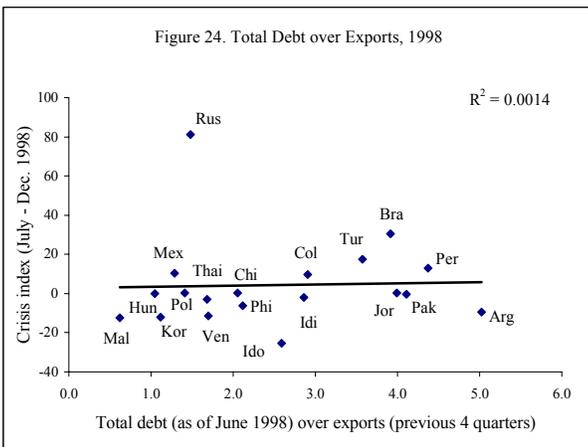
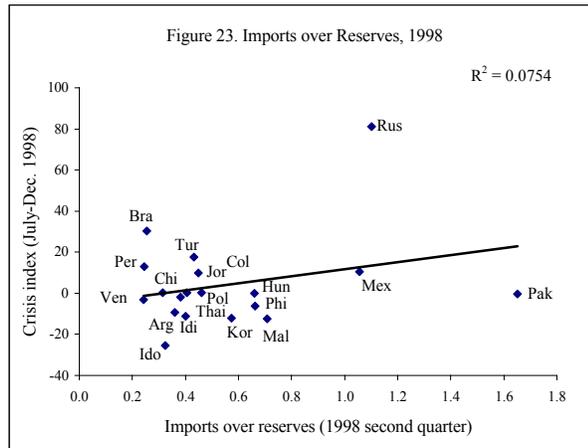
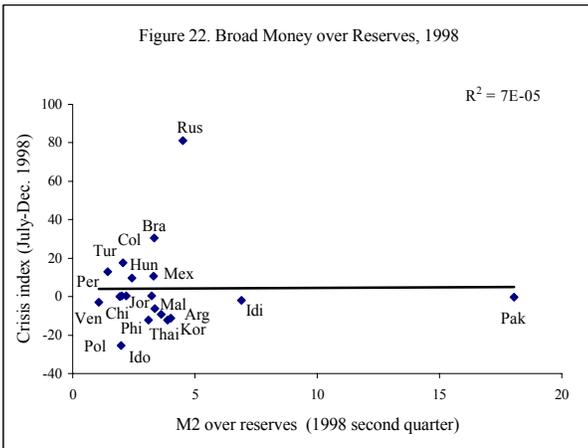
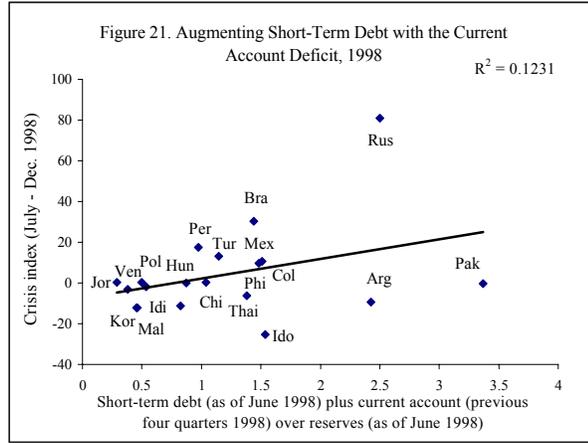
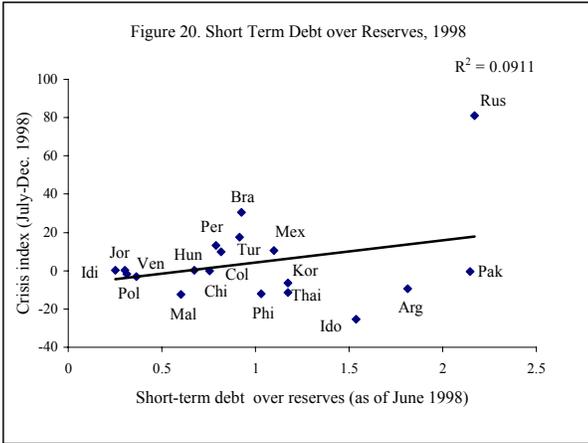


Figure 19. Debt Service over Exports, 1997



Panel 3. Reserve and Debt Indicators of Selected Emerging Market Economies in 1998



Illustrative Table on Reserve and Debt Indicators for Industrial Countries

The table below describes key debt- and reserve- related indicators for a number of industrialized countries. The data are derived from International Investment Position (IIP) data reported to the Fund. Certain conventions had to be used to distinguish between short-term debt and medium-and long-term debt in the reported data (e.g., currency and deposits and the data on the value of financial derivatives have been included under short-term), and these data should be considered to be approximations. National sources may contain better estimates.

The availability of IIP data for these countries, as well as the importance of assets, both allow and suggest the presentation of a number of additional indicators such as the net IIP position, and the ratio of short-term debt over total assets. Other IIP based indicators could provide useful information as well, such as the ratio of currency and deposits to short-term debt, and a sectoral breakdown of the ratios.

Table 3. Debt- and Reserve-Related Indicators for Selected Industrial Countries, end-1998

	Average	Canada	France	Germany	Italy	Japan	Nether-lands	Spain	Sweden	Switzer-land	United Kingdom	United States
Reserve/Debt indicators												
Reserves/STD	0.22	0.17	0.13	0.20	0.16	0.21	0.15	0.33	0.14	0.21	0.02	0.65
Reserves/Imports	0.24	0.09	0.19	0.16	0.16	0.43	0.13	0.34	0.14	0.48	0.07	0.11
Reserves/M2	0.13	0.07	0.06	0.07	0.08	0.04	0.11	0.14	0.15	0.16	0.03	0.03
STD/Total assets	0.39	0.34	0.36	0.31	1/ 0.34	0.36	0.31	1/ 0.47	0.38	0.32	1/ 0.67	0.04
STD/Total debt	0.49	0.31	0.55	0.38	1/ 0.40	0.71	0.62	1/ 0.56	0.45	0.81	1/ 0.87	0.06
Net IIP/GDP (in percent)	-9.47	-35.02	1.77	3.06	1/ -1.70	30.50	5.69	1/ -23.15	-41.77	118.84	-12.42	-17.55
Memorandum items:												
Current account deficit/GDP (in percent) 2/	2.26	-1.86	2.77	-0.16	1.71	3.19	7.61	1/ -0.29	2.05	9.36	-0.06	-2.52
REER appreciation (in percent) 3/	-1.77	-8.37	-1.31	-3.59	9.05	-13.37	-1.28	-0.18	-6.53	-1.51	19.26	13.02
STD/Imports	1.35	0.51	1.40	0.85	1.03	2.08	1.00	1/ 1.05	1.00	2.55	1/ 4.35	0.17

Source: IFS, WEO, BOPS Yearbook.

1/ End 1997.

2/ (-) refers to a deficit.

3/ Change over previous 4 years.

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Interpreting Central Bank Forward Positions

Several central banks have taken or currently have large forward positions in support of the domestic currency. This annex asks how such positions should be interpreted. Is forward intervention equivalent to spot intervention? Will it eventually cause reserve drains, and to what extent?

1. Equivalence

In response to shifts in portfolio preferences by market participants against the local currency (e.g., because of changed exchange rate expectations), the central bank may choose to relieve the pressure on the exchange rate by intervening in either the spot or the forward market. Abstracting from monetary policy changes affecting the interest rate, the spot and forward exchange rates will move in concert, since the difference between them will remain equal to the interest rate differential plus a risk premium/cost margin reflecting counterparty, legal risks, etc. (otherwise there would be arbitrage opportunities).

For example, fear of exchange rate depreciation could lead importers increasingly to seek protection against depreciation, while exporters seek less protection against appreciation. The central bank can clear the excess demand and maintain the exchange rate by selling foreign currency to importers on the spot market, or by offering them forward cover. The pressure may also be due to market participants reshuffling their currency portfolio. They may shorten their positions by selling existing holdings of local currency in the spot market or by borrowing local currency and selling it in the spot market. Instead of offsetting this pressure by intervening in the spot market and losing (gross) reserves, the central bank can offer to sell foreign currency forward and induce market participants to abstain from a spot market transaction. Similarly, by selling forward the central bank can induce arbitrageurs to borrow foreign currency, sell it on the spot market, and invest it in local currency. In all cases, the central bank can choose between an immediate loss in reserves or a build up in its forward book.

Given the equivalence between spot and forward market intervention of the central bank, it is important that the central bank reveal both—changes in reserves and in its forward book—in order for market participants to realize the full extent of pressure on the exchange rate. Transparency about the size of the forward book is also important if market participants are accurately to gauge the quasi-fiscal risks involved. Therefore, merely revealing a forward position that was not previously known to markets can create or relieve pressure on the exchange rate, as market participants reassess their expectations and adjust their portfolio positions.

2. Eventual drain on reserves

In analyzing the eventual drain on gross reserves from unwinding forward contracts, we posit that the unwinding takes place by decision of the central bank (and is thus a given), and we assume that the exchange rate is fixed by the central bank.⁶³

The key factor that will determine the drain on reserves is **whether the shift in desired portfolio allocations described above is temporary or permanent**—that is, whether it will have been reversed by the time the contract matures.

- **If the shifts in desired portfolio allocations are temporary** and are reversed by the time the contract matures, the demand for forward cover subsides and the central bank can concomitantly reduce its forward position **without losing reserves** (compared to the point in time when the desired portfolio allocation first shifted).

For example, as expectations of exchange rate depreciation subside, exporters may begin to seek more cover in the forward market. Importers then no longer need the central bank as a counterparty, and/or the central bank can offset its existing book vis-à-vis importers by buying foreign currency forward from exporters. The pressure may also subside because market participants reverse the reshuffling of their portfolio. They can unwind their position by selling foreign currency forward, which enables the central bank to unwind its commitment to deliver foreign exchange without losing reserves.

- **If the shifts in desired portfolio allocations are permanent**, the central bank can unwind its forward position only by accepting a drain on its reserves. The drain will encompass **the full notional value** of the forward contract.

For example, importers unable to obtain desired forward cover, once the central bank closes its book, will buy foreign currency on the spot market. Portfolio managers, instead of taking a forward short position in local currency, will borrow local currency and sell it on the spot market. Arbitrageurs will unwind their position once the central bank stops providing forward cover, and will repurchase foreign currency at the contractual rate to the tune of the full notional value of their position.

The analysis above considers whether desired portfolio allocations have shifted between the time the contract was issued and when it matures. The analysis generalizes to the situation where **one views the forward position at any intermediate time**, between issuance and maturity, and where one asks what will be the drain on reserves at maturity: the key question

⁶³We also assume that interest rates are unchanged. Furthermore, to simplify the discussion, we assume that the central bank deals directly with the counterparties to the forward contracts, so as to avoid a discussion of central bank intervention in the money market to sterilize the impact from the foreign exchange intervention.

then becomes whether desired portfolio allocations will shift between the time of viewing and the time of maturity.

The above analysis does, however, assume that portfolios are continuously in equilibrium and is based implicitly on the absence of capital controls or transactions costs, allowing investors to swiftly adjust their portfolio position in response to changing economic parameters. To the extent that, at the time one views the forward position, **portfolios are not in equilibrium**, the drain on reserves may be more limited.

For example, suppose that market participants took short positions in anticipation of a devaluation, and that a devaluation occurred such that participants want to close their position, but have not yet been able to do so, for example because of an illiquid market. If the central bank agrees to close the positions at the prevailing spot rate, the net effect on the reserves would be the quasi-fiscal loss, as the central bank receives less foreign exchange at the prevailing rate.⁶⁴ However, if some of the counterparties already have *some* of the local currency needed to settle the claims, the loss of reserves will be higher than the quasi-fiscal loss as they will take delivery of the foreign exchange without first having to acquire domestic currency by selling foreign currency. The quasi-fiscal loss is accordingly the minimum loss of reserves following the unwinding of the forward contracts.

3. Instruments of intervention

Central banks can use outright forward contracts or non-deliverable forward (NDF) contracts for their forward market interventions. Outright forward contracts provide for the sale or purchase of a specified amount of foreign currency, at a specified exchange rate and date with the settlement involving the full exchange of principal in foreign currency. NDFs, in contrast, do not involve the exchange of principal. But they provide for the payment of the difference, usually in domestic currency but sometimes in foreign currency, between the actual exchange rate on the day the contract matures, and the contractual NDF rate, multiplied by the notional value of the contract.

The general analysis above goes through for NDFs as well as for outright forwards. This is because, for the counterparty, a NDF produces exactly the same profit or loss at maturity as an outright forward. Thus, portfolios of NDFs and of outright forwards will adjust similarly in the presence of shifts in preferences as to currency exposure (regardless of whether settlement takes place in domestic or foreign currency and involves the corpus of the contract or not). In particular, in both cases, the counterparties face similar incentives to acquire domestic currency

⁶⁴This argument is developed in more detail in *International Capital Markets, Developments, Prospects and Key Policy Issues*, September 1998, Box 2.11.

ahead of the unwinding of the contracts.⁶⁵ In the case of an outright forward, that domestic currency is then used to purchase foreign currency at the forward rate from the central bank; in the case of a NDF, the counterparty receives from the central bank, usually in local currency, the difference necessary to enable purchases of the same amount of reserves as would be available with an outright forward contract. Thus, unwinding NDF positions normally has the same impact on reserves as unwinding outright forward contracts.

The equivalence between outright forwards and NDFs breaks down, however, in the presence of exchange restrictions. Under an outright forward, the counterparty receives foreign exchange from the central bank; under a NDF (all the more so if it is settled in domestic currency), the counterparty must purchase the foreign exchange with domestic currency, and may encounter exchange restrictions.

4. Resident vs. nonresident counterparties

The effect on reserves of unwinding the central bank's forward book may also depend on whether counterparties are residents or non-residents:

- Most obviously, if capital outflow controls prevent residents from cross-border transactions, the foreign currency paid out to residents by the central bank as a result of maturing forward contracts will generally find its way back into reserves, probably through the deposit of such foreign currency at domestic banks.
- In addition, taxes paid on residents' profits from forward contracts will work to limit the loss of reserves.
- Moreover, permanent shifts in desired portfolio allocations against the domestic currency may be more limited both in size and frequency among residents, given that residents' expenditure is usually denominated in domestic currency, and that their portfolios tend to be smaller compared to the amounts managed by nonresidents. Thus, the chances that the portfolio shift that induced the buildup of the forward book will be reversed, so that the book can be unwound without loss of reserves, may be higher if the counterparties are residents than if they are nonresidents.

⁶⁵In both cases, the counterparties are exposed to the risk of exchange rate fluctuations up to the time of maturity, and they can avoid this risk by buying domestic currency early.

Liquidity at Risk

Mr. Greenspan, Chairman of the Federal Reserve Board of the United States, has recently proposed what he called a “liquidity-at-risk” standard.⁶⁶ Under this standard, a country’s external liquidity position would be calculated for a wide range of possible events, as in stress tests; but events now have to be assigned probability distributions. An appropriate level of reserves is defined as one which provides a high probability (e.g., 95 percent) that external liquidity will be sufficient to (say) avoid new borrowing for one year. This approach is closely related to the value-at-risk methodology, widely used by financial institutions to provide a single yardstick for a multitude of risks in their portfolio, by estimating (usually from past information on prices) the maximum loss an institution can expect over a given period of time, at a given confidence interval.

There are, however, a number of drawbacks to value at risk methodology, especially in a macroeconomic setting. The allure of value-at-risk has declined recently, as variances and covariances over historic periods of relative calm ceased to be reliable guides in a period of turbulence in capital markets, and similar problems would likely beset attempts to apply this methodology to the economy as a whole. In addition, prices of assets, to which value-at-risk techniques are normally applied, tend to follow random walks, and their movement is dominated by the probability distribution. This key assumption cannot be made for most economic time series that influence the balance of payments: exports, imports, or reserves do not follow random walks. Therefore, in a macroeconomic setting, value-at-risk depends less on the probability distributions of unexplained events, and much more on the behavioral relations underlying the movements in economic variables—in other words, on a macroeconomic model, which, if it were to be used to generate not just point estimates but very detailed probability distributions, would have to be highly accurate. Moreover, there is the further complication that the probability distributions, both past and future, of many relevant economic events (e.g., declines in capital inflows) are importantly influenced by the authorities’ policy responses to them.

Nevertheless, in particular country cases random movements of balance of payments variables may play an important role. Examples are countries whose exports are dominated by commodity prices. Even in such cases stress tests may hold more promise, as they are more analytically tractable. The type of stress test, however, can usefully be inspired by value-at-risk or liquidity-at-risk type of arguments. For example, stress tests can be conducted that seek to analyze the effect of a change in the price of a key commodity export of the order of twice the standard deviation (for a 97 percent probability interval if the prices are normally distributed). For countries whose trade balance is geographically tilted (imports from one region, exports to another), such statistical analysis might also be useful. All in all,

⁶⁶An early elaboration of this idea is contained in Blejer and Schumacher, “Central Bank Vulnerability and the Credibility of Commitments—A Value-at-Risk Approach to Currency Crises,” IMF Working Paper WP/98/65, 1998.

while the liquidity-at-risk approach may be useful in the evaluation of individual instruments and to inspire stress tests, underlying economic relations are at present too uncertain to allow more general applicability of this technique.

Numerical Interpretation of Debt Ratios

To obtain an idea of the magnitude of the transfers implied by debt to export ratios, as background for assessing the sustainability of debt, one can conveniently make use of the following formula which describes the constant fraction of exports, b , to be transferred (interest after net debt inflows), if the debt stock is to satisfy the solvency condition that the present value of debt goes to zero:⁶⁷

$$b = (r-n)D/X_{+1}$$

where r is the (constant) interest rate, n the growth rate of exports X , and D the inherited debt stock measured in net present value terms. X_{+1} is next year's exports.

A similar ratio can be derived for GDP, replacing X by GDP, and interpreting b as the fraction of GDP to be transferred.

Therefore, the higher the initial stock of debt relative to exports or GDP, and the higher the interest rate on debt relative to the country's growth outlook, the larger the share of GDP or export earnings that has to be earmarked for debt payments.

The formula can readily be used for quantitative illustrations. For instance:

- For $r-n$ of 5 percentage points, and D/GDP of 50 percent (key ratios and assumptions used by Cohen, 1997, op. cit.), 2.5 percent of GDP needs to be transferred in order to stabilize the debt ratio.
- For $r-n$ of 5 percentage points, and D/X of 200 percent, 10 percent of export earnings needs to be transferred in order to stabilize the debt ratio.

The formula can also be used to illustrate the point that the pure *ability* to pay is not a very useful concept of solvency:

- For $r-n$ of 5 percentage points, if all resources were devoted to repayment ($b=100$ percent), D/X could amount to 20. Countries rarely reach such levels of indebtedness and normal debt service ceases well before they do.

⁶⁷If the growth rate exceeds the interest rate on a country's debt no payments on the debt are necessary to ensure a declining debt to GDP ratio. See also Cohen, "How to evaluate the solvency of an indebted nation," *Economic Policy*, p.140–167, 1985.

Summary of Aggregated Microprudential Indicators

Capital adequacy

- Aggregate capital ratios
- Frequency distribution of capital ratios

Asset quality

(a) Lending institution

- Sectoral credit concentration
- Foreign currency-denominated lending
- Nonperforming loans and provisions
- Loans to loss-making public sector entities
- Risk profile of assets
- Connected lending
- Leverage ratios

(b) Borrowing entity

- Debt-equity ratios
- Corporate profitability
- Other indicators of corporate conditions
- Household indebtedness

Management soundness

- Expense ratios
- Earnings per employee
- Growth in the number of financial institutions

Earnings/profitability

- Return on assets
- Return on equity
- Income and expense ratios
- Structural profitability indicators

Liquidity

- Central bank credit to financial institutions
- Deposits in relation to monetary aggregates
- Loans-to-deposits ratios
- Maturity structure of assets and liabilities/liquid asset ratios
- Measures of secondary market liquidity
- Indicators of segmentation of the money market

Sensitivity to market risk

- Foreign exchange risk
- Interest rate risk
- Equity price risk
- Commodity price risk

Market-based indicators

- Market prices of financial instruments, incl. Equity
 - Indicators of excess yields
 - Credit ratings
 - Sovereign yield spreads
-