FISCAL SUSTAINABILITY: ISSUES FOR EMERGING MARKET COUNTRIES

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Abstract

This paper surveys the recent literature on fiscal sustainability with particular focus on emerging market countries. It discusses the main elements that differentiate emerging market countries from industrial countries and then discusses how probabilistic models can help to evaluate fiscal sustainability in an uncertain environment. Based on this discussion, the paper uses Egypt to illustrate an application of the probabilistic model and to evaluate the impact of shocks to current account financing on sustainability.

ملخص

تستعرض هذه الورقة الأدب الاقتصادي الحديث الذي يتناول موضوع الاستدامة المالية مع التركيز على دول الأسواق الناشئة، وتناقش العناصر الرئيسية التي تجعل دول الأسواق الناشئة مختلفة عن الدول الصناعية. كما تناقش الورقة أيضا كيفية استخدام النماذج الاحتمالية (probabilistic models) لتقييم الاستدامة المالية في بيئة تتسم بعدم اليقين. وفي ضوء هذه المناقشة، تطبق الدراسة النموذج الاحتمالي على مصر لتقييم أثر صدمات الحساب الجاري على الاستدامة المالية.

I. INTRODUCTION

The purpose of this paper is to review the recent literature on fiscal sustainability with particular reference to the problems that are specific to emerging market countries (EMs). While the original literature on fiscal sustainability mostly focused on industrial countries (see, for instance, Buiter, 1985; Blanchard, 1990), there are now a few pieces like this one that focus on fiscal sustainability in EMs.[1]

The paper focuses on the role of currency and maturity mismatches, original sin, sudden stops in capital flows, debt intolerance, and concessional debt. After discussing standard models of fiscal sustainability, the paper highlights the importance of moving from deterministic models of fiscal sustainability to probabilistic models, and describes in greater detail the probabilistic model developed by Mendoza and Oviedo (2003).

The paper is organized as follows. Section 2 introduces the concept of fiscal sustainability and discusses its main definitions and the main sustainability indicators that have been proposed in the literature. Section 3 focuses on the case of EMs and discusses what makes these countries different from industrial countries. Section 4 briefly reviews the main stochastic models of fiscal sustainability. Section 5 examines the case of Egypt, and includes three different approaches to fiscal sustainability. Section 6 summarizes the study's main findings.

2. WHAT DO WE MEAN BY FISCAL SUSTAINABILITY?

The term “fiscal sustainability” is often used without having a clear definition in mind. A country’s policies are defined as fiscally sustainable if they lead to a situation in which the country can satisfy its budget constraint. However, Mendoza (2003) suggests that this is an imprecise definition of sustainability. He points out that the “true” budget constraint is an accounting identity that, by definition, is always satisfied. A government, for instance, can decide to satisfy its budget constraint by not paying (via outright default) or by inflating away its debt. In this sense, any analysis of fiscal sustainability ultimately reflects a value judgment on the cost and benefits of alternative adjustment mechanisms. So, standard

[1] Work that is closely related to ours is Mendoza (2003). Other relevant papers include IMF (2002, 2003b), Chalk and Hemming (2000), and Cuddington (1996). Alba, Al Shawarby, and Iqbal (Forthcoming) focus on fiscal sustainability in Egypt.

sustainability analysis implicitly assumes that adjustments through the level and composition of tax revenues or primary expenditure are preferable to adjustments via default or inflation (Mendoza, 2003).

IMF (2002) and Croce and Juan-Ramon (2003) discuss the difference between solvency[2] and sustainability. According to their definition, a set of policies is unsustainable if it leads to insolvency. However, they suggest that solvency is only a necessary condition for sustainability because it could be achieved with very large and costly future adjustments. Sustainability, instead, requires achieving solvency with unchanged policies. So, we can define a policy stance as sustainable if "a borrower is expected to be able to continue servicing its debt without an unrealistically large future correction to the balance of income and expenditure" (IMF, 2002, 4).

With these considerations in mind, we define a sustainable situation as one that satisfies the following two conditions: (i) if a country can satisfy its current period budget constraint without recurring to default or excessive debt monetization; and (ii) if a country does not keep accumulating debt by knowing that a major future adjustment will be needed in order to be able to service its debt.

2.1 More Definitions

Up to this point, we made use of two terms that are key in the fiscal sustainability debate without giving proper definitions. The terms are current period budget constraint and inter-temporal budget constraint.

The current period budget constraint is an expression that equates the flows of government revenues and expenditures to changes in the stock of public debt and in the monetary base. Formally:

$$\left(D_{t+1} - D_t\right) + \left(M_{t+1} - M_t\right) = iD_t + G_t - REV_t \qquad (1)$$

[2] Solvency is defined as a situation in which the future paths of spending and revenue satisfy the inter-temporal budget constraint.

where D measures the stock of public debt (measured at the beginning of the period), M is the monetary base, i is the interest rate paid by government debt, G is government expenditure in goods and services, and REV represents taxation (net of transfers) and other revenues (they could be royalties from natural resources). Equation (1) clearly shows that a given deficit can be financed either by issuing debt (bond financing) or by printing money (money financing). As excessive money financing may lead to hyperinflation, equation (1) is often written as $(D_{t+1} - D_t) = iD_t + G_t - REV_t$. It should be clear that the equation does not impose a strong constraint on governments that are able to issue debt. In fact, Wilcox (1989, 291) points out that "virtually any pattern of deficit would be sustainable if it were possible to borrow money and pay the interest by borrowing more."

The inter-temporal constraint, instead, imposes a limit on the government's ability to borrow indefinitely, by requiring net initial debt plus the present value of expected future government expenditures to be equal to (or not greater than) the present value of expected future government revenues. Formally:

$$D_t + \sum_{k=0}^{\infty} \frac{E_t(G_{t+k} + iD_{t+k})}{(1+i)^k} \leq \sum_{k=0}^{\infty} \frac{E_t(REV_{t+k})}{(1+i)^k} \qquad (2)$$

where E_t denotes expectation taken at time *t*, and all other variables are defined as above. Note that evaluating equation (2) requires formulating expectations on the future path of government revenues and expenditures. Furthermore, we greatly simplified the equation by assuming that the interest rate paid on government debt is constant and equal to the discount rate. Relaxing these assumptions would further complicate the analysis.[3]

[3] Equation 2 would become $D_t + E_t \sum_{k=0}^{\infty} \frac{(G_{t+k} + i_{t+k} D_{t+k})}{\prod_{j=1}^{k}(1+\delta_{t+j})} \leq E_t \sum_{k=0}^{\infty} \frac{(REV_{t+k})}{\prod_{j=1}^{k}(1+\delta_{t+j})}$ where δ is the time-varying discount rate.

One implication of equation (2) is that in the limit (as *t* goes to infinity), the present value of debt in the terminal period should be zero. Formally, equation (2) requires that:

$$\lim_{\tau \to \infty} \frac{D_{t+\tau}}{(1+i)^{\tau}} = 0 \qquad (3)$$

This condition is often referred to as no Ponzi game condition or NPG. Since sustainability requires that the above conditions be satisfied without a radical change in policies, sustainability can be tested by looking at whether the current fiscal stance will eventually lead to a violation of equation (3). Starting with Hamilton and Flavin (1986), a long series of papers used data from OECD countries to perform sustainability tests.[4] As these types of tests require long time series of fiscal data (and these time series should not have large structural breaks), research on developing countries has been much more limited.

2.2 Sustainability Indicators

As formal tests of sustainability tend to be problematic and tend to be rather demanding in terms of data requirement, some analysts have developed rule of thumb indicators aimed at checking whether current policies can stabilize or reduce a given debt ratio. While these indicators have the advantage of being simple, it should be recognized that they are not based on any well-specified definition of sustainability.[5]

The starting point for deriving these indicators is the current period budget constraint of equation (1) that, after dividing all variables by GDP, can be re-written as:

$$\Delta d = (r - g)d - ps \qquad (4)$$

where *d* is the debt to GDP ratio, *r* the steady state real interest rate, *g* the long-run growth rate of real GDP, and *ps* the primary surplus (defined as *(REV-G)/GDP*). A positive value

[4] For a survey of these papers, see Cuddington (1996). Bohn (1995) was the first to explicitly include uncertainty in these tests.

[5] For a description of the practical approach to sustainability followed by the IMF, see Chalk and Hemming (2000).

of (4) indicates that debt to GDP is expanding and may be interpreted as an unsustainable policy. After setting Δd equal to zero, equation 4 is often rewritten as $ps = (r-g)d$, and *ps* is interpreted as the primary surplus required to stabilize the debt-to-GDP ratio for a given real interest rate, growth rate of the economy and initial stock of debt.[6] Given its simplicity, equation (4) is probably the most commonly used indicator of sustainability.[7]

Buiter (1985) suggests an alternative indicator of sustainability can be defined as:

$$SUS = ps - (g-r)\frac{W}{GDP} \qquad (5)$$

where *W* is public sector net worth and all the other variables are defined as above. The first term on the right hand side of equation (5) is equal to the primary surplus that keeps the public sector wealth-to-GDP ratio constant. So, according to this indicator, sustainability depends on the difference between actual primary surplus and the surplus that stabilizes net government wealth (scaled by GDP). Negative values of *SUS* are taken as indication that the current fiscal stance is unsustainable. One advantage of equation (5) is that it explicitly assumes that government expenditure could increase government wealth (this is one of the points recently raised by some developing countries, which we will discuss in detail later). One of the main problems with equation (5) is that government net worth is very difficult to measure.

Blanchard (1990) defines a set of sustainability indicators that require computing the constant tax rate that satisfies $t^* = \mathrm{E}(e+(r-g)d)$, where t^* measures taxes over GDP and e government expenditure over GDP.[8] This technique can be used to compute short-

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[6] All the indicators discussed in this section assume that $(r-g)>0$, which is a necessary condition for dynamic efficiency. For a discussion on this condition, see Blanchard (1990).

[7] Equation (4) is the standard textbook formulation of the evolution of debt over GDP. A more precise definition for the evolution of debt in discrete time is $\Delta d = \frac{(r-g)}{1+g}d - ps$. With this second formulation, the standard sustainability equation becomes: $ps = \frac{(r-g)d}{1+g}$. For all practical purposes, the two definitions yield similar debt stabilizing primary surpluses.

[8] Under certainty, as $ps = t - g$, this is equivalent to $ps = (r-g)d$.

run (where expectations are replaced with current values of *e*, *r*, and *g*) or, depending on the length of the period for which expectations are taken, medium and long-run indicators. Blanchard (1990) points out that t^* has an easy interpretation because it is equal to the annuity value of expected future spending and transfers plus the difference between expected real interest rate and growth rate multiplied by the current debt-to-GDP ratio. Then, if t^* is larger than the current tax rate (t), an adjustment in spending or taxation will be required and hence the fiscal policy stance would not be sustainable. The sustainability indicator ($t^* - t$) measures the size of the required adjustment in the current period.

Blanchard (1990) suggests that different values of ($t^* - t$) will have different implications for sustainability depending on the starting level t. Countries with a low tax rate may have more room to adjust, while countries that already have high tax levels or limited ability to raise taxes (maybe because of the presence of a large informal sector, as it often happens in developing countries) may have to resort to debt monetization or outright default.[9]

There are several caveats that apply to the indicators discussed above. First, they mostly focus on stabilizing a particular debt-to-GDP ratio but they do not say anything about the optimality of this ratio. Hence, some countries may need to aim at a lower debt target, and sustainability should be defined as the policy stance needed to reach this new target.

Second, all the indicators discussed so far are sufficient (but not necessary) conditions for long-run sustainability. There are good reasons why a country may want to run a large deficit. Hence, it may be sub-optimal to prevent a country from smoothing expenditure (or conducting counter-cyclical policies) because this would lead to overshooting a fiscal ratio that corresponds to a long-run equilibrium.[10]

Third, these indicators require assumptions on GDP growth, interest rate, government expenditures and revenues, and implicitly assume that these variables are

[9] However, countries with larger public sector and larger tax bases have more ability to adjust. See IDB (1995).

[10] For example, see the discussion on the Growth and Stability Pact within the European Monetary Union in the *Economist* (2002).

exogenous. However, most of these variables tend to be endogenous and correlated with one another. It is clearly unrealistic to assume that changes in the primary deficit will have no effect on the interest rate and growth, or that changes in growth do not affect the primary surplus. Croce and Juan-Ramon (2003) propose a recursive fiscal sustainability indicator aimed at addressing these issues. They derive the primary surplus and discount rate that would prevail when a country reaches its target debt-to-GDP ratio and then build a fiscal sustainability indicator that lets these variables react to shocks that move the debt-to-GDP ratio out of its equilibrium value. This indicator identifies the reaction function of the government, and, hence, allows the analyst to evaluate whether the fiscal stance is moving toward or away from sustainability.

Finally, most of these indicators do not take into account a host of factors that characterize the situation in most emerging market and developing countries and greatly increase uncertainty.

3. WHY ARE EMERGING MARKETS DIFFERENT?

Several features make emerging market countries different from OECD countries, for which most of the indicators discussed above have been derived. In particular, EMs often have limited capacity to raise taxes (because of a large informal sector), have volatile revenues base, are subject to large external shocks (both real and financial) that increase the volatility of GDP growth and that of debt service, and are characterized by large levels of liability dollarization (IMF, 2003c). All of these elements complicate the management of fiscal policy and greatly increase the difficulty of evaluating sustainability.

In order to clarify this statement, let us start by modifying equation (4) to include some of the elements that are common to EMs:

$$\Delta d = (\alpha r^{dl} + \beta r^{ds} + \gamma \frac{(1+\rho+r^f)(1+\varepsilon)-1}{1+\pi} + (1-\alpha-\beta-\gamma)\frac{(1+r^f)(1+\varepsilon)-1}{1+\pi} - g)d - ps \quad (6)$$

where α is the share of debt denominated in local currency at a fixed (long-term) interest rate, and r^{dl} is the corresponding real interest rate. β is the share of debt denominated in local currency at a floating (short-term) interest rate and r^{ds} is the corresponding real interest rate. γ is the share of debt denominated in foreign currency, ε is nominal

depreciation, π is inflation, r^f is the international interest rate, and ρ is country risk. (1-α - β - γ) is official debt contracted with multilateral or bilateral institutions.[11] Contrary to OECD countries, in the typical EM, β and γ tend to be high and α tends to be small. Therefore, EMs will tend to have a large share of their debt in either domestic currency at a floating rate or in foreign currency at a fixed rate (some EMs have a substantial share of concessional and official debt, but this tends to be the case for poorer developing countries).[12]

It is now easy to see how the characteristics of EMs complicate the sustainability exercises discussed in the previous section.

Real external shocks (like a terms of trade shock) tend to be larger in EMs. This affects the volatility of GDP growth and hence makes g difficult to estimate. There is also some evidence that the effect of external shocks is amplified by the presence of sudden stops in capital flows (Galindo and Izquierdo, 2003).

A weak fiscal position is another key characteristic of EMs and developing countries. Fiscal policies and budget institutions in EMs are often not credible and this prevents them from managing counter-cyclical policies by making credible announcements to reduce public expenditure or cut taxes in good times (IMF, 2003c).

Liability dollarization and original sin refer to the fact that in most EMs there are limited opportunities to borrow long-term in the country's own currency (hence, EMs have high values of β and γ).[13] Because of pervasive liability dollarization, EMs tend to suffer from "fear of floating" (Calvo and Reinhart, 2002; Hausmann, Panizza and Stein, 2001) and hence tend to overstabilize the exchange rate, even if, formally, the exchange rate regime is announced as a flexible one. However, stabilizing the exchange rate requires

[11] We assume that this debt is contracted at the international interest rate. In some cases the actual rate will be higher (when the debt is not concessional) and in others, lower. However, this does not change our analysis as long as the interest rate applied to this type of debt has limited volatility.

[12] Edwards (2002) and IMF (2003a) focus on debt sustainability in low-income countries.

[13] Eichengreen, Hausmann and Panizza (2003a) point out that this is especially true in the case of external debt. They define original sin as the inability of a country to borrow abroad in its own currency. In earlier work, Eichengreen and Hausmann (1999) used the term original sin to refer to both the inability of some countries to borrow abroad in their own currencies and their inability to borrow at home at long maturities. For a discussion of the determinants of original sin, see Hausmann and Panizza (2003).

large adjustments in the domestic interest rate, which amplifies uncertainty about the costs linked to servicing debt expressed in domestic currency at a floating rate. At the same time, episodes of financial contagion and the possibility of self-fulfilling fiscal crises affect country risk and increase the volatility of the cost of servicing foreign currency debt. Barnhill and Kopits (2003) point out that as the budget constraint of EMs is particularly difficult to observe, investor sentiments tend to be particularly volatile. These shocks may lead to multiple equilibria: a country that under a tranquil condition may have a perfectly sustainable policy stance may suddenly jump to an unsustainable situation because fear of default leads international investors to ask for larger risk premia. Barnhill and Kopits (2003) study the case of Ecuador and show that the volatility of sovereign spread is a major source of fiscal vulnerability (more important than terms of trade shocks). In this sense, there are instances in which the behavior of creditors is the ultimate determinant of sustainability.

Sudden stops in capital flows could also be a key determinant of sustainability. For instance, Calvo, Izquierdo and Mejía (2003), argue that a loss of access to credit markets need not be the result of over-indebtedness *in the context of a good equilibrium*, but rather the result of an economy having fallen into a bad equilibrium *triggered by a sudden stop in capital flows*. This inverse fiscal view finds support in the fact that sudden stop episodes tend to occur around the same time, and for countries exhibiting a variety of fiscal situations. Sudden stops in capital flows force abrupt adjustments of the current account deficit that may require a large adjustment (depreciation) of the real exchange rate (Calvo, Izquierdo and Talvi, 2002). This adjustment may have large valuation effects and multiply the cost of servicing foreign currency debt because of excessive liability dollarization, thus pushing a country over the edge of unsustainability.[14] There is also evidence that apart from amplifying the effect of sudden stops, liability dollarization may itself be a determinant of the probability of having a sudden stop (Calvo, Izquierdo and Mejía, 2003).

[14] A liquidity crisis arises when an otherwise solvent debtor does not have enough liquid assets to meet or roll-over its maturing liabilities. IMF (2002) correctly points out that liquidity may not be an issue for low income countries that, while having high debt ratio, do not need to borrow from the private capital market (because most of their external liabilities are with official creditors). However, it is a serious issue for even moderately indebted EMs.

Debt is riskier in EMs, leading to a situation in which relatively low (for industrial country standards) debt-to-GDP ratios result in very poor credit ratings. Switzerland and Costa Rica have similar debt-to-GDP ratios and so do the United States and Turkey, or Italy, Japan, and Belgium, and Jordan, Pakistan and Jamaica. However, these EMs have very different credit ratings than those of developed countries. Switzerland, the United States, Italy, Japan and Belgium have a rating of at least AA, while the EMs listed above are well below investment grade. This de-linkage between credit ratings and debt ratios has been recognized by several authors who attribute it to different causes. Hausmann (2003), and Eichengreen, Hausmann and Panizza (2003b) emphasize the role of original sin and suggest that foreign currency debt makes the cost of servicing the debt dependent on the real exchange rate, which is uncertain and pro-cyclical. As these elements increase the probability of being in a state of the world in which payment becomes very difficult, they will lead to lower credit ratings (Hausmann, 2003, discusses a formal model). Reinhart, Rogoff and Savastano (2003), instead, introduce the concept of "debt intolerance" and define it as the inability of emerging markets to manage levels of external debt that are manageable for advanced industrial countries. In their view, lower credit ratings are due to poor credibility (proxied by high levels of past inflation) and a history of repeated default.[15] Finally, Mendoza (2003) emphasizes the role of limited and volatile tax bases.[16]

Whatever the cause (and irrespective of whether there is a solution or not), there is a consensus that under the current rules of the game, EMs can safely manage fairly low levels of external debt. While IMF (2002) sets the threshold for a safe level of debt at around 40 percent of GDP, Reinhart, Rogoff and Savastano (2003) are even more pessimistic and argue that some countries may not safely manage levels of external debt that are above 15 percent of GDP.

Non-renewable resources may affect the outcome of standard sustainability calculations. Chalk and Hemming (2000) show that, in presence of non-renewable

[15] For a discussion of the differences between currency mismatches, debt intolerance, and original sin, see Eichengreen, Hausmann and Panizza (2003b).

[16] Tax-to-GDP ratios in industrial countries average above 40 percent and 30 percent in developing countries. At the same time, volatility of tax revenues (measured as the coefficient of variation) tends to be twice as large in developing countries.

resources, sustainability would require equalizing a country's net worth (including the value of the nonrenewable resources) to the net present value of primary non-resource deficits. This highlights the fact that increasing resource exploitation to pay debt would not affect sustainability. There are, however, at least two problems with this Ricardian Equivalence of natural resources. The first was highlighted in our discussion of Buiter's indicator of fiscal sustainability, i.e., computing a country's net worth is a very difficult exercise. Second, it assumes that "oil in the ground" has the same return as the various financial assets and liabilities of the government.

Concessional debt also plays an important role in determining sustainability. In adopting any of the steady-state approaches described above it is important to recognize that as developing countries grow and become richer, the share of their concessional debt is bound to decrease and this will increase the cost of financing total debt. This increase in the cost of debt should be taken into account in estimating the steady state real interest rate paid by government debt.[17]

3.1 Other Issues

In standard IMF-led stabilization programs, countries are often asked to commit to achieving a given target in terms of primary deficit with the implicit objective of stabilizing or reducing its debt ratios.[18] This approach has come under criticism for not taking into account two factors: (i) not all debt has the same level of risk; and (ii) deficits incurred to finance public investment should be treated differently from deficits incurred to finance current expenditure.

Equation (6) shows that the stock of public sector debt cannot be considered a monolithic entity. We have already discussed the fact that different types of debt have different implications for the volatility of the public sector deficit and, hence, for sustainability. Local currency fixed-term debt is clearly the safest form of debt because the cost of servicing this debt is by and large predetermined. Foreign currency official debt is also relatively safe. While it is subject to exchange rate risk, the interest rates charged by

[17] For a discussion of the relationship between concessional debt, debt relief and fiscal sustainability, see Edwards (2002).

[18] For a survey, see Chalk and Hemming (2000).

official creditors tend to be stable and the flow of financing is either cyclical or slightly counter-cyclical. Local currency floating rate debt is subject to interest rate volatility and the cost of servicing this kind of debt may increase substantially during periods of financial turmoil. Foreign currency non-official debt is the riskiest. The cost of servicing this debt is subject to the volatility of both the exchange rate and of sovereign risk (the latter applies only if the debt needs to be rolled over). Furthermore, sudden stops in capital flows may impede the ability of emerging market governments to roll over the debt leading to both a liquidity and solvency crisis.

On the basis of these considerations, it has been argued that debt sustainability exercises should be performed by making use of weighed debt-to-GDP ratios. Where, akin to the Basel principles for evaluating banks' balance sheets, different types of debt should be weighed according to their risk.

The second issue relates to the way in which investment expenditures should be recorded in government accounts. The debate is motivated by the concern that, according to current practice, public sector adjustment strategies bundle together current expenditure and public investment. The Rio Group (a permanent mechanism of political consultations and interaction between 19 Latin American countries) put forward a proposal aimed at excluding investment expenditure from fiscal deficit targets. The main argument in favor of this proposal is that as current expenditure tends to be difficult to adjust (because it is mostly composed of wages and entitlement programs) investment is the typical adjustment variable when the deficit exceeds the target. The proposal argues that the inclusion of investment expenditures in the target budget balance may be problematic because it basically considers every increase in debt as a reduction in government wealth, implicitly assigning no value to investment expenditure as an addition to net wealth. The Rio Group, instead, would favor the adoption of sustainability indicators similar to the one proposed by Buiter (equation 2).

We have already mentioned that a potential problem with targets based on net worth is that net worth is very difficult to compute. Furthermore, this issue is linked to the role that the public sector in an EM should play in terms of its investment strategy. EMs typically face periods of financial constraints where capital markets close, and are subject to credibility problems regarding their ability to remain sustainable in times of distress.

Crises occur in a context in which expenditure remains inflexible, particularly given its high wage content, and there are a myriad of unsatisfied social demands facing EMs. Under this scenario, it may be beneficial for the government to remain involved only in co-financing investment activities that would otherwise not be carried out completely by the private sector, and that are deemed to be socially profitable (instead of assuming responsibility for full financing of investment projects). This, of course, does not mean that governments should not invest, but that they should do so selectively, complementing private sector participation. If this principle is accepted, it follows that the share of a project that is financed by the government is essentially a subsidy, and as such should be computed "above the line." This does not imply that public investment will always result in a higher fiscal deficit, because the possibly higher fiscal revenue that such investment might entail should be taken into account (and which, again, should be computed "above the line"). Of course, to the extent that governments are not following this rule, there is still an issue regarding the need for accounting public investment as an addition to net wealth, but then again, there are several factors that make valuation of this investment quite difficult, particularly because this capital is not easily marketable (it is basically a non-tradable good). Also, keeping a separate budget for current expenditures and investment expenditures may make it much harder to ensure sustainability.

4. Evaluating Sustainability under Uncertainty

Standard sustainability analysis starts by picking values for steady state growth and the real interest rate, and then uses these values to compute the level of primary surplus that is consistent with debt stabilization. The previous section highlighted that evaluating sustainability in emerging markets and developing countries is more difficult than evaluating sustainability in industrial countries because emerging market countries are characterized by higher volatility in both revenue and expenditure, and, hence, the various implications based on steady state values for growth and the real interest rate (where volatility is not an issue) may not make much sense.

In this vein, a policy paper published by the International Monetary Fund (IMF, 2003b) describes several methodologies to stress test standard sustainability analysis with shocks to the main macroeconomic variables (this could be done by observing the past

volatility of the main variables or by using stochastic simulations) and explicitly including contingent liabilities. These simulations can then be used to build confidence intervals around the projected evolution of debt over GDP.

To address the issue of volatility, some authors are now developing probabilistic models of sustainability that specifically take into account volatility in macroeconomic variables. Barnhill and Kopits (2003) develop models based on the concept of value-at-risk and apply it to the case of Ecuador. Hausmann (2003) also uses the value-at-risk concept and applies it in a cross-country context. Croce and Juan-Ramon (2003) develop a stochastic model aimed at deriving a fiscal policy rule that could be observable by external analysts and indicate whether a country is adopting a sustainable policy stance. Since surveying all these models would require a considerable amount of space and technicality, in our analysis, we will focus on the probabilistic model developed for the Inter-American Development Bank by Mendoza and Oviedo (2003). This is the model that we will use as a benchmark for our analysis, focusing on revenue volatility and expenditure inflexibility. Section 4.1 describes the main characteristics of the model. We then illustrate its application for the case of Egypt in section 5.1.

4.1 The Mendoza-Oviedo Model

The guiding principle of the Mendoza-Oviedo (MO) model is that of "credible payment commitment" (CPC). According to their definition, a commitment to repay is credible only if the government is able (not necessarily willing) to repay its debt in every state of nature.[19] This implies that the government cannot accumulate more debt than the level it could service if it were to enter a fiscal crisis, defined as the case in which the primary balance remains forever at its lowest possible value. Were the actual level of debt to remain higher than the threshold determined by the CPC, then the government would be facing a positive probability of default on its debt, something that a risk-averse lender would not allow to happen.[20]

[19] Including the case in which government revenues (expressed as a share of GDP) remain indefinitely at their minimum.

[20] For more on this, including a discussion on outcomes using optimal contracts, see Mendoza (2003).

With these considerations in mind, Mendoza and Oviedo (2003) develop a full-blown dynamic stochastic general equilibrium model where the path of government revenues is endogenously determined by the behavior of utility-maximizing individuals and profit-maximizing firms, in a context where both tradable and non-tradable goods are produced. In their model, there is a mismatch in the government's balance sheet because the government debt is mostly denominated in tradables and tax revenues are mostly denominated in non-tradables. They also assume that volatility in government revenues can be traced back to volatility in fundamentals such as the terms of trade, foreign interest rates, or productivity. Since discussing the full specification of this model would require considerable technical detail, we follow a simplified version of Mendoza and Oviedo (2003) which transmits the essence of its more complex formulation. This simplified version is the one we use to conduct an application to Egyptian data in section 5.1.

We make the following three assumptions: (i) the path of government revenues is stochastic and exogenously determined; (ii) there is no currency mismatch (government revenues and debt are denominated in the same currency); and (iii) both the interest rate (r) and long-run GDP growth (g) are known with certainty.

These assumptions lead to a simple formulation of the credible repayment commitment where the threshold value for the debt-to-GDP ratio satisfies the following condition:[21]

$$d \leq d^* \equiv (t^{\min} - e^{\min}) \frac{1+g}{r-g}. \qquad (7)$$

Here d^* represents the threshold value for the debt to GDP ratio, $t^{\min}$ is the lowest possible realization of government revenues over GDP, and $e^{\min}$ is the minimum level of government expenditure-to-GDP ratio that can be sustained if the country were to enter a fiscal crisis in which tax revenue reaches (and stays at) $t^{\min}$ and pushes d above d^*. Heuristically, $e^{\min}$ measures a government's ability to reduce expenditure in the presence of a prolonged negative shock to revenue. Countries that can sustain larger adjustments

[21] Equation (7) could also be written as $d \leq d^* \equiv \frac{(t^{\min} - e^{\min})}{r-g}$. See footnote 7 for a discussion.

will be able to sustain larger debt-to-GDP ratios relative to countries with rigid public expenditure.

In this version of the model, the government has a constant desired level of primary expenditure, $\bar{e}$. For each period (year), it observes the realization of revenue and finances any gap between revenue and total expenditure (including interest payments) with new debt, as long as the resulting debt does not hit the debt threshold d*. Otherwise, it needs to adjust expenditure in order to meet the debt threshold restriction. Thus, as long as debt is lower than the threshold, the debt-to-GDP ratio evolves according to the following formula:

$$d_t = d_{t-1}\frac{(1+r)}{(1+g)} + \bar{e}_t - t_t \qquad (8)$$

Given an initial debt level, and a sequence of revenue realizations based on the stochastic characteristics of the revenue process (mean, standard deviation, and persistence), the model generates a set of relevant results, despite its simplicity. Not only does it determine a threshold debt level, but it also produces estimates for the number of periods it will take to reach the debt threshold, as well as a probability distribution of debt *n* periods ahead. This probability distribution can then be used to calculate the probability of reaching the debt threshold.

An important difference between the probabilistic approach to sustainability of Mendoza and Oviedo and the traditional long-run approach is that the traditional approach defines a policy target (expressed as the primary-balance-to-GDP ratio) aimed at stabilizing the current debt-to-GDP ratio (which is assumed to be the steady state level of debt to GDP). In contrast, in the probabilistic model only the maximum level of debt to GDP is defined, but this level is not the equilibrium that will necessarily be observed and is clearly not the optimal level of debt. The task of the government is to strengthen fundamentals so that the probability of reaching the maximum level of government debt remains low.

An implication of the probabilistic model is that, for any given average revenue-to-GDP ratio, governments that have a less volatile revenue base (for instance, governments

that depend less on natural resources) will have higher values of $t^{\min}$ [22] and hence they will be able to sustain higher levels of debt. Furthermore, what really matters is not the actual value of expenditure adjustment that a country can announce, but the value of $e^{\min}$ that can be *credibly* announced. Countries that can commit to large adjustment in expenditure, can sustain higher debt-to-GDP ratios and may never be asked to act on these commitments.[23]

Mendoza (2003) uses equation (7) to compute sustainable debt-to-GDP ratios under different assumptions for the volatility of revenues, the difference between GDP growth and the real interest rate, and the ability to adjust expenditure. He shows that the results are very sensitive to the choice of this last parameter. In particular, he finds that emerging market countries that cannot adjust expenditure by more than 1 percent of GDP will not be able to sustain positive debt. EMs with a larger capacity to adjust[24] may be able to sustain debt-to-GDP ratios that range between 40 and 150 percent. When he calibrates the results to the "average" emerging market country, he finds a sustainable debt-to-GDP ratio of 60 percent for low-risk emerging market countries[25] and 30 percent for high-risk emerging market countries. Comparable estimations calibrated for industrial countries yield a sustainable debt-to-GDP ratio that can reach up to 350 percent with average values of 85 percent.

Notice that these large differences in sustainability were obtained by just assuming differences in the volatility of revenues and the capacity to adjust primary expenditure. Hausmann (2003) suggests that valuation effects brought about by liability dollarization and original sin are likely to greatly amplify these differences. In fact, liability dollarization will affect the difference between real interest rate and GDP growth by making a given country riskier and hence play a role in determining which countries lie in the high-risk group.

[22] Where, for example, $t^{\min}$ is assumed to be equal to the mean minus two standard deviations.

[23] Countries could also commit to adjusting their tax rate and, by increasing $t^{\min}$, obtain a similar result.

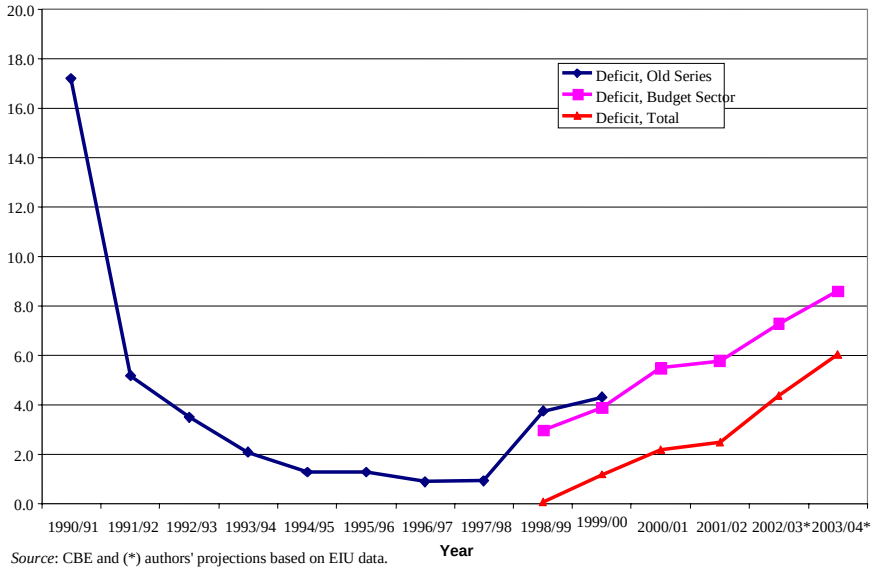
[24] Defined as countries that can adjust the expenditure-to-GDP ratio by at least 8 percent.

[25] Low-risk is defined as having a small difference between real interest rate and GDP growth.

5. THE CASE OF EGYPT

This section surveys the main issues related to fiscal sustainability in Egypt. Figure 1 describes the evolution of the public deficit (expressed as share of GDP) over the period 1990-2004.[26] The trends are somewhat difficult to interpret because of a revision in the way in which the government reports the budget. For this reason, the figure reports the historical series (where the deficit is measured with the old reporting system) plus two series that start in 1998 and measure the deficit with the new reporting system. The first of the new series measures the deficit of the narrowly-defined budget sector and the second focuses on the total budget sector that includes the National Investment Bank (the institution that funds public projects), the General Agencies for Supply of Commodities (which administers the main subsidies), and the Social Insurance Fund. As the Social Insurance Fund runs a surplus (approximately 5 percent of GDP), the latter definition is the one that yields the lower deficit.[27]

(%) Figure 1: Deficit Over GDP (various definitions)



Source: CBE and (*) authors' projections based on EIU data.

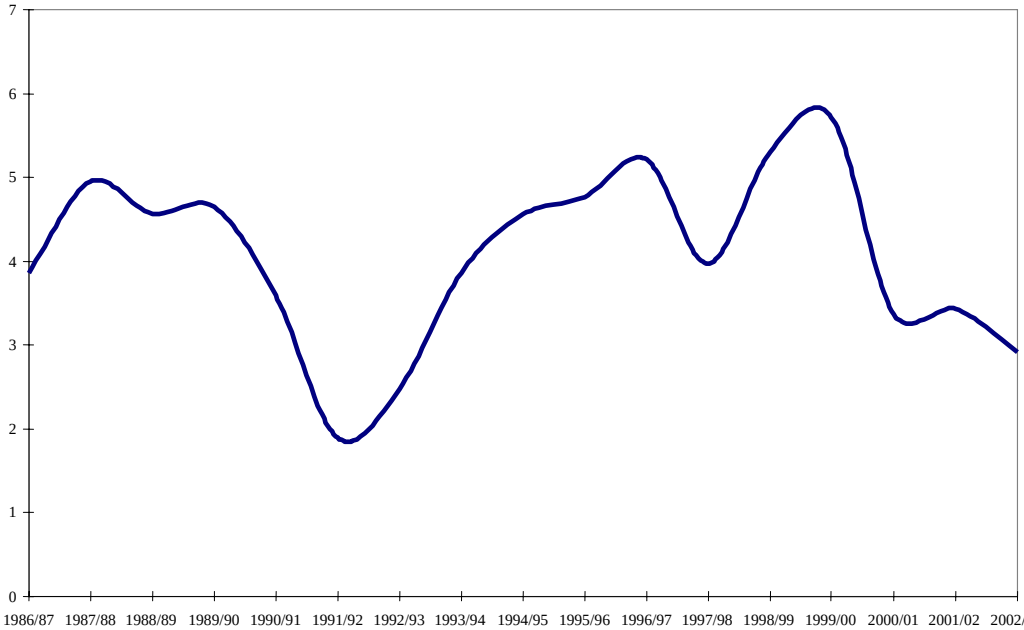
[26] The data for the period 1990-2002 are from the Central Bank of Egypt. The data for 2003 and 2004 are our own projections based on information obtained from the Economist Intelligence Unit.

[27] The government presents three sets of fiscal accounts. Besides the two described in Figure 1, it also reports a set of fiscal accounts that includes the activities of the National Investment Bank (NIB) and the General Agencies for Supply of Commodities (GASC), but not the Social Insurance Fund. As NIB and GASC have large losses, this third definition is the one that yields higher deficits. Part of the confusion in reading the budget numbers arises from the fact that the budget presented to the parliament does not use this three-tier methodology. Also, peculiar budget institutions always lead to large amendments and produce a final budget that is very different from the one that is initially proposed (see Panizza, 2002).

Whichever definition of the deficit one focuses on, Figure 1 clearly shows an inversion of the trend towards fiscal adjustment that characterized the early 1990s.[28] The deficit as a share of GDP bottomed out in 1997/98 and then started growing at a fast rate with the last figures placing the deficit well above 5 percent of GDP (2.5 percent of GDP after including the activities of the Social Insurance Fund). Furthermore, the deficit is projected to increase to 8.5 percent in 2003/04 (6 percent of GDP) after including the Social Insurance Fund.

This deterioration is partly due to the drop in GDP growth (Figure 2) caused by the large external and domestic shocks that have impacted the Egyptian economy in recent years. The Asian crisis of 1997 led to a reduction in portfolio flows and foreign direct investment and to a deterioration of terms of trade that affected Egypt's external account both directly (Egypt is a net oil exporter) and indirectly (through the remittances of Egypt's expatriates who work in Gulf countries).[29]

Figure 2: GDP Growth



Source: CBE and authors' calculations based on EIU data.

[28] The fiscal consolidation of the late 1980s and early 1990s was helped by debt rescheduling and large international packages. A first major rescheduling took place in 1987 and a second one, mostly a reward for Egypt's role in the first Gulf War, occurred in 1991.

[29] There are about 1.9 million expatriates (more than 10 percent of total employment).

The Luxor incident of November 1997 and the events of September 11, 2001 also led to large drops in tourism revenues.[30]

The large balance of payments deficit of 1998 was a shock for the Central Bank, which responded to this new situation in a rather incoherent manner. Monetary policy was tightened, then relaxed, then tightened again, and the exchange rate parity was defended with market-unfriendly policies that generated a black market for foreign currency that still exists. Some observers have suggested that policy uncertainty played a key role in amplifying the effect of the external shocks (Panizza, 2002).

It should be pointed out that, while the economic downturn of the last few years played an important role in the deterioration of Egypt's fiscal accounts, Egypt's budgetary problems are not purely cyclical. They have a structural component that needs to be addressed by a change in policy stance. This can be seen by observing the main components of Egypt's budget (Table 1). The upper part of the table focuses on the budget sector and the bottom part on the total budget sector; all figures are expressed as shares of GDP.

When we focus on the budget sector, we find an increase in current expenditure that is mostly due to a higher wage and interest rate bill and a decrease in capital expenditure. As these two trends compensate each other, total expenditure remained unchanged during the period under observation. This suggests that the deficit was due to lower revenues rather than higher expenditure. In fact, total revenues dropped from 24 percent of GDP in 1998/99 to 20.6 percent of GDP in 2001/02.

[30] In 1988, tourism surpassed oil and became the main source of hard currency. The tourism sector currently employs 2.2 million people and, according to official data, is responsible for 5 percent of GDP. Because of limited reserves, oil revenues are likely to further decrease and Egypt is estimated to become a net importer within the next 2 decades (EIU).

Table 1: Egypt's Main Budget Items (as a share of GDP)

	Budget Sector					
	1998/99	1999/00	2000/01	2001/02	2002/03*	2002/04*
Total Expenditure	26.90	26.17	26.46	26.45	26.94	27.59
Current Expenditure	20.57	20.61	22.25	22.35	22.26	23.21
Wages	6.58	6.55	6.94	7.38	7.30	7.44
Interests	5.52	5.49	5.75	5.99	6.09	6.57
Local	4.73	4.96	5.25	5.38	5.52	5.88
Foreign	0.78	0.53	0.50	0.61	0.58	0.69
Capital Expenditure	5.90	4.94	4.16	3.99	4.37	4.23
Total Revenues	23.90	22.27	20.96	20.65	19.61	18.93
Deficit	3.00	3.90	5.50	5.80	7.33	8.67
Primary Deficit	-2.52	-1.59	-0.25	-0.19	1.23	2.10
	Budget Sector + NIB+GASC+SIF					
	1998/99	1999/00	2000/01	2001/02	2002/03*	2002/04*
Total Expenditure	30.95	30.08	30.02	29.71	30.26	31.00
Current Expenditure	22.65	22.52	24.77	23.84	23.75	24.76
Wages	6.65	6.62	7.01	7.45	7.37	7.51
Interests	4.88	4.82	5.18	5.32	5.41	5.84
Local	4.10	4.29	4.68	4.71	4.83	5.15
Foreign	0.78	0.53	0.50	0.61	0.58	0.69
Capital Expenditure	5.90	4.94	4.16	3.99	4.37	4.23
Total Revenues	30.87	28.85	27.81	27.20	25.84	24.93
Deficit	0.07	1.23	2.21	2.51	4.42	6.06
Primary Deficit	-4.81	-3.59	-2.98	-2.82	-0.99	0.22

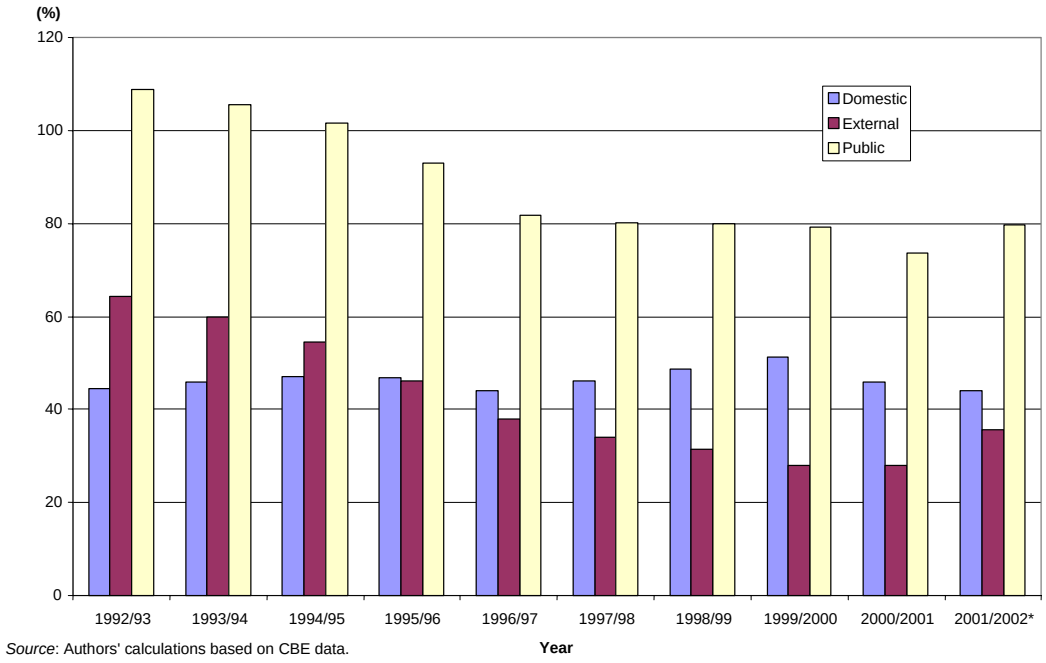
Source: Authors' calculations based on CBE data and (*) projections based on data from the Economist Intelligence Unit.

While the external situation is now improving, the most recent budgets show no sign of improvement in fiscal accounts and the budget for 2003/2004 does not seem to correct the negative trend described above. In particular, a small drop in public investment will not be enough to compensate the drop in revenues and an increase in current spending (the main components are wages and pensions). Because of the deterioration of the fiscal accounts, Standard and Poor's downgraded Egypt's sovereign foreign currency debt from BBB- (investment grade) to BB+ (speculative) with a negative outlook.

Figure 3 describes the behavior of public debt expressed as a share of GDP. It separates total debt into public domestic and public external debt. The data reported on the figure (like all debt data used in this paper) refer to net debt. If we were to use gross debt,

we would obtain much higher debt to GDP ratios.[31] Alba, Al Shawarby and Iqbal (Forthcoming) discuss the difference between net and gross debt. The figure shows that there is a tendency toward greater reliance on domestic debt. The share of domestic debt over total debt climbed from 40 percent in the early 1990s to about 65 percent in 2000/2001. The Egyptian government has also been successful in lengthening the maturity of its debt. In 1995, it started placing 5-year domestic currency bonds and currently issues bonds with maturities of up to 7 years. Most of this debt, however, is held by domestic banks. If these bonds are financed with demand deposits, the fact that the government is able to place long-term bonds does not reduce the aggregate maturity mismatch, but it only transfers it to the banks' balance sheets.

Figure 3: Public Debt Over GDP

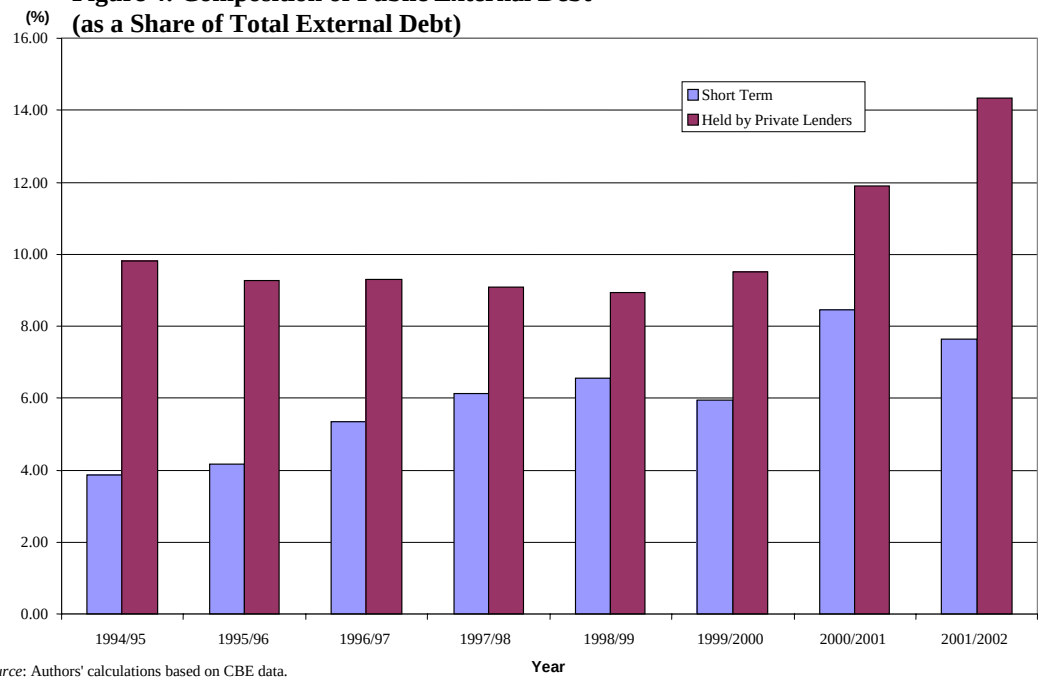


Source: Authors' calculations based on CBE data.

[31] Net debt is difficult to estimate. While we use official figures form the Central Bank of Egypt, IMF estimates (release of Article IV consultation for 2000) suggest that netting out government deposits with the Central Bank and a blocked account created at the time of the Paris Club rescheduling would reduce the stock of domestic debt by approximately 5.5 percentage points. This would bring debt to GDP in 2000/2001 to approximately 66 percent (versus 71.5 percent reported in Figure 3). While different methods of calculation affect the level of debt, they should not affect the trend described in Figure 3.

Figure 4 looks at the composition of external debt. Most public external debt is long and medium-term, but in the last 6 years the share of short-term debt almost doubled (from 4 to 7.5 percent). The figure also shows that official creditors (mostly bilateral) hold about 90 percent of medium and long-term external debt (approximately 70 percent of long-term debt is granted on concessional terms). However, the share of public external debt held by private creditors has increased substantially in the last few years, from 10 percent to approximately 14.5 percent (this calculation assumes that all short-term debt is held by private creditors).

Figure 4: Composition of Public External Debt (as a Share of Total External Debt)

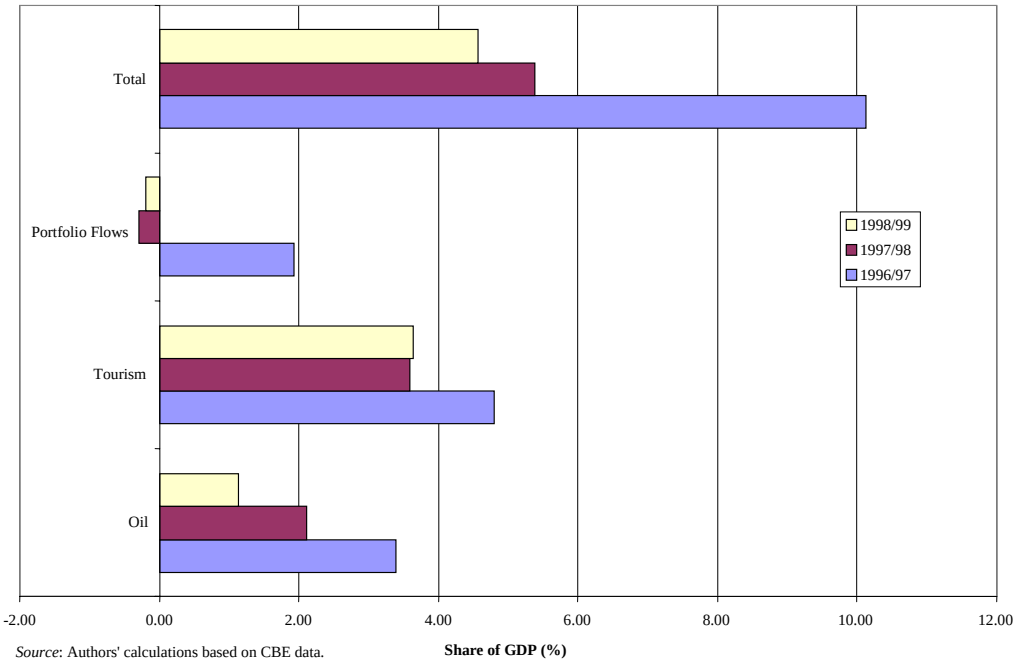


Source: Authors' calculations based on CBE data.

The fact that only a small share of external debt is short-term and held by private creditors suggests that Egypt's debt structure is fairly safe (from the borrower's point of view). Sudden stops in capital flows or large jumps in country risk due to international contagion are unlikely to have a large negative effect on Egypt's external balance and fiscal accounts. There is also little reason to be worried about a sudden stop in international aid. While net official development assistance decreased from $2.2 billion in 1996 to $1.3 billion in 2000, the World Bank and the United States government recently pledged large grants and loans.

The events of 1998, however, show that an unfavorable external climate may cause a sudden drop in foreign revenues and have an effect that is similar to that of a sudden stop in capital flows. Figure 5 shows that during 1997-1999, three components of the balance of payment (oil, tourism revenues, and portfolio flows) were responsible for a drop in foreign currency revenues equivalent to 6 percent of GDP. Such a sudden stop in foreign revenue may lead to a currency depreciation that may have serious valuation effects. According to the Central Bank of Egypt, the jump in external debt observed in 2001/2002 (from 28 to 32 percent of GDP) was mostly due to the depreciation of the Egyptian pound. While the depreciation of the pound is expected to further increase external debt to well above 40 percent of GDP, one should remember that the government has large foreign currency deposits with the Central Bank and with the banking system that partly offset the negative effect of a currency depreciation. In fact, some analysts think that the currency depreciation had either a neutral or even a positive effect on the overall government balance.

Figure 5: Main Components of BOP



Source: Authors' calculations based on CBE data.

5.1 Sustainability Analysis

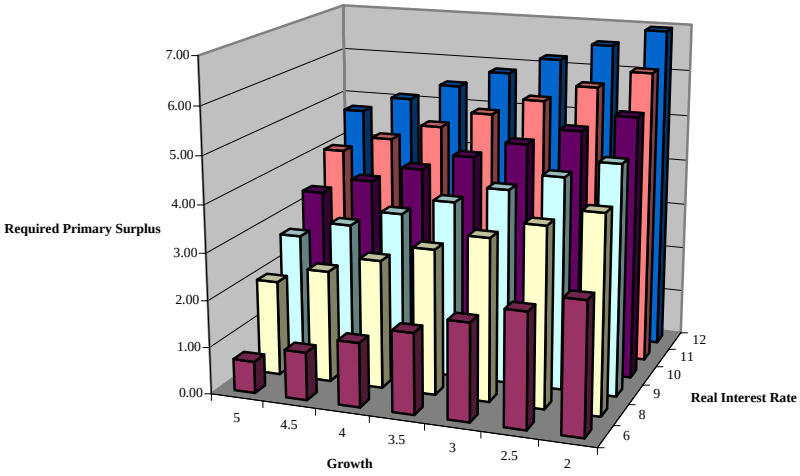
Motivated by Egypt's recent developments, we now focus on three fiscal sustainability exercises: (i) a standard sustainability analysis; (ii) the Mendoza-Oviedo (2003) probabilistic approach; and (iii) the Calvo-Izquierdo-Talvi (2002) sudden stop approach.

These three approaches are useful in assessing different sustainability issues. The traditional approach, which equates the current debt to GDP ratio to the steady state debt level, is useful to calculate the primary surplus that is consistent with that debt at alternative interest rates and growth rates. The second approach incorporates revenue volatility and expenditure flexibility to the previous case. Finally, the third approach is concerned with the effects of an external shock that leads to adjustment in the current account balance and real exchange rate depreciation.

Standard Approach to Sustainability

The standard approach requires assumptions on initial debt, steady-state GDP growth and steady-state real interest rate. For our baseline calculation, we assume that the starting level of debt is 71.5 percent of GDP, i.e. the value for net public debt prevailing in 2002, and we let the steady state growth rate range between 2 and 5 percent and the real interest rate range between 6 and 12 percent. Figure 6 shows that under the most favorable conditions (6 percent real interest rate and 5 percent growth rate of the economy), the Egyptian government could stabilize the debt with a primary surplus equivalent to 0.7 percent of GDP. If we move away from this scenario, however, we find that required primary surpluses go well above 3 percent of GDP. In particular, if we assume that steady-state long-run growth is 4 percent and the real interest rate is 10 percent, we find a required primary surplus of 4.1 percent of GDP. This is a much higher figure than the surpluses that the government has been able to run in the past few years.

Figure 6: Primary Surplus Required to Stabilize Debt at 71 percent of GDP



Probabilistic Approach to Sustainability

The Mendoza-Oviedo probabilistic approach is useful in illustrating how revenue volatility can be incorporated in a sustainability analysis. Given methodological changes in fiscal data reporting and the lack of consistent time series, we need to take some shortcuts. We first calculate volatility based on a measure of the cyclical component of government revenue (obtained by taking a Hodrick-Prescott filter to the log of revenue) in real terms for the period 1981-2002.[32] Next, we approximate cyclical component behavior to a first order autoregressive (AR1) process, and take the standard deviation of this process as our measure of volatility.[33] This yields a value of 2.5 percent.

We then construct measures of average revenue and average non-interest expenditure for a wider measure of the public sector, which includes the National Investment Bank and GASC, over the period 1999-2002.[34] These measures yield 24.9

[32] We use data on budget sector revenues. We could not incorporate a wider definition of the public sector (including the National Investment Bank and GASC) in our estimation of revenue volatility given the lack of sufficiently long time series, particularly after the changes in definition that took place in 1998.

[33] This measure of volatility is expressed in percentage terms relative to the Hodrick-Prescott trend. We also use the estimated autocorrelation coefficient of the AR1 process to generate a Markov chain, defining transition probabilities for the revenue process. The latter are used later to simulate revenue paths.

[34] These were the only years for which information is available under the new reporting system of the CBE.

and 22.3 percent of GDP, respectively. Next, we estimate the effective real interest rate paid by the central government based on interest payments and prevailing debt stocks at the beginning of the period.[35] In order to avoid the effects of substantial recent devaluation, we compute average interest payments for 2001.[36] This estimate includes the effect of real exchange rate depreciation that took place in 2001 (given that the nominal exchange rate depreciated at a faster rate than the increase in domestic prices), thus raising the value of the real interest rate paid on dollar debt. With this caveat in mind, we estimate the average real interest rate paid on government debt to be 10.6 percent. Given that we measured volatility for the period 1981-2002, we use the same time span to estimate the average growth rate of the economy,[37] yielding a value of 4.1 percent. Finally, we take net public debt prevailing in 2002 as our initial debt level.[38] This figure is equivalent to 71.5 percent of GDP.

At this stage, we need to make further assumptions about minimum revenue, as well as the flexibility of public expenditure. We make the following two assumptions: (i) the minimum revenue level lies two standard deviations below the mean (this is equivalent to a probability of 2.5 percent); given our measures for volatility and mean revenue, this yields a value of 20 percent of GDP; (ii) the government can reduce non-interest expenditure by 30 percent in the event of a fiscal crisis.

The assumptions on revenues volatility and ability to adjust non-interest expenditure are particularly important and merit further discussion. In particular, we assumed an ability to adjust expenditure that is much larger than the one that is suggested by the cross-country evidence. Figure 7 is helpful to depict debt threshold sensitivity to revenue volatility and expenditure adjustment. Taking interest and growth rates as given,

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[35] Data on interest payments and net debt is obtained from CBE sources.

[36] The real interest rate facing the government (r) is defined as follows:

$r = \frac{(1+r^*)(1+\varepsilon)}{1+\pi}\alpha + \frac{1+r^d}{1+\pi}(1-\alpha) - 1$, where r* is the interest rate on dollar debt, ε is the devaluation rate, π is the inflation rate, r^d is the interest rate on domestic currency debt, and α is the share of foreign debt in total debt.

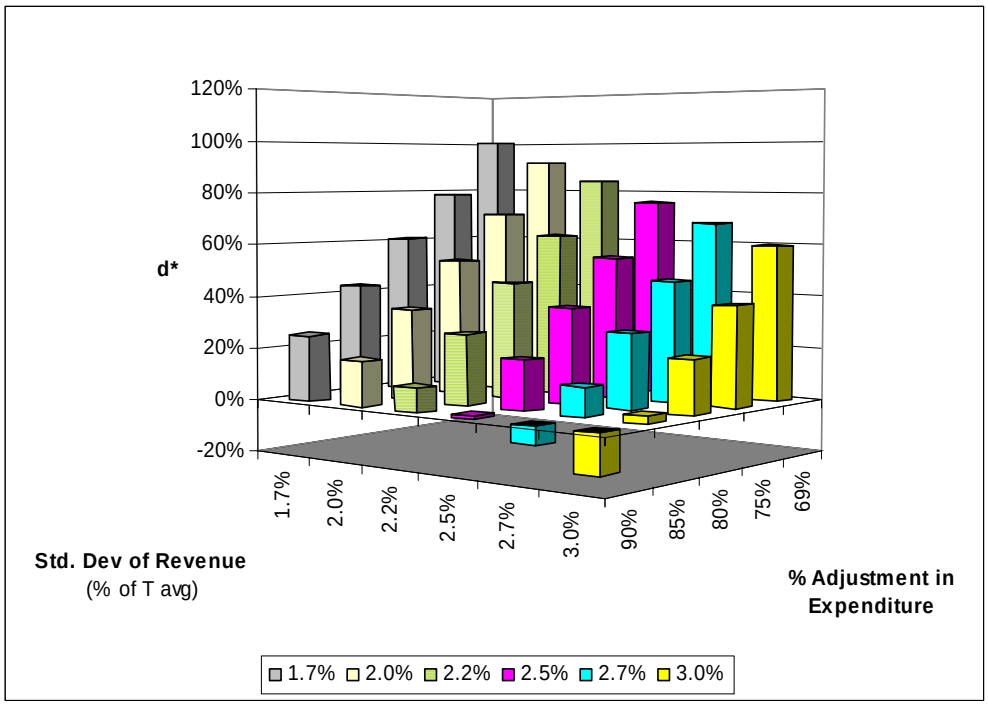
[37] GDP data was obtained from IMF (2003d).

[38] CBE data.

different debt thresholds are calculated for various values of volatility and adjustment levels. For example, using as a benchmark our estimate for revenue volatility (2.5 percent of the mean) and our assumption on ability for expenditure adjustment (30 percent), the debt threshold yields 77 percent of GDP. Reducing volatility to 1.7 percent would allow for higher debt levels (100 percent of GDP).

On the other hand, if we were to relax our highly unrealistic assumption that the government can adjust expenditure by 30 percent and replace it with the still generous assumption that government can adjust expenditure by 20 percent (an even more realistic assumption would put the maximum adjustment at around 15 percent), we would obtain a debt threshold close to 45 percent of GDP. This would imply that current debt is already above the threshold that guarantees debt repayment under all states of nature and that fiscal adjustment is necessary.

Figure 7: Debt Threshold Sensitivity



While we were very lenient in assuming a large capacity to adjust, we were stricter in calculating the interest rate paid on government debt. If we were to assume that most of the adjustment in the exchange rate has already taken place, the average interest rate on

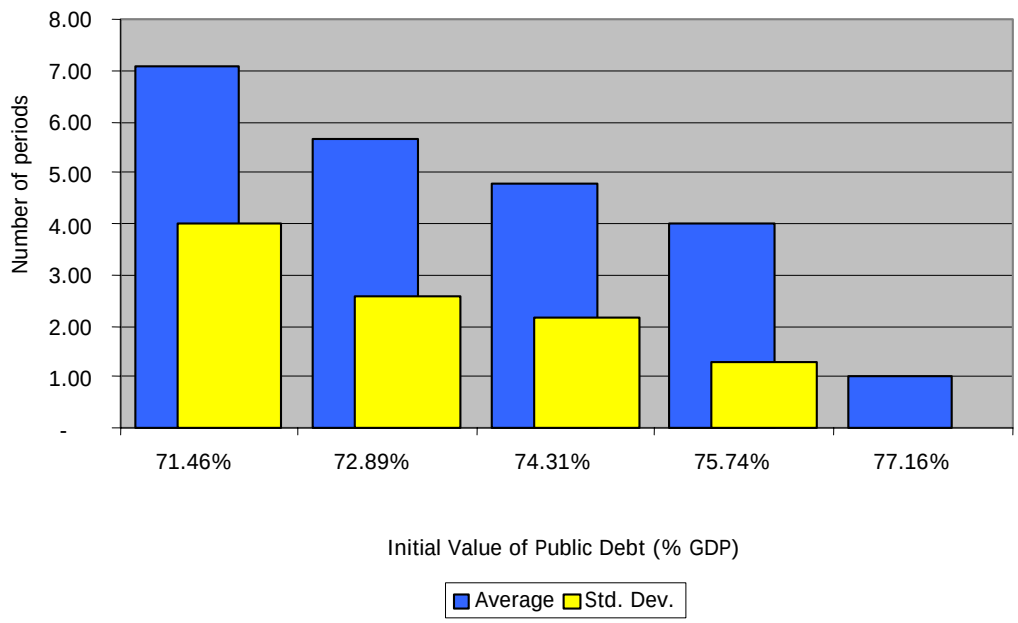
government debt will be lower than the one used in our calculations, thus yielding a higher debt threshold.

This simple exercise points out that Egypt's fiscal position is far from being lenient. The current level of debt appears to be sustainable (in the probabilistic definition) only if we are ready to assume unrealistically high flexibility in government expenditure. The definition of sustainability is very conservative because it insures the public sector against default even under the worst scenario (in which revenue remains at its minimum forever) and it may be argued that this is a very unlikely event. The threshold level obtained with the probabilistic sustainability analysis is a good benchmark for comparison against actual debt levels, particularly so for developing countries where uncertainty about the future path of revenue and credibility about debt repayment is always an issue. Furthermore, this exercise has the advantage of highlighting that macroeconomic policies that reduce revenue volatility and increase flexibility in public spending are two key determinants of access to credit markets.[39]

We now turn to model simulation. We assume a given level of initial debt and perform 1000 replications of the model to estimate the average number of periods it takes to hit the debt threshold, given all above-stated assumptions. Figure 8 shows the results for various initial debt levels. If we take as initial level of debt, the one prevailing in 2002 (71.5 percent) we find that it would take on average 7 periods to reach the debt threshold. However, given the high volatility of government revenue, the standard deviation of the number of periods in which debt can hit the threshold is also high (implying that the threshold could be reached sooner). While this is a simple exercise subject to further fine-tuning, it suggests that Egypt may have to enter a fiscal adjustment phase relatively soon.

[39] So far, we have treated debt thresholds as triggers of an adjustment phase in government expenditure. Alternatively, if authorities could not come up with the necessary adjustment assumed initially to be feasible by lenders, it would be equivalent to a default situation. Thus, hitting the threshold could have an interpretation of hitting default.

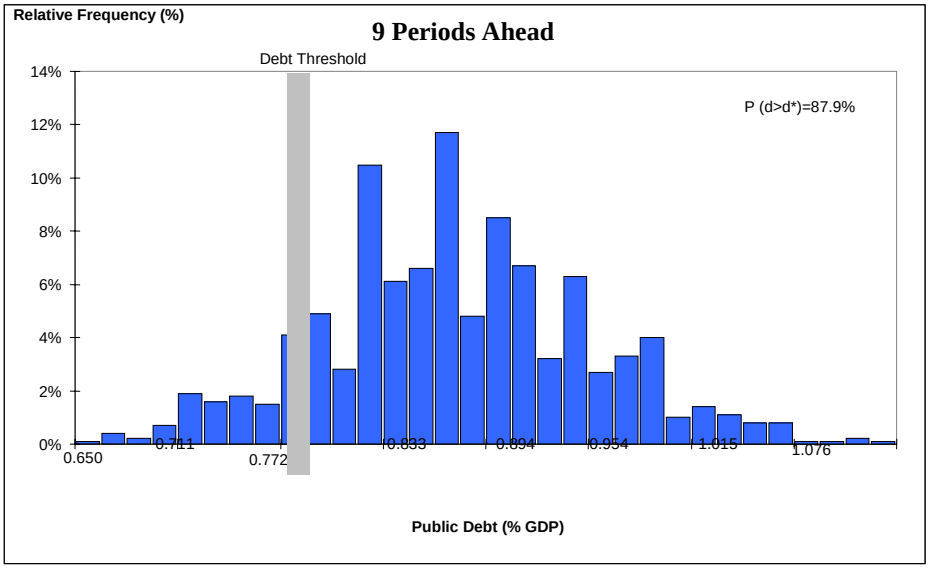
Figure 8: Number of Periods before Hitting Debt Threshold

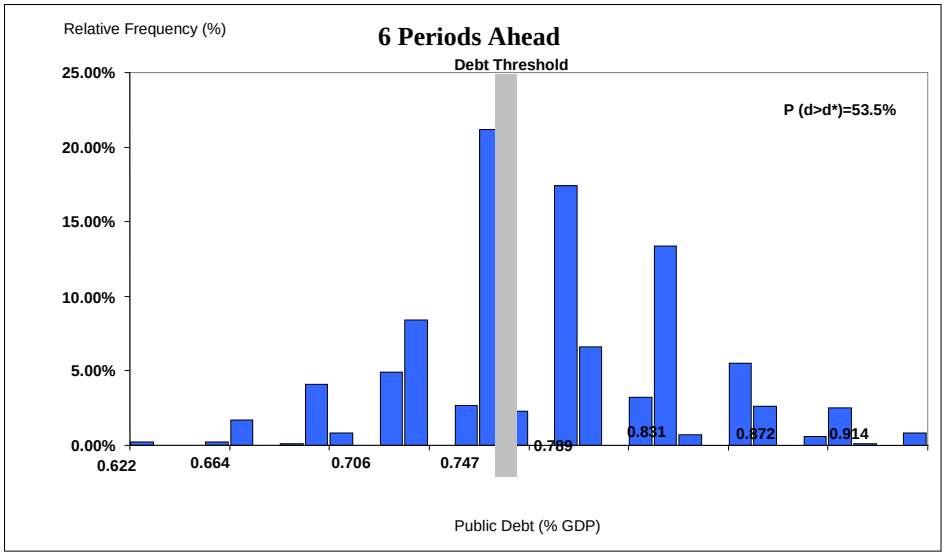


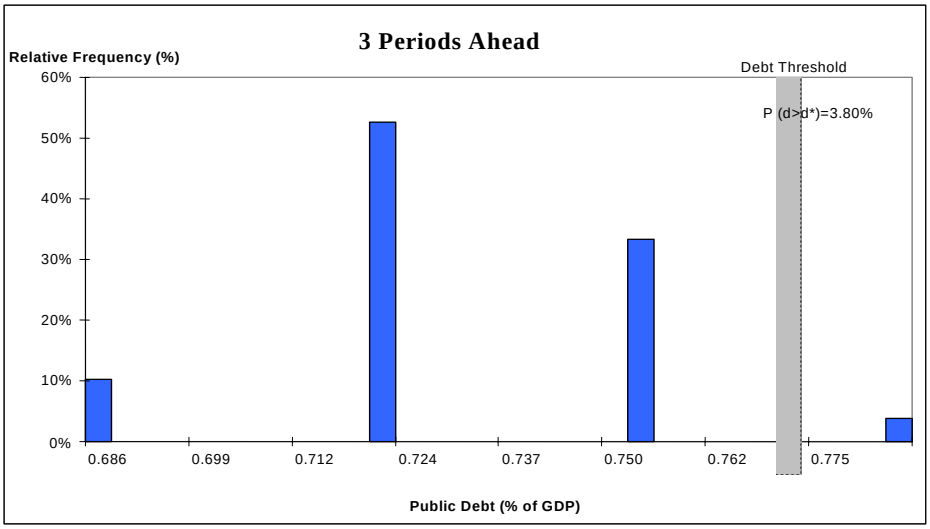
This simple model also allows computing the relative frequency distribution of government debt *n* periods ahead. This distribution contains all the information needed to compute the probability of reaching the debt threshold. Figure 9 displays debt distributions 3, 6, and 9 periods (years) ahead. The first graph indicates that, under the favorable assumptions described above, the probability of entering an adjustment phase within three periods is rather low (3.8 percent). This changes substantially if we focus on a six-period horizon. In this case, even with our favorable assumptions, the probability of entering the adjustment phase jumps to 53.5 percent. The probability of entering the adjustment phase reaches 87.9 percent if we look at a nine-period horizon.

Figure 9 illustrates one of the key advantages of the probabilistic approach which, by allowing estimation of the future behavior of debt, can highlight possible negative outcomes with enough anticipation, giving authorities a chance to correct fiscal policy well before hitting debt thresholds.

Figure 9: Public Debt Distribution







Sudden Stop Approach to Sustainability

We now focus on the fiscal distress that is typically generated by shocks to financing of the current account, or sudden stops in capital flows. As stated in Calvo, Izquierdo and Talvi (2003), this type of shock has been quite relevant for emerging markets, particularly so following the Russian crisis of 1998. These events can be interpreted as shocks to credit. A fall in the financing of the current account deficit implies a forced adjustment in the absorption of tradable goods. To the extent that consumption of non-tradable goods is a complement in consumption of tradable goods, a fall in the latter will imply a fall in the former, leading to a decrease in non-tradable prices. Since for a small open economy tradable prices are taken as a given, this implies that the real exchange rate will have to adjust. Adjustment in the real exchange rate will generate valuation effects on the debt-to-GDP ratio, which, in turn, affect fiscal sustainability.

The case of Egypt is different from the typical EM in that its current account deficit is small. For example, according to IMF (2003d), it reached only 0.01 percent of GDP (or 0.04 percent of imports) in 2002, a much smaller figure than pre-crisis levels in countries like Argentina or Ecuador, where current account deficits exceeded 4 percent of GDP and 9 percent of GDP, respectively. Thus, the shock to financing of the current account deficit, from a capital flow perspective, would be very small for the case of Egypt. Yet, there are alternative sources of vulnerability that could work as sudden stops. If the government faced restrictions to increase its debt levels (as would be the case under the Mendoza-Oviedo framework), then shocks such as a fall in the price of oil or a decrease in remittances may generate effects similar to those of a sudden stop, given that there may be no additional sources of financing available to smooth out the shock.

In order to assess the significance of this type of shock to the Egyptian economy, we focus on a scenario where the price of oil goes back to 1999 levels, equivalent to a fall in real terms relative to current prices of 49 percent. Under the assumption that oil output remains constant, we compute this percentage price fall as the percentage fall in the value of oil exports. Thus, financing could fall by as much as US$1 billion, equivalent to 5 percent of imports on impact.[40] Assuming that the latter represents the percentage fall in

[40] We take this as a proxy of the fall in absorption of tradable goods following the shock.

the absorption of tradable goods, that a similar percentage fall in the demand for non-tradable goods would take place,[41] and that the relative price elasticity of non-tradable goods has a value similar to that of other developing countries,[42] this would yield an increase in the real exchange rate of about 11 percent.[43] This figure does not seem to be very high, at least compared to the effects that sudden stops have had in Latin America, where the real exchange rate skyrocketed in the aftermath of a sudden stop, particularly because of the large current account deficits that many of these countries were running before the crisis.

We focus next on the effect of real depreciation on fiscal sustainability through its impact on the debt-to-GDP ratio. A remarkable characteristic of the Egyptian economy is the currency composition of government debt. As of 2002, domestic currency debt was 15 percent higher than foreign currency debt, something quite uncommon for a developing economy, where, typically, an inflationary past has led to the acceptance of foreign currency denominated debt only. On one hand, this fact could be interpreted as a healthy sign, indicating that expectations of inflationary repudiation are low. On the other hand, it may be reflecting that much of domestic public debt acceptance is due to financial repression and large government bond holdings by public banks.[44] Having said this, at least from the non-financial public sector perspective, a substantial share of government debt seems to be shielded from real exchange rate fluctuations.

We analyze this in more detail by taking a look at government mismatches in debt composition *vis-à-vis* output composition. It can be shown that real exchange rate fluctuations will have no valuation effects on the debt-to-GDP ratio as long as the ratio of debt in domestic currency (or in non-tradables, B) relative to debt in foreign currency (or in tradables, B*) is the same as the ratio of non-tradable output (Y) to tradable output (Y*), or equivalently:

[41] Given that utility functions are assumed to be homothetic.
[42] This value is taken to be 0.4.
[43] An increase is interpreted as an increase in the price of tradable goods *vis-à-vis* that of non-tradable goods. For a detailed description of this calculation, see Calvo, Izquierdo, and Talvi (2003).
[44] Data on government bond holdings held by public banks was not available, although commercial banks as a group (including public banks) hold a substantial amount of those assets, and public banks represent a relevant share in total commercial banks, at least in terms of their number of branches relative to total commercial bank branches.

$$\frac{B}{B^*}\frac{Y^*}{Y}=1 \qquad (9)$$

Compared with other developing countries, Egypt ranks very well in terms of its B/B* ratio, but it has average values in its Y/Y* ratio.[45] The measure $\frac{B}{B^*}\frac{Y^*}{Y}$ yields a value of 0.25, much larger than that of crisis countries like Argentina or Ecuador (where this ratio was close to zero) and closer to that of sudden stop survivors such as Chile, where this ratio yielded 0.48.

We put Egyptian data to the test by analyzing the effect on the required primary surplus (using standard sustainability analysis) of a real exchange rate (RER) depreciation triggered by the fall in the price of oil indicated above. The results are shown in Table 2.

Table 2: Egypt: Fiscal Sustainability After a Shock to the Current Account (Fall in Oil Prices, Data as of 2002)

	Case 1	Case 2
$(B+B^*)/(Y+Y^*)$	71.47	71.47
r	10.57	6.79
g	4.11	4.11
Observed Primary Surplus	0.19	0.19
Required Primary Surplus		
a. Base Exercise	4.43	1.84
b. Change in Relative Prices	4.56	1.89
c. b + Increase in Interest Rate of 100 bps	5.27	2.60
d. c + Decrease in GDP Growth of 1%	6.03	3.34
e. d + Contingent Liabilities (3.4% GDP)	6.33	3.50
$(B/B^*)/(Y/Y^*)$	0.25	0.25
Fall in Oil Exports/Imports of G&S	0.05	0.05

We first use the same assumptions on interest and growth rates used in the Mendoza-Oviedo framework, and then conduct a second exercise with a different assumption on the real interest rate. As expected, the RER valuation effect has a very small impact on the required primary surplus (0.13 points of GDP). There are two reasons for this: (i) the

[45] Where Y* is proxied by exports. This result will change in a more thorough analysis of output composition, although, as shown in Calvo, Izquierdo and Talvi (2002), sustainability calculations may not differ substantially.

increase in the RER is small;[46] and (ii) debt mismatches are not very substantial. However, it is not uncommon for negative shocks to the current account to be accompanied by increases in interest rates and economic crises (with the consequent drop in GDP growth). An increase in interest rates of 100 basis points (1 percent) would increase the required primary surplus by 0.71 points of GDP, while a 1 percent drop in output growth would require an additional adjustment of 0.77 points of GDP.

Finally, we also explore the potential impact that contingent liabilities in the financial sector could have on the government. In many recent crises, governments have bailed out banks in trouble, particularly because of the emergence of non-performing foreign currency loans handed to non-tradable sectors that turn bankrupt after a substantial rise in the RER. In this respect, the Egyptian banking system does not seem to be particularly vulnerable to valuation effects in non-tradable sectors. Adding up private and public banks, credit in foreign currency to the private business sector represents slightly more than 20 percent of total credit to that sector.[47]

Once we roughly split foreign currency private business sector credit into tradable (agriculture and industry) and non-tradable activities (trade and services), we found that only about 12 percent of total credit to the private business sector is allocated to non-tradable activities, representing about 7 percent of GDP. Assuming half of these loans turn bankrupt following a rise in the RER, and that the government incorporates this amount into government liabilities following a bailout, public sector debt would increase by 3.5 points of GDP. This increase in debt would, in turn, require an additional adjustment in the primary surplus of 0.3 points of GDP. As can be seen, none of these elements individually would add significantly to the adjustment requirement, but put *together*, they could introduce stress in the government fiscal position, particularly so once we consider that there is already a *relevant gap between the observed primary surplus and the required one, even in the absence of an external shock.*

[46] Where the rise, once again, is interpreted as a rise in the price of tradable goods relative to that of non-tradable goods.

[47] In turn, the private business sector gets the bulk of credit to the private sector, which represents about 86 percent of that total. Other claims of the banking sector include loans to the public sector, which are presumably allocated in domestic currency, thus leaving our non-tradable sector mismatch calculation unaffected.

As previously stated, the real interest rate used in the calculations (10.6 percent) is that obtained for 2001, when a rise in the RER of close to 10 percent substantially increased the real interest rate on dollar debt, and raised the effective real interest rate paid by the government. If one were to exclude this effect, assuming that in the future no additional RER adjustment would take place, the effective real interest rate would fall to 6.8 percent. The second column of Table 2 shows results for the same analysis carried out previously at the new interest rate. Again, although the effects are now obviously smaller, there is still a substantial gap between the observed primary surplus and the required surpluses both before and after the external shock.

6. CONCLUSION

In this paper, we survey the recent literature on fiscal sustainability with special focus on emerging market countries. We highlight that, because of greater uncertainty and high revenue volatility, standard sustainability analysis is not easily applicable to emerging market countries. With these considerations in mind, we describe in detail a model that aims at evaluating sustainability by using probabilistic methods. We conclude our discussion with an application to the case of Egypt.

Table 3 summarizes our main findings. On one hand, we find that Egypt's debt structure is rather safe and that the country is not likely to suffer from international contagion or from the disruptive sudden stops in capital flows that were at the basis of several financial crises in emerging market countries. Furthermore, our calculations suggest that even a worst case scenario – with a 50 percent drop in the price of oil, a jump in the steady state interest rate, a drop in steady state growth, and widespread bankruptcies – would add, at most, 2 points of GDP to the debt stabilizing primary surplus (not that this is an irrelevant matter, but the calculations were made under a very pessimistic scenario).

Table 3: Egypt Sources of Vulnerability

Possible Source of Vulnerability	Discussion
Sudden Stops in Capital Flows	**NO**. Most of the external debt is long term and held by official creditors
Terms of trade shocks coupled with large real depreciation	**UNLIKELY**. It will have significant effect on required primary surplus only under extreme circumstances
Large structural Deficit	**YES.** Current primary surpluses are well below what is required to stabilize the debt to GDP ratio
High level of current debt	**YES.** Under current policies, Egypt may be close to hitting a level of debt that will require fiscal adjustment

Furthermore, our calculation did not consider that: (i) Egypt's oil exports are broadly balanced by oil imports; (ii) in terms of the fiscal balance, a depreciation of the currency has uncertain effect because it affects both government expenditure and government revenue; and (iii) although tourism can be volatile, it has always recovered quickly after shocks. Therefore, we conclude that sudden stops should not be an important cause of concern in the case of Egypt.

On the other hand, even without shocks and under rather benign assumptions, fiscal sustainability in Egypt is a real concern. Observed primary surpluses are well below those that would guarantee debt stabilization, and simulations of the probabilistic model suggest that, under the current policies, Egypt is either already in a state of fiscal difficulty or is not far from reaching a debt threshold that would require a substantial fiscal adjustment.[48] It would therefore be advisable that the Egyptian government immediately start a fiscal adjustment program.

[48] One point that is worth making is that the government has a captive financing source from the public banks. A scenario of unsustainable fiscal policies would therefore more likely take the form of bank bailouts, rather than a refusal of these banks to lend to the government.

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