ASSESSING FISCAL SOUNDNESS: THEORY AND PRACTICE

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This paper presents a survey of methods to assess fiscal soundness, i.e. *the capability of governments to honour their obligations in the short run and in the long run. The need for a comprehensive monitoring of fiscal soundness derives from the risks for economic stability arising from a government's actual or expected difficulties to honour its obligations. For the long run, methods derived from the government's intertemporal budget constraint allow an assessment of the size of a necessary adjustment to achieve sustainability of the debt burden. Uncertainty regarding shocks to the fiscal situation or the behaviour of financial market participants calls for the monitoring of financial flows and government obligations in the short run. Vigilance needs to be higher, the greater the uncertainty regarding long-term sustainability.*

1. Introduction

Sound government finances are a prerequisite for price and macroeconomic stability and strengthen the conditions for sustainable growth. Thus, public finances have an immediate impact on the environment in which central banks are operating. Sound government finances contribute to keeping inflationary expectations low, thus facilitating a central bank's task of maintaining price stability. Deviations from sound fiscal positions can disturb the macroeconomic environment, induce economic uncertainty and raise inflation expectations.

Monitoring fiscal soundness is especially necessary in a monetary union for two reasons. First, in a monetary union national policy makers may be inclined to run higher fiscal deficits as market signals via the national exchange rate are absent and interest rate risk premia may react more slowly to rising fiscal imbalances. Second, an unsound fiscal situation raises the risk that national policy positions may be geared increasingly towards short-term domestic objectives which may diverge from – or even run counter to – the common goals of the currency union. For example, countries with increasing fiscal problems would be in favour of a loose implementation of the EU fiscal rules, which could over time erode public confidence in the conduct of sound economic policies. Also, national policy objectives could conflict with those of the central bank as regards the need to preserve price stability.

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The analysis of fiscal soundness needs to operationalise the concept, choosing appropriate indicators to identify emerging risks. The term "soundness" covers the health of public finances in the short run (fiscal stability) and in the long run (fiscal sustainability; see for this distinction also IMF, 2006). In the short run, stable public finances can be characterised as the government's ability to service all upcoming obligations. In the long run, fiscal sustainability refers to the fulfilment of the government's present value budget constraint, requiring that the present value of liabilities is not greater than the present value of assets.

Given the long time horizon underlying the concept of fiscal sustainability, its assessment is necessarily subject to considerable uncertainty. From a theoretical point of view, a full sustainability analysis would require a projection of fiscal and macroeconomic variables into the infinite future. But even more practicable approaches warrant coverage of long time periods, e.g. to capture the impact of population ageing. Such projections carry necessarily large margins of error.

The degree of uncertainty regarding fiscal sustainability determines the importance of analysing short-run fiscal stability: the higher the uncertainty regarding the long-term sustainability of public finances, the greater the need to assess a government's short-term financing conditions to gauge its ability to stay liquid. Long-run sustainability and short-run stability are linked via behaviour of financial market participants. As long as investors are assured about the long-term sustainability of a government's finances, they will be willing to provide short-term liquidity if necessary. However, if sustainability is questioned, investors have to assess the potential risks for their credits. These risks are determined by the size of the long-term fiscal imbalance as well as by short-term variables that determine the government's liquidity, such as the maturity and currency structure of its debt, the ability to raise funds internally at short notice and the exposure of public finances to exogenous shocks.

While numerous publications in the literature address the many specific aspects of fiscal soundness in the long and in the short run, there appears to have been a gap regarding a survey of the concepts and approaches and the relationship among them. With the intention to help fill this gap, this paper presents the theoretical foundations, including in the form of mathematic models, and discusses practical applications of fiscal analysis where formal relations play a lesser role. Reflecting the distinction of fiscal soundness in long-term and short-term aspects, the paper is composed of two major parts: The first part presents the analytical background for long-term sustainability analysis and discusses the major practical applications. The second part focuses on short-term stability concepts, using the relevant analytical approaches as a background for a description of the relevant determinants of fiscal stability and presenting the major practical applications of the concept. The final section concludes.

2. Long-term sustainability concepts

Fiscal sustainability is generally defined as the government's ability to service its debt obligations over the long run. This section will focus on the approaches that are used to determine the long-term sustainability of fiscal policies. The first part will deal with theoretical concepts that cover both the infinite and the finite time horizon. After introducing the intertemporal budget gap, two theoretical indicators are developed and further refinements regarding general equilibrium effects and the impact of uncertainty are discussed. The second part deals with practical approaches to gauge fiscal sustainability and shows examples for their use.

2.1 Analytical approaches

2.1.1 The intertemporal sustainability gap

The discussion of sustainability starts from the government flow budget constraint, which relates the change in debt to current fiscal policy and leads to the government intertemporal budget constraint (IBC).[1]

The government's intertemporal budget constraint can be derived from the government flow budget constraint. In each budgetary year, the change in government nominal debt $(B_t - B_{t-1})$ is given by the sum of primary expenditure (E_t) and interest payment on outstanding government debt $(r_t B_{t-1})$ minus government revenue (T_t).[2]

$$B_t - B_{t-1} = E_t - T_t + r_t B_{t-1} \tag{1}$$

In a growing economy, where output grows at rate g_t $(Y_t = (1+g_t)Y_{t-1})$, the flow budget constraint (1) can be rewritten dividing its elements by GDP:

$$\frac{B_t}{Y_t} = \frac{E_t}{Y_t} - \frac{T_t}{Y_t} + \frac{1+r_t}{1+g_t}\frac{B_{t-1}}{Y_{t-1}} \tag{2}$$

Expression (2) shows that the evolution of the debt-to-GDP ratio depends on two sets of factors, namely the primary deficit ratio $(\frac{E_t}{Y_t} - \frac{T_t}{Y_t})$ and the inheritance of past fiscal policies $(\frac{1+r_t}{1+g_t}\frac{B_{t-1}}{Y_{t-1}})$. Clearly if the nominal interest rate exceeds the growth rate, a primary surplus is needed to maintain the debt ratio at its current level. However, as the flow budget constraint is an accounting identity, it does not

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[1] Perotti *et al.* (1998) provide a wider concept of fiscal sustainability, focusing on the controllability of the deficit and the risk of disruptive adjustments.

[2] No revenues from seignorage are assumed.

impose any restriction on current fiscal policy, unless a specific debt-to-GDP ratio is targeted for the current year. In other words, there is no restriction on current fiscal policy if any additional deficit can be financed by government borrowing. However, this additional borrowing will only be possible if lenders are confident in the future solvency of the government; *i.e.*, if they consider that government finances will remain sound in the long term. Therefore it is interesting to answer the following question: Does the need to maintain long-term sustainability impose concrete restrictions on current and future fiscal policies?

To answer this question it is useful to investigate further the implications of the flow budget constraint (2). Assuming that the economy starts in year $t = 0$, inherits a stock of debt resulting from past fiscal policies (B_{-1}/Y_{-1}), and substituting B_0 by means of the government budget identity in year 1, we obtain:

$$\frac{B_{-1}}{Y_{-1}} = \frac{1+g_0}{1+r_0}\left(\frac{T_0}{Y_0} - \frac{E_0}{Y_0}\right) + \frac{(1+g_0)(1+g_1)}{(1+r_0)(1+r_1)}\left(\frac{T_1}{Y_1} - \frac{E_1}{Y_1}\right) + \frac{(1+g_0)(1+g_1)}{(1+r_0)(1+r_1)}\frac{B_1}{Y_1} \qquad (3)$$

Substituting further forward up to year $T - 1$, it is possible to derive the government intertemporal budget constraint from year 0 to T:

$$\frac{B_{-1}}{Y_{-1}} = \frac{1+g_0}{1+r_0}\left(\frac{T_0}{Y_0} - \frac{E_0}{Y_0}\right) + \ldots + \frac{(1+g_0)..(1+g_T)}{(1+r_0)..(1+r_T)}\left(\frac{T_T}{Y_T} - \frac{E_T}{Y_T}\right) + \frac{(1+g_0)..(1+g_T)}{(1+r_0)..(1+r_T)}\frac{B_T}{Y_T} \qquad (4)$$

It is worth noticing that, absent a target for government debt in year T, equation (4) does not impose any restriction on fiscal policies from year 0 to T. Any additional expenditure can be financed by an increase in government debt. However, if there is a binding debt target in year T the government intertemporal budget constraint imposes that the present discounted value of primary surpluses must be equal to the difference between initial debt and the present discounted value of terminal debt:

$$\frac{B_{-1}}{Y_{-1}} - \rho_T \frac{B_T}{Y_T} = \sum_{i=0}^{T} \rho_i \left(\frac{T_i}{Y_i} - \frac{E_i}{Y_i}\right) \qquad (5)$$

where the discount factor $\rho_t = \frac{1+g_t}{1+r_t}\rho_{t-1}$ is introduced for notational simplicity ($\rho_{-1} \equiv 1$). Equation (5) can be used to introduce a more precise definition of fiscal sustainability. A fiscal policy is considered sustainable over the considered horizon if it ensures that the terminal debt-to-GDP ratio is not greater than the initial debt ratio:

$$(1-\rho_T)\frac{B_{-1}}{Y_{-1}} \leq \sum_{i=0}^{T} \rho_i \left(\frac{T_i}{Y_i} - \frac{E_i}{Y_i}\right) \qquad (6)$$

If the LHS of this equation is positive, primary deficits in some years have to be compensated for by primary surpluses.[3] If the LHS of this equation is negative, which is the case when the rate of interest is lower that the growth rate, there is no such restriction on fiscal policy and the government can run primary deficits in every year and still satisfy its intertemporal budget constraint.

Assuming that government action extends up to infinity the government intertemporal budget constraint becomes:

$$\frac{B_{-1}}{Y_{-1}} \leq \sum_{i=0}^{+\infty} \rho_i \left(\frac{T_i}{Y_i} - \frac{E_i}{Y_i} \right) + \lim_{T \to +\infty} \rho_T \frac{B_T}{Y_T} \tag{7}$$

If the discounted value of public debt, $\lim_{T \to +\infty} \rho_T \frac{B_T}{Y_T}$, were positive, there would be cases where the intertemporal government budget constraint would be fulfilled even if the government runs primary deficits forever by rolling its debt over and borrowing to finance its deficits; this would be the case in an economy where the growth rate exceeds the interest rate.[4] However, if the government was running such a Ponzi game, it would imply that some agent would have to be holding government bonds at some point in the future and reduce her consumption in at least one period. This outcome is strictly dominated, in welfare terms, by the option of not holding debt at all. To avoid this situation a no-Ponzi game restriction is commonly assumed, $\lim_{T \to +\infty} \rho_T \frac{B_T}{Y_T} \leq 0$, and a widely used definition of fiscal sustainability is obtained:

$$\frac{B_{-1}}{Y_{-1}} \leq \sum_{i=0}^{+\infty} \rho_i \left(\frac{T_i}{Y_i} - \frac{E_i}{Y_i} \right) \tag{8}$$

This equation says that a fiscal policy is sustainable if the present discounted value of the ratio of primary surpluses to GDP is greater than or equal to the current level of public debt.[5] In other words, this solvency condition for the government sector states that for a fiscal policy to be sustainable, the government, which has

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[3] The Maastricht Treaty debt criterion (debt to GDP below 60 per cent or, if above, decreasing at a satisfactory pace) could be seen as an attempt to operationalise equation (6) A debt to GDP target could be reached in *T* periods, guaranteeing sustainability but allowing, at the same time, some degree of intertemporal smoothing of deficits and surpluses.

[4] No fiscal adjustment is for example necessary to ensure sustainability in an overlapping generation economy when the long-run growth rate of the economy is greater than the interest rate (dynamic inefficiency or over-accumulation of capital). In such a case the government intertemporal budget constraint cannot be defined. Moreover, on efficiency grounds, governments would have to increase fiscal deficits with a view to increasing consumption.

[5] Theoretically, the relevant concept of debt is net debt, *i.e.* the difference between government liabilities and assets. However, given the scarce availability of data on government assets, gross debt measures are more widely used. In practical terms, the flows of income from government-held assets can be discounted on the RHS of this equation, leaving gross debt on the LHS.

debt outstanding, will have to run primary budget surpluses in the future. Those surpluses should be large enough to satisfy equation (8).[6]

2.1.2 Simple indicators

Equation (8) can be used to derive simple indicators such as the intertemporal sustainability gap. The need to develop indicators derives from the fact that compliance with the intertemporal budget constraint in (8) cannot be assessed in real time. For instance a fiscal policy plan whereby the government runs a primary deficit forever would breach the solvency condition. This means that sooner or later the government will have to change fiscal policy and run primary surpluses, by either increasing revenue or decreasing expenditure. Therefore, there is a need for specifying indicators of the extent to which a fiscal adjustment is necessary at a given point in time. In addition, changes in these indicators over time, e.g. between two fiscal years, allow an assessment to what extent a government's sustainability situation has improved or deteriorated, which may provide important signals for policy makers.

Let us define a first indicator – the financing gap in year 0. It is the difference between the current debt ratio and the present discounted value of future primary surpluses:[7]

$$\Gamma_0 = \frac{B_{-1}}{Y_{-1}} - \sum_{i=0}^{+\infty} \left(\frac{1+g}{1+r} \right)^i \left(\frac{T_i}{Y_i} - \frac{E_i}{Y_i} \right) \tag{9}$$

If Γ_0 is positive, the sustainability gap has a simple interpretation. It is the present discounted value of the increase in primary surpluses which is necessary to guarantee that the IBC is fulfilled and measures the minimum effort required from the government to restore long term fiscal sustainability. Looking at (9) from a different perspective, the sustainability gap represents the share of public debt-to-GDP which, if repudiated today, would make the fiscal policy plan sustainable.

For simplicity let us consider a fiscal policy plan characterised by constant tax and expenditure ratios. Both taxes and primary spending follow a linear rule, $T_i = \tau Y_i$ and $E_i = \varepsilon Y_i$. Therefore the sustainability gap (9) can be simplified as follows:

$$\Gamma_0 = \frac{B_{-1}}{Y_{-1}} - \frac{1+r}{r-g}(\tau - \varepsilon) \tag{10}$$

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[6] The so-called fiscal theory of the price level (FTPL) considers equation (8) from a different perspective: if at the current price level, the amount of outstanding debt and the present value of future surpluses do not match in real terms, then the price level can jump to restore the equilibrium. This paper does not deal with this issue.

[7] Interest and growth rates are assumed to be constant thereafter.

Two further simple indicators can be derived from this expression. The first one is the gap between the current tax rate and the sustainable tax rate; the second is the gap between the current expenditure ratio and the sustainable expenditure ratio. The sustainable tax rate (τ^*) and the sustainable expenditure ratio (ε^*) are the solutions to the equation $\Gamma_0 = 0$ and are given by:

$$\tau^* = \frac{r-g}{1+r}\frac{B_{-1}}{Y_{-1}} + \varepsilon \tag{11}$$

$$\varepsilon^* = \frac{r-g}{1+r}\frac{B_{-1}}{Y_{-1}} - \tau \tag{12}$$

The sustainable tax (expenditure) rate represent the tax (expenditure) rate which, if constant, would achieve an unchanged debt-to-GDP ratio over the horizon taken into account (infinite in our case), given nominal growth and interest rates. The tax gap $(\tau^* - \tau)$ and the expenditure gap $(\varepsilon - \varepsilon^*)$ are sustainability indicators which are easy to interpret. Provided that the current tax rate is below the sustainable tax rate and given expenditure policy, the tax gap indicates the size of the tax adjustment – a permanent increase in the tax rate, were it to take place today. Alternatively, the expenditure gap indicates the size of adjustment, were it to take place on the expenditure side.[8]

There is a clear symmetry between these two sustainability indicators. They only indicate the size of fiscal adjustment necessary to restore the solvency of the government sector in terms either of a permanent increase in the tax rate or a permanent decrease in the expenditure ratio. Although a positive tax gap points to the need for adjustment at some stage in the future, a tax gap of say 5 per cent would be a source of greater concern in a country where the current tax rate is 60 per cent than in a country where it is 30 per cent. In this respect one may prefer sustainability indicators that are able to discriminate between these two countries by capturing the extent to which governments have sufficient leeway to adjust fiscal policies. Such an indicator can be obtained by dividing the tax gap by $(1-\tau)$,[9] as this term is the maximum amount of resources that the government can still appropriate.[10]

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[8] A combination of tax and expenditure changes could be also used to close the financing gap.

[9] This indicator assumes that governments can appropriate 100 per cent of GDP. This is obviously unrealistic in market economies, where higher tax rates – above a given threshold – even lead to lower tax receipts. Among OECD countries the maximum total revenue to GDP ratio could be observed in Sweden in 1989 (65.4 per cent of GDP). Overall, considering that governments would find it difficult to appropriate more that around 60 per cent of GDP, a more discriminating indicator could therefore be obtained by dividing the tax gap by $(0.6-\tau)$.

[10] Similar arguments could be used for the expenditure gap by considering that a country with a limited public sector finds it more difficult to cut spending than a country with a large public sector. It should be noted that there may exist an incompressible level of public expenditure. Among OECD the minimum total expenditure to GDP ratio could be observed in Korea in 1987 (18 per cent of GDP).

The size of the sustainability gap measures the amount of the increase in taxes (or decrease in expenditure) required "today" in order to preserve long-term fiscal sustainability. Postponement of such an adjustment would entail a cost, which can be measured by the increase in the required adjustment and can be represented as a simple function of the indicator itself. In the simple case above, waiting one year would cost the difference between the debt ratios at two consecutive years $\left(\frac{B_0}{Y_0} - \frac{B_{-1}}{Y_{-1}}\right)$ time the discount factor $\frac{r-g}{1+r}$.

The indicators discussed so far have been derived from the intertemporal budget constraint (8) in an infinite horizon. It is however useful to describe another set of indicators which can be derived from the intertemporal budget constraint in its finite horizon form as formalised in equation (5). This is particularly useful to monitor public finance developments in the medium term, once an objective for the public debt has been established for a definite future period of time T.

Similarly to the financing gap discussed above, let us define the indicator Φ_0 as the difference between the current debt ratio and the present discounted value of the debt ratio at time T plus the flow of primary surpluses between time 0 and time T, where the interest and growth rates are assumed constant:

$$\Phi_0 = \frac{B_{-1}}{Y_{-1}} - \rho_T \frac{B_T}{Y_T} - \sum_{i=0}^{T} \rho_i \left(\frac{T_i}{Y_i} - \frac{E_i}{Y_i}\right) \quad ; \qquad \rho_t = \frac{1+g_t}{1+r_t}\rho_{t-1} \tag{13}$$

If Φ_0 is positive, the indicator measures the present discounted value of the increase in primary surpluses which is necessary to reach the targeted debt level at time T. Although the indicator is unable to fully capture the long term sustainability of public finance in a given country ($\Phi_0 = 0$ does not guarantee the fulfilment of the intertemporal budget constraint beyond T) it might represent a useful monitoring tool in showing gross error in fiscal strategies aiming at reaching a determinate debt to GDP ratio.

As for the sustainable gap indicator, assuming a constant tax (expenditure) ratio, it is possible to calculate the expenditure (tax) gap which measures the size of the tax (expenditure) adjustment needed to guarantee a reduction of the debt level towards the target within the period between year 0 and year T.

2.1.3 Refinements: feedback effects and uncertainty

The standard models of fiscal sustainability discussed above highlight the necessary adjustment of the primary balance under exogenous assumptions on trend growth and interest rates. This means they fail to capture two important aspects:

i) the relationship between public finances and macroeconomic developments and

ii) macroeconomic uncertainty and governments' capacity to fulfil their debt obligations in the face of economic shocks.

Regarding the first aspect, simple sustainability indicators hinge upon assumptions on the path of revenue and primary expenditure, economic growth and interest rates. Growth and interest rate assumptions are considered as exogenous. The feedback effects[11] that unsustainable debt developments have on interest and growth rates are neglected. Since higher debt ratios may exert an upward pressure on interest rates and crowd out economic growth, thereby further exacerbating debt dynamics, simple sustainability indicators may be misleading, in particular underestimating the fiscal risks associated with a given path of primary deficits. Accounting for feedback effects requires a general equilibrium approach, in which macroeconomic developments are endogenously determined on the basis of public finance assumptions.

General equilibrium models have been widely used in the academic literature to analyse the impact of population ageing on fiscal sustainability and macroeconomic developments. While such models are more consistent with economic theory than sustainability assessments based on simple indicators, their results are more difficult to communicate in the context of policy discussions. The cost of development and maintenance of such models are high, so that so far the trade-off between theoretical consistency and transparency or communicability still remains in favour of simple sustainability indicators.

Turning to the second aspect, uncertainty affects the upper bound of a country's sustainable debt level. Taking into account uncertainty to either macroeconomic or public finance developments is crucial for assessing governments' capacity to fulfil their debt obligations regardless of economic shocks. The realisation of a series of particularly adverse macroeconomic or fiscal shocks can make a government unable to fulfil its debt obligation. Even if the probability of such adverse developments is low, they have implications for a government's sustainable debt level.

Sustainability analysis under uncertainty assesses the likelihood that a government cannot repay its debt. Fiscal risks are estimated on the basis of a probabilistic approach. In particular, in the presence of shocks to the deficit ratio, the debt ratio in period T would depend on both the initial debt ratio and the realised sequence of primary deficits. From equation[12] (5) one can easily derive the expected value (at the initial date) of the debt ratio at date T:

$$E_{-1}\left(\tilde{b}_T\right)=\sum_{i=0}^{T}\left(\frac{1+r}{1+g}\right)^{T-i}E_{-1}\left(\tilde{d}_i\right)+\left(\frac{1+r}{1+g}\right)^{T+1}b_{-1} \qquad (14)$$

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[11] Mongelli, 1996, analyses the linkage between sustainability and fiscal discipline in a model in which the interest rate is determined endogenously as a function of public debt.

[12] For the sake of simplicity, we assume here that both the interest rate and the growth rate are constant.

where E is the expectation operator, stochastic variables are indicated with a tilde, $b_{-1} = B_{-1} / Y_{-1}$ is the initial debt ratio, $\tilde{b}_T \left(= B_T / Y_T\right)$ the debt ratio at date T and $\tilde{d}_i \left(= E_i / Y_i - T_i / Y_i\right)$, the primary deficit at date i. In a nutshell, assessing fiscal risks amounts to estimating the probability that a sequence of adverse shocks would lead to an unsustainable debt ratio:

$$\Pr ob\left(\tilde{b}_T \geq \hat{b} | b_{-1}\right) = f\left(b_{-1}, r, g, \{\tilde{d}_i\}\right) \tag{15}$$

where $\hat{b}$ is defined as the debt ratio above which the government is no longer able to fulfil its debt obligations.[13] While this probability is clearly increasing in the initial debt ratio and the interest rate and decreasing in the growth rate, its dependence on path of primary deficits is affected by the underlying stochastic process. Knowing the process driving primary deficits one can assess the sustainability risks by generating a set of scenarios on which the probabilities of a government exceeding its maximum debt ratio by a given date are calculated.

This approach needs to be underpinned by a fully fledged model of the economy in order to estimate the probability of different macroeconomic scenarios. To be meaningful, risk scenarios have to account for the economic relationship between macroeconomic variables, in particular the correlations between observed shocks. Sustainability analysis under uncertainty is therefore often carried out in the context of an estimated macroeconomic model. This probabilistic approach is particularly relevant for countries subject to significant macroeconomic or revenue uncertainty, such as emerging market economies.[14]

A deterministic approach to assessing sustainability would clearly not be able to capture fiscal risks in countries characterised by significant macroeconomic or revenue volatility (see Hausmann and Purfield, 2004, for a practical discussion). In the case of developed economies, which are in general less subject to macroeconomic volatility and where long-term sustainability is less uncertain, deterministic sustainability assessments complemented with risk scenario analysis generally provide an adequate picture of the fiscal risks ahead.

2.2 Practical applications

This section sets out the different approaches that are used in practice to assess the long-term sustainability of public finances.

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[13] On the endogenous determination of this debt limit, see Mendoza and Oviedo, 2005.

[14] See Mendoza and Oviedo, 2004, and Celasun, Debrun and Ostry, 2006, for applications to emerging market countries.

2.2.1 Debt

From the theoretical part above, the debt ratio emerges as a central variable for the assessment of sustainability. An analysis of the behaviour of the debt ratio is therefore a consequent first step in the analysis of fiscal sustainability.

The most straightforward and for practical purposes widely-used indicator for assessing fiscal sustainability is *(gross) government debt*, usually expressed as a percentage of GDP. High and rising debt-to-GDP ratios indicate potential sustainability problems. Accordingly, governments trying to signal a substantive shift in their fiscal policies, e.g. to regain or establish credibility, have frequently used the announcement and implementation of declining public debt to GDP ratios to convince markets of their ability to maintain long-term solvency. Furthermore, the stabilisation (and reduction) of the debt-to-GDP ratio is frequently part of IMF-supported stabilisation programmes. The advantages of this indicator are that it is easy to interpret and the underlying data are usually widely available and relatively reliable (at least when compared to other fiscal data).

However – and this is a major drawback of this indicator – neither theory nor practical experience give a clear indication of what debt level is too high and would thus threaten the fiscal sustainability of a country. Looking at country experiences of the recent 20 years, solvency crises occurred at very different levels of debt-to-GDP ratios. The IMF identified that more than half of the sovereign debt crises have occurred at public debt levels of below 40 percent and two thirds at public debt ratios below 60 percent. Likewise solvency crises did *not* occur at debt levels very similar or even higher than those of crises countries. Chart 1 shows this point. The chart depicts on the one hand countries that had a solvency crisis during the last 20 years with the debt and deficit ratio recorded in the year before the crisis. In addition it depicts selected high-debt European and other countries that did not have a solvency crisis.

The shortcomings of the debt ratio as an indicator of fiscal sustainability point to three areas of further development:[15]

First, as the debt ratio on its own can not explain *ex ante* the sustainability of public finances, a wide range of ratios is used that express the *debt level as a percentage of other economic variables*, for example, the debt-to-revenue ratio. However, like the debt-to-GDP ratio these other ratios suffer from the difficulty of determining an appropriate *ex ante* threshold. Because this aspect is closely related to short-term stability concepts it will be discussed in the section on short-term stability.

Second, the debt concept should take account of the assets that could quickly be liquidated to repay gross debt. The gross debt is the value of total outstanding financial liabilities. *Net debt* equals gross debt less liquid financial assets (for

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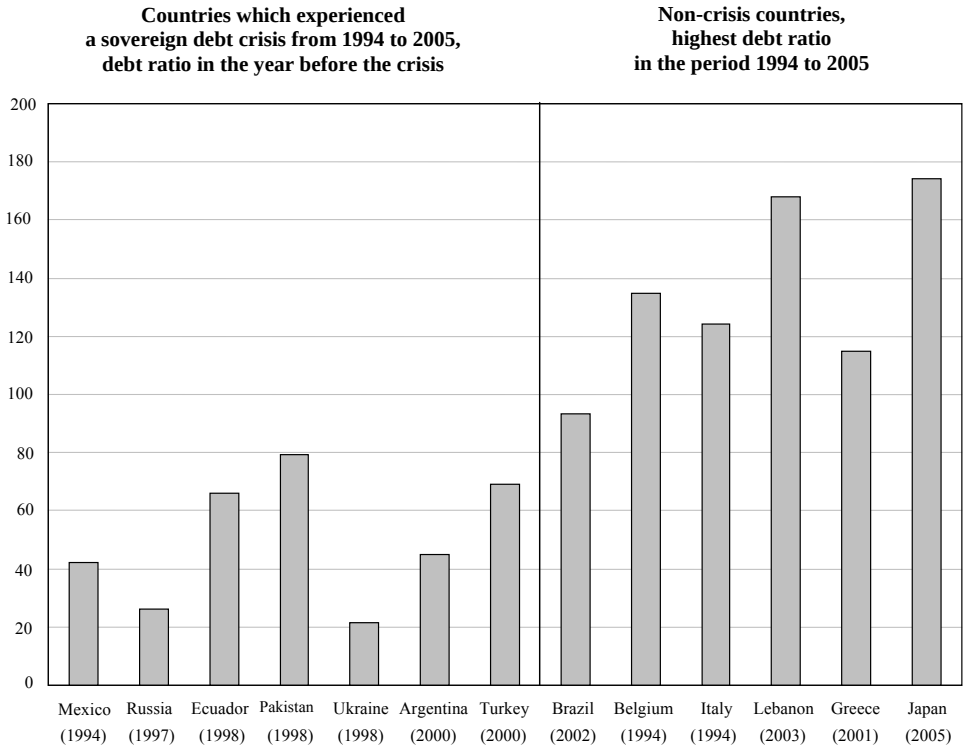
[15] See also Mink and Rodríguez-Vives (2004) for a discussion of the debt concept from a statistics perspective.

Chart 1

A Comparison of Public Debt-to-GDP Ratios in Crisis and Non-crisis Countries
(percent)



Data source: WEO.
Crises dates for countries experiencing a sovereign debt crisis were taken from Roubini and Setser (2004).

instance, shares of stock and bonds) held by the government. The net debt is more relevant because financial assets can be sold to service the debt. In the EU, financial assets are estimated to be 27 per cent of GDP. An extreme example is Japan where the difference between gross debt and net debt is about 100 per cent of GDP, indicating that the Japanese government holds considerable financial assets (gross debt: 161 per cent of GDP, net debt: 62 per cent).[16] The disadvantage of the net debt concept is the difficulty to assess the extent to which assets might be actually available for immediate liquidation to meet outstanding liabilities.

Third, the definition of the gross debt ratio as it is recorded in the national accounts needs to be expanded. *Other liabilities* not conventionally recorded as

[16] OECD's *Economic Outlook* Statistical Annex.

public debt (e.g. government guarantees, etc.) are often an important source of increases in public liabilities. The most prominent examples are implicit guarantees extended to the financial system and large non-financial enterprises. The fiscal costs of banking crises have been estimated at about 16 per cent of GDP for a large sample of past crises and can be even higher when banking crises are accompanied by currency crises (for the crises in Sweden and Finland the fiscal costs have been estimated at up to 15 per cent of GDP). It follows that the definition of debt should be as comprehensive as possible, which implies that obligations, which the government has taken outside its budgetary system (e.g. pension liabilities, government guarantees, etc.) should be taken into account, too.

To account for all fiscal obligations, it is useful to categorise fiscal liabilities by their particular degree of certainty and the existence of a legal basis for such an obligation. If government obligations arise only if a particular event occurs, then the corresponding liabilities are contingent liabilities. In contrast, if the liability arises in any event, it is a non-contingent liability. If government obligations have a legal basis (are backed by law or contracts) then the corresponding liabilities are said to be explicit. If they are instead generated by legitimate expectations in the public related to a past pattern of government behaviour or to pressure by interest groups the corresponding liabilities are said to be implicit. Table 1 lays out the categories of public liabilities.[17]

Conventional fiscal analysis tends to concentrate on governments' *non-contingent explicit liabilities*. In national accounts, liabilities arise for the government only as a result of obligations backed by law and if the obligation is independent of a particular event. These include repayments of sovereign debt, already committed budget expenditures and future expenditures for legally mandated obligations (such as civil service pensions).

Non-contingent implicit liabilities are often a presumed, longer-term consequence of fiscal policies and are generally not captured in government balance sheets. In countries with pay-as-you-go pension schemes, for example, future pensions constitute non-contingent implicit liabilities. Their magnitude is determined by the level of the pension benefits and eligibility. Often health and education expenditures are included in estimations of non-contingent implicit liabilities. In contrast to future pensions, there exists no intergenerational contract for health and education expenditures beyond a minimum provision. And even in the case of pension obligations – which are usually considered as a clear-cut case of non-contingent implicit liabilities – it could be argued that the legal basis might in principle be changed at any time.

Contingent explicit liabilities are legal obligations for governments to make payments only if particular events occur. Common examples are government guarantees and government insurances. Guarantees are normally issued on an

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[17] Brixi Polackova, H. and A. Mody (2002), "Dealing with Government Fiscal Risk: An Overview", in H. Brixi Polackova and A. Schick (eds.), *Government at Risk*, The World Bank.

Table 1

Categories of Government Liabilities

	Non-contingent liabilities (the existence of government obligations does not depend upon particular events)	*Contingent liabilities* (the existence of obligations depends upon the realization of particular events)
Explicit (government obligations have legal basis)	• Government debt • Government expenditures commitments (legally enforceable) • Provisions (e.g., clearly defined accrued pension rights not backed by a fund)	• Government individual guarantees on the debt issued by public and private entities • Government umbrella guarantees (e.g., on household mortgages,…) • Government insurance schemes (on bank deposits, on returns from private pension funds,…)
Implicit (government obligations do not have a legal basis and arise as a consequence of expectations created by past practice or pressures by interest groups)	• Future welfare payments (pension payments related with pension rights which have not matured yet, future health care payments,…) • Future government expenditures related to recurrent operations (e.g., capital stock refurbishment,…)	• Bail out of defaulting public sector or private entities (pubic corporations, banks or other private financial institutions, pension and social security funds,…) • Disaster relief • Environmental damage • Military financing

Source: Brixi, Polackova and Mody (2002).

individual basis to the beneficiaries via contracts. In contrast to government guarantees, the government's risk attached to insurance schemes is not necessarily related to the liabilities of particular entities and may concern a wide set of events. Typically, they cover risks deemed uninsurable via private contracts, e.g. those of infrequent but potentially very large losses. An example could be government insurance of private pension schemes where the purpose is to reduce the risk of private pension subscribers in the event that the private pension scheme fails. *Contingent implicit liabilities* are not officially recognised until after a failure occurs. The triggering event, the value at risk, and the amount of the government outlay that could eventually be required are all uncertain. In most countries, the support of the financial system in case of crisis represents the most serious contingent implicit liability. Experience has shown that, when the stability of a country's financial system is at risk, markets usually expect the government to provide the necessary financial support to stabilise the system.

2.2.2 Debt projections

Given the long-term nature of the concept of fiscal sustainability, not only the current level of the debt ratio (even if expanded to cover additional potential liabilities) is relevant but also its future development.

Projections of the development of the debt ratio represent therefore a central element for the assessment of fiscal sustainability. In their simplest form, such projections use equation (2) to derive the behaviour of the debt ratio for a specific set of assumptions regarding the other variables, *i.e.* output, interest rate as well as government revenues and expenditures. This simple approach can be expanded to capture additional risks and macroeconomic interlinkages. For example, scenario analysis allows to assess the impact of alternative growth and interest rate assumptions on the results. For small open economies assumptions regarding exchange rates may also play a major role as they determine the foreign currency denominated debt burden as well as affect importantly the behaviour of output. Contingent liabilities, e.g. the costs of banking crises, can be added to assess the risk of an explosive debt path as a result of a one-off shock to the debt ratio. As a practical example, IMF country reports routinely incorporate debt sustainability analysis for the medium term based on projections regarding fiscal and macroeconomic variables.

For the industrialised countries, demographic ageing has been identified as a major source of future public expenditure obligations with important effects on fiscal sustainability (see Maddaloni *et al.* for a comprehensive presentation of the economic consequences of demographic ageing). Consequently, the fiscal burden arising from population ageing has received particular attention for the assessment of sustainability. In the European context, the Economic Policy Committee (EPC) and the European Commission developed projections of ageing-related expenditure until 2050 (see Box 1). Such projections can then be used to project the development of the debt ratio.

2.2.3 Synthetic indicators: sustainability gaps

From debt projections synthetic indicators can be computed to gauge the size of a necessary fiscal adjustment for the achievement of a specific debt target in the future. For example, the European Commission presents two indicators reflecting finite and infinite horizon considerations, respectively. The S1 indicator is the difference between the constant primary balance to GDP ratio required to reach a gross debt ratio of 60 percent of GDP in 2050 and the current primary balance ratio. It is therefore similar to the sustainability gap with a finite horizon and a fixed debt ratio discussed in equation (13). *The S2 indicator shows the change in the primary balance to GDP ratio that would be needed to equate the present discounted value of future primary balances over the infinite horizon to the current level of debt.* The S2 indicator is therefore derived in the same spirit of equation (9). These indicators provide a gauge of the scale of budgetary adjustment required for a Member State to reach a sustainable public finance position. Box 2 presents an example for the calculation of the S1 and S2 indicators.

Box 1

Projections on the impact of ageing on public expenditure

The Economic Policy Committee and the European Commission published its report "Age-related public expenditure projections for the EU25 Member States up to 2050" on 14 February 2006. The report presents projections of the impact of demographic ageing on public expenditure until 2050 for all EU countries. The report is an update of earlier studies by the Working Group on Ageing, including a similar report of 2001, which was endorsed by the ECOFIN Council in November 2001.

The five areas of public expenditure considered in this report are: pensions, health care, long-term care, education and unemployment benefits. The projections are based on commonly agreed assumptions regarding the future behaviour of demographic and key macroeconomic variables. The demographic projections were provided by Eurostat in cooperation with national statistical institutes. With regard to macroeconomic variables, the overall employment rate (age 15-64) in the countries now forming the EU25 is assumed to rise from 63.1 in 2003 to 70.9 per cent in 2050, reflecting higher participation rates and declining unemployment. In particular, the aggregate unemployment rate would fall from 9.3 to 6.1 per cent. Labour productivity growth in the EU15 would rise from an average of 1.3 per cent in the period 2004-10 to 1.8 per cent from 2011 to 2030 and remain broadly stable thereafter. Labour productivity growth rates in the EU10 countries would be on average about 1.2 percentage points higher than in the EU15 until 2030 and only slightly higher thereafter. Potential GDP growth is derived by combining the employment and productivity assumptions. For the EU25, the annual average potential GDP growth rate is projected to decline from 2.4 from 2004 to 2010 to 1.2 per cent from 2031 to 2050. The projected fall in potential growth rates is much higher in the EU10. For the EU10, an average potential GDP growth rate of 4.5 per cent between 2004 and 2010 is projected to fall to 0.9 per cent between 2031 and 2050. In addition, a real interest rate of 3 per cent is assumed throughout the projection period, while inflation is set at 2 per cent. Sensitivity tests are carried out to assess the elasticity of the results with regard to changes in the underlying assumptions.

Different methodologies are applied to estimate the ageing-induced expenditure change in the individual areas. Pension projections were carried out by national authorities, using their own respective methods. By contrast in the areas of health and long-term care as well as education and unemployment benefits, the European Commission estimated the effects. For this, the Commission combined country-specific information with a commonly agreed projection methodology.

The results for the baseline assumptions point to substantial ageing-induced expenditure pressures for many EU countries (see Table 2). By 2050, the increase in spending amounts to 3 per cent of GDP p.a. or more in thirteen countries and is close to or exceeds 7 per cent in Spain, Luxembourg, Portugal, Cyprus, Hungary and Slovenia (even without long-term care expenditures for some countries). By contrast, for some

countries, the projected burden is relatively small, reflecting mainly low (or even negative) additional expenditures for pensions. At the aggregate level, in spite of the reforms implemented in several countries, the results are similar to those of the earlier study. Changes in the projected burden at the country level reflect the implementation of reforms, but also different assumptions regarding demographic and macroeconomic variables as well as coverage of the simulations.

From a policy perspective, the projections point to a clear need for some countries to address the issue of ageing-induced expenditure pressures as a matter of urgency. The need for reforms is also reflected at the European level. In the current BEPGs, it was agreed that "Member States should, in view of the projected costs of ageing populations, undertake a satisfactory pace of government debt reduction to strengthen public finances, reform pension and health care systems to ensure that they are financially viable while being socially adequate and accessible, and take measures to raise employment rates and labour supply". The report shows that countries that have reduced their pension obligations by reforming their pay-as-you-go pension systems and by introducing privately funded arrangements have alleviated significantly the ageing-induced pressure on public finances. In the area of health care, the extent of public financing of health care services may need to be reviewed. Higher employment ratios, including of older people, could also contribute importantly to improve fiscal sustainability.

Uncertainty with regard to the projection results calls for increased prudence to ensure fiscal sustainability. For example, the assumptions on employment and productivity growth may be optimistic and not materialise fully. In the area of health care costs, the impact of other factors in addition to ageing, such as the introduction of new expensive technologies, may have been underestimated. Education expenditure projections are based on the assumption that employment is rapidly adjusted to the declining number of students. In addition, the pension projections are based on national models whose structure has not been disclosed in detail, so that the derivation of the results is not fully transparent and their assessment tentative. The national institutions assigned to make the projections are often those responsible for designing social policy. On the policy side, while some public pension systems may appear financially sustainable, this may reflect very low benefits for future pensioners, raising questions as to future political pressures to raise benefit levels. Similarly, further fiscal risks could arise if private pension systems fail to provide the envisaged pension benefits, forcing governments to take up additional burdens.

Overall, the projections of the Working Group on Ageing represent a useful contribution to the discussion of long-term fiscal sustainability. It is expected, that they will form an important basis for a wider assessment of fiscal sustainability in EU countries. The fiscal challenges related to the ageing process and the role that long-term projections are assuming in the SGP call for further technical efforts at the EU and national level to improve the quality and comparability of the projections. Assumptions, models and results should be thoroughly described in order to ensure transparency.

Table 2

Projected Changes in Age-related Public Expenditure between 2004 and 2030-50

(percent of GDP)

Country	Pensions		Health Care		Long-term Care		Unemployment Benefits		Education		Total of All Available Items	
	Change from 2004 to		Change from 2004 to:		Change from 2004 to:		Change from 2004 to:		Change from 2004 to:		Change from 2004 to:	
	2030	2050	2030	2050	2030	2050	2030	2050	2030	2050	2030	2050
BE	4.3	5.1	0.9	1.4	0.4	1.0	–0.5	–0.5	–0.6	–0.7	4.5	6.3
DK	3.3	3.3	0.8	1.0	0.6	1.1	–0.3	–0.3	–0.4	–0.3	4.0	4.8
DE	0.9	1.7	0.9	1.2	0.4	1.0	–0.4	–0.4	–0.8	–0.9	1.0	2.7
EL			0.8	1.7			–0.1	–0.1	–0.5	–0.4		
ES	3.3	7.1	1.2	2.2	0.0	0.2	–0.4	–0.4	–0.7	–0.6	3.3	8.5
FR (1)	1.5	2.0	1.2	1.8			–0.3	–0.3	–0.5	–0.5	1.9	2.9
IE	3.1	6.4	1.2	2.0	0.1	0.6	–0.2	–0.2	–0.9	–1.0	3.3	7.8
IT	0.8	0.4	0.9	1.3	0.2	0.7	–0.1	–0.1	–0.8	–0.6	1.0	1.7
LU	5.0	7.4	0.8	1.2	0.2	0.6	0.0	–0.1	–0.5	–0.9	5.4	8.2
NL	2.9	3.5	1.0	1.3	0.3	0.6	–0.2	–0.2	–0.2	–0.2	3.8	5.0
AT	0.6	–1.2	1.0	1.6	0.3	0.9	–0.1	–0.1	–0.9	–1.0	0.9	0.2
PT (1)	4.9	9.7	–0.1	0.5			–0.1	–0.1	–0.6	–0.4	4.1	9.7
FI	3.3	3.1	1.1	1.4	1.2	1.8	–0.4	–0.4	–0.6	–0.7	4.7	5.2
SE	0.4	0.6	0.7	1.0	1.1	1.7	–0.2	–0.2	–0.7	–0.9	1.3	2.2
UK	1.3	2.0	1.1	1.9	0.3	0.8	0.0	0.0	–0.5	–0.6	2.2	4.0
CY (1)	5.3	12.9	0.7	1.1			0.0	0.0	–1.9	–2.2	4.1	11.8
CZ	1.1	5.6	1.4	2.0	0.2	0.4	0.0	0.0	–0.9	–0.7	1.8	7.2
EE (1)	–1.9	–2.5	0.8	1.1			0.0	0.0	–1.1	–1.3	–2.3	–2.7
HU (1)	3.1	6.7	0.8	1.0			0.0	0.0	–1.0	–0.7	2.8	7.0
LT	1.2	1.8	0.7	0.9	0.2	0.4	–0.1	–0.1	–1.6	–1.6	0.3	1.4
LV	–1.2	–1.2	0.8	1.1	0.1	0.3	–0.1	–0.1	–1.2	–1.4	–1.5	–1.3
MT	1.7	–0.4	1.3	1.8	0.2	0.2	–0.2	–0.2	–1.2	–1.2	1.8	0.3
PL	–4.7	–5.9	1.0	1.4	0.0	0.1	–0.4	–0.4	–2.0	–1.9	–6.1	–6.7
SK	0.5	1.8	1.3	1.9	0.2	0.6	–0.2	–0.2	–1.5	–1.3	0.3	2.9
SI	3.4	7.3	1.2	1.6	0.5	1.2	–0.1	–0.1	–0.7	–0.4	4.4	9.7
EU 25	1.3	2.2	1.0	1.6	0.2	0.6	–0.3	–0.3	–0.7	–0.6	1.6	3.4
EU 15 (old EU)	1.5	2.3	1.0	1.6	0.3	0.7	–0.2	–0.2	–0.6	–0.6	1.9	3.7
Euro area	1.6	2.6	1.0	1.5	0.2	0.5	–0.3	–0.3	–0.7	–0.6	1.9	3.7
EU 10 (new MS)	–1.0	0.3	0.9	1.3	0.1	0.2	–0.2	–0.2	–1.5	–1.3	–1.8	0.2
EU9 (EU10 excl PL)	1.6	4.8	0.9	1.3	0.2	0.3	–0.1	–0.1	–1.1	–0.9	1.5	5.4

(1) Total expenditure for: EL, FR, PT, CY, EE, HU does not include long-term care.

Notes: these figures refer to the baseline projections for social security spending on pensions, education and unemployment transfers. For health care and long-term care, the projections refer to "AWG reference scenarios".

Source: EPC/AWG, EU Commission (2006), Age-related public expenditure projections for the EU25 Member States up to 2050.

Box 2

Stylised example for the S1 and S2 indicator

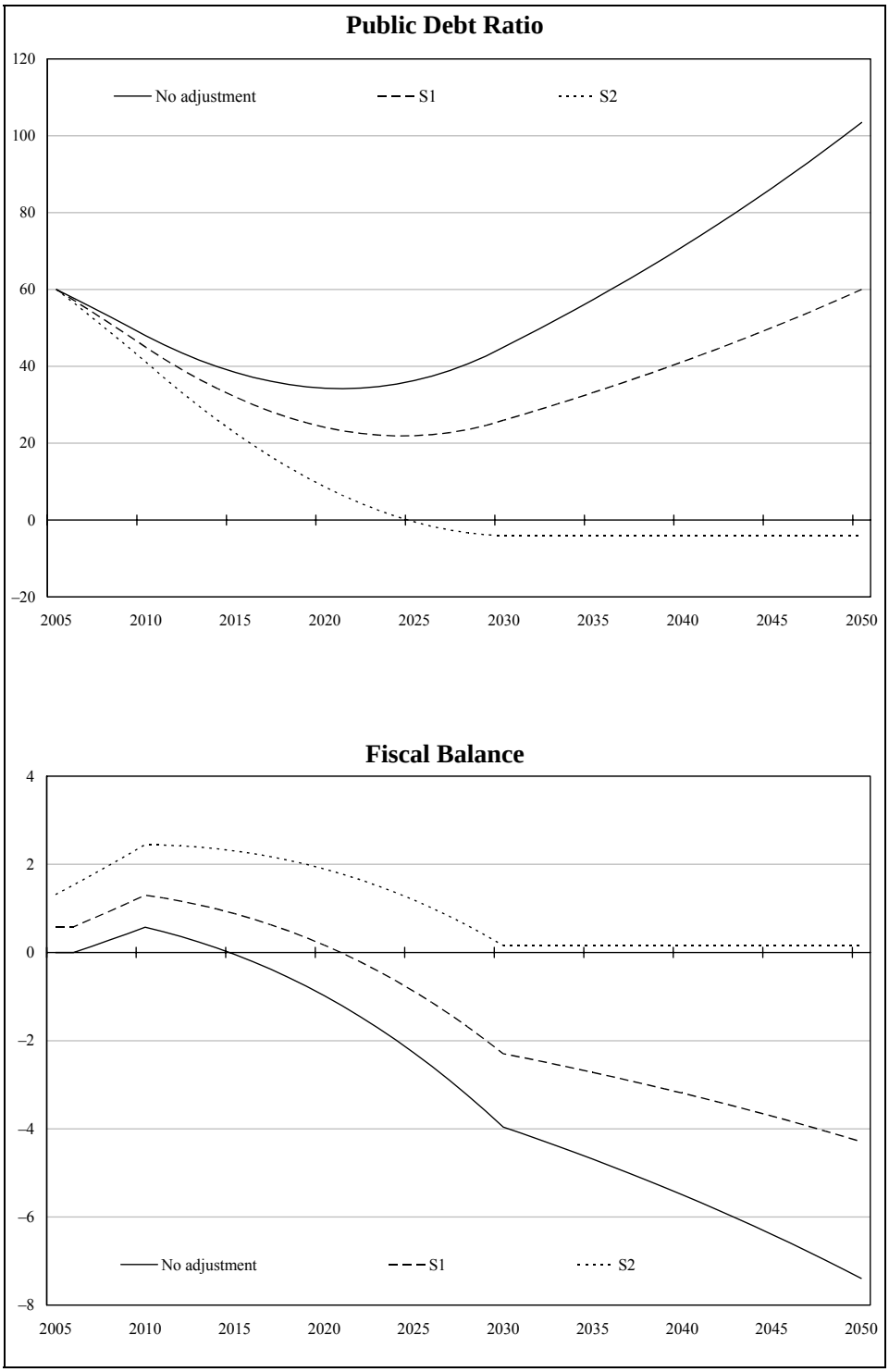
The mechanics of the application S1 and S2 can be shown using a hypothetical model country with a debt ratio of 60 per cent of GDP, nominal interest rate of 6 per cent, a nominal growth rate of 4 per cent and a (fixed) revenue ratio of 42.6 per cent of GDP. With an initially balanced budget, total primary expenditure is 39 per cent of GDP and interest expenditure amounts to 3.6 per cent of GDP. Assuming further a linear increase in ageing-related expenditures by a total of 5 ppt of GDP between 2010 and 2030, the primary expenditure ratio rises to 44 per cent of GDP by 2030.

Without any adjustment, the model country initially moves from a balanced budget to fiscal surpluses which peak in 2010, reflecting lower interest cost with a declining debt ratio (see fat line in Chart xx). However, with the onset of the ageing-induced cost pressures, total expenditures rise and the country starts to run increasing deficits in 2015. Until 2030 these deficits are driven by the combined effect of higher interest expenditure and the rising ageing costs. The termination of the latter effect in 2030 reduces the slope of the fiscal balance curve. The debt ratio declines until 2021 and then increases to more than 100 per cent of GDP by the end of the projection period, with a steep upward trend.

The S1 indicator is calibrated to achieve a debt ratio of 60 per cent in 2050. For the given parameters, this requires an immediate and permanent increase in the primary balance by 0.6 per cent of GDP. As can be seen from the light lines in the Chart this adjustment shifts deficit and debt curves upwards. With this fiscal adjustment high and accelerating deficit and debt ratios can be delayed, but they will not be averted and the debt ratio is on an unsustainable path at the end of the forecast horizon.

Fiscal adjustment in line with the S2 indicator ensures fiscal sustainability over the infinite horizon. As is shown by the dotted line, this requires an immediate and permanent increase in the primary balance by 1.3 per cent of GDP. Such an adjustment will set the debt ratio on a permanently declining path as it is sufficient to cover the total ageing-related cost increase as well as the ongoing costs of the initial debt burden. After a peak of 2.4 per cent of GDP in 2010 the overall fiscal balance declines to close to zero in 2030. The debt ratio declines rapidly and converges to a negative value (*i.e.* an asset position) of 4 per cent of GDP.

It should be noted that the model country starts from the relatively favourable position of a balanced budget and a solid primary surplus before the onset of the ageing-induced fiscal burden. A lower primary surplus or even a primary deficit would translate fully into a larger adjustment need at the start of the projection period.


Public Debt Ratio
120
100
80
60
40
20
0
–20
No adjustment
S1
S2
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
Fiscal Balance
4
2
0
–2
–4
–6
–8
No adjustment
S1
S2
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050

Based on this approach the Commission and the Ecofin Council regularly assess long-term sustainability in the context of the Stability and Growth Pact. These assessments are an integral part of budgetary surveillance in the EU. An overview of these assessments is usually made available in the Commission's *Public Finances in EMU* reports.[18]

The main quantitative results of the 2006 report are as follows (see European Commission, 2006): The Commission projects that population ageing will lead to an increase in public spending of up to 12 percentage points of GDP by 2050, if no corrective action is taken. Due to the increase in age-related expenditures, around two thirds of the EU Member States will experience debt levels of above 60 per cent in 2050 even if current fiscal plans as provided in stability and convergence programmes are fully implemented. The risk of debt-levels above 60 per cent increases considerably if the Member States do not achieve their own targets. The sustainability gap indicates that an additional permanent budgetary adjustment – beyond attaining the current fiscal targets – of 2 per cent of GDP or more is needed in more than half of the Member States to ensure long-term sustainability of public finances.

The limitations of the use of synthetic indicators are clear and the results need to be interpreted with caution. Based on a mechanical, partial equilibrium analysis, projections are sensitive to the underlying assumptions and in some cases show highly accentuated profiles. In particular, alternative assumption regarding the primary balance at the start of the projection period can result in sizeable differences regarding the projected behaviour of the debt ratio. In addition, different assumptions regarding the real interest rate and the growth rate (possibly reflecting measurement problems for past values) can lead to substantial differences in the assessment. As a consequence, the projected evolution of debt levels is not a forecast of possible or even likely outcomes. Instead, the indicators are a tool to facilitate policy debate and at best provide an indication of the timing and scale of emerging budgetary challenges that could occur on the basis of "no policy change". For this reason the Commission assessment supplements the quantitative indicators by qualitative assessments of the overall economic and fiscal situation.

2.2.4 Other indicators

Beyond the information from debt ratios and sustainability gaps the method of generational accounting adds a further dimension to long-term fiscal analysis. This dimension is the net contribution of an average member of an individual cohort to public finances. In particular, generational accounts are defined as the present value of taxes paid minus transfer payments received by individuals of different

[18] The long-run budgetary projections and the methodology underpinning the quantitative indicators used to assess the sustainability of public finances were prepared by the Ageing Working Group attached to the Economic Policy Committee. The actual assessment of the sustainability of public finances based on stability and convergence programmes is made by the Commission. Another example for the application of synthetic indicators is the approach by Treasury of the United Kingdom (HM Treasury, 2005).

cohorts over their remaining lifetimes. As a result, the accounts show each generation's net contributions to or net benefits from the public.

The underlying projection methodology of generational accounts is similar to that outlined above. In particular, fiscal projections are generated using a set of macroeconomic and fiscal policy assumptions. To project the generational accounts, it is assumed that cohort specific transaction patterns remain stable. For example, a typical agent of 40 years of age today is expected in ten years to pay the same net transfer to the public household as today's typical agent of 50 years of age. An adjustment is made for productivity increases.

The use of generational accounts is twofold. They allow to assess fiscal sustainability similar to the approaches discussed above and they permit an analysis of the distribution of fiscal burdens across generations. Regarding fiscal sustainability, the basic approach of generational accounting to assess fiscal sustainability is akin to the above approaches. From the generational accounts of all living generations the difference between total public revenues and expenditures is computed in net present value terms. The sustainability gap is then assumed to be borne entirely by future generations. For simplicity, it is generally assumed that all future generations bear the same share of the burden.

Information regarding the distribution of the fiscal burden represents the major benefit from generational accounts. This is of particular interest when assessing the distributional impact of fiscal reforms, such as changes in pension arrangements. While their impact on fiscal sustainability can be computed without regard to specific generational effects, the answer to the question who is eventually paying for the reform needs to be based on a generational comparison. Thus, generational accounts are useful to determine also the political acceptability of certain reform proposals by identifying the groups which profit and loose, respectively.

The additional information from generational accounts comes at a cost. On the technical side, the method is quite data intensive as it requires information regarding the age-wise distribution of all current payment streams between the public accounts and households. In other words, all taxes and social security contributions as well as all transfer payments need to be allocated across the age structure of the population. From the theoretical perspective, the usefulness of the information from generational accounts regarding distributional effects hinges on the validity of the life-cycle hypothesis.[19] Only if consumers maximise utility exactly over their entire lifetime can changes in payment streams to and from the public accounts be used to determine changes in welfare. By contrast, if the period for utility maximisation exceeds the lifetime (e.g., with altruism for future generations) or if it falls short (with myopic behaviour or borrowing constraints), generational accounts no longer reflect the welfare implications of fiscal policy measures. It should be noted that empirical support for the life-cycle hypothesis is

[19] See Buiter (1995) for a discussion.

mixed. In addition, generational accounts have generally nothing to say about the distributional effects of government consumption, which amounts to some 20 per cent of GDP in the euro area. In view of the difficulties in allocating the implicit transfers, public consumption is generally assumed to be distributionally neutral.

A final empirical avenue to assess fiscal sustainability from a backward-looking perspective is based on econometric tests of the past time series behaviour of fiscal variables.[20] In particular, under certain assumptions regarding the behaviour of GDP growth and interest rates, stationarity and co-integration tests can be used to assess fiscal policy sustainability. One approach focuses on the stationarity properties of public debt. Another approach looks at the behaviour of the determinants of the deficit ratio, *i.e.*, the growth rates of expenditures and revenues. If the two variables are cointegrated, the fiscal deficit is stationary and fiscal policies are deemed sustainable. Finally, cointegration between the primary balance and public debt has been proposed as a test of sustainability, as, broadly speaking, with constant interest rates sustainability is ensured if primary surpluses rise with rising public debt. The advantage of the *ex post* approach is its relatively intuitive explanation and connection to the theoretical foundations as explained above. However from a practical point of view, its major downside is its backward orientation. According to this approach, the fiscal policies of many industrialised countries in the past 30 years qualify as "unsustainable" even though no solvency crises occurred.

3. Short-term stability concepts

In addition to long-term fiscal sustainability discussed in the previous section, another dimension of a government's financial position is crucial for fiscal soundness. This is financial stability, *i.e.* the ability to fulfil short-term payment obligations without causing disruptions in the economy. As discussed above, the importance of analysing short-term stability increases the more uncertain are the prospects of the government's ability to honour its obligations in the long term. Essential for maintaining financial stability is the availability of liquid assets. Financial stability derives from two sources:

i) the government's ability to generate the necessary resources internally via revenues increases or expenditure reductions and
ii) the access to borrowing liquidity on the financial market.

By contrast, instability could arise in response to short-term liquidity shortages that force a government to adopt emergency tax or expenditure measures to preserve its ability to pay its obligations. Alternatively, disruptions can emerge when an illiquid government is forced to borrow at very high interest rates due to a loss of creditworthiness.

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[20] See Chalk and Hemming (2000) for a discussion of the concepts and Afonso (2004) for a recent application to European countries.

This section will focus on the factors determining access to external financing in the short run. This is because given the size of liquidity needs most governments rely to a large extent on continuous market financing. In view of the voluntary nature of such transactions, the financial stability assessment needs to take the determinants of investor behaviour into account.

3.1 Analytical approaches

Two approaches in the theoretical literature provide insight why financial market participants may cease to provide external financing to governments. Basically, unwillingness by investors to provide financing for governments reflects the expectation that the government may not redeem the credit, given that governments cannot credibly commit to honour their obligations *ex ante*. The first (fundamentals-based) approach focuses on a government's failure to ensure fiscal sustainability as discussed above. Once investors become convinced that a government will not be able to service its debt obligations they may shut off access to further financing or raise risk premia. The second (expectation-based) approach reflects the fact that a large number of lenders cannot coordinate their activity among themselves. Thus, once an individual investor becomes convinced that the other investors will terminate their financing to the government, he will end his own extension of credit. This behaviour can result in a self-fulfilling creditor run where a government finds itself shut off from external financing even if all creditors agree collectively that its fiscal position is sustainable in the long run.

3.1.1 Fundamentals-based approach

In the first approach, the unwillingness of financial market participants results from their perception that government finances are not sustainable. Such a change in perception could be brought about by a shock to one of the variables entering the sustainability assessment. For example, an increase in the interest rate level would increase the government's debt servicing burden. Alternatively, a negative shock to public finances due to the need to assume additional debt to resolve a banking crisis could lead to the perception that the new debt level is no longer sustainable. Thus in this approach the investor behaviour simply transforms the unsustainability of the fiscal position, which would necessitate some adjustment in the future, into a fiscal crisis in the present.

The perception of a decline in expected long-term fiscal sustainability can trigger an actual fiscal crisis in the short run in the spirit of Krugman (1979). Reduced willingness by investors to supply funds would ceteris paribus result in higher risk premia and, consequently, in a larger fiscal debt servicing burden. In addition, investors may increasingly be willing to lend only at short maturities. While borrowing at shorter maturities tends to be cheaper for the government, it raises the frequency at which the government has to draw on the capital market for its financing. As a consequence, a decision by market participants not to roll over

debt or to do so at much higher risk premia would affect a larger share of total public debt and could eventually force the government into default.

3.1.2 Creditor coordination based approach

The second approach takes into account that governments generally borrow from a relatively large number of financial market participants who cannot coordinate their lending decisions among themselves. Uncertainty over the lending behaviour of other investors results in the existence of multiple equilibria where the outcome is driven by the market participants' expectations. As long as the individual lender expects other participants to continue their financing of the government at low risk premia, he will also provide financing anticipating that the government will be able to redeem the old credit by taking up new credit. However, if expectations switch, risk premia will rise and government credit will dry up. In the simplest case, once the individual investor expects that the government may fail to raise sufficient credit to cover its existing obligations, he will cease entirely to provide financing. Alternatively, the individual investor may raise the risk premium for new lending if he assumes others are behaving similarly.

In the aggregate, if a sufficient number of investors share this expectation the outcome will be in line with the expectations: In the simplest case, government credit is terminated entirely. Calvo (1988) pointed to the existence of multiple perfect foresight equilibria early in the context of domestic debt issuance where the government could default on its nominal debt via inflation. With adjustable risk premia, the government's cost of servicing its debt rises and consequently the risk of default (Cohen and Portes, 2004). Thus, investor expectations turn into a self-fulfilling prophecy.

In contrast to the first approach, the mechanism in the second approach may be triggered even if government finances are widely considered to be sustainable. As in this approach investors are concerned with government's ability to honour its obligations in the short run, the sustainability assessment does not necessarily determine investor considerations. This approach to modelling sovereign debt crises is similar to bank run models, where the fear of depositors that a bank may not have sufficient liquidity to cover their withdrawals can trigger a run on the bank's short-run obligations (see also Alesina, Prati and Tabellini, 1989).

A number of policy consequences follow from these considerations. On the side of the borrowing government self-insurance against the unfavourable equilibria is possible by issuing long-term debt that is less prone to creditor runs as shown by Cole and Kehoe (1998) in a dynamic stochastic general equilibrium model. In addition, Detragiache (1996) and Drudi and Prati (2000) show how governments can build up a reputation for fulfilling their debt obligations and thus contribute to the formation of favourable investor expectations that should reduce the probability of abrupt changes in investor attitude. On the side of lenders, institutional mechanisms are also possible to alleviate the risk of crises due to insufficient coordination among creditors. For example, the existence of a lender of last resort, who would guarantee

the redemption of government debt, would reduce the risk of a creditor run. Similarly, debt contracts could be designed to incorporate so-called collective action clauses to reduce investors' risk of being excluded from repayments in a sovereign crisis (see Rogoff and Zettelmeyer, 2002 for a survey of proposals).

3.2 Determinants of fiscal stability

From the theoretical considerations above it is clear that the lending decision of potential creditors plays an important role for the assessment of fiscal stability. While the precise design of the debt contract may vary, standard credit contracts are asymmetric, *i.e.* creditors bear the risk of default but do not participate if economic developments turn out more favourable than expected. Consequently, potential creditors are interested only in downside risks to governments' willingness and ability to service their debt obligations. The downside risks for creditors are determined by the probability and size of potential shocks and their impact on the government's financial situation. A further determinant is the government's ability to offset such effects, e.g. by drawing on an existing safety net or by implementing offsetting measures.

3.2.1 Shocks

The list of shocks to be considered by potential creditors comprises a wide range of variables. From the fundamentals-based approach to fiscal stability, all factors that affect the government's *long-term fiscal sustainability* can also have an impact on stability. For example, changes in growth expectations, in particular with regard to the long-term trend growth of potential output, and new information on a government's overall obligations and capacity to generate revenues have a bearing on the stability assessment.

In addition, numerous short-term variables can affect fiscal stability. Starting with the *international environment*, changes in international interest and exchange rates directly affect public debt servicing obligations with the size of the impact depending on the currency and maturity structure of outstanding debt. Similarly, changes in international risk attitudes may induce fluctuations in liquidity and financing conditions in government bond markets. Moreover, international energy price increases can affect the situation of public finances, if governments try to keep domestic energy prices at lower levels via subsidies. Adverse effects on economic activity resulting from price changes would contribute further to the fiscal pressure.

On the *domestic side*, government finances can come under pressure due to the government's explicit or implicit obligation to support large enterprises in difficulties or the domestic banking system in times of crises. For the stability analysis such sectoral links require to analyse not only the situation of public finances in a narrow sense, but also the risk of imbalances in other sectors that might create financial pressures for the government.

Shocks can also negatively affect *governments' reputation, i.e.* investors' belief about the government's willingness and ability to comply with its debt obligations. Such changes in perception could be linked to changes in government, as evidenced by the fact that several sovereign crises started close to general elections. But also government behaviour can induce changes in its reputation. For example, a government's persistent failure to achieve its own fiscal targets not only undermines fiscal sustainability but can also lead to a switch in investor confidence regarding the government's ability to implement politically difficult consolidation measures. In this regard, the implementation and application of a credible framework of fiscal rules can lend support to a government's credibility. One example is the framework of rules provided by the Maastricht Treaty and the Stability and Growth Pact in EMU. However, analogous to the consequences of missing fiscal targets, non-compliance with previously agreed rules can undermine public confidence in the soundness of economic policies. On the structural side, a government avoiding or postponing crucial structural reforms will reduce investors' trust in its ability to maintain the necessary conditions for stable and balanced growth. Finally, the reputation of the government can be undermined by the disclosure of previously hidden fiscal obligations, pointing to deficiencies in the transparency of fiscal data.[21] Once investors doubt the official fiscal data, uncertainty over the true fiscal position rises, possibly also raising the perception that the respective government is trying to deceive potential creditors.

In this context, the independence of monetary policies can provide an additional important signal regarding the government's intentions. In economies where the independence of monetary policies is curtailed, governments may seek to take recourse to printing money to finance fiscal deficits and so escape necessary fiscal and structural reforms. Over time, this erodes the credibility of economic policies in general and of a stable currency in particular. By contrast, establishing a credible independent central bank, a government signals its intention to refrain from monetary financing and put its finances on a sound and sustainable footing.

Finally, in view of the findings of the expectations-based approach creditors will need to take the expected *behaviour of other potential lenders* into account. Thus, the financial stability assessment depends also on perceptions regarding the willingness of financial markets to provide financing. This will reflect, in particular, global financial conditions, such as investors' risk appetite, as well as the borrower's reputation for servicing its obligations.

3.2.2 Safety nets and flexibility

The *government's ability to withstand shocks* can derive from an existing safety net or from its ability to adapt to changes in the environment and maintain a safe financial position. Prime examples for an existing safety net are government holdings of liquid assets, including foreign reserves, and access to existing credit

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[21] See Balassone *et al.* (2004) for the implications in the EU context.

lines. In addition, potential creditors will assess the likelihood of a government receiving emergency financial assistance from other countries or international financial institutions in times of difficulty.

With regard to a government's ability to adapt to shocks, the size of the current fiscal deficit and debt burden are crucial. With a low deficit and sustainable debt burden, unforeseen fiscal pressures will not destabilise public finances.[22] Governments can resort to external financing to alleviate immediate pressures while gaining time to adjust to the new environment. Beyond these core variables, further important criteria are the flexibility of revenue and expenditure arrangements. On the revenue side, low tax rates and broad tax bases can generally be expected to provide a government with the option of generating additional revenue through raising tax rates moderately without creating major disruptions. The lower the overall tax burden in the economy, the greater would be the expected flexibility on the revenue side. On the expenditure side, an essential factor determining fiscal flexibility is the share of expenditures that are open to discretionary changes by the government. Conversely, if a large part of expenditures is tied up in mandatory programmes, like, e.g., pension expenditure and social transfers, short-term adjustments on the expenditure side will become more difficult.

3.3 Practical applications

The importance of the above factors is reflected in their impact on the assessment of fiscal stability in financial markets, international financial institutions and in the academic literature. In particular, the factors have entered into the empirical literature dealing with the prediction of sovereign crises. In addition, they have been found to contribute to the explanation of the behaviour of bond spreads. Finally, they are also taken into account in the practical work of sovereign rating agencies and the country assessment of the IMF. (See also Manasse and Roubini, 2005, for a literature survey.)

3.3.1 Sovereign crisis literature

In trying to determine the drivers of sovereign debt crises and develop possible early indicators, the sovereign crisis literature has focused on emerging markets. As some EU countries envisaging to participate in monetary union share major characteristics with emerging markets (e.g. representing small open economies with relatively low integration in global capital markets), this literature is immediately relevant for the assessment of fiscal stability in the EU. In addition, the lessons learnt from emerging markets may also be important for the analysis of current euro area countries given that exchange rate based adjustments for the

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[22] See Fernández-Huertas Moraga and Vidal (2004) and Michel, Von Thadden and Vidal (2006) for theoretical illustrations of how the size of fiscal imbalances affect a government's ability to react to shocks.

correction of macroeconomic imbalances are precluded by their status as members of a currency union.

The literature on sovereign crises puts emphasis on the link between countries' exposure to macroeconomic volatility and the risk of default. In a relatively early contribution, Gavin *et al.* (1996) assess the importance of macroeconomic volatility for the explanation for the relatively frequent fiscal crises in Latin America. They find that reliance on small and volatile fiscal revenue bases induce fiscal volatility which in turn augments macroeconomic fluctuations. With high debt ratios, this destabilisation mechanism can raise the likelihood of default as risk averse investors limit external financing when crises occur. More recently, Catao and Kapur (2004) present a theoretical model and empirical evidence showing that differences in macroeconomic volatility are key determinants for fiscal stability. Macroeconomic volatility raises the need for international borrowing to smooth domestic consumption, but at the same time the ability to borrow is constrained by the higher risk of default. An empirical study of 26 emerging market economies shows indeed a close correlation between volatility and default frequency. At the country level, Hausmann and Purfield (2004) identify the relatively high macroeconomic stability in India as an explanation for the country's ability to maintain relatively high levels of public debt without adverse market reactions. Finally, Barnhill and Kopits (2003) explicitly incorporate the impact of macroeconomic volatility in their assessment of fiscal stability by constructing a value-at-risk model for government finances. This approach, which is widely applied in the financial sector, captures the quantitative impact of macroeconomic shocks, including their correlation with government financial positions on the basis of historically observed patterns. Thus, it simulates a distribution of possible future financial conditions for the government and allows to gauge the probability of financial failure.

Other liquidity factors are also found to contribute importantly to the explanation of fiscal crises. Manasse *et al.* (2003) find that the ratio of short-term debt to international reserves and measures of debt-servicing obligations contribute to explaining sovereign crises. With a wider set of explanatory variables, Detragiache and Spilimbergo (2001), find that short-term debt, debt service and reserves enter an explanatory regression model individually.

As a consequence of the possible macroeconomic spill-over effects, comprehensive stability analyses try to identify liquidity risks anywhere in the economy. Under the macroeconomic balance sheet approach a financial balance sheet is constructed for the entire economy, detailing for each sector the structure (seniority, maturity, currency) of assets and liabilities and their links across sectors (Gray *et al.*, 2003). This helps to identify possible weaknesses in specific sectors (e.g. the enterprise sector) and the most likely transmission channels to other sectors. The approach can be enhanced by applying sophisticated risk models. On the basis of past behaviour and structural sectoral assessments the response of the macroeconomic balance to exogenous shock can be modelled, capturing all sectoral and inter-sectoral effects.

3.3.2 Sovereign ratings

Similar to the academic sovereign crisis literature, rating agencies assess the likelihood of sovereign default for individual countries. Their assessment serves as input for sovereign bond market participants.

In view of the long list of factors affecting a country's default probability, rating agencies examine a wide range of quantitative and qualitative information to gauge a sovereign's fiscal stability. The quantitative variables cover a country's economic structure and development, the status of government finances, external performance and developments in the financial sector. Important variables used include GDP per capita, output growth, fiscal deficit and debt ratios, external balances and monetary indicators, such as the size of financial intermediation and the growth of money and credit. To capture a country's vulnerability to changes in investor sentiment, ratings incorporate also information on fiscal flexibility to generate internal funds as well as the currency and maturity structure of external public and private indebtedness. Inclusion of the latter reflects the observation from past financial crises that private sector difficulties can rapidly lead to burdens for the public sector.

The quantitative information is combined with qualitative information on issues such as political stability and the effectiveness of the administration. Given the complexity of the interaction among macroeconomic variables themselves as well as between those and institutional variables, there is generally no fixed weighting of the individual pieces of information in the overall assessment. Instead, expert rating committees strive to ensure consistency of ratings over time and across countries (see Bhatia, 2002).

In view of the uncertainty regarding the concrete factors driving country ratings, academic studies have identified a number of factors that have significantly affected country ratings in the past. In an early major study on this issue, Cantor and Packer (1996) find that per capita income, inflation, external debt, economic development and default history significantly explain ratings levels by Moody's and Standard & Poor's. Subsequent studies, using alternative data sets and econometric approach, have largely confirmed these findings (see, e.g., Afonso, 2003). The importance of political and institutional variables, which are more difficult to quantify, is shown by Martinez (2003), who finds that the World Bank index on government effectiveness significantly contributes to the explanation of government ratings.

From a fiscal stability perspective, it is noteworthy that variables reflecting short-term vulnerability, such as the maturity and currency structure of debt or the ratio of liquid assets over short-term liabilities, are generally not found to exert a significant effect on sovereign ratings. A possible reason is that these variables may be correlated with other explanatory variables. For example, countries with low external debt may generally also exhibit a longer average debt maturity so that both variables may not be found significant in empirical investigations. Furthermore, it has been argued that due to the objective of rating stability country ratings may fail

to capture fully short-term variations in sovereign default risk which would be mainly driven by changes in vulnerability indicators. However, indirect evidence of the importance of vulnerability for sovereign ratings could be inferred from the positive impact of EU membership and euro aspiration on the country ratings of the recently acceded EU member states. Rother (2005) shows that euro area convergence has a significant positive impact on those countries' sovereign rating, which reflects the additional stability provided by the EU institutional framework.

3.3.3 Bond spreads

Finally, countries' default risk should be constantly reflected in the risk premia that they have to pay to investors. In theory, the risk premia can be defined as the difference between the bond yield of a country with no default risk and that of a risky country, with all other variables (e.g. currency, maturity) equal. In practice, other factors, such as a bond's liquidity, enter as additional factors in the determination of the market price and the interest spread. Thus, it is of interest to what extent the factors driving fiscal stability discussed above can be identified empirically as affecting observed risk premia. Given the importance of risk considerations, the relevant sample for such analyses is largely composed of emerging markets. However, it is noteworthy that for developed market economies a literature is developing to assess the impact of variables reflecting fiscal sustainability, in particular public debt levels, on market risk assessments (see, e.g., Codogno *et al.*, 2003, Afonso and Strauch, 2004 and Bernoth *et al.*, 2004).

In a seminal study, Goldstein and Woglom (1992) find that municipal issuers in the US with unfavourable fiscal situations paid higher risk premia than fiscally sound borrowers. Eichengreen and Mody (1998) find that stability indicators have a significant impact on risk spreads for bonds issued by sovereign, public and private borrowers. In particular, a history of previous defaults raises the risk premium demanded by investors. In addition, a higher ratio of (liquid) foreign currency reserves to GNP reduces the risk premium, suggesting that investors indeed perceive such reserves a safety buffer that can be used in adverse circumstances. The results regarding the importance of reserves for the risk premium have since been corroborated (see Zlacki, 2002, Dailami *et al.*, 2005). Findings of the importance, among other variables, of the level of short-term debt (Ferrucci, 2003) and contagion (Dailami *et al*., 2005) also point to the importance of short-term stability considerations for the determination of risk premia by the financial market.

4. Conclusions

Preservation of the soundness of public finances is a necessary condition for macroeconomic stability and sustainable growth. This makes the continuous and forward-looking assessment of the situation of public finances indispensable for central banks. The importance of sound public finances becomes even more eminent in a monetary union. Not only could disruptions arsing from fiscal imbalances harm

national economic developments. Given the close integration in the union, such disruptions would immediately spill over to all participating countries. Moreover, there is a risk that fiscal imbalances could induce national policies that are not in line (or even run contrary) to the objectives of the union.

The practical assessment of fiscal soundness needs to combine analysis of the long-term sustainability with that of the short-term stability of public finances. The former concept refers to the fulfilment of the government's intertemporal budget constraint, requiring that currently outstanding public debt needs to be covered by the future primary surpluses. However, the analysis cannot stop here for two reasons:

i) the long-term sustainability assessment is necessarily uncertain and
ii) it does not provide a clear policy prescription as corrections of fiscal imbalances can be postponed indefinitely without violating the sustainability condition.

The greater the uncertainty over the long-term sustainability of a government's finances, the more important is an assessment of the financial situation in the short term.

The need to combine long-term sustainability and short-term stability criteria in the analysis of fiscal soundness implies that a wide array of variables has to be monitored. These include the conventional indicators for sustainability, in particular fiscal deficit and debt ratios combined with assumptions regarding interest rates and GDP growth rates. Implicit and contingent liabilities have also been shown to play an important role. Beyond these, country experience and academic literature point to the importance of further variables, including macroeconomic imbalances (such as high inflation and external imbalances) and balance sheet mismatches in all sectors of the economy.

The continuous comprehensive analysis of all aspects of fiscal soundness helps prevent the need for short-term disruptive policy adjustments and supports the smooth implementation of economic policies which contribute to macroeconomic stability.

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