Session 3

FISCAL SUSTAINABILITY

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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We thank Jürgen von Hagen, Philippe Moutot and participants in the 2006 Banca d'Italia Workshop on Fiscal Indicators for helpful comments.

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:

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

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

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

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:

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

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:

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

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:

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

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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:

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

[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, $\widetilde{b}_T \left(= B_T / Y_T\right)$ the debt ratio at date T and $\widetilde{d}_i \left(= E_i / Y_i - T_i / Y_i\right)$, 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:

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

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.

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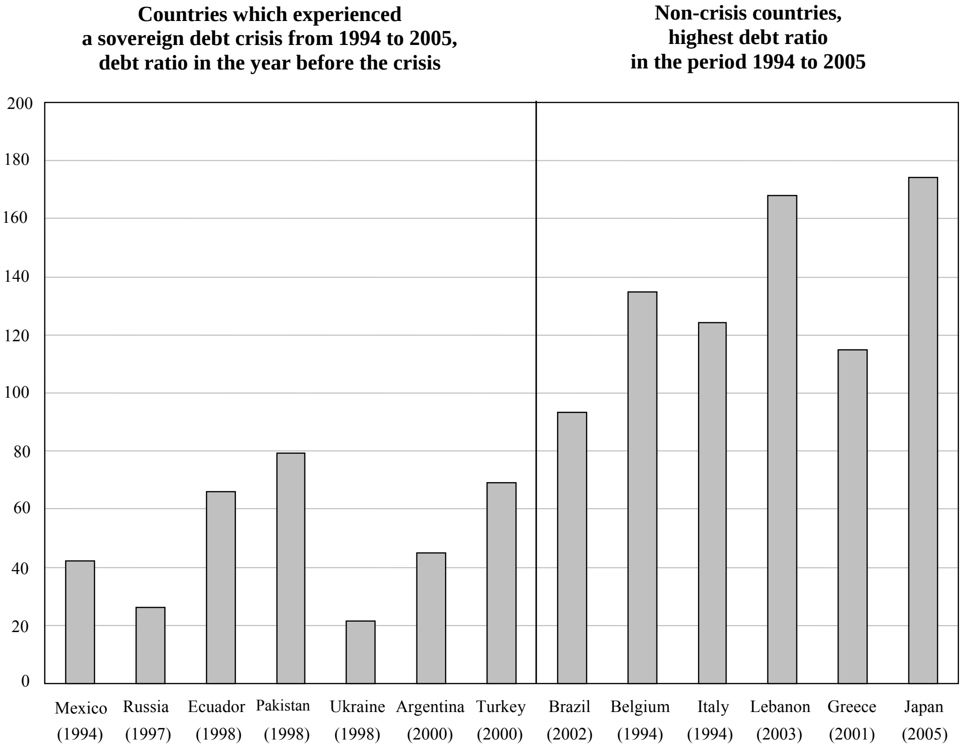
[15] See also Mink and Rodríguez-Vives (2004) for a discussion of the debt concept from a statistics perspective.

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

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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

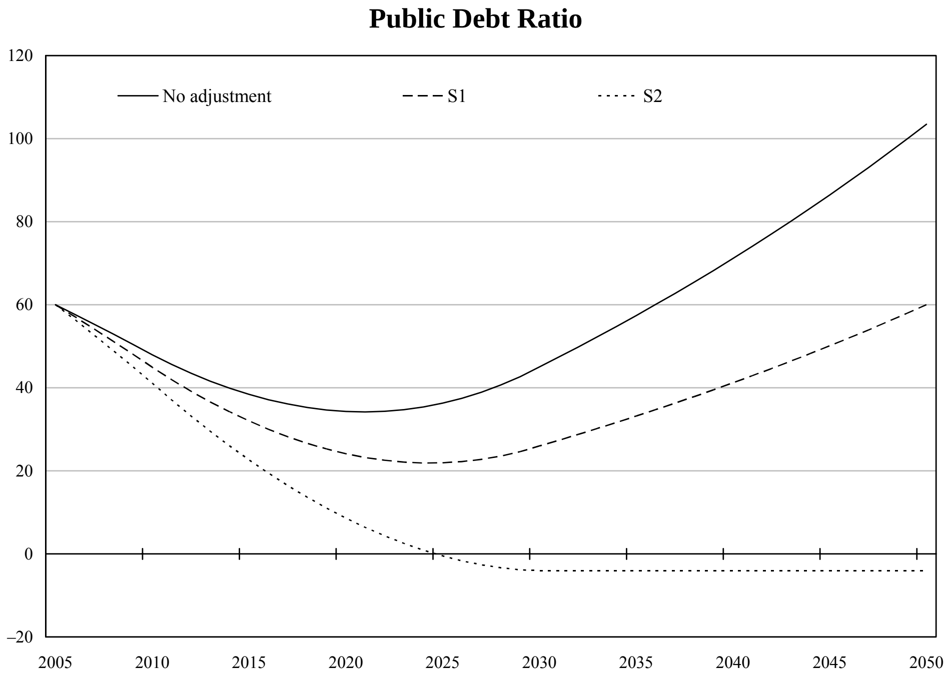
The mechanics of the application S1 and S2 can be shown using a hypothetical model country with a debt ratio of 60 per cent of GDP, nominal interest rate of 6 per cent, a nominal growth rate of 4 per cent and a (fixed) revenue ratio of 42.6 per cent of GDP. With an initially balanced budget, total primary 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.

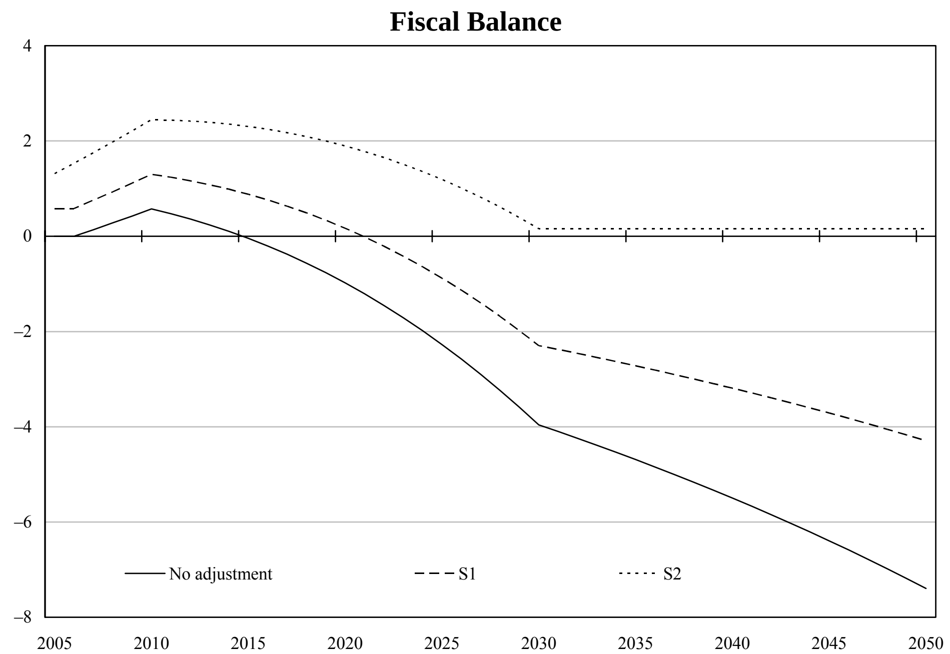
Without any adjustment, the model country initially moves from a balanced budget to fiscal surpluses which peak in 2010, reflecting lower interest cost with a declining debt ratio (see fat line in Chart xx). However, with the onset of the ageing-induced cost pressures, total expenditures rise and the 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
No adjustment
S1
S2
120
100
80
60
40
20
0
–20
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.

[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

[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

[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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DEBT SUSTAINABILITY IN EMERGING MARKET COUNTRIES: A "FAN-CHART" APPROACH

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Introduction

A sustainable fiscal position is often viewed as one where the government (or public sector) is solvent. To be deemed solvent, a government must be expected to honor current and future financial obligations, including the implicit commitment to continue providing certain public goods, services, and transfers in the future. Solvency thus implies that the present value of government disbursements (including inherited debt amortization, interest payments, and non-interest expenditure) should not exceed the present value of revenues, or equivalently that, the present value of future revenues *net of* non-interest spending (the primary balances) should at least cover the existing public debt. The intertemporal budget constraint and the relationship between the primary balance and the public debt have therefore been at the center of the literature on debt sustainability.

In practice, the notion of sustainability is less straightforward than it appears. First, at a conceptual level, it always implies a judgment as to what constitutes an acceptable strategy for the government to ultimately satisfy its intertemporal budget constraint (Mendoza and Oviedo, 2004). By definition, solvency excludes outright default or forced restructuring.[1] Yet most analysts would also exclude the inflation tax from the set of acceptable strategies, limiting the latter to adjustments in the primary balance. Hence, solvency is only a necessary condition for sustainability, and defining sufficient conditions involves judgment. Second, at a technical level, the forward-looking nature of solvency makes it difficult to assess. No one knows for sure the primary surplus a government will be able (or willing) to generate in 5, 10, or 20 years, nor the future path of interest rates, inflation, and productivity growth over that period. Absent uncertainty, of course, assessing solvency would be a mere arithmetical exercise. In reality, however, it requires making judgments under uncertainty, as well as the recognition that such judgments are subject to risk.

Assessments of debt sustainability – including those performed by IMF country teams – rely on medium-term simulations of the debt-to-GDP ratio given specific macroeconomic forecasts and fiscal policy assumptions. In the absence of reliable "sustainability thresholds", however, such estimates *per se* do not allow one to determine the sustainability of a particular public debt position. Instead, the

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This is a revised version of Celasun, Debrun and Ostry (2006). The views expressed in this paper are those of the authors and do not necessarily represent those of the IMF or IMF policy.

[1] Solvency is generally defined as the ability to meet one's financial obligations on time.

expected *dynamics* of the debt-to-GDP ratio over the medium term (generally 5 to 10 years) are interpreted as a signal as to whether underlying policies can be sustained under plausible macroeconomic conditions without endangering solvency. Specifically, a declining trend in the debt ratio signals that government policies are unlikely to jeopardize sustainability, whereas a positive trend or even stabilization at a high level may motivate concerns about sustainability, especially if other factors – such as the fiscal adjustment needed to stabilize or reduce the debt ratio – point to likely difficulties in keeping debt under control.

Uncertainty about future macroeconomic conditions and fiscal policy inevitably weakens the basis for drawing compelling policy conclusions using such analyses. This paper proposes a methodology that improves our understanding of the risks surrounding debt dynamics, and explicitly acknowledges the inherently probabilistic nature of debt sustainability analysis (DSA) exercises. A more nuanced and more credible assessment of long-term sustainability results.

Of course, standard DSA does recognize the importance of uncertainty, with risks to the baseline debt projection appraised through simulating alternative debt paths under less favorable conditions – so-called "bound tests." This approach to risk assessment is entirely deterministic, however, involving a set of scenarios in which one key variable at a time is hit by an adverse shock – including lower growth, higher interest rates, a lower primary balance, and exogenous debt increases, such as those resulting from exchange rate depreciation or the recognition of off-budget obligations. The calibration of the shocks generally uses a multiple or fraction of the unconditional variance of the underlying series.

Although the bound tests approach gives a broad sense of the sensitivity of the sustainability assessment to adverse developments, significant methodological limitations undermine its credibility and operational relevance. First, both the correlations among shocks and the *joint* dynamic response of the variables relevant for debt dynamics are ignored. Indeed, simulated deterministic disturbances can realistically be of only two types: large and transitory, or small and permanent.[2] Second, fiscal policy is assumed not to react to the simulated economic developments, as if a deterministic policy process could reasonably prevail in an intrinsically stochastic environment. Third, in an uncertain world of course, each individual bound test formally has a near-zero probability of occurrence, making any meaningful quantification of risk impossible.

Measuring risk to debt dynamics requires a stochastic simulation apparatus whereby many bound tests covering a range of likely shock combinations could be generated. With a framework capable of randomly generating a large sample of bound tests, frequency distributions of the debt ratio can be derived for each year of a projection, permitting an explicitly probabilistic assessment of debt sustainability.

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[2] Recent adjustments to the IMF's DSA template placed greater emphasis on small and permanent shocks, leaving only exogenous debt increases as large and temporary disturbances.

Our paper proposes a stochastic DSA algorithm along these lines. The algorithm preserves a certain degree of standardization (to ease cross-country comparisons) while allowing for country-specific risk factors to be reflected. To illustrate its versatility, it is applied to five emerging market countries with fairly different risk profiles, namely Argentina, Brazil, Mexico, South Africa, and Turkey.

The algorithm consists of three building blocks. First, for each country, the joint distribution of shocks is calibrated to fit the statistical properties of historical data. These properties are captured in unrestricted VAR models which:

(i) describe comovements among the determinants of debt dynamics (essentially GDP growth, interest rates and exchange rates);

(ii) provide estimates of the conditional variances and covariances of the shocks; and

(iii) generate a consistent set of projections for the determinants of debt dynamics.

The estimation of the VAR model requires quarterly data.

A second block characterizes fiscal behavior through an explicit fiscal reaction function. The latter is calibrated using panel estimates obtained for a sample of 34 emerging market economies during 1990-2004, and can be adjusted to reflect country-specific information on future policies. Allowing for endogenous fiscal policy improves the risk analysis by taking into account the plausible policy response of the primary balance to economic shocks and public debt developments. The use of panel techniques to estimate fiscal policy responses provides a common benchmark for all countries represented in the sample, though if sufficient time series data are available to estimate a country-specific reaction function, this could replace the use of panel techniques.[3]

The third block combines simulated economic scenarios (first block) with the estimated fiscal policy process (second block) to produce annual public debt paths.[4] Hence, the latter not only reflect plausible constellations of shocks, but also consistent projections for growth, interest rates, exchange rates, and fiscal policy. Through repeated simulations of random shocks, we construct a large sample of public debt projections for each year of the forecasting horizon. The corresponding frequency distributions yield a probabilistic assessment of debt dynamics. Specifically, we use "fan charts" to depict confidence bands for varying degrees of uncertainty around the median projection, which helps refine the usual debt sustainability assessment – based solely on the trend in the central projection for debt.

The paper also draws on earlier work looking at public debt sustainability in relation to primary surplus behavior. IMF (2003) focuses on determining debt

[3] We are dubious about the utility of using quarterly fiscal data in country-specific VARs, given the observation that these data have a very high noise-to-signal ratio.

[4] Quarterly projections generated by VARs thus need to be annualized and fed into the conventional stock-flow identity of the public debt-to-GDP ratio. Simulated primary balances and public debt are determined recursively to account for the fiscal policy response to public debt developments.

thresholds beyond which sustainability could be considered at risk given average fiscal behavior. The same study introduces the concept of "overborrowing," defined as the excess of current public debt over the annuity value of future primary surpluses. Using an expanded version of the dataset in IMF (2003), Abiad and Ostry (2005) refine the estimations of fiscal reaction functions (including a richer set of political and institutional variables) and of the determinants of overborrowing, and calculate the impact on sustainable debt levels of a variety of fiscal and institutional reforms. The present paper marries the approach to fiscal policy reaction functions in Abiad and Ostry (2005) and the stochastic analysis of debt issues in Garcia and Rigobon (2005) and Penalver and Thwaites (2004). These latter papers, by focusing on higher frequency macroeconomic data, pay insufficient attention to the constraints on the evolution of public debt created by the endogenous response of fiscal policy to debt shocks.

The remainder of this paper is organized as follows. Section 1 discusses some building blocks of deterministic DSA, and compares the latter with newer, stochastic approaches. In Section 2, we present the estimates of primary surplus behavior, and how we overcome a number of pitfalls (endogeneity problems) in estimation. Section 3 describes the simulation algorithm for public debt and presents fan charts for five major emerging market economies. Concluding remarks and policy implications are provided in Section 4.

1. Debt sustainability analysis and risk

This section compares deterministic DSA with stochastic approaches, highlighting the value added of the latter over the former. As previously mentioned, debt sustainability is directly related to the notion of solvency, which requires that, in present value terms, future revenues be at least as large as the stock of current obligations and future commitments. As a consequence, a given debt position is sustainable as long as it does not exceed the present value of all future primary surpluses. The path of primary surpluses over the indefinite future being essentially unknown, however, implementing this definition is a tremendous challenge, calling for operational alternatives.

1.1 DSA frameworks

Since the time horizon for macroeconomic projections rarely extends beyond a few years, the solvency concept is typically operationalized by asserting that sustainability is *not* in jeopardy if the expected path of primary surpluses causes the debt-to-GDP ratio to decline over the simulation horizon. Concerns about sustainability may arise if the debt ratio trends upwards or if it stabilizes at a high level relative to peer countries with similar fundamentals, or relative to its own historical track record; sustainability could also be called into question if the magnitude of fiscal adjustment required to stabilize the debt ratio were deemed to be excessive. In the standard DSA setup, the assessment does not relate to the sustainability of a particular debt position but rather to whether given policies lead to particular trends in the debt-to-GDP ratio which may in turn motivate calls for policy corrections.

A key issue with the DSA as just described is the omission of uncertainty – be it for example about future income growth, interest rates, fiscal policies, exchange rate movements, or even the recognition of contingent liabilities. A natural response is to subject the DSA's baseline projection to a series of shocks ("bound tests") that deteriorate the outlook. These include lower GDP growth, higher interest rates, a weaker primary balance, a depreciation of the exchange rate, and the recognition of off-budget obligations. The standard bound-testing approach is deterministic, however, and limited to either isolated shocks or *ad hoc* combinations of them. While the *unconditional* variance of the underlying series determines the magnitude of the simulated disturbances, actual covariances – especially between fiscal and nonfiscal variables – are ignored. This may lead one to severely underestimate risks to debt sustainability if adverse shocks – say to growth, interest rates, and exchange rates – combine in an explosive cocktail for debt dynamics.[5]

Calibrating deterministic bound tests to reflect economic and policy patterns observed in a given economy thus constitutes another challenge for the standard DSA framework. One possibility is to devise a small number of standardized scenarios – where isolated shocks are expressed as a proportion of the historical standard deviations of the variables – such that both the shock itself *and* the resulting debt path appear plausible in probabilistic terms (IMF, 2003). By its nature, this approach lends itself to the construction of standardized bound tests applicable to many different countries, and requires only a fairly parsimonious dataset.

For the sake of illustration, the outcome of the IMF's deterministic bound-testing exercise is presented in Figure 1 for South Africa over the 2005-10 time horizon.[6] The DSA template provides debt paths corresponding to several standardized scenarios: the baseline (reflecting macroeconomic projections and policy assumptions); small but permanent adverse shocks (half a standard deviation) to real GDP growth, the real interest rate and the primary balance; a combination of these three shocks (this time assuming a quarter of a standard deviation); and two large temporary disturbances, namely a 30 per cent real depreciation and a shock to the debt stock (mimicking the recognition of contingent liabilities) equivalent to 10 per cent of GDP. In line with South Africa's relatively stable economic environment and low external indebtedness, the selected bound tests suggest fairly low risks to public debt sustainability over the medium term (Debrun, 2005a).

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5 That would be the case if a slowdown in economic activity were typically followed by a depreciation of the currency, rising interest rates, and deteriorating primary balance.

6 This is based on the new DSA template introduced in July 2005.

1.2 Benefits of an explicit risk assessment

One drawback of the deterministic bound-testing approach depicted in Figure 1 is that the underlying scenarios hardly ever follow shock patterns observed in the economy. Specifically, the method ignores co-movements among the determinants of debt dynamics whereas such comovements are central in the stability of the debt ratio (see Goldfajn, 2005). Furthermore, the standardization of those tests implies fairly different degrees of realism across countries. Since the likelihood of the resulting debt paths cannot be precisely assessed, observers have no choice but to judge the plausibility of these bound tests on the basis of their core assumptions – e.g., a growth slowdown without repercussions on interest rates or fiscal policy – rather than on their probabilistic merits in terms of debt outcomes.

A legitimate question is thus to ask whether a diagnostic based on a few highly stylized scenarios is robust to more realistic constellations of shocks. If a joint distribution of relevant economic disturbances can be estimated for the country under review, stochastic simulations reflecting actual co-movements of shocks in the economy can produce a large sample of more realistic bound tests from which country-specific frequency distributions of debt can be derived. These frequency distributions provide a quantitative assessment of the risks to the baseline debt projections that may ultimately help refine fiscal policy recommendations.

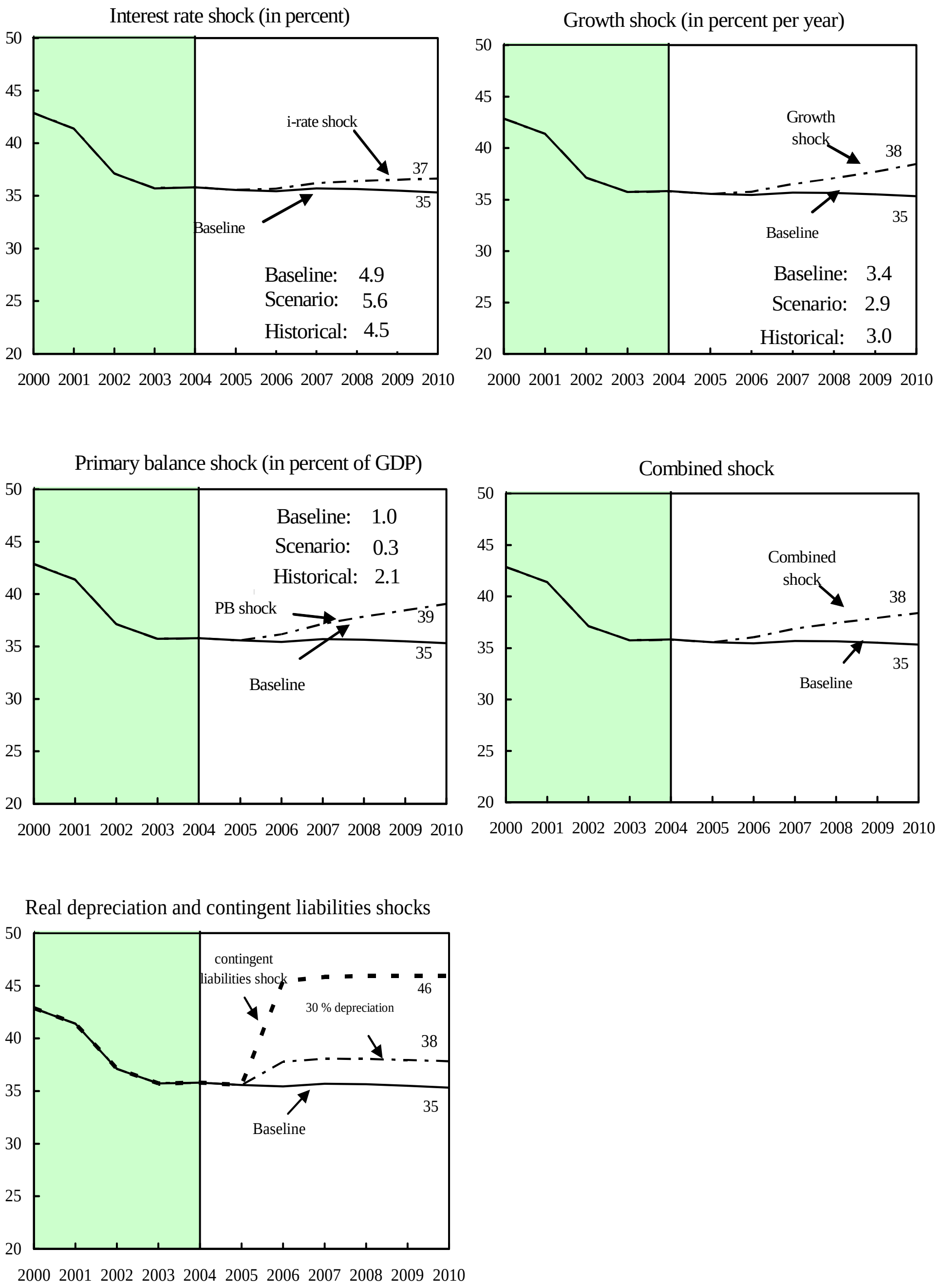
Another issue is the extent to which the sustainability diagnostic reflects plausible fiscal policy behavior and properly accounts for the fact that fiscal policy itself is a source of uncertainty. Commonly used DSA scenarios assume that fiscal policy is invariant to the stylized shocks. While this assumption contributes to the policy dialogue by highlighting the consequences of policy inaction, there are strong *a priori* grounds as well as ample evidence that the primary balance tends to systematically respond to variations in public debt and to the business cycle, among other factors. Ignoring these feedbacks may thus distort the risk assessment.[7] In particular, assuming a constant primary surplus in the face of business cycle fluctuations reduces the estimated risk to debt dynamics because slowdowns are generally accompanied by fiscal easing while expansions often fail to improve the primary balance (see Section 2). Also, the estimated residuals of the reaction functions provide information on the stability of fiscal behavior, with erratic policy impulses being another independent source of uncertainty. Conversely, the passive policy assumption fails to capture the stabilizing response of the primary surplus to the debt itself, thereby increasing estimated risks to debt.

In addition to improved reliability of the risk analysis, accounting for systematic features of the policy process should lead to more focus of policy advice on fiscal effort (measured as the departure from the estimated reaction function) rather than on the unconditional change in the fiscal balance. Deviations of actual policies from the benchmark provided by the estimated reaction function may prove

[7] This being said, our simulation tool can accommodate any normative policy scenario, including the constant policy assumption.

Figure 1

South Africa: IMF Standard Debt Sustainability Analysis, 2004-10



Sources: South African National Treasury and IMF staff estimates.

useful in assessing such effort, and thereby the room for fiscal adjustment (Abiad and Ostry, 2005 and Debrun, 2005b).

Table 1 summarizes some key difference between the usual DSA framework and the extended DSA proposed in this paper.

1.3 Overview of the simulation algorithm

Our simulation algorithm seeks to satisfy three main objectives: (*i*) provide a sensible way to account for fiscal behavior and simulate changes to it; (*ii*) provide a tool easily applicable to different emerging market countries while referring to a common benchmark for policy assessment; and (*iii*) keep data requirements close to those in the standard DSA.

The first objective puts the fiscal reaction function as an essential building block. The second objective points to panel data techniques to estimate an average behavior across a group of countries that could serve as a "positive" benchmark for each individual member of the group though, as suggested earlier, if sufficient country-specific data are available, it would in principle be possible to estimate a country-specific fiscal reaction function. The third objective suggests relying as much as possible on annual data.

These objectives impose a significant departure from existing algorithms.[8] Specifically, there is a need to initially separate the estimation of the fiscal reaction function from that of the other economic relationships before merging them again when simulating the behavior of the public debt ratio. There are (at least) two compelling reasons for doing so. First, the estimation of the variance/covariance matrix of shocks inevitably relies on time-series techniques (an unrestricted VAR model) that demand higher-than-annual frequency data. However, in contrast to financial variables and GDP, budgetary data at such frequency are often either unavailable or unreliable for the purpose of policy evaluation.[9] The second reason is that the VAR framework restricts the specification of the reaction function in

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8 IMF (2003) develops a tractable stochastic simulation tool that shares many features with subsequent research, including ours. However, the IMF algorithm relies on annual data for all relevant variables, placing a premium on the availability of long and stable time series. In contrast, the simulation tools developed by Garcia and Rigobon (2005), Penalver and Thwaites (2004) and Tanner and Samake (2005) require high-frequency data, including for fiscal variables. Such data requirements limit the number of countries to which these algorithms can be applied. Our approach tries to better internalize data constraints, focusing on a shorter time span (during which regime shifts and structural changes are less likely) while keeping annual fiscal data at the center of the analysis. This potentially increases the number of countries to which our algorithm could be applied.

9 Higher frequency budgetary data (quarterly or monthly) are typically quite noisy, and are meant to serve cash management purposes rather than policy assessment. While countries with Fund-supported programs or greater leeway to vote supplementals during the budget year may well undertake policy corrections on a quarterly basis in response to shocks or slippages, the overall policy stance still tends to be reflected in the annual figures (see Wyplosz, 2005, who finds standard reaction functions to fit very poorly using monthly data for Brazil).

Table 1

DSA and Risk Assessment

	Deterministic bound-testing (commonly used DSA)	**Probabilistic approach (in this paper)**
Diagnostic based on...	...a few stylized, isolated shocks; exogenous policies	...a large number of random shock constellations drawn from an estimated joint distribution; endogenous fiscal policy
Calibration of shocks	Fraction or multiple of historical standard deviations of underlying variables. Calibration based on the likelihood of the resulting debt path for a sample of emerging market economies	Directly based on the estimated joint distribution of disturbances (country specific)
Output	Large temporary shocks provide a probabilistic upper bound to the debt ratio; small permanent shocks delineate interval of most probable outcomes	Frequency distributions of the debt ratio over time, "fan charts"
Main advantages	Amenable to standardized bound tests across countries; low data requirement	Better reflection of country specificity (in terms of shocks and fiscal policy behavior); explicitly probabilistic output

Sources: IMF and the authors.

undesirable ways: e.g., the primary surplus responds to contemporaneous variations in the output gap, not lagged ones, as imposed by the VAR framework.

Accordingly, our algorithm comprises three building blocks, the first one being discussed more fully in Section 2 below, and the other two in Celasun, Debrun and Ostry (2006).

1) A fiscal *reaction function* – in the *positive* sense of a *description* of average fiscal policy patterns – is estimated for a panel of emerging market economies with annual data. In line with the literature, the general specification is given by:

$$p_{i,t} = \alpha_0 + \rho d_{i,t-1} + \gamma\, ygap_{i,t} + X_{i,t}\beta + \eta_i + \varepsilon_{i,t}, \qquad t = 1,...T, i = 1,..., N \qquad (1)$$

where $p_{i,t}$ is the ratio of the primary balance to GDP in country i and year t, $d_{i,t-1}$ is the public debt to GDP ratio observed at the end of period $t-1$, $ygap_{i,t}$ is the output gap, η_i is an unobserved, country fixed-effect, and $X_{i,t}$ is a vector of control variables.

2) For each country, we estimate an unrestricted VAR model comprising the non-fiscal determinants of public debt dynamics. Formally, we have $Y_t = \gamma_0 + \sum_{k=1}^{p} \gamma_k Y_{t-k} + \xi_t$ where $Y_t = \left(r_t^{us}, r_t, g_t, z_t\right)$, and γ_k is a vector of coefficients, r^{us} denotes the real foreign interest rate, r, the real domestic interest rate, g, the real GDP growth rate, z, the (log of the) real effective exchange rate, and ξ is a vector of well-behaved error terms: $\xi_t \sim N(0, \Omega)$. This model serves two purposes. First, the variance/covariance matrix of residuals Ω characterizes the joint statistical properties of the contemporaneous, non-fiscal disturbances affecting debt dynamics. Specifically, the simulations use a sequence of random vectors $\hat{\xi}_{t+1}, \ldots, \hat{\xi}_T$ such that $\forall \tau \in [t+1, T]$, $\hat{\xi}_\tau = W \upsilon_\tau$, where $\upsilon_\tau \sim N(0,1)$, and W is such that $\Omega = W'W$ (W is the Choleski factorization of Ω). Second, the VAR generates forecasts of Y consistent with the simulated shocks. As shocks occur each period, the VAR produces joint dynamic responses of all elements in Y. It should be noted that the method is not sensitive to the ordering of variables in the VAR. Ordering matters only to the extent that one tries to capture causal relationships between innovations and the other variables (e.g., for impulse response functions). In the present context, stochastic simulation results are shaped by the variance/covariance matrix of reduced-form errors Ω, which is unique (see also Garcia and Rigobon, 2005).

3) For each simulated constellation of shocks, quarterly VAR projections are annualized, and the simulated annual output gap results from the growth differential between predicted GDP growth and the (annualized) steady-state growth rate produced by the VAR (to ensure that shocks to the output gap are zero on average). The corresponding debt path can then be calculated recursively using equation (1) and the conventional stock-flow identity: $d_t \equiv (1+g_t)^{-1}\left[(1+r_t^{us})(1+\Delta z_t)d_{t-1}^{*} + (1+r_t)\tilde{d}_{t-1}\right] - p_t + s_t$, where d_t^{*} captures the foreign-currency-denominated debt, $\tilde{d}_t$ designates the public debt in domestic currency, and s_t, stock-flow adjustments, for instance due to the recognition of contingent liabilities or the realization of assets. Notice that in each simulation, the primary surplus incorporates a fiscal policy shock $\varphi_{i,t} \sim N\left(0, \sigma_{\varphi_i}^2\right)$, where $\sigma_{\varphi_i}^2$ is the country-specific variance of the reaction function's residuals.

This algorithm can produce an arbitrarily large number of debt paths (say 1000 or 10,000) corresponding to different shock constellations. Frequency distributions of the debt ratio can then be obtained for each year of projection, and used to draw "fan charts" and develop probabilistic sustainability analysis discussed below in Section 3.

Results from using this algorithm are still subject to three limitations. First, in many emerging market economies, a lack of long time series combined with ongoing structural change and frequent shifts in policy regime reduce the reliability of econometric estimates for predicting future developments. Second, extreme situations – such as crises – are bound to remain low-probability events in this framework. Fan charts can at best detect the risk of undesirable "non-crisis" situations.[10] Third, the combination of annual and quarterly data shuts off any feedback effect of fiscal policy on economic variables (the causation runs only in the other direction), and in particular interest rates (through credibility effects) and growth (through the quality of fiscal policy). This may be an important issue if fiscal reforms, for example, are likely to produce significant changes in the future course of growth and interest rate spreads. While our proposed methodology will not pick up such effects (with future growth and interest rates being driven by the steady state values of these variables from the VAR), our approach can nonetheless accommodate imposing such effects on the results (overriding the steady state values from the VAR used in the algorithm) if these are believed to be important in coming to appropriate judgments about the risks to future debt dynamics.

The next section turns to the first building block of our model, and provides a benchmark fiscal reaction function for a group of emerging market economies.

2. Debt dynamics and the conduct of fiscal policy

As shown by Bohn (1998), governments concerned with solvency would be expected to raise the primary balance in response to an increase in the public debt-to-GDP ratio. If all other determinants of fiscal policy are stationary, the positive correlation between debt and the primary surplus is sufficient to guarantee that the debt ratio will revert to some finite steady-state value. This section describes the estimation of fiscal reaction functions for a group of emerging market economies over 1990-2004, where the regressors include debt and a range of other economic, policy, and institutional variables of interest.

[10] Conversely, fan charts will inevitably tend to exaggerate the risks faced by countries coming out of troubled times. More generally, it is critical to bear in mind that the simulated frequency distributions of debt are not the "true" probability distributions at a point in time.

2.1 Primary surplus behavior and public debt sustainability

A growing number of studies have recently estimated fiscal reaction functions (Mélitz, 1997; Galí and Perotti, 2003; IMF, 2003, 2004; Wyplosz, 2005, among others). The aim of this literature is to identify a stable relationship between fiscal policy (measured by the primary balance) and various potential determinants. Such an exercise does not attempt to establish causality; the idea is rather to extract information on the key considerations that may shape and be correlated with policy decisions. Debt sustainability is expected to be one of those considerations, along with cyclical developments, and institutions affecting a government's incentives. Accordingly, a version of equation (1) is commonly estimated.

One difficulty with estimating fiscal rules is the scarcity of relevant budgetary data, which has led researchers to use panel data methods. The most meaningful data from the perspective of policy evaluation is available annually, in line with the budget procedure of most countries. Although fiscal policy adjustments may occur at lower (say quarterly frequency), these signals are blurred by the intrinsically noisy nature of high frequency budgetary data, which are generally used for cash management purposes rather than policy evaluation.[11] Wyplosz's (2005) attempt to fit a fiscal rule to high-frequency data for Brazil shows how difficult it is to capture policy behavior at higher-than-annual frequency.

Panel estimation assumes similar fiscal behavior across countries. To account for possible heterogeneity, we control for a large number of potential determinants of fiscal policy (that may differ across countries), and also explore the possibility of non-linear relationships between the primary balance and some of its determinants.

2.2 Estimating fiscal reaction functions

In line with the literature, the reaction function we estimate, given in equation (1), relates the annual primary fiscal balance to the outstanding level of public debt, the gap between actual and trend output, and a number of potentially important drivers of the primary balance in emerging market economies.[12] These include real oil prices in oil exporters, an index of institutional quality, and two indicator variables accounting for whether the country is in a status of sovereign default and whether it is committed to an IMF-supported program.

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[11] One notable exception is in the case of an IMF-supported program, where quarterly reviews of policy implementation take place.

[12] Fiscal balances react to economic fluctuations both through the discretionary attempts of policymakers to stabilize output fluctuations and the tendency for primary balances to "automatically" decline (increase) as a share of GDP during cyclical downturns (expansions). The literature on policy cyclicality typically focuses on the first channel (see Kaminsky, Reinhart and Vegh, 2004). Given our interest in debt sustainability, we focus on the evolution of actual primary balances (rather than the cyclically adjusted balances which better reflect discretionary behavior), implying that our specification captures both the automatic and discretionary responses of fiscal policy to the business cycle.

The estimation of equation (1) needs to take into account three sources of endogeneity bias. The first is simply the endogeneity of the output gap with respect to contemporaneous fiscal policy shocks, $\varepsilon_{i,t}$. The remaining two sources stem from the dependence of lagged debt on past values of the primary surplus. As to the second of the three sources, clearly the lagged debt level, $d_{i,t-1}$, will necessarily be correlated with the country-specific and time-invariant determinants of primary surpluses, η_i: countries able to generate higher surpluses on average – captured by higher values of the fixed-effects η_i – will tend to have a lower level of public debt; and if this is not properly accounted for, the negative correlation between debt levels and the unobserved country fixed-effects would exert a downward bias on the estimated primary surplus response to debt. As to the third source of endogeneity, to the extent that there is persistence in the idiosyncratic error term, $\varepsilon_{i,t}$, the dependence of lagged debt on past surpluses will render lagged debt in equation (1) endogenous.[13]

Ideally, one could address these potential endogeneity problems with adequate instrumentation. To tackle the first source of endogeneity, the output gap needs to be instrumented with variables that are exogenous to the idiosyncratic primary surplus shocks. The second source of endogeneity – the endogeneity of debt to the primary surplus fixed-effects – can in principle be addressed by the inclusion of country indicator variables among the regressors, but this method would still be subject to the third endogeneity problem if there is strong serial correlation in the idiosyncratic errors.[14] Moreover, the use of country dummies can potentially introduce an additional bias, commonly referred to as the small-sample bias of the fixed effects estimator.[15] By contrast, instrumenting both the output gap and lagged debt (with variables that are exogenous to the primary surplus fixed effects and to the idiosyncratic errors) would simultaneously address all three potential endogeneity problems. That said, reliable instrumental variables (IV) based estimations require the use of suitable exogenous instruments that are strongly correlated with the endogenous regressors. Such ideal instruments are difficult to find in our context. Moreover, IV-based regressions are generally not very efficient, yielding estimates with relatively large standard errors.

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[13] For instance, a positive shock to the primary surplus in period $t-1$, *i.e.* a positive realization of $\varepsilon_{i,t-1}$, would reduce the debt stock, $d_{i,t-1}$. Thus, persistence in the idiosyncratic policy shocks (serial correlation between $\varepsilon_{i,t-1}$ and $\varepsilon_{i,t}$) would result in a negative correlation between $d_{i,t-1}$ and $\varepsilon_{i,t}$.

[14] The inclusion of country indicator variables addresses the endogeneity of debt to η_i by transforming the equation to eliminate η_i. Specifically, when country dummies are included, the mean values of the dependent and explanatory variables across all time periods for each country are obtained and the regression is performed on the variables in deviations from their country means.

[15] A large literature analyzes the bias of the least squares with dummy variables estimator in dynamic models that include the lagged dependent variable as a regressor. The bias of this estimator decreases with the time dimension of the sample and the variance of the lagged dependent variable that is attributable to factors other than the disturbance terms (see, e.g., Kiviet, 1995, or Judson and Owen, 1999). Our model falls into the category of dynamic panel models given the presence of lagged debt among the regressors.

Against this background, our strategy is to estimate five possible specifications. The first two, a LIML regression and a system GMM specification, respectively, instrument for the output gap and lagged debt, and exclude country dummies. A third uses instruments for the output gap only and includes country dummies to account for the fixed effects. This specification eliminates the first two sources of endogeneity, but not the endogeneity from the persistence in idiosyncratic policy shocks; it should yield similar results to the first two methods if the serial correlation in the errors is weak and if the small-sample bias associated with the use of country dummies is small.[16] Beyond this, specifications 4 and 5 below incorporate nonlinearities to better capture heterogeneities in fiscal behavior across countries and circumstances. A detailed discussion of the estimation strategy is given in Celasun, Debrun, and Ostry (2006).

Our panel comprises 34 countries and a maximum of 15 years (1990-2004); data on primary balances and public debt levels were obtained from IMF desk economists for the largest available coverage of the fiscal sector (see Appendix).

For the linear reaction function, we present in columns 1-3 of Table 2 three specifications. The first eliminates the country effects by using first differences, and instruments for the lagged change in debt and contemporaneous change in the output gap, using as instruments lags of one-year U.S. bond rates, changes in real oil prices, lagged fiscal costs of banking crises, and import demand in industrial-country trading partners.[17] We run a LIML regression, which is preferable to GMM if the instruments are not very strong. In the second regression, we implement Blundell-Bond (1998) system-GMM (SGMM), which jointly estimates the level and differenced forms of the equation, using lagged differences and levels of the endogenous regressors as instruments in addition to the exogenous instruments used in the LIML regression. Third, we estimate a version with country dummies, instrumenting only the output gap with import demand in industrialized trade partners (GMM-DV).[18]

All three estimations suggest a positive response of primary surpluses to public debt. The LIML and SGMM estimates of ρ (Columns 1 and 2) imply an only slightly weaker response (0.030-0.039) than the GMM-DV regression (0.046). With a positive estimated coefficient on the output gap, primary balances are estimated to be countercyclical. However, this effect is likely to be driven mostly by the worsening of the balance during recessions rather than improvements during

16 Analytical derivations show that the expected small sample bias of the fixed effects estimator would be positive for ρ, the coefficient of lagged debt. Monte Carlo simulations suggest that the magnitude of the bias on ρ is typically less than 15-20 per cent of the true coefficient (Celasun and Kang, 2005).

17 The fiscal costs of banking crises typically take the form of below-the-line expenditures, thereby increasing the public debt burden without affecting recorded primary surpluses.

18 Including time dummies in this equation slightly increases the estimated standard error of the coefficient on the output gap (from 0.11 to 0.17), while the estimated coefficients on the time dummies are not statistically significant and the coefficients on all other regressors remain the same. This suggests that any common time trend in fiscal policy behavior is due to, and fully captured by, comovements in the output gap across countries.

Table 2

Estimates of the Fiscal Reaction Function, 1990-2004
(dependent variable: level or change in the primary fiscal balance)

	(1) LIML (Difference)	(2) System GMM	(3) GMM with DV	(4) LIML (Difference)	(5) GMM with DV
Lagged Debt	0.039	0.030***	0.046***	0.121	0.097***
	[0.032]	[0.007]	[0.008]	[0.172]	[0.036]
Output Gap	0.104	0.217***	0.328***		
	[0.109]	[0.072]	[0.113]		
Real Oil Price	0.481***	0.084**	0.354***	0.487***	0.361***
	[0.072]	[0.030]	[0.082]	[0.112]	[0.086]
Institutions	0.374	–0.219	–0.675***	0.463	–0.380
	[0.484]	[0.322]	[0.258]	[0.445]	[0.256]
IMF Program	0.765**	1.121	1.108***	0.777**	0.939**
	[0.347]	[0.689]	[0.328]	[0.344]	[0.328]
Default	0.870**	0.884	1.190***	0.749***	1.077***
	[0.351]	[0.813]	[0.401]	[0.297]	[0.368]
Debt Spline				–0.108	–0.062*
(50 per cent)				[0.194]	[0.037]
Positive output gap				–0.092	0.181
				[0.358]	[0.631]
Negative output gap				0.258	0.268
				[0.246]	[0.225]
Constant		–0.684	–0.963		–3.628
		[1.479]	[1.138]		[2.892]
Country dummies	No	No	Yes	No	Yes
Observations	349	399	418	368	418
Hansen test (*P*-value)	0.84	1.00	0.45	-	0.03
AR(1) test (*P*-value)		0.05			
AR(2) test (*P*-value)		0.09			
Cragg-Donald Stat.	7.23		19.63	1.96	

Notes: Standard errors in brackets, * denotes significance at 10 per cent; ** at 5 per cent; *** at 1 per cent. *P*-values of the test statistics are reported for the tests of overidentifying restrictions and tests of serial correlation in the residuals of the difference equation in the System GMM regressions (AR tests). In the LIML regression in the first column, the second and third lags of U.S. one-year bond rates, second and third lags of the changes in real oil prices, lagged fiscal banking crisis costs, the contemporaneous value of trade partners import demand were used as instruments for lagged debt and the output gap. The Blundell and Bond (1998) system-GMM regression in Column 2 uses the second lags of the output gap and debt, in addition to the banking fiscal cost measure and the trade partners import demand. The third column presents a GMM regression with country dummies, where the output gap is instrumented with the contemporaneous and lagged values of trade partners import demand. The equation in Column 4 is exactly identified, hence there is no test of overidentifying restrictions. The instruments include lagged fiscal banking crisis costs, the contemporaneous value of trade partners import demand, and the interaction of these variables with a dummy that indicates whether debt exceeds 50 per cent, and a dummy that indicates whether the output gap is positive. The estimation in column 5 instruments only for the positive and negative output gap terms, using the interactions of the trade partners import demand measure.

booms, as discussed below in the context of the nonlinear specification. Our estimates confirm that countries with IMF-supported programs run higher surpluses. And countries in default – that is, not current on their sovereign obligations – run larger primary balances, reflecting their restricted market access.[19]

The estimated coefficient of the index of institutional quality is mostly negative, but significant only in the GMM-DV regression that explicitly controls for country fixed effects.[20] An interesting observation is that the estimated country fixed effects in the GMM-DV regression are positively correlated with the average institutional quality over the sample period (Figure 2). This suggests that countries with stronger institutions run larger primary balances on average, holding all other factors constant. The negative estimated impact of institutions may stem from the fact that improvements in institutional quality are typically associated with decreases in borrowing costs, implying that countries would need to run smaller primary balances to service a given level of debt as their institutions improve. Thus, once debt levels and the country fixed effects are controlled for, an improvement in institutional quality is estimated to be associated with lower fiscal effort.

Columns 4-5 in Table 2 present estimates of the nonlinear fiscal reaction function, which allows for a "kinked" response to debt at 50 per cent of GDP, and a different response to the output gap depending on the latter's sign.[21] The specification takes the form:

$$p_{i,t} = \alpha_0 + \rho d_{i,t-1} + \bar{\rho} D_{i,t-1}\left(d_{i,t-1} - 50\right) + \gamma^p P_{i,t}\, ygap_{i,t} + \gamma^n N_{i,t}\, ygap_{i,t} + X_{i,t}\beta + \eta_i + \varepsilon_{i,t}$$

where $D_{i,t-1}$ is a dummy variable that equals one if debt in period $t-1$ exceeds 50 per cent of GDP, $P_{i,t}$ is a dummy variable that equals one if the output gap is positive (a boom), and $N_{i,t}$ is a dummy variable that equals one if the output gap is negative (a downturn).

The larger number of parameters and required instruments limits the choice of estimation methods.[22] In particular, SGMM is known to be unreliable when the total number of instruments becomes large relative to the number of cross-section units.

19 The size of the estimated coefficient on the default dummy is robust to dropping Argentina from the sample.

20 When we replace the country fixed effects with the time average of institutional quality as a time-invariant regressor for each country, it is estimated to have a positive coefficient.

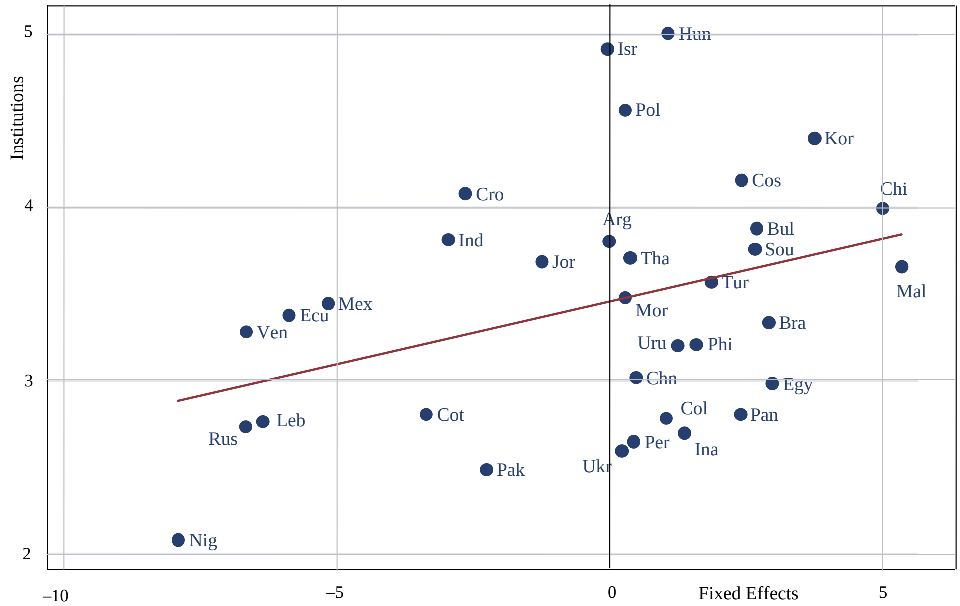
21 Previous work suggests a structural shift in the primary surplus equation when debt reaches 50 per cent of GDP and a different response of the surplus depending on the sign of the output gap (Abiad and Ostry, 2005).

22 Given the interaction terms in the specification, any instrument used for debt needs to be interacted with $D_{i,t-1}$ as an instrument for the splined term, and any instrument for the output gap needs to be interacted with $P_{i,t}$ and $N_{i,t}$ to serve as instruments for the positive and negative gap measures. Thus, the number of excluded instruments needed for the nonlinear specification is double that needed for the linear specification.

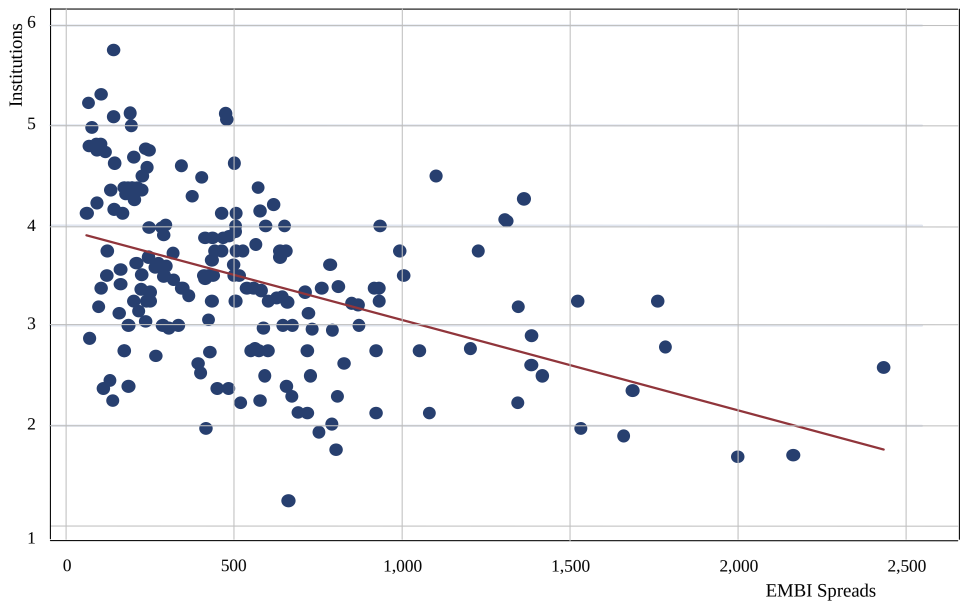
Figure 2

Institutional Quality, Primary Surplus Behavior and EMBI Spreads

Primary Surplus Fixed Effects and Institutions



EMBI Spreads and Institutions, 1994-2002



Thus, for this specification, we present two regressions: a LIML regression that excludes country dummies and uses instruments for lagged debt and the output gap,[23] and a GMM regression that includes country dummies and instruments only for the (negative and positive) gap terms.

Although the findings are less precise than those obtained for equation (1) (due to the lower degrees of freedom given the two extra parameters that are estimated), they qualitatively confirm the hypotheses that the fiscal response to debt is stronger when debt is below 50 per cent of GDP, and that the response to booms and recessions is asymmetric. Once debt exceeds 50 per cent of GDP, ρ declines to 0.01-0.03 – slightly lower than the response indicated by the linear specifications. Moreover, both regressions suggest that the worsening in primary balances during economic contractions exceeds the improvements attained during economic booms, qualitatively confirming the hypothesis proposed in discussing the linear specification.

For our baseline calibration exercise in the next section, we use the GMM-DV parameter estimates in Column 3. This regression provides us with estimated country fixed effects which are useful for gauging heterogeneity across countries, and we also note that the parameter estimates in column 3 are statistically more significant than those using other methods. As a robustness check, however, we also present simulations based on the SGMM method in Column 2, with a somewhat weaker response to debt accumulation. For simulations using the nonlinear specification, we use the GMM-DV estimates in Column 5.

3. Risks to debt sustainability in five emerging market economies

This section proposes various prospective and retrospective risk analyses of public debt in five emerging market economies with fairly different risk profiles: Argentina, Brazil, Mexico, South Africa, and Turkey. After a discussion of the calibration, we apply the simulation algorithm outlined in Section 1 to generate a sample of 1000 simulations from which we derive frequency distributions of public debt. We then discuss possible tools of analysis – fan charts and a probabilistic analysis of debt sustainability – under two possible "baseline scenarios." Finally, we examine the sensitivity of the risk analysis to variations in the underlying assumptions.

3.1 Calibrating the simulations

For a given country, all simulations assume the same joint distribution of

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[23] In the LIML estimation in column 4, the banking-crisis fiscal cost measure and its interaction with $D_{i,\,t-1}$ were used to instrument for lagged debt and splined debt. The interactions of the import demand measure with $P_{i,\,t}$ and $N_{i,\,t}$ were used as instruments for the gap measures, respectively. This equation was thus exactly identified.

disturbances and comovements among the variables.

The fiscal reaction function combines both standardized and country-specific features as follows – an upper "hat" designates parameter estimates obtained in Section 2 as well as the corresponding predictions:

$$\hat{p}_{i,t+\tau} = \Lambda_{i,t+\tau} + \hat{\rho} d_{i,t+\tau-1} + \hat{\gamma}\ ygap_{i,t+\tau} + \varphi_{i,t+\tau}, \text{ for } \tau = 1,...,5 \tag{3}$$

with $\Lambda_{i,t+\tau} = \hat{p}_{i,t} - \hat{\rho} d_{i,t-1} - \hat{\gamma}\ ygap_{i,t} + \kappa_{i,t+\tau}$, and $\varphi_{i,t+\tau}$, a policy shock drawn from a mean-zero normal distribution with variance equal to the country-specific variance of residuals.[24]

Equation (3) splits fiscal policy into an automatic, a pre-determined, and a random part. The automatic component follows the average response of the primary balance to the public debt and to the output gap, and is considered identical for all countries. The pre-determined part, summarized by $\Lambda_{i,t+\tau}$, captures the impact of all other determinants of the primary surplus, including institutional quality, the existence of an IMF-supported economic program, a default/restructuring option and, if relevant, the budgetary effect of oil-price fluctuations. By default, $\kappa_{i,t+\tau} = 0$ so that $\Lambda_{i,t+\tau}$ is a country-specific constant providing an anchor to simulated primary balance paths. We also allow for non-zero, time-varying values for $\kappa_{i,t+\tau}$ to account for specific information about future policy changes, such as those related to institutional reforms likely to affect fiscal performance, the adoption of an IMF-supported adjustment program, or alternatively, discretionary impulses envisaged in medium-term budget plans. The estimated reaction functions discussed in Section 2 may provide some guidance for the calibration of $\kappa_{i,t+\tau}$.

Although this paper emphasizes the usefulness of estimated fiscal reaction functions, the simulation framework is flexible enough to accommodate a range of policy behavior, including under normative scenarios (e.g. the constant primary surplus assumption or program targets). Where sufficiently long data series are available, parameters corresponding to country-specific estimates of the fiscal reaction function can also be used. Finally, it is worth noting that deterministic stress tests representing shocks ignored in the empirical model, such as the materialization of contingent liabilities, are straightforward to perform (see Debrun, 2005a).

3.2 Baseline scenarios

Our baseline scenarios only allow for automatic responses of the primary balance to real output shocks and public debt developments. One issue however is

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24 Recall that the fiscal disturbance is assumed to be orthogonal to economic developments.

that $\Lambda_{i,t+\tau}$ incorporates the residual of the reaction function in year t. The discrepancy between the predicted primary surplus and actual fiscal behavior may result from discretionary slippages or adjustment efforts. Depending on whether that deviation is expected to be permanent or temporary, two baseline scenarios can be envisaged.

In the first one (the "constant" policy scenario), any deviation from the predicted primary surplus in t is assumed to persist over the entire simulation horizon, as if the most recent stance signaled a sustained departure from past primary surplus behavior (in that case, $\kappa_{i,t+\tau} = 0$ over the entire simulation horizon). That scenario is reminiscent of the "constant policy scenario" commonly found in deterministic DSAs although our framework only freezes the (non-debt related) discretionary part of policy. Alternatively (the "predicted" policy scenario below), recent deviations from the predicted primary surplus may result from purely temporary factors, in which case it is more appropriate to assume that the simulated surplus paths follow those predicted by the reaction function (so that $\kappa_{i,t+\tau} = -\hat{\varepsilon}_{i,t}$ over the simulation horizon). In both cases, we calibrate surplus behavior using a fairly common specification of the reaction function – linear relationship with country fixed-effects – where only the output gap is instrumented (see Section 2). Simulations are performed for $t = 2004$ and $\tau = 5$, except for Argentina where we used $t = 2005$ to account for the debt exchange operation. In line with the DSA analysis presented in the latest staff country report (No 05/236), for Argentina we applied our framework to federal-level fiscal data rather than the more comprehensive data used for the other countries in the sample.

Fan charts summarize risks to debt dynamics by representing the frequency distribution of a large sample of debt paths generated by means of stochastic simulations (Figure 3). Different colors delineate deciles in the distributions of debt ratios, with the zone in dark grey representing a 20 per cent confidence interval around the median projection and the overall colored cone, a confidence interval of 80 per cent. A number of results flow from the charts.

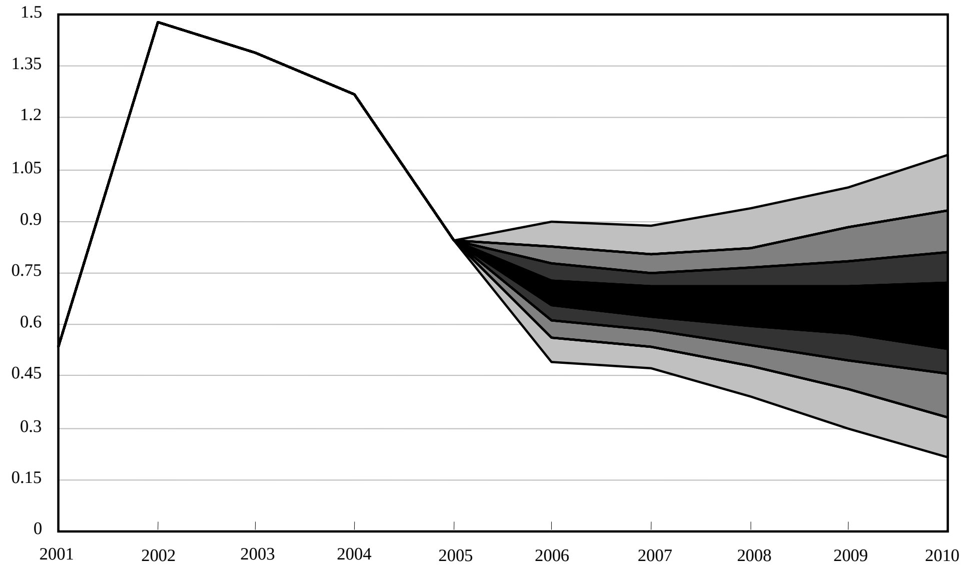
First, compared with the outcome of simple bound tests (reported in Figure 1 for the example of South Africa), it appears that these fall within the 40 per cent confidence interval only, confirming that deterministic bound tests very imperfectly account for the overall magnitude of risks to public debt sustainability. Fan charts provide a more comprehensive, and therefore reliable picture of the uncertainty surrounding public debt simulations.

Second, in the five countries under review, the fiscal reaction function generally appears sufficiently responsive to the public debt to ensure that the median debt path is sustainable (in the sense that the debt ratio is stable or declining over the simulation horizon). However, in most instances, the response proves too weak to prevent growing debt ratios in the two upper bands of the charts, representing the second and third deciles of the debt ratio. Hence, in those cases, there is at least a 30 per cent chance that combinations of adverse economic and policy shocks may lead

Figure 3

Fan Charts for Public Debt-to-GDP Ratios in Five Emerging Market Economies, 2005-09

Argentina: "Constant" Policy



Argentina: "Predicted" Policy

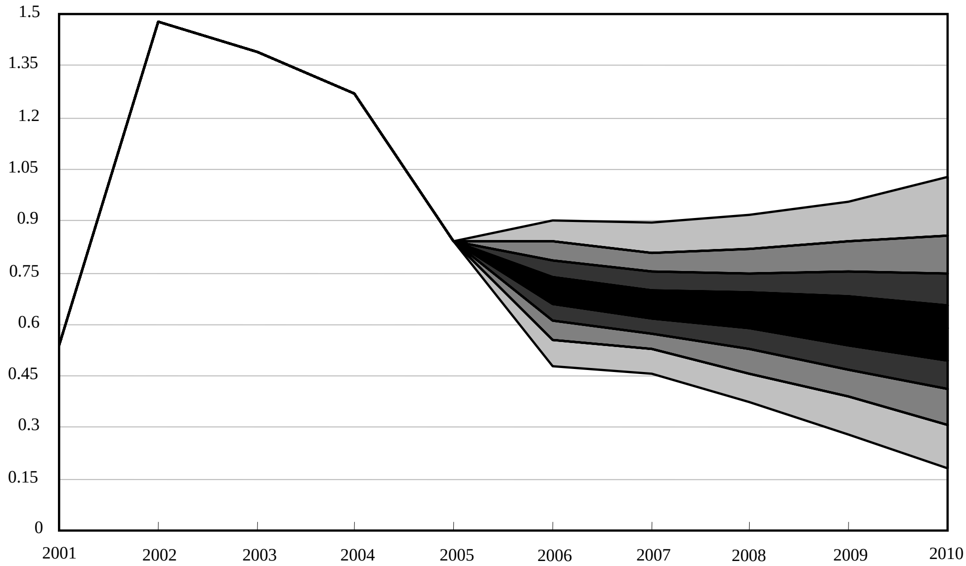
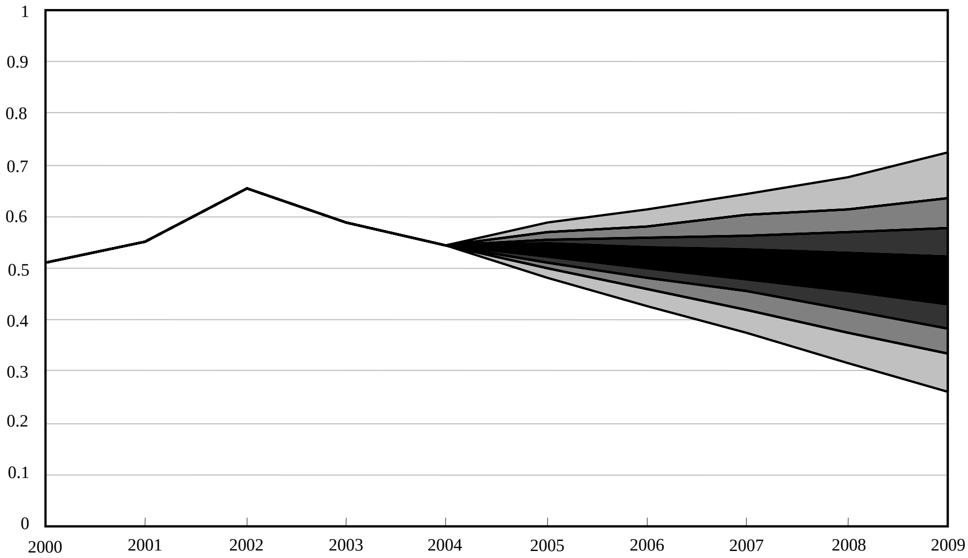


Figure 3 (continued)

Fan Charts for Public Debt-to-GDP Ratios in Five Emerging Market Economies, 2005-09

Brazil: "Constant" Policy



Brazil: "Predicted" Policy

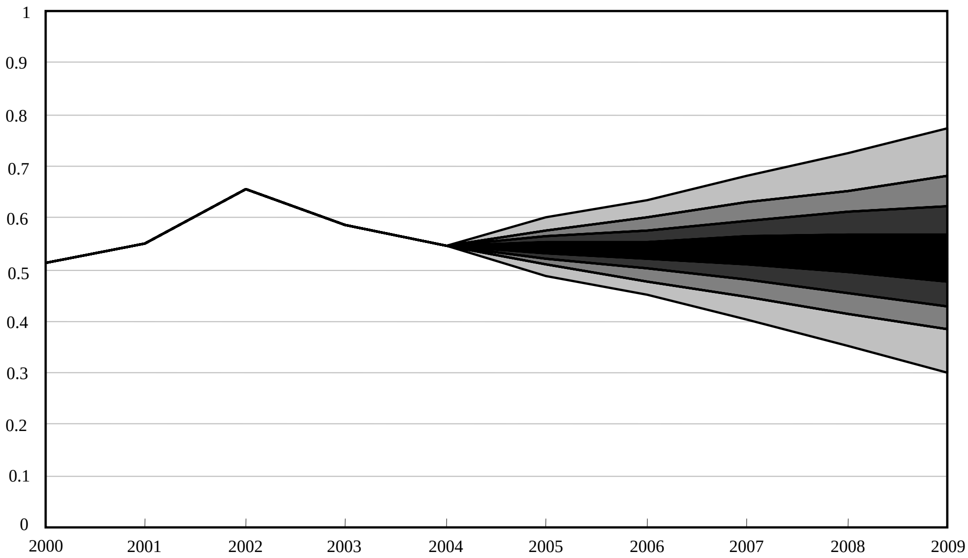
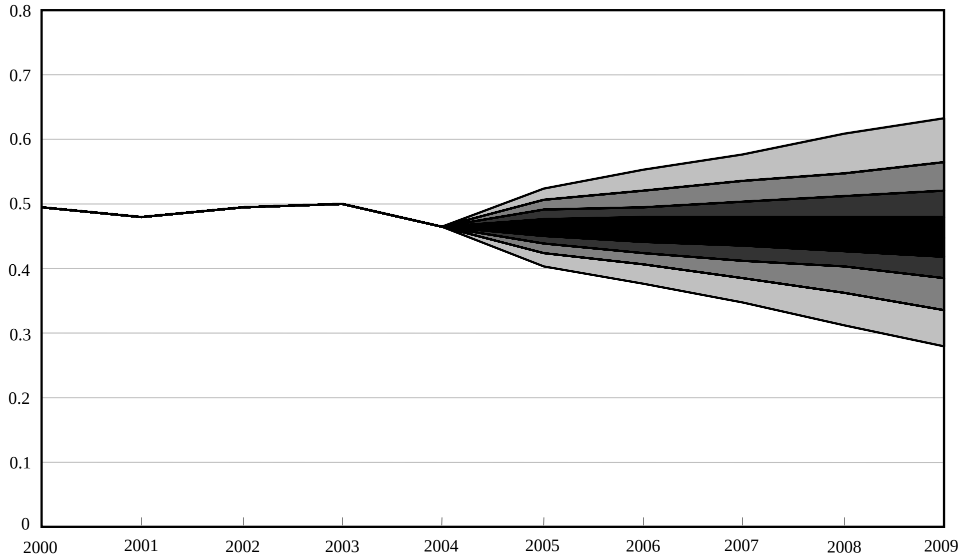


Figure 3 (continued)

Fan Charts for Public Debt-to-GDP Ratios in Five Emerging Market Economies, 2005-09

Mexico: "Constant" Policy



Mexico: "Predicted" Policy

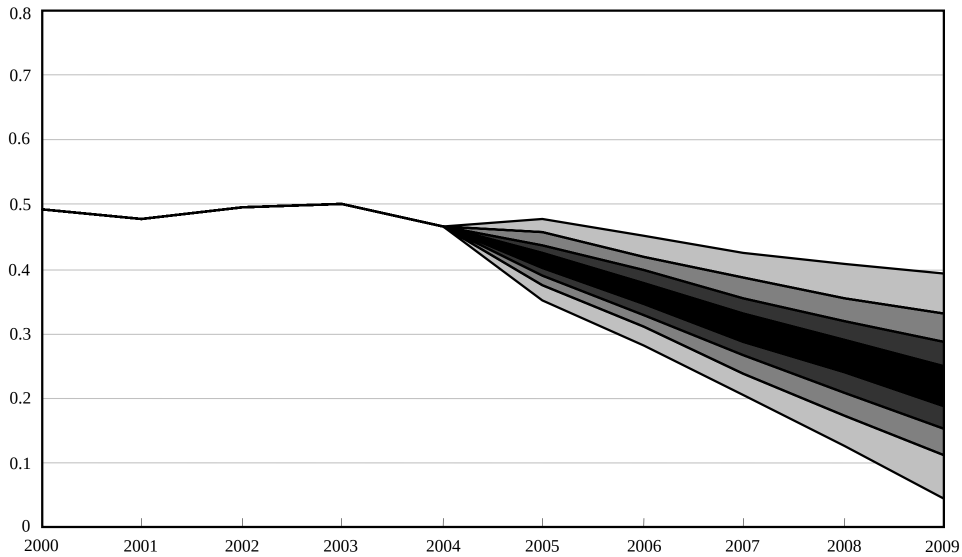
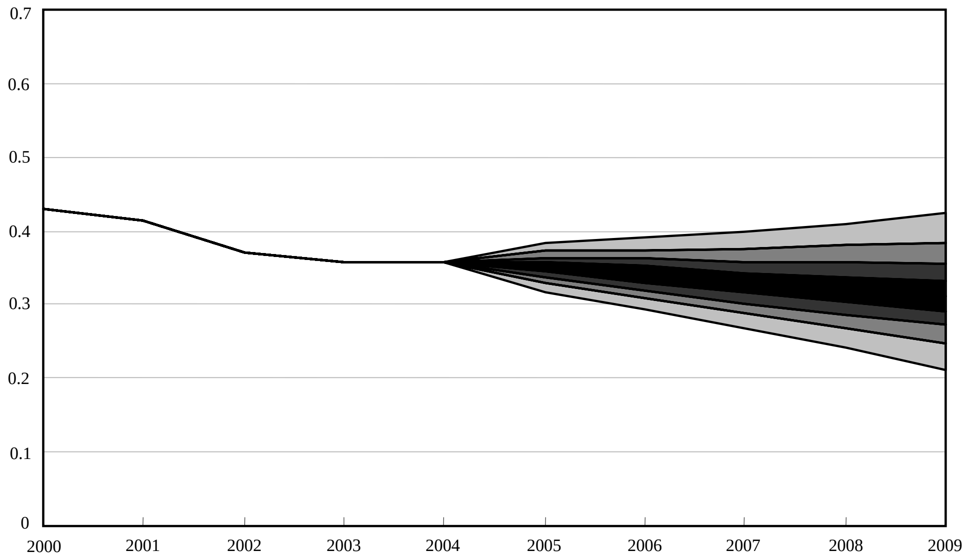


Figure 3 (continued)

Fan Charts for Public Debt-to-GDP Ratios in Five Emerging Market Economies, 2005-09

South Africa: "Constant" Policy



South Africa: "Predicted" Policy

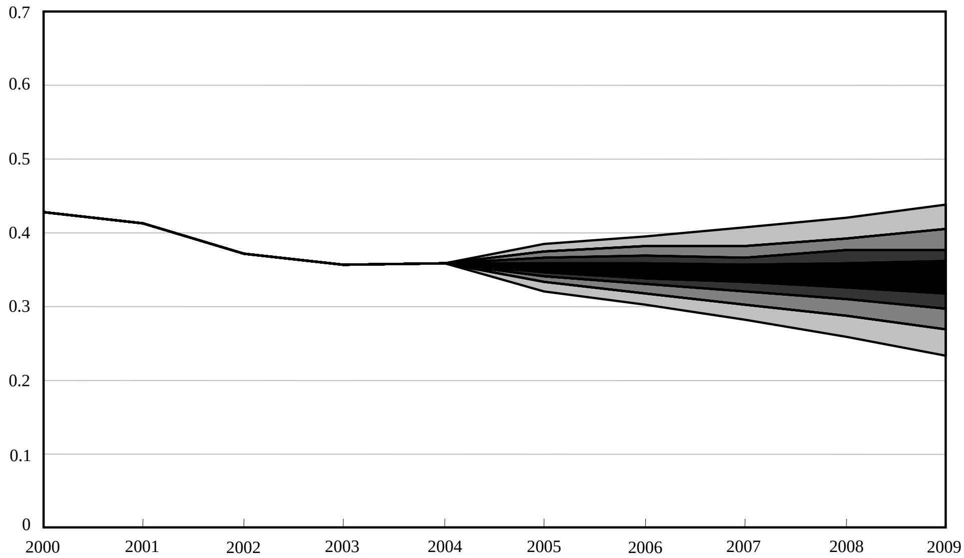
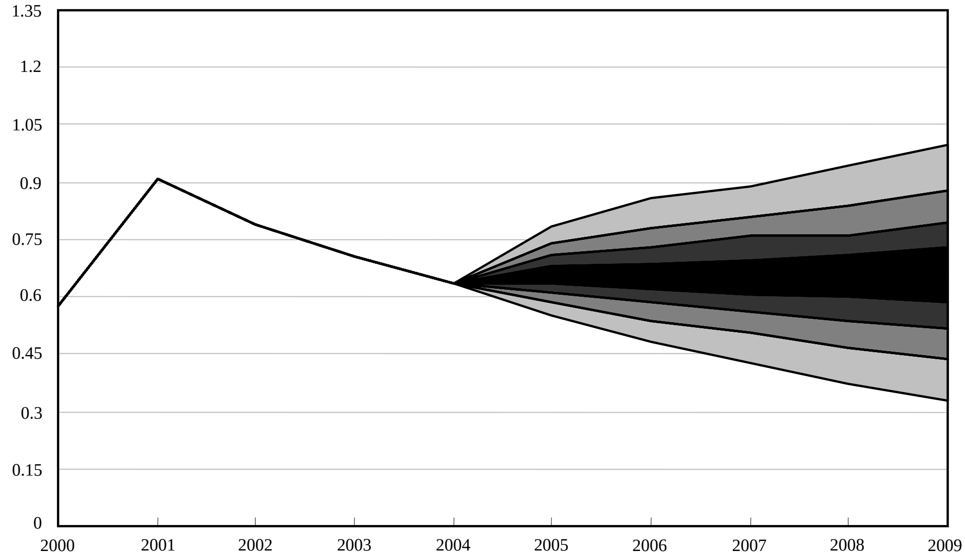


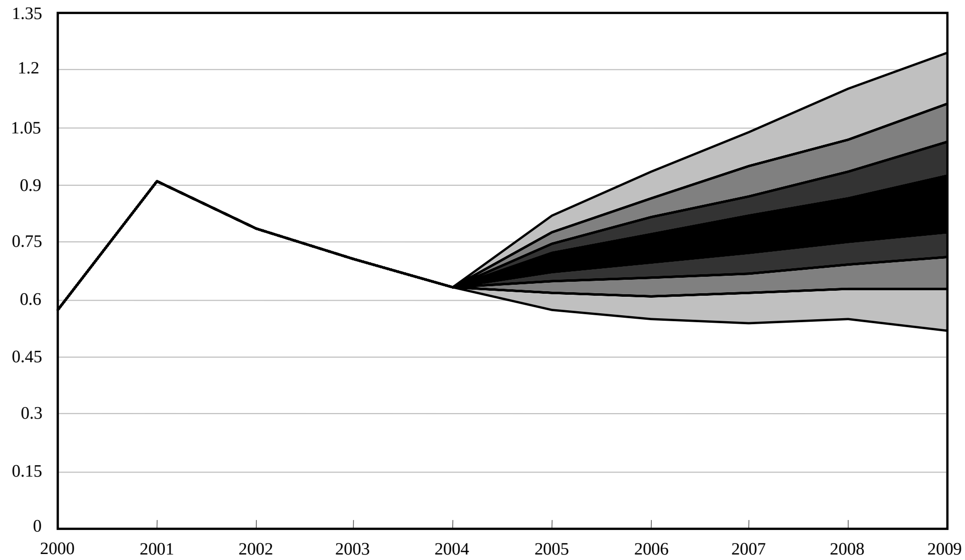
Figure 3 (continued)

Fan Charts for Public Debt-to-GDP Ratios in Five Emerging Market Economies, 2005-09

Turkey: "Constant" Policy



Turkey: "Predicted" Policy



to concerns over debt sustainability.[25]

Third, the overall risk profile obtained for the different countries reflects the intrinsic volatility of their respective economies, with less volatile economies – e.g., South Africa – exhibiting narrower confidence intervals than others. Incidentally, such cross-country differences cast further doubt on the merits of standardized bound tests. Of course, our assessment is contingent on the relatively short period of time over which the VARs are estimated. In particular, wide confidence intervals inevitably reflect past crises, and may thus overestimate the true magnitude of risks. This is especially evident in the simulations for Argentina and Turkey.

Fourth, the fan charts for Mexico and Turkey illustrate the issue of large residuals in the last year of observation. In Mexico's case, a highly negative residual (close to 5 per cent of GDP) was observed in 2004, reflecting the lesser sensitivity of Mexico's primary balance to oil prices in comparison to other oil producers in our panel. The very large increase in real oil prices in 2004 thus showed up in the residual. A more detailed analysis of Mexico could usefully discuss alternative scenarios, including a reaction function excluding oil prices as a determinant of the primary balance. In Turkey, large positive residuals were observed in 2003 and 2004, reflecting significant fiscal adjustment efforts (Debrun, 2005b). Here, the charts clearly show that sustaining those high-primary surpluses (as reflected in the "constant" policy scenario) is key to containing the risks to debt sustainability.

Finally, fan charts give a good sense of the symmetry of the risks to debt. In Argentina and Turkey for instance, the distribution of debt ratios is skewed towards the upside. As the joint distribution of simulated shocks is symmetric, this outcome indicates that the standard response of the primary balance to debt proves insufficiently stabilizing in these cases. Hence, given the shock configurations typically observed in these countries, a more aggressive response of the surplus to debt increases than in the "average" emerging market country would seem warranted to contain upside risks to debt dynamics.

3.3 Sustainability assessments

So far, the value added in our approach has been to produce probability distributions of debt at different horizons, rather than a deterministic path for debt.[26] But what is the policymaker to make of all these distributions? Presumably, while recognizing that there is more information in being able to say "There is a 30 per cent chance that debt will be below a given ratio to GDP in three years' time, and a

[25] Recall, as previously mentioned, that the simulations use the steady state values of growth and interest rates from the VAR, which may differ – in some cases substantially – from those used in the deterministic DSAs undertaken by country desks.

[26] Although not undertaken as an explicit exercise in this paper (but see Abiad and Ostry, 2005), the approach can also be used to assess how the distribution of debt shifts in response to changes in policy fundamentals that are captured in the estimated reaction function (such as institutional reform, an IMF-supported program, etc.).

20 per cent chance that it will be above another threshold over the same horizon" than in simply asserting "Under present policies, the debt ratio will decline over time or rise over time", the policymaker is ultimately likely to be interested in whether the country's debt profile/distribution is a problem or not.

At the most basic level, the prospect of a downward trend in the debt ratio in a deterministic setup corresponds to the probability that the debt ratio falls below its initial value in our stochastic setting. How large this probability is – 10 per cent, 50 per cent, 90 per cent – which can be read off the fan charts, is clearly more informative than what is available to the policymaker from a deterministic exercise. But the policymaker may be interested in more than simply an assessment of whether debt is likely to decline or not, particularly if he/she is very concerned about the possibility that the debt ratio could rise (*i.e.*, is very averse to upside risk).

Clearly, two countries with the same probability of a declining debt ratio may face quite different upside risks for debt, and those upside risks also matter to assess vulnerability. In Table 3, we thus report two particular probabilities a policymaker may be interested in: the probability that the debt ratio declines and the probability that debt rises by more than 10 per cent of GDP. Of course, the choice of specific thresholds ultimately depends on highly country-specific factors, such as the extent of policymakers' risk aversion, the initial debt position, and the existence of liquidity constraints.

Probabilities underscore vulnerability particularly in the case of Turkey, which stems from a relatively low probability of seeing debt decline relative to GDP, and the upside risks to debt driven by the shocks – notably to domestic real interest rates and the exchange rate – identified through the VAR. Mitigating this vulnerability requires, as shown by a comparison of the constant policy and predicted policy fan charts, persisting with Turkey's strong fiscal effort of recent years.

Probabilities of specific debt outcomes can prove especially useful for policymakers if they convey a credible signal that fiscal policy needs to be changed in order to reduce the likelihood of adverse outcomes to acceptable levels. A reasonable test of our approach to sustainability is thus whether it gives appropriate warnings of trouble on the eve of a crisis. Given data constraints, we investigate this issue – namely the track record of our probabilistic sustainability analysis – in three "eve-of-crisis" cases: Argentina and Brazil at end-2000; and Turkey at end-1999, using only information available to policymakers at the time.[27] As a control, we also introduce a retrospective analysis of South Africa (at end-2000) to check whether our model would have properly differentiated the risks faced by these countries. The fan charts in Figure 4 point to clear upside risks in all three "crisis" countries, with Argentina looking particularly vulnerable to explosive debt outcomes.

[27] The dating of crises is problematic for Brazil and Turkey, since neither country defaulted. While it is straightforward to extend the exercise to other dates, the dates chosen correspond to instances where sovereign spreads rose to very high levels (above, say, 1,000 basis points) at some point during the following year.

Table 3

Probabilistic Debt Sustainability Assessment
("constant" policy scenario)

	t+1	*t*+2	*t*+3	*t*+4	*t*+5
Debt Ratio Lower than in *t*					
Argentina (*t* = 2005)	0.83	0.85	0.82	0.76	0.73
Brazil (*t* = 2004)	0.59	0.63	0.64	0.63	0.64
Mexico (*t* = 2004)	0.51	0.54	0.53	0.55	0.56
South Africa (*t* = 2004)	0.60	0.64	0.69	0.70	0.71
Turkey (*t* = 2004)	0.40	0.45	0.46	0.47	0.47
Debt Ratio More than 10 per cent of GDP Higher than in *t*					
Argentina (*t* = 2005)	0.06	0.06	0.10	0.15	0.20
Brazil (*t* = 2004)	0.00	0.05	0.10	0.15	0.19
Mexico (*t* = 2004)	0.03	0.08	0.11	0.16	0.20
South Africa (*t* = 2004)	0.00	0.00	0.00	0.03	0.04
Turkey (*t* = 2004)	0.21	0.28	0.34	0.35	0.38

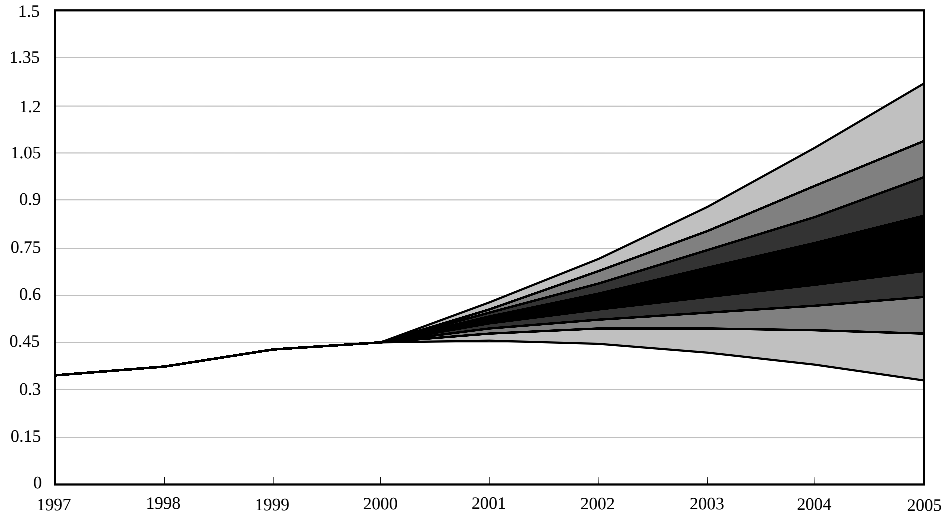
Turkey's public debt dynamics also looked unmanageable under most circumstances, while Brazil's situation appeared broadly under control albeit with significant upside risks. This indicates that the endogenous debt-stabilizing response typically observed in emerging market economies was insufficient to prevent explosive debt dynamics, calling for significant fiscal adjustment efforts in Argentina and Turkey, and prudent fiscal management in Brazil. In contrast, our model nicely predicts the declining debt path that was effectively observed in South Africa.

This impression is reflected in the probabilistic analysis (Table 4), which shows high upside risks for Argentina and Turkey over the simulation horizon. The situation in Brazil at end-2000 looked less alarming than that in Argentina and Turkey, although rising upside risks over the simulation horizon signaled a deteriorating sustainability outlook. In sum, the probabilistic sustainability assessment would have been very negative for Argentina and Turkey in 2000 and 1999, respectively, and negative in the case of Brazil in 2000, providing a signal of

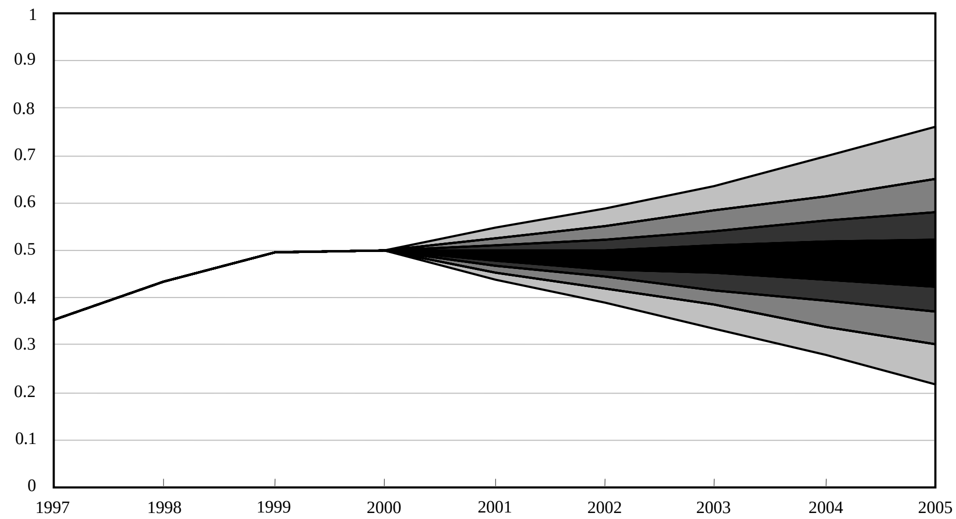
Figure 4

Fan Charts on the Eve of Troubled Times
("constant" policy scenarios)

Argentina at end-2000*



Brazil at end-2000

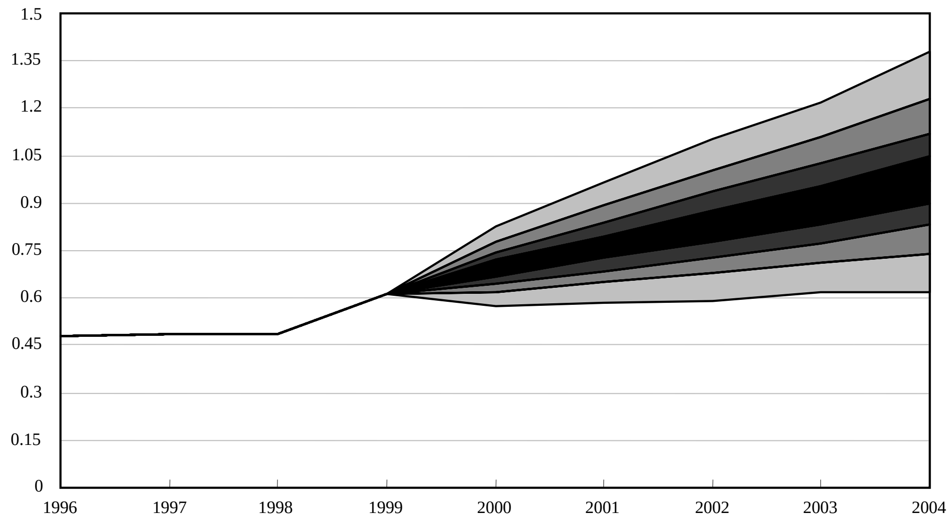


* This considers the "U.S. junk bond" rate as the relevant foreign interest rate. Other specifications of the VAR proved unstable.

Figure 4 (continued)

Fan Charts on the Eve of Troubled Times
("constant" policy scenarios)

Turkey at end-1999



South Africa at end-2000

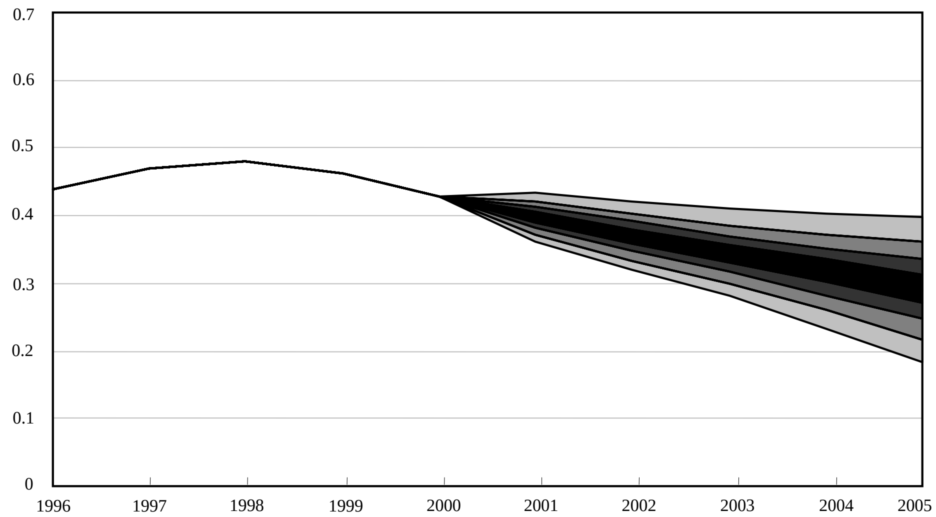


Table 4

Probabilistic Debt Sustainability Assessment:
Looking Back at the Eve of Troubled Times
("constant" policy scenario)

	2000	2001	2002	2003	2004	2005
Debt Ratio Lower than in 2000 (1999 for Turkey)						
Argentina	n.a.	0.07	0.11	0.13	0.17	0.18
Brazil	n.a.	0.71	0.66	0.61	0.59	0.58
South Africa	n.a.	0.87	0.93	0.96	0.95	0.95
Turkey	0.18	0.14	0.12	0.09	0.10	n.a
Debt Ratio more than 10 per cent of GDP Higher than in 2000 (1999 for Turkey)						
Argentina	n.a.	0.24	0.60	0.68	0.72	0.75
Brazil	n.a.	0.01	0.06	0.14	0.20	0.25
South Africa	n.a.	0.00	0.00	0.00	0.00	0.00
Turkey	0.19	0.64	0.73	0.80	0.83	n.a

impending troubles.[28] In contrast, the sustainability outlook for South Africa would have been bright.

3.4 *Alternative calibrations and policy scenarios*

The outcome of simulation exercises is potentially sensitive to initial assumptions. The impact of plausible variations in our baseline assumptions on the sustainability analysis thus needs to be assessed. For the sake of brevity, we only show and discuss the results for Argentina, Brazil and Turkey.

First, we consider the impact of a change in the specification of the fiscal reaction function along the lines suggested in Section 2. In particular, we use parameters stemming from the system-GMM estimates of the linear reaction function (to account for a possible upward bias in the estimated responsiveness of the primary surplus to the debt). We also envisage a nonlinear reaction function,

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[28] As already mentioned, it would be worth repeating the exercise for Brazil for 1998 and 2001, which are arguably more plausible dates ahead of crises the following years.

including a debt spline and differentiated responses to the output gap depending on the sign of the latter.

Those changes in the policy reaction function do not materially affect the risk analysis (see Figure 5). In a sense, this should not be too surprising since all parameter estimates are based on the same information concerning fiscal behavior. Specifically, the weaker responsiveness to the public debt associated with system-GMM estimates is compensated by a higher pre-determined component of fiscal policy ($\Lambda_{i,t+\tau}$).

The apparent robustness of the risk analysis to different specifications of the fiscal reaction function immediately raises the question of the importance of accounting for policy endogeneity in this type of analysis. We therefore produced a set of simulations under the assumption of deterministic paths for the primary surpluses (using publicly available data from IMF staff reports). The corresponding fan charts reported in Figure 6 indicate that a deterministic path for the primary surplus can substantially reduce the overall perception of risk. This is due to the fact that the deterministic assumption ignores the fiscal response to output gap variations as well as the volatility in the fiscal policy process itself. Although the deterministic assumption also overlooks the *stabilizing* response of the primary balance to debt, primary balance variations related to output gap and fiscal shocks appear to dominate. Overall, the deterministic policy assumption leads one to underestimate the risks to public debt sustainability.

Although the reaction function plays an important role in the analysis, the overall risk profile of public debt is essentially shaped by the statistical properties of economic shocks as identified by the VAR. This makes the method particularly sensitive to the choice of data entering the VAR.[29] While the selection of statistical series for GDP and the real exchange rate is relatively uncontroversial, choosing the relevant interest rates raises important questions, notably because actual interest payments do not respond one-for-one to market interest rates. To illustrate that sensitivity, we performed simulations using the U.S. junk bond rate (instead of the 10-year treasury bond) as the relevant foreign interest rate. Although the latter still ignores country-specific shocks to risk premia, it provides a reasonable approximation of changes in market sentiment regarding high-risk borrowers. Unsurprisingly, fan charts reveal much wider confidence intervals (Figure 6), confirming vulnerability to higher and more volatile interest rates.

3.5 *Implications of the analysis*

The analysis in this section has shown that our simulation algorithm could be easily applied to various emerging market economies in order to help develop a "risk-management" approach to public debt sustainability (Garcia and Rigobon,

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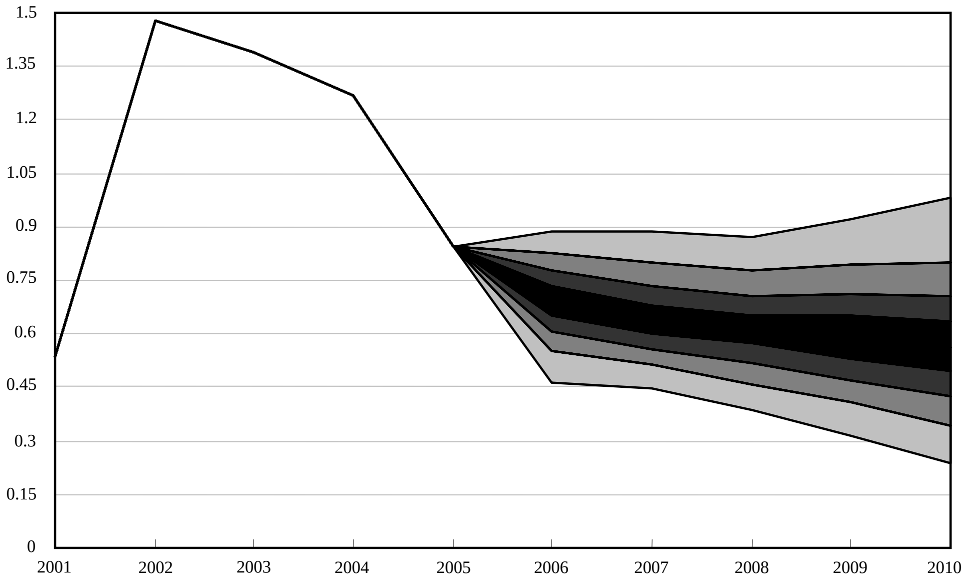
29 Data availability also dictates the use of only one lag in the VAR.

Figure 5

Fan Charts for Public Debt-to-GDP Ratios in Argentina, Brazil and Turkey Based on Alternative Specifications of the Reaction Function

Argentina: System-GMM Estimates of the Linear Specification



Argentina: Non-linear Reaction Function

(debt spline and differentiated response to negative and positive output gaps)

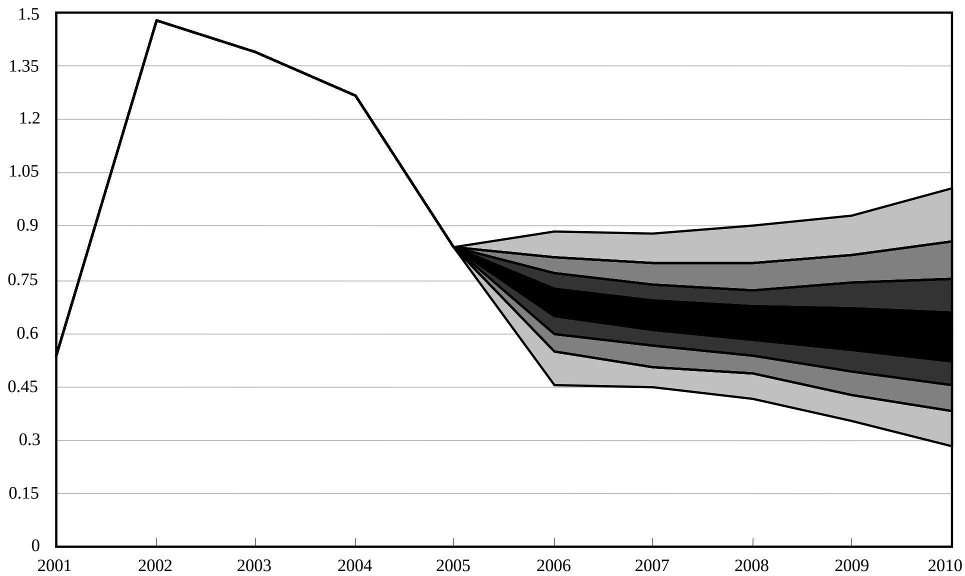
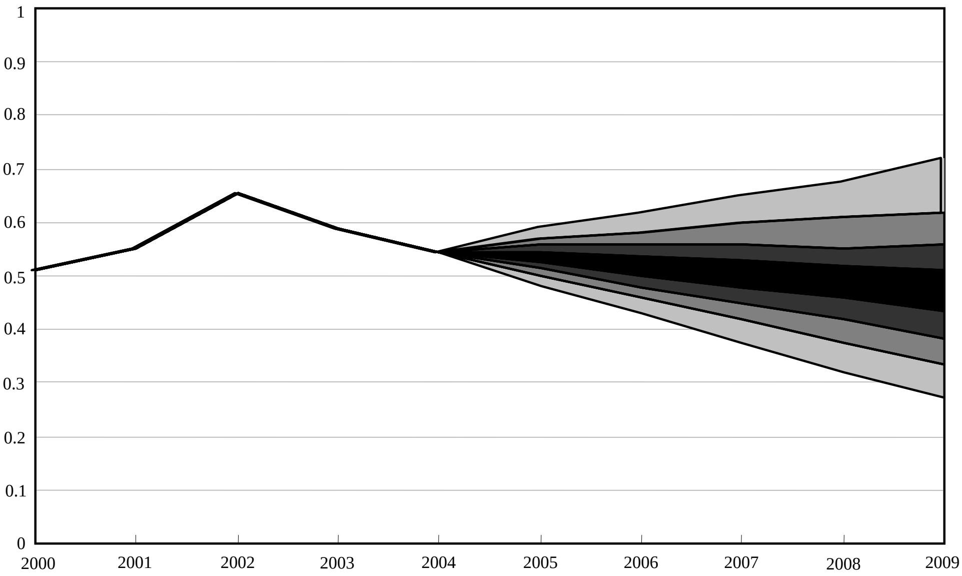


Figure 5 (continued)

Fan Charts for Public Debt-to-GDP Ratios in Argentina, Brazil and Turkey Based on Alternative Specifications of the Reaction Function

Brazil: System-GMM Estimates of the Linear Specification



Brazil: Non-linear Reaction Function

(debt spline and differentiated response to negative and positive output gaps)

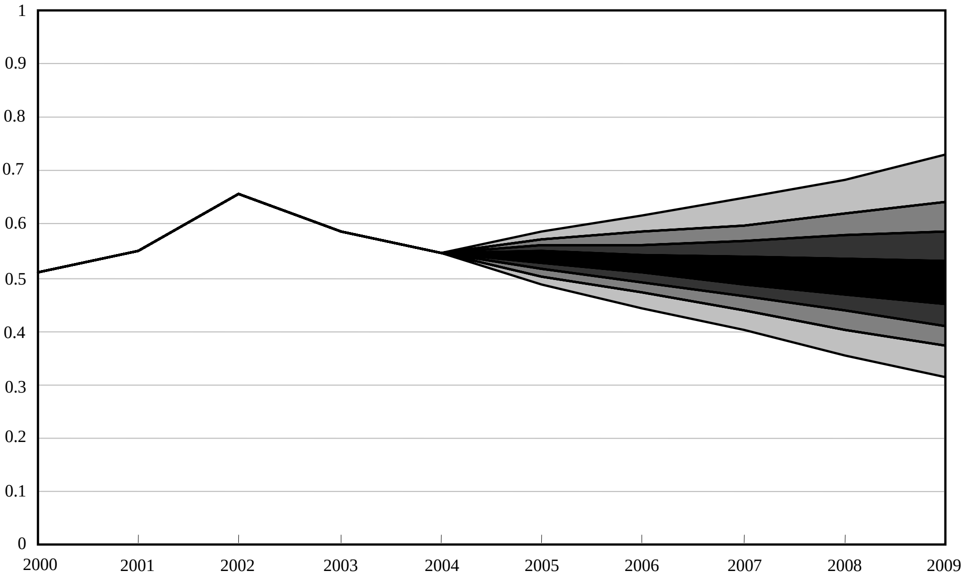
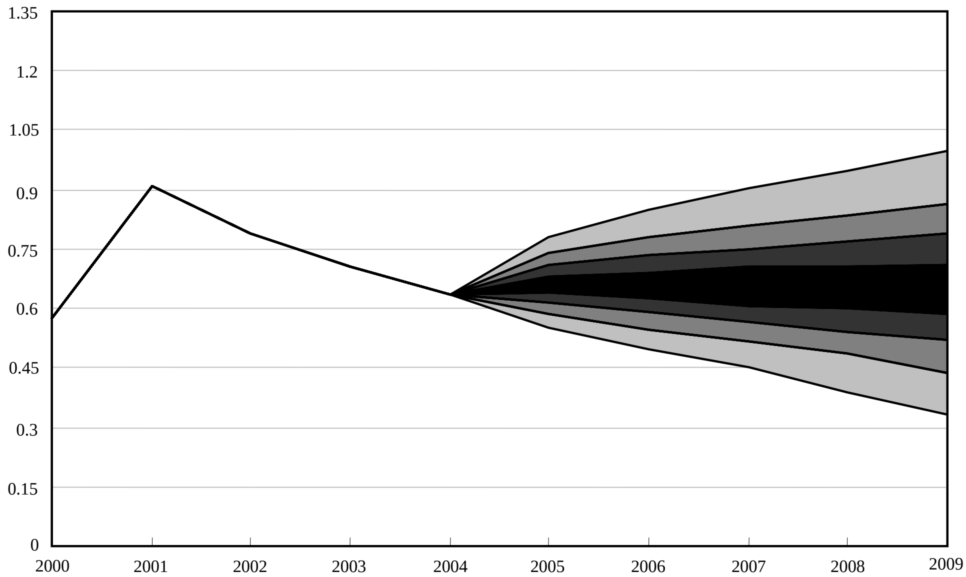


Figure 5 (continued)

Fan Charts for Public Debt-to-GDP Ratios in Argentina, Brazil and Turkey Based on Alternative Specifications of the Reaction Function

Turkey: System-GMM Estimates of the Linear Specification



Turkey: Non-linear Reaction Function

(debt spline and differentiated response to negative and positive output gaps)

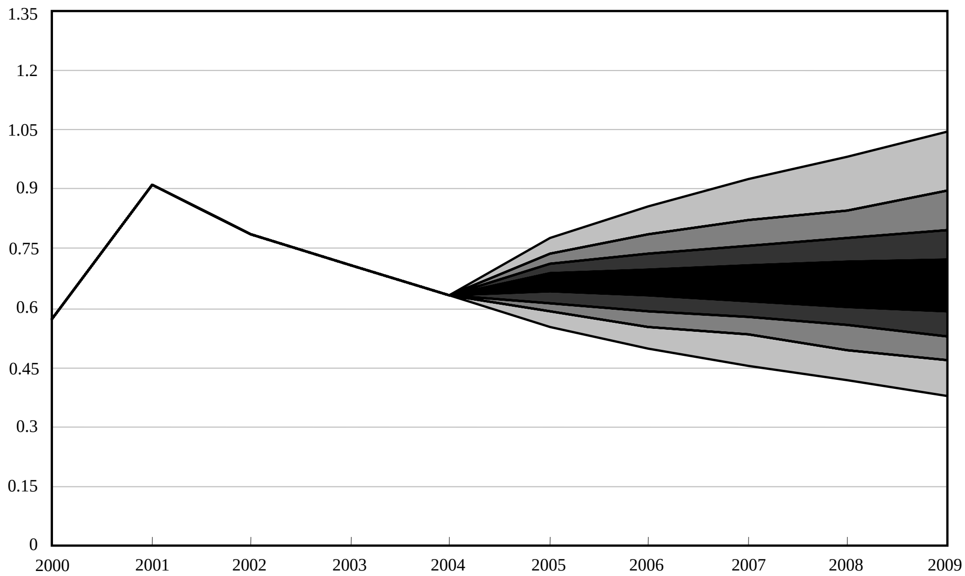
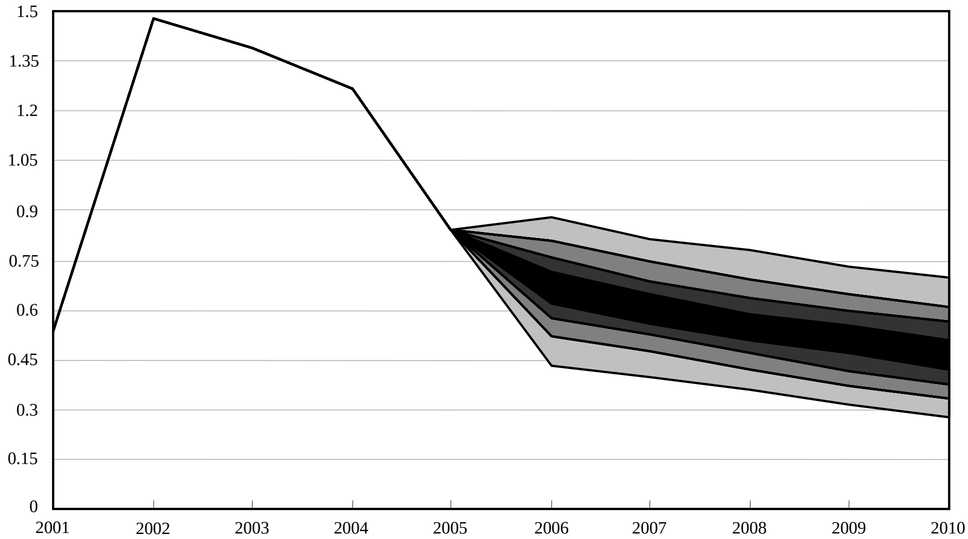


Figure 6

Fan Charts for Public Debt-to-GDP Ratios in Argentina, Brazil and Turkey (Alternative Scenarios – 2005-09)

Argentina: Deterministic Policy
(from IMF staff reports)



Argentina: Using U.S. Junk Bonds Interest Rates

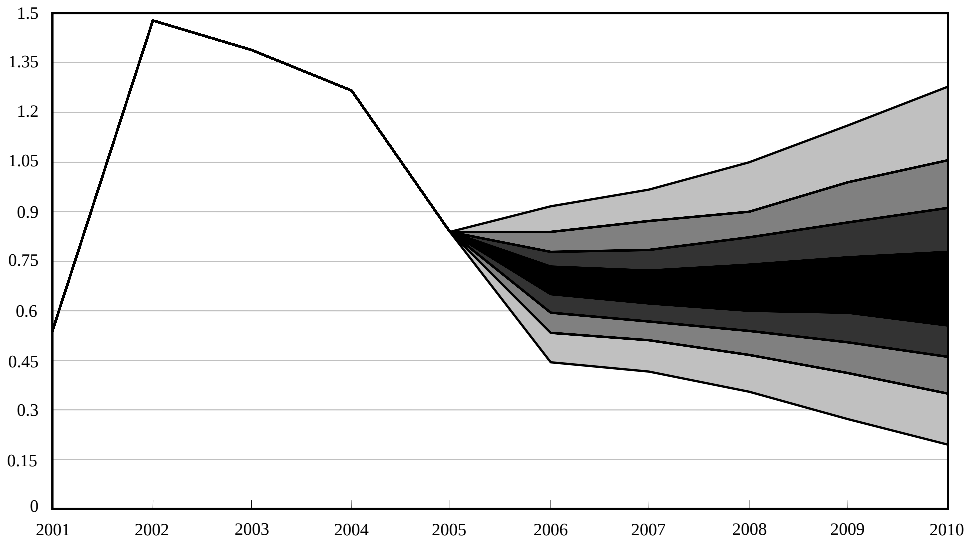
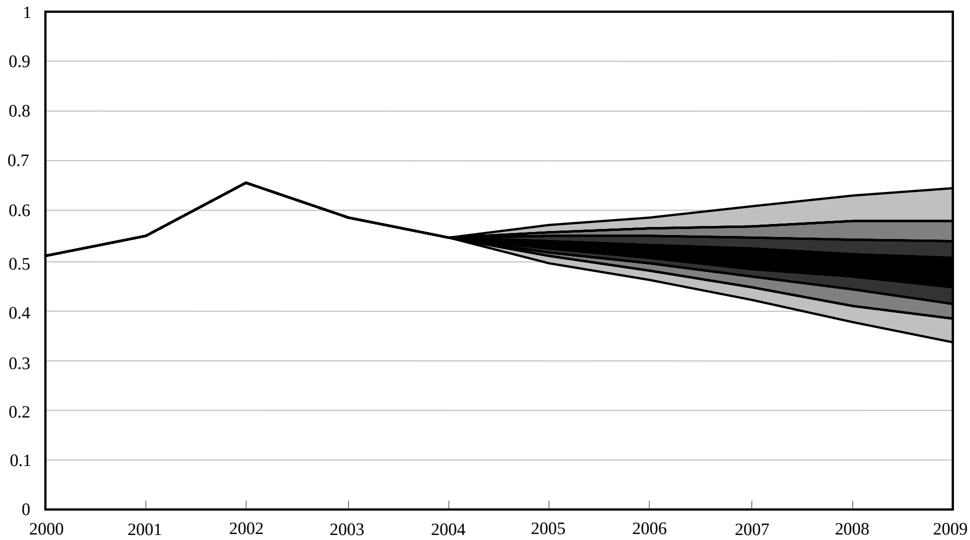


Figure 6 (continued)

Fan Charts for Public Debt-to-GDP Ratios in Argentina, Brazil and Turkey (Alternative Scenarios – 2005-09)

Brazil: Deterministic Policy
(from IMF staff reports)



Brazil: Using U.S. Junk Bonds Interest Rates

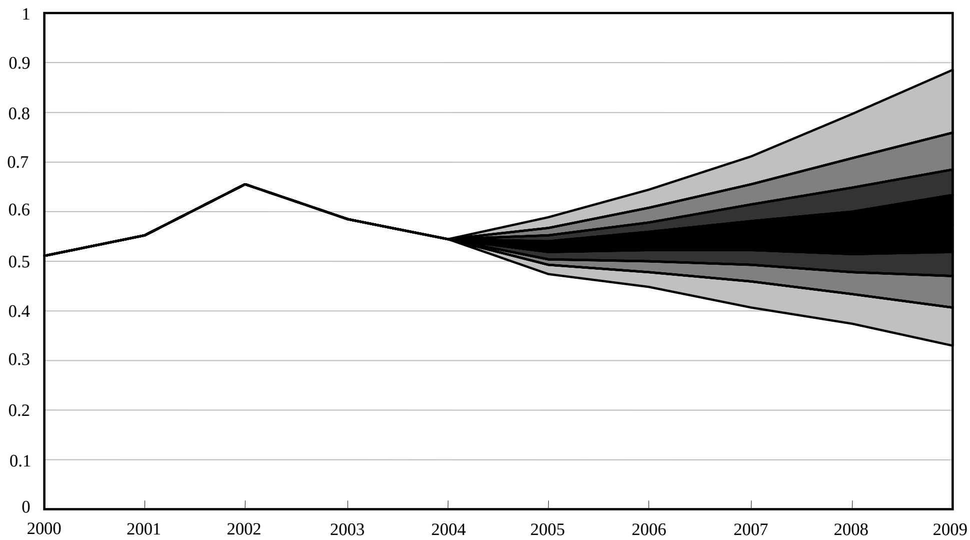
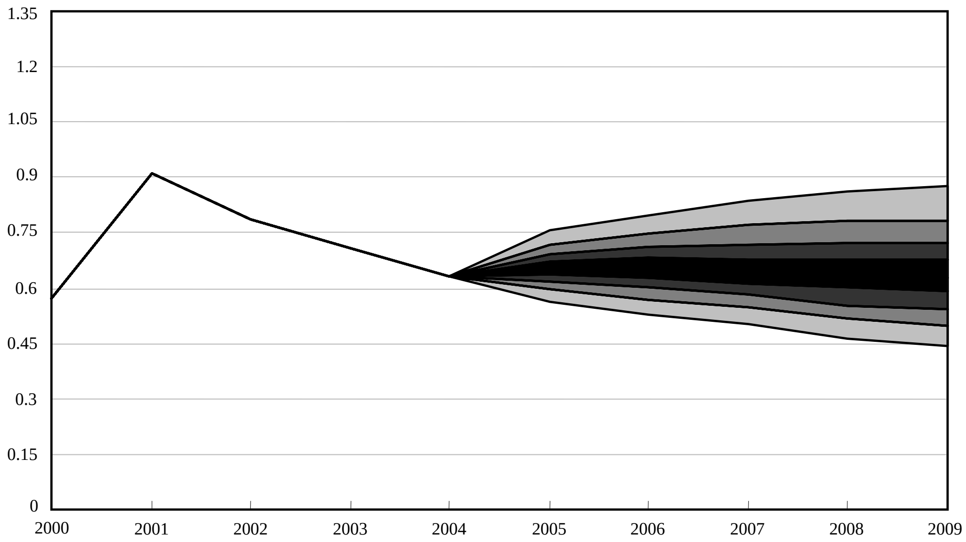


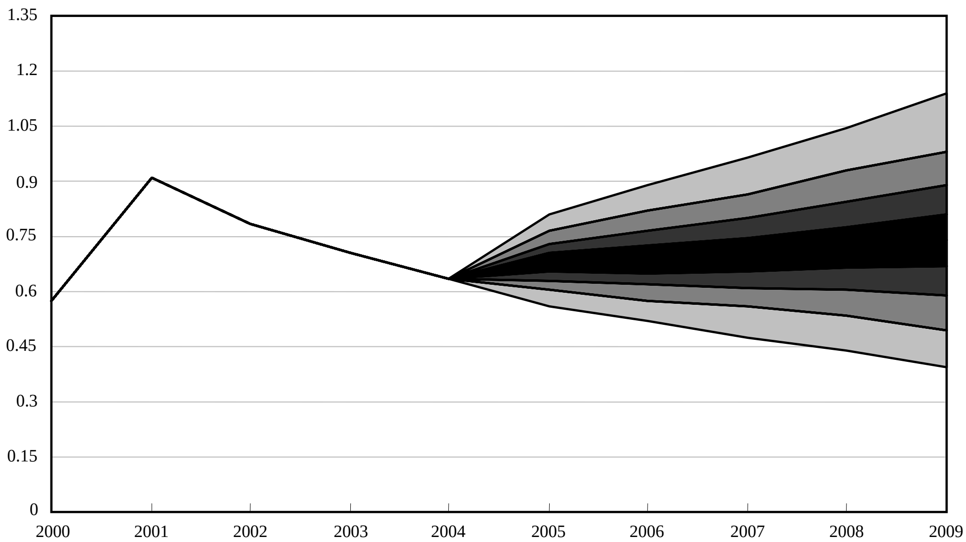
Figure 6 (continued)

Fan Charts for Public Debt-to-GDP Ratios in Argentina, Brazil and Turkey (Alternative Scenarios – 2005-09)

Turkey: Deterministic Policy
(from IMF staff reports)



Turkey: Using U.S. Junk Bonds Interest Rates



2005). The central idea was to provide policymakers with graphical illustrations (in the form of fan charts) that summarize the distribution of public debt, as well as explicit probabilities of “desirable” or “undesirable” debt developments.

The algorithm we proposed was also used to generate fan charts and probabilistic assessments on the eve of crises in order to check whether our approach would have provided credible early warning to policymakers. Both the fan charts and the probabilistic analysis would have led to issue serious warnings on the eve of crises. The analysis also illustrates the extent to which fiscal policy – summarized in the estimated fiscal reaction function – provides adequate insurance to stabilize the debt ratio in the face of shocks (on the eve of the above crises, it clearly did not). The algorithm is also flexible enough to study alternative policy scenarios, and assess their implications for risks to debt dynamics.Sensitivity analysis showed that the method was robust to various specifications and estimation methods of the fiscal reaction function. We also showed that assuming a deterministic path for the primary balance – besides being highly unrealistic under changing economic conditions – led one to significantly underestimate risks to debt dynamics by ignoring the effect of the business cycle on the primary balance and the volatility of fiscal policy itself. For these reasons in our view, the probabilistic approach to debt sustainability represents a significant improvement over bound tests used in deterministic DSAs.

4. Conclusion and future research

This paper has developed an algorithm for generating an explicit risk analysis of debt dynamics, and applied it to five emerging market economies. The method builds on the standard approach to debt sustainability used at the IMF and elsewhere by accounting for country-specific risk factors regarding the economy and the fiscal policy process. Overall, we obtain a more complete, objective, and realistic assessment of risks than is possible with nonstochastic DSA templates, which rely on a few deterministic and standardized bound tests.

Our approach improves debt sustainability assessments in three critical dimensions. First, it uses estimates of joint probability distributions of economic shocks to construct a large number of scenarios that capture covariances among disturbances as well as the dynamic response of the economy. Second, it allows for fiscal policy to adjust to these shocks (to debt and growth, for example) according to the pattern commonly observed in emerging market economies, as given by our estimated fiscal reaction functions; the latter also appropriately shift the focus of policy analysis from adjustments in the nominal primary balance to measures of fiscal effort (defined as the difference between the predicted and actual or projected surplus). Third, we allow for fiscal policy itself to be a source of risk.

The debt sustainability assessment proposed here is explicitly probabilistic and can prove useful for policymakers in a variety of ways. First, the method offers a flexible tool allowing policymakers to capture country-specific features relevant for debt dynamics, and to have clearer signals of the risks involved in delaying fiscal adjustment or undertaking fiscal expansions. Second, more complete information on the debt risk profile should in turn improve medium-term fiscal planning. Indeed, one would expect greater awareness of the risks to public debt to promote caution in the conduct of fiscal policy. For instance, this could imply less reliance on debt to finance new expenditure programs, thereby reducing the likelihood that the dynamics spin out of control due to the realization of macroeconomic risks such as lower growth, or higher interest rates. Also, an explicit quantification of risks could help in the design of consolidation strategies, as governments could evaluate the merits of alternative adjustment plans not only in terms of their impact on future trends of debt, but also on the upside risks to the debt path itself. More generally, governments with low credibility and operating in a volatile environment could better internalize the costs of policies implying higher debt ratios, while governments with greater credibility and facing a more stable environment could avoid taking excessive comfort in a benign baseline outlook.

Applications to five emerging market economies with different risk profiles illustrate the merits of our approach. In particular, we show how the fan charts and probabilistic analysis can be used to guide policymakers in making judgments about whether the present course of fiscal policy will, or will not, lead to problems (a crisis) down the road. As important, the estimated fiscal reaction functions – which connect fiscal behavior to various economic and institutional fundamentals – should also be of use in guiding policymakers on how to forestall problems by pursuing reforms that will shift the distribution of public debt paths that the economy faces. On both scores, the approach advocated here yields significant value added relative to deterministic approaches that are still widely used to assess debt sustainability issues in emerging market countries.

The analysis presented here nevertheless remains exposed to two significant drawbacks that we would like to address in future research. This first is that simulations based on econometric estimates lead one to assume that history is bound to repeat itself. By doing so, we may overestimate risks in countries that have experienced troubles or crises during our estimation period because the variance/covariance matrix may still be heavily influenced by these extreme events. On the other hand, by assuming that future shocks are normally distributed, our fan charts may underestimate the likelihood of extreme events if "fat tails" are persistent features in these countries. The second drawback is that the approach focuses on the uncertainty arising from our models' residuals; it ignores the uncertainty present in the model's parameters.

APPENDIX
DATA SOURCES AND DESCRIPTIONS

The dataset covers the following countries: Argentina, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Côte d'Ivoire, Croatia, Ecuador, Egypt, Hungary, India, Indonesia, Israel, Jordan, Korea, Lebanon, Malaysia, Mexico, Morocco, Nigeria, Pakistan, Panama, Peru, the Philippines, Poland, Russia, South Africa, Thailand, Turkey, Ukraine, Uruguay, and Venezuela. Data descriptions and sources are listed below.

Primary fiscal surpluses and public debt: Data provided by IMF desk and fiscal economists for the most comprehensive coverage of the fiscal sector available (percent of GDP).

Output gap: The percent deviation of real GDP from its Hodrick-Prescott filtered trend. Real GDP series were obtained from the IMF's *International Financial Statistics* or the *World Economic Outlook* databases.

Institutional quality: Defined as the average of five indicators on the level of corruption, bureaucratic quality, democratic accountability, rule of law, and government stability from the *International Country Risk Guide*. The index takes values between the range of 0-6, with a higher value designating a higher level of institutional quality.

IMF program: An indicator variable that takes on a value of one if the country is participating in an IMF-supported program and zero otherwise. Source: IMF Survey, various issues.

Default Indicator: An indicator variable that equals one if the government is not current on any debt payments. Source: IMF desk economists.

Fiscal Costs of Banking Crises: The fiscal cost, in percent of GDP, of systemic banking crises. Source: Honohan, Klingebiel, Laeven, and Noguera (2005). The fiscal costs were distributed evenly over the crisis horizon if an annual breakdown was not available.

Interest rates on one-year U.S. government bonds: FRED database, the Federal Reserve Bank of St. Louis.

Real Oil Prices: The average of Brent, Dubai, and Texas crude oil price indices, deflated by the U.S. consumer price index. Sources: IMF's *International Financial Statistics* database.

Import Demand in Trading Partners: Weighted average of the non-oil import volume (2000=100) of goods, of all trading partners, in percentage deviation from a

Hodrick-Prescott filtered trend. Weights correspond to the share of exports to all partner countries. Source: IMF's *World Economic Outlook* database.

Real GDP: real gross domestic product in billions of domestic currency. Source: IMF's *World Economic Outlook.*

Real interest rate: Calculated using domestic (nominal) T-Bills (short-term maturity)[30] and domestic CPI inflation through the expression, both at quarterly frequency:

$$\frac{(1+(\text{int. rate}_t/100))^{0.25}}{1+\text{CPI inflation}_{t+1}}-1 \qquad \text{(C.1)}$$

where int. rate_t is the domestic nominal interest at quarter t and $\text{CPI inflation}_{t+1}$ is the CPI inflation for the quarter $t+1$ (Source: *International Financial Statistics*).

Real effective exchange rate: *International Financial Statistics*.

Real foreign interest rate: Calculated through (C.1) above, using inflation from GDP deflator. For nominal interest rates, we considered two cases:

(i) 10-year constant maturity U.S. T-bill rate (monthly data from Jan/1980 to Dec/2004); and

(ii) U.S. junk bonds index (daily data from 1/31/1990 to 12/31/2004).

To estimate quarterly values, we averaged corresponding period data. Sources: U.S. 10-year treasury data from Federal Reserve of Saint Louis web site, and high yield bond data came from Merrill Lynch.

[30] For South Africa, we used 10-year government bond yields. Source: International Financial Statistics.

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FISCAL SUSTAINABILITY INDICATORS AND POLICY DESIGN IN THE FACE OF AGEING

Geert Langenus[*]

Mainly due to increasing concerns about the potential impact of population ageing the sustainability of public finances has become one of the key issues in fiscal assessments. This paper briefly reviews the different theoretical benchmarks and empirical tests for sustainability and assesses the sustainability of public finances in euro-area countries on the basis of the latest projections of the Ageing Working Group of the EU Economic Policy Committee. Two alternative operational indicators for fiscal sustainability are proposed and appropriate policy options to restore fiscal sustainability are explored for three individual euro-area countries. Pre-funding strategies that create the budgetary room that is needed to finance ageing costs in advance require important consolidation efforts for most euro-area countries and can imply aiming at significant budgetary surpluses in the coming years for some. However, a simplified technical exercise assessing the evolution of the fiscal burden of the average worker shows that such strategies generally imply a more even distribution of the fiscal burden across generations than more gradual adjustment strategies.

1. Introduction

The usefulness of headline annual budgetary balances and the official public debt figures for assessing the medium-term and long-term soundness of public finances has gradually decreased. On the one hand, governments that have to comply with simple numerical budgetary rules such as those that apply in the EU have been implementing all kinds of temporary and self-reversing measures on a large scale. On the other hand, it is clear that the sweeping demographic changes in many industrialised countries will imply an increasing burden on government budgets in the not so distant future. Against this background, the sustainability of public finances has become one of the key issues in the analysis and assessment of budgetary positions.

In the context of EU fiscal surveillance, EU Member States are required to outline the strategies to ensure the sustainability of public finances in their stability or convergence programmes while the Ageing Working Group (henceforth the

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The views expressed in this paper are those of the author and do not necessarily reflect the views of the National Bank of Belgium.

The author would like to thank Henri Bogaert and Giuseppe Carone for the provision of detailed data and Noelle Baele and Bruno Eugène for helpful discussions. The comments of Hugues Famerée and Kris Van Cauter are greatly acknowledged.

AWG), attached to the Economic Policy Committee, is responsible for producing common projections of the budgetary impact of population ageing. Based upon these projections, the European Commission routinely calculates quantitative sustainability indicators.

The aim of this paper is to analyse fiscal sustainability in the euro area using the most recent ageing cost estimates of the AWG and to explore appropriate policy choices for individual countries.

The remainder of the paper is organised as follows. The following section will focus on the meaning of fiscal sustainability and very briefly discuss the different theoretical interpretations and the wide range of operational definitions. Section 3 will then assess fiscal sustainability in the euro area and introduce alternative sustainability indicators. The fourth section addresses the appropriate policy choices for a number of individual euro-area countries while the fifth section concludes the paper.

2. What is fiscal sustainability?

2.1 Theoretical benchmarks

The general intuition of fiscal sustainability is self-evident: sustainable policies are those that can be continued indefinitely while unsustainable policies will ultimately have to be modified. In principle, fiscal sustainability is typically a multidimensional concept as the reasons for a discontinuation of fiscal policies could be diverse and e.g. pertain to a persistent failure to comply with fiscal rules, the lack of support of the voting population in democratic societies, etc. However, the interpretation is usually narrowed down to specific limits on the government debt or debt accumulation.

Balassone and Franco (2000) provide a detailed overview of the different specifications proposed in the literature and of the definitional and conceptual issues involved. With respect to the former, three main benchmarks can be distinguished. The first and oldest specification, going back to Domar (1944), requires the public debt ratio to converge to a finite value in order to avoid a continuously growing tax ratio. A second specification, used by Buiter (1985) and Blanchard *et al.* (1990), requires the debt ratio to converge back to its initial level. Finally, Blanchard *et al.* (1990) also propose a tougher restriction in that the present discounted value of all future primary surpluses should be equal to the current level of public debt. If this restriction is expressed in nominal values (and the discount rate is the interest rate on public debt), it implies that the debt ratio should converge to zero.[1]

[1] However, Balassone and Franco (2000) show that if it is expressed in ratios to GDP, it can be consistent with the undiscounted value of the debt ratio converging to any finite value or even diverging (depending on the interest and growth rates).

While there seems to be no unique theoretical benchmark for fiscal sustainability, most specifications would imply that an ever-growing debt ratio is not sustainable. In addition, fiscal sustainability is typically assessed in a partial equilibrium framework ignoring any impact of alternative budgetary policies on the economic environment.

With respect to the definitional issues, Balassone and Franco (2000) point out that it is not always straightforward to choose appropriate real-world equivalents for the theoretical concepts of government debt and deficit. Different options can be taken regarding gross or net debt levels, real or nominal variables, the nominal or market valuation of government securities, the delineation of the government sector (especially including or excluding public enterprises), etc.

2.2 Operational definitions

In view of the conceptual and definitional problems described in the previous section, it is hardly surprising that a wide range of operational definitions have been used to assess the sustainability of public finances. In this connection, it is useful to distinguish between backward-looking and forward-looking approaches.

2.2.1 Backward-looking approaches

The backward-looking approaches have in common that they try to test econometrically whether the development of fiscal variables in a given period in the past suggests that policies have been affected by the government budget constraint.

A first group of tests assess the univariate statistical properties of individual public finance variables. Early examples include Hamilton and Flavin (1986) who pioneered this strand of the empirical literature and Trehan and Walsh (1991). Both studies test the stationarity of public debt and the primary surplus in the US with non-stationarity interpreted as an unsustainable policy. In both cases, fiscal data were assessed to be consistent with the sustainability hypothesis.

A second group of tests focus on the relation between different fiscal variables. In this respect, several studies assess fiscal sustainability by formally testing the cointegrating relations between government revenue and expenditure and more specifically whether the coefficient of expenditure in the cointegration regression with revenue as a dependent variable is not below 1.[2] Afonso (2000) finds that the hypothesis of a cointegration between government revenue and expenditure should be rejected for most EU15 countries. In addition, for the three countries for which the existence of a cointegration vector between revenue and expenditure

[2] However, it should be stressed that the lag structure might matter. The absence of a "simultaneous" cointegrating relationship between revenue and expenditure of time *t* does not preclude that the government can correct an expenditure slippage by raising revenue in a following period and ensure sustainability in this way.

could not be excluded, the expenditure coefficients were smaller than 1 suggesting that also for these countries fiscal policies may be unsustainable. Marinheiro (2005) used a similar approach.

Bohn (1991, 1998, 2005), on the other hand, assesses fiscal sustainability by econometrically testing for a positive relationship between the primary surplus and the initial public debt ratio. The sustainability indicators developed by Croce and Juan-Ramón (2003) are based upon a similar approach: fiscal sustainability is defined as a sufficient yearly adjustment in the primary balance towards a target ratio consistent with a country-specific target debt ratio. Hence, in their interpretation, a rising public debt can be sustainable as long as it is below the target ratio (which seems to be chosen rather arbitrarily however).

While all these backward-looking studies provide valuable insights concerning the way fiscal policy was designed in the past, there is obviously no guarantee that the same policy regime will apply in the future and, hence, they can in principle not provide robust conclusions regarding the current sustainability of public finances.

2.2.2 Forward-looking approaches

The forward-looking approaches have in common that they try to assess fiscal sustainability by analysing the future development of public finances based upon the currently available information and a number of macroeconomic and demographic assumptions. They differ, however, in the way in which the results are presented.

a) Long-term projections

The most basic approach consists in simply projecting government deficit and debt dynamics over a long time period. The development of these projections has been fuelled by growing concerns over the long-run budgetary impact of population ageing.

They typically define a limited number of budgetary items which are sensitive to ageing (such as pensions, health care, education expenditure, etc.) and project their evolution taking into account the expected changes in the size and the composition of the population. In addition, the impact of ageing on economic activity growth is usually assessed taking into account the projected evolution of the working-age population and assumptions concerning the participation and structural employment rates.[3] The change in the ratio of these ageing-related budgetary items to GDP over the period under review is then considered as the “total cost of ageing”.

[3] In principle, ageing and, in particular, the average age of the workforce could also affect total labour productivity but this is rarely modelled explicitly.

Typical examples of such studies are the work by the aforementioned AWG that will be discussed in Section 3 and the annual Reports of the Belgian Study Group on Ageing (e.g. Conseil Supérieur des Finances, 2005).

Taking into account these estimates of the total ageing costs, the sustainability of public finances can be assessed by analysing how the budget balance and public debt would evolve if ageing costs would materialise as projected. This requires additional assumptions on the development of variables such as the implicit interest rate on public debt, the level of deficit-debt adjustments and, especially, the budgetary items that are deemed not to depend directly on the age structure of the population. An unsustainable fiscal policy is then defined as one that leads to a high and rising debt ratio at the end of the period considered.

It should be stressed that elaborating long-term projections of public finances necessarily implies a high degree of uncertainty. However, the latter is also true for the other forward-looking approaches discussed below as they are based upon these projections.

b) Synthetic indicators

On the basis of the long-term projections of deficit-debt dynamics different synthetic indicators are proposed in the literature that try to measure which adjustment effort is required to reach a certain sustainable debt ratio at a given point in the (distant) future.

One of the early examples is the tax-gap indicator proposed by Blanchard *et al.* (1990). It measures the average tax rate that, given the projected development of primary expenditure, would generate at the end of the period considered a public debt ratio which is identical to the one prevailing at the beginning of this period. If the actual average tax ratio is below that level, public finances are considered unsustainable and an adjustment is needed. Apart from the shortcomings listed by Balassone and Franco (2000) related to the rather arbitrary choice of the period and the initial debt ratio as the "sustainable benchmark", it should be pointed out that closing the tax gap, *i.e.* bringing the tax ratio to the level suggested by the indicator, only leads to a given debt *level* at the end of the period but does not restrict debt *dynamics* after that date in any way. Hence, an adjustment to the sustainable tax ratio which is then maintained indefinitely could actually be consistent with an exploding debt ratio after the period considered by the indicator, which is somewhat counter-intuitive.

Delbecque and Bogaert (1994) follow a different approach for Belgium and calculate a required primary balance that would allow a reduction in this balance equal to the estimated ageing costs over a certain period and generate a balanced budget at the end of this period. The sustainability gap is the (positive) difference between this required primary balance and the current one. Apart from updating this indicator for Belgium Langenus and Eugène (2005) also propose a required primary balance that would allow a reduction in this balance equal to the estimated ageing costs over a certain period and generate a debt-stabilising budget balance at the end of that period. Both indicators will be used in the third section of this paper.

In the European context the most well-known indicators are undoubtedly the sustainability gaps that are now routinely calculated by the European Commission for all EU-25 Member States (e.g. European Commission, 2005b). The Commission typically calculates these indicators for the period up to 2050 as this is also the time horizon for which ageing-related cost pressures are projected by AWG. In addition, the indicators are calculated for two different base years, the current one and the final year of the medium-term projections.

The first indicator, the so-called S1, is a variant of the aforementioned tax-gap indicator: it measures the difference between the average tax ratio required to generate a debt ratio equal to 60 per cent (rather than the initial level) at the end of a given period and the actual one. Again, a positive S1 is thought to signal an unsustainable policy. However, as acknowledged by the European Commission (2005b) and similarly to the tax-gap indicator, even a negative S1 can be consistent with unsustainable public finances as the debt ratio might be on an explosive path after the end of the period (while it could also be consistent with a rising debt ratio during part of the period).

The second indicator, S2, is based upon the aforementioned second definition of sustainability according to Blanchard *et al.* (1990) and measures the change in the tax ratio required to equalise the present discounted value of all future primary balances to the current gross public debt. This indicator is also translated into a required primary balance concept, RPB, *i.e.* the average primary balance in the first five years of the projection that would be equivalent to S2 and allow the government to comply with its intertemporal budget constraint.

While the S2 (and RPB) indicator avoids the risk of unfavourable debt dynamics at the end of the period due to its time horizon being, in principle, infinite, it in practice narrows down fiscal sustainability to convergence to a relatively low debt ratio, as acknowledged by the European Commission (2003).[4] This might be somewhat too restrictive as, taking into account positive growth of the nominal GDP, relatively significant debt ratios could also be sustainable and consistent with the new EU fiscal rules after the March 2005 reform of the Stability and Growth Pact. The latter introduced country-specific medium-term benchmarks that might include deficits of up to 1 per cent of GDP for a number of Member States. Taking into account reasonable assumptions for trend nominal GDP growth, a persistent deficit of 1 per cent of GDP would be consistent with steady-state debt ratios of 20 to 30 per cent of GDP.

All in all, both the S1 and S2 indicators can only be considered as rough approximations of the sustainability gap. As noted by the European Commission (2005b), the sign and the order of magnitude of the indicators are more important

[4] As indicated in the previous section, the intertemporal budget constraint expressed in nominal values rather than ratios to GDP even implies convergence to a zero debt ratio.

than the exact value. These indicators would only signal whether a fiscal adjustment is required (the sign of the indicator) and feasible without large structural reforms (the order of magnitude). The European Commission is typically very cautious in interpreting the results of these indicators and tends to refrain from giving specific quantitative recommendations to individual Member States concerning the appropriate adjustment efforts.[5]

c) Generational accounting

Generational accounting exercises such as those contained in Auerbach, Kotlikoff and Leibfritz (1999) also calculate the required fiscal adjustment in order to comply with the government's intertemporal budget constraint but add an intergenerational perspective.

The key principle of those studies is that they focus on the intertemporal fiscal burden for different generations. More specifically, for each presently-living generation and taking into account current policies the present value of total remaining net payments to the government (taxes minus transfers) is calculated. Then, given the government's intertemporal budget constraint, the average fiscal burden for unborn generations can be derived by subtracting the sum of all these generational burdens of present generations from the government's net debt and the present value of the flow of planned government consumption and investment (or all expenditure items which have not been allocated to different generations).

Fiscal sustainability or the generational balance is then assessed on the basis of the difference between the generational burden of the unborn generation and that of the youngest presently-living generation. If this difference is positive, then the policy is considered to be unsustainable and a fiscal adjustment is required. In this classical generational accounting set-up the focus is on calculating the generational imbalance and it is assumed that the adjustment effort equally affects the generational burden of all future generations (corrected for productivity growth) but leaves the fiscal burden of presently-living generations unchanged; a change in the tax or transfer rules is considered to only apply to future generations. Balassone and Franco (2000) argue that this feature produces an upward bias in the measurement of the adjustment effort. However, the results of generational accounting studies can also be translated into other indicators such as the permanent increase in the average tax ratio or the permanent decrease in the average pension that would be necessary to equalise the generational burden of the youngest living generation and that of the future generations.

The main value added of generational accounting studies compared to the long-term projections and the synthetic indicators discussed above is that they do not only signal sustainability problems but also clearly show their potential implications

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[5] Typically, the S1 and S2 indicators are only used to put Member States into different groups according to their "sustainability risks".

in terms of intergenerational fairness. They can be used to assess the impact of alternative policy responses on the welfare of different generations. However, full-fledged generational accounting exercises tend to be very data-intensive and require an even more important number of assumptions than the synthetic indicators. Hence, their results should be interpreted with caution.

3. Fiscal Sustainability in the euro area

3.1 Most recent AWG estimates of the ageing costs

In February 2006 a new report prepared by the Economic Policy Committee and the European Commission concerning the budgetary impact of ageing was published (European Commission, 2006). This report is an update of earlier, albeit slightly less comprehensive studies in 2001 and 2003.

The demographic projections used in the 2006 AWG report were prepared by Eurostat and indicate that, all in all, the total population in the present euro-area countries would remain virtually constant in the 2004-50 period. Population decreases in some countries such as Italy, Germany and Portugal are projected to be roughly offset by increases in other countries such as France, Ireland, the Netherlands and Belgium. However, the structure of the population is set to change dramatically in nearly all euro-area countries: the working-age population would decline by some 16 per cent on average (with increases projected for Ireland and Luxembourg only) whereas the elderly population would increase by some 75 per cent by 2050.

With respect to the macroeconomic parameters used in the projections for the euro area, participation rates are projected to increase by 6 percentage points on average while unemployment rates would drop by 2.5 percentage points by 2050. This would to a large extent cushion the dramatic fall in the working-age population. The number of people employed in the present euro-area countries would still grow until 2025 – by an average of 0.4 per cent a year – but decline thereafter; the whole 2004-50 period would see a decrease of more than 6 million persons, *i.e.* much less than the decline of around 30 million in the working-age population. This is due to limited increases projected for some countries such as France, Ireland and the Netherlands being more than offset by larger reductions in other countries such as Germany, Italy, Portugal, Spain and Greece. Labour productivity growth in the euro area was estimated to work out at 1.1 per cent of GDP in the 2004-10 period but to increase to 1.8 per cent in the 2010-30 period and decline marginally to 1.7 per cent in the following two decades. Taking into account the projections for employment and labour productivity, potential activity growth would average 2.1 per cent in the 2004-10 period and slow down to 1.7 per cent in the 2010-30 period and 1.2 per cent in the 2030-50 period.

Table 1

Timing and Size of Ageing-related Budgetary Pressures
Increase in Age-related Public Expenditures during Ascending Phase
(percent of GDP)

Country	Period	Increase	P.M. Increase 2005-50
Portugal*	2005-50	9.4	9.4
Spain	2015-45	9.1	8.6
Luxembourg	2010-45	8.7	8.3
Ireland	2005-50	8.1	8.1
Belgium	2010-45	6.7	6.4
Netherlands	2005-40	5.7	5.3
Finland	2005-35	5.6	5.4
Germany	2015-50	4.2	3.0
France[1]	2005-45	3.1	3.0
Italy	2015-40	3.1	1.8
Austria	2015-35	2.5	0.4
Greece*, **	2020-50	1.5	1.3
Euro area	2010-50	4.4	3.9
P.M. Other EU countries			
Cyprus*	2005-50	11.8	11.8
Slovenia	2010-50	9.8	9.6
Czech Republic	2015-50	7.8	7.1
Hungary*	2005-50	6.8	6.8
Denmark	2005-40	5.3	4.8
United Kingdom	2010-50	4.2	4.0
Slovakia	2015-50	4.2	2.6
Sweden	2010-40	3.7	2.6
Lithuania	2015-50	2.6	1.4
Malta	2005-25	2.3	0.3
Latvia	2015-35	2.1	–0.7
Estonia*	2045-50	0.1	–3.1
Poland	none	none	–6.4

* Excluding long-term care.
** Excluding pensions.
Source: European Commission (2006).

Against this background, the report presents the projected increases in five different expenditure categories sensitive to population ageing: pensions, health care, unemployment benefits, long-term care and education expenditure.[6] In the euro area as a whole spending for these five items would increase by 3.9 per cent of GDP in the 2005-50 period.[7] The outlays for pensions, health care and, to a lesser extent, long-term care would rise while both education and unemployment expenditure would drop.

However, the timing and the size of these ageing-related cost pressures differ significantly across euro-area countries. In Portugal, Ireland, Finland, the Netherlands and France ageing would already push up expenditure in the 2005-10 period while spending pressures would only start to materialise in the 2010-15 period in Luxembourg and Belgium and in the 2015-20 period in Spain, Germany, Italy and Austria. Expenditure would also reach its peak earlier in countries like Austria and Finland than in other countries where ageing costs would continue to increase during the last-five year period considered in the 2006 AWG report, *i.e.* from 2045 to 2050. The total impact of ageing over the whole 2005-50 period varies from a mere 0.4 per cent of GDP in Austria to more than 8 per cent of GDP in Portugal, Spain, Luxembourg and Ireland. In the non-participating Member States the change in ageing-related expenditure in the 2005-50 period varies from minus 6.4 per cent of GDP in Poland to close to 12 per cent of GDP in Cyprus.

It should be pointed out that the quantification of these ageing-related cost pressures depends upon a wide range of demographic, macroeconomic and policy assumptions. Hence, they come with a significant degree of uncertainty. In addition, the projections for different countries might not be fully harmonised: national institutions were responsible for carrying out pension projections and, apart from using their own models, took into account country-specific policy assumptions. With respect to the indexation of individual pension entitlements, for instance, projections are still based upon different rules ranging from mere price indexation to indexation to gross or net wages. While these assumptions may reflect current policies, it is unclear, however, to what extent those differences between pension systems in individual countries can be maintained over a long period, especially since the least generous systems might come under pressure due to the increasing weight of the elderly in the voting population.[8] Finally, one should bear in mind that the AWG only considers the impact of ageing on public expenditure ignoring possible effects

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6 However, for Greece no projections on pensions and long-term care are included. As, for most countries, pensions are the most important component of the total ageing costs, Greece will not be considered in the empirical part of this paper. Projections on long-term care expenditure are also not included for Portugal and France but the projected increases for this spending category tend to be less important such that the total ageing costs for these countries is likely to be biased to a smaller extent.

7 For health care, in particular, different scenarios are considered. As in the 2006 AWG Report itself, the projections of the so-called AWG reference scenario are used here for aggregation with other components of the ageing costs.

8 As shown for Belgium by the Conseil Supérieur des Finances (2005) and Langenus and Eugène (2005), a change in the assumption concerning the indexation rule of individual pension entitlements can have a substantial impact on the estimate of the ageing costs.

Table 2

Impact of Ageing on Debt Dynamics*
(percent of GDP)

Country	2050 Budget Balance	2050 Government Debt
Belgium	–8.5	127.7 and rising
Germany	–10.4	172.9 and rising
Spain	–14.3	175.4 and rising
France	–12.1	205.6 and rising
Ireland	–12.3	139.5 and rising
Italy	–11.7	228.1 and rising
Luxembourg	–15.1	208.0 and rising
Netherlands	–11.9	182.3 and rising
Austria	–1.5	49.8 and falling
Portugal	–30.0	433.9 and rising
Finland	–3.6	47.7 and rising

* Budgetary developments taking into account the Autumn 2005 EC projections up to 2007 and assuming that the primary balance ratio only changes due to the ageing costs afterwards.
Sources: European Commission (2005a and 2006), own calculations.

on government revenue (e.g. rising tax receipts from levies on second- and third-pillar pensions).

3.2 Debt dynamics

In order to assess the sustainability of public finances in the euro-area countries it is worthwhile to analyse the impact of the aforementioned ageing costs on public debt. For this purpose, a technical exercise is carried out taking into account the European Commission's Autumn 2005 projections until 2007 and the macroeconomic framework used in the 2006 AWG report for the 2008-50 period. The implicit interest rate on public debt is assumed to remain unchanged and deficit-debt adjustments to be zero after 2007. From 2008 onwards, the primary balance ratio is only affected by the evolution of the ageing-related components as projected by the AWG; the other primary balance components are assumed to remain constant relative to GDP. Due to the aforementioned different timing of the ageing costs, this implies that the primary balance worsens from 2008 onwards in France, Ireland, the Netherlands and Finland[9] while it first remains constant or even improves in the countries of the "late ageing group".

[9] In Portugal ageing costs increase from 2004 to 2005 but remain constant in the 2005-10 period.

All in all, this exercise shows that only in Austria fiscal sustainability is not immediately jeopardised by population ageing. However, in Austria the 2050 deficit of 1.5 per cent of GDP could be “unsustainable” for other reasons than a rising debt ratio as it does not comply with the Stability and Growth Pact’s current rules regarding the country-specific medium-term benchmarks for fiscal policy (the range of which is restricted by a deficit ceiling of 1 per cent of GDP). In Finland, the 2050 deficit would exceed both the debt-stabilising level and the 3 per cent of GDP reference value but public debt would still remain below the Maastricht reference value of 60 per cent of GDP. All other countries would post double-digit deficits (with the exception of Belgium) and triple-digit and exploding debt ratios in 2050.

3.3 Alternative approach to sustainability gaps: RPB3 and RPB4

From the above analysis of the impact of ageing on debt dynamics it is clear that for nearly all euro-area countries doing nothing is not an option. However, as suggested by the differences in the level of the projected 2050 debt ratios, the fiscal adjustment required to avoid an explosion of the debt ratio may differ across countries. As indicated in Section 2, the European Commission traditionally uses the S1 and S2 (or RPB) indicators to measure this required adjustment. In view of the fact that especially S1 but to a lesser extent also S2 (and RPB) can only be considered as rough indicators of the sustainability gap, two alternative approaches are proposed in this paper based upon the indicators used by Delbecque and Bogaert (1994) and Langenus and Eugène (2005).

The first alternative approach tries to gauge sustainability in the most literal interpretation and considers the fiscal effort needed to reach a debt-stabilising budget balance at the end of the projection horizon, *i.e.* 2050 in the 2006 AWG report. This alternative indicator, say RPB3 (or S3), is operationally defined as the minimum primary balance (or the improvement in the primary balance) that is required in (by) the year that ageing costs start to materialise in order for the subsequent worsening of the budget balance due to the ageing costs not to lead to a budget balance that, if it remains constant after 2050, would increase the debt ratio. Put differently, it gauges the fiscal effort required up front in order to “absorb” ageing costs without jeopardising fiscal sustainability.

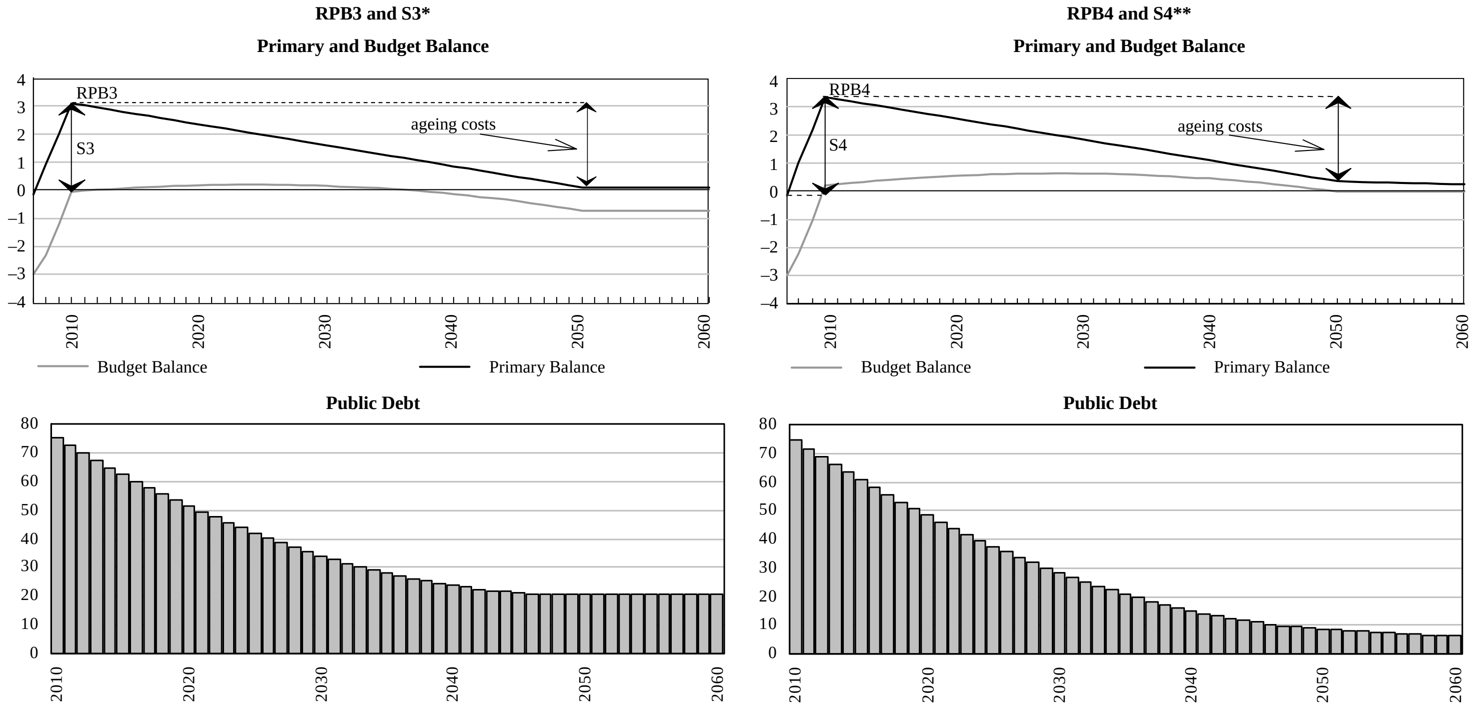
The second alternative approach tries to capture the adjustment needed for a full pre-emptive financing or pre-funding of the estimated ageing costs. This indicator, say RPB4 (or S4) is operationally defined as the primary balance (or the improvement in this balance) required in the year that ageing-related spending starts to increase in order to allow the primary balance to worsen due to ageing costs afterwards and still generate a balanced budget in 2050.

Both alternative sustainability indicators, RPB3 (S3) and RPB4 (S4), are graphically illustrated in Figure 1 that considers a country with an initial public debt ratio of 80 per cent and an ageing-related expenditure shock of 3 per cent of GDP. In both cases the worsening in the primary balance between 2010, considered here as the year in which ageing-related expenditure starts to rise, and 2050, is exactly equal

Figure 1

Alternative Sustainability Indicators: A Graphic Illustration

(percent of GDP)



* Pre-ageing primary balance (RPB3) or increase in the primary balance (S3) required to generate a debt-stabilising budget balance in 2050 taking into account the budgetary impact of ageing up to 2050.

** Pre-ageing primary balance (RPB4) or increase in the primary balance (S4) required to generate a balanced budget in 2050 taking into account the budgetary impact of ageing up to 2050.

Source: own calculations.

to the ageing costs. The RPB3 target for 2010 in addition generates a stable debt ratio in 2050 while the RPB4 target leads to a balanced budget in 2050. S3 differs from the traditional S1 in that it, by definition, avoids the risk of unfavourable debt dynamics at the end of the period considered. S4 differs from both sustainability indicators used by the European Commission as it explicitly targets a pre-funding of ageing costs and, hence, restricts the budget balance at the end of the period rather than public debt.

These alternative sustainability indicators can be calculated for the euro-area countries taking into account the macroeconomic framework used in the previous section, *i.e.* the framework described in the 2006 AWG report and additional assumptions on the implicit interest on government debt and the deficit-debt adjustments.[10] However, data on ageing costs are only reported by the European Commission (2006) for five-year intervals. Hence, the first year of the five-year period in which ageing-related expenditure starts to rise was chosen as the target year for the calculation of the alternative sustainability indicators. In addition, as indicated before, for some euro-area countries ageing-related costs are already rising. For those countries 2010 was selected as the "pre-ageing" target year. Finally, for all countries the Autumn 2005 fiscal projections of the European Commission were taken as given and fiscal adjustment towards the pre-ageing target year was modelled in a linear way from 2008 onwards.

The calculations for RPB3 reveal that, after 2007, all euro-area countries considered have to improve their primary balance before ageing-related spending starts to increase in order to avoid the need to take additional consolidation measures afterwards to bring the public debt ratio on a sustainable path. However, the required adjustment, as measured by S3, differs substantially across countries, from a mere 0.4 per cent of GDP in Austria to close to 10 per cent of GDP or more in Portugal and Luxembourg. Taking into account the estimated evolution of ageing-related spending – rising for the "early ageing" group consisting of France, Ireland, the Netherlands and Finland; constant for Portugal; and falling for the other countries – the required change in non-ageing-related budgetary items is actually negative for Austria while the required increase in revenue or reduction in non-ageing expenditure in other countries ranges from 1.5 per cent of GDP in Finland to 11.5 per cent of GDP in Luxembourg. In view of the different timing of ageing-related cost pressures, Germany, Spain and Italy can spread out the adjustment effort over a longer period than other countries and would have to tighten the non-ageing part of the budget by some 0.3 per cent of GDP (Germany and Italy) to 0.8 per cent of GDP (Spain) per year until 2015. Apart from Finland, the required yearly adjustment is (much) higher for countries where ageing-costs start to rise earlier: from some 1 to 1.5 per cent of GDP in Belgium, France and the Netherlands to close to or more than 3.5 per cent of GDP in Portugal and Luxembourg.

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[10] The calculations of RPB3 and S3 are also based upon the technical assumption that, for all countries considered here, productivity growth will continue to work out at 1.7 per cent after 2050 (as assumed for the 2030-50 period in the 2006 AWG report) while employment would stay at its 2050 level and inflation would remain 2 per cent in the post-2050 period.

Table 3

RPB3 and S3 Indicators[*] for Euro-area Countries
(percent of GDP)

Country	RPB3 (1)	by	2007 Primary Surplus (2)	S3 (3)=(1)–(2)	Change in Ageing-related Expenditure[**] (4)	Required Fiscal Effort[***] Total (5)=(3)+(4)	Required Fiscal Effort[***] Per Year	2050 Debt
Belgium	6.4	2010	3.4	3.0	–0.1	2.9	1.0	–22.3
Germany	4.2	2015	–0.4	4.6	–1.1	3.5	0.4	3.6
Spain	8.2	2015	1.2	7.0	–0.3	6.7	0.8	–162.1
France	3.0	2010	–0.7	3.8	0.1	3.8	1.3	22.0
Italy	3.2	2015	0.3	2.9	–0.4	2.5	0.3	93.7
Ireland	7.4	2010	0.9	6.5	0.1	6.6	2.2	–138.4
Luxembourg	9.6	2010	–2.0	11.5	–0.1	11.5	3.8	–94.0
Netherlands	5.1	2010	1.0	4.1	0.1	4.1	1.4	–15.3
Austria	1.8	2015	1.4	0.4	–0.6	–0.2	0.0	62.9
Portugal	8.2	2010	–1.6	9.8	0.0	9.8	3.3	–129.5
Finland	4.9	2010	3.6	1.3	0.2	1.5	0.5	–27.0

[*] Pre-ageing primary balance (RPB3) or increase in the primary balance (S3) required to generate a debt-stabilising budget balance in 2050 taking into account the budgetary impact of ageing up to 2050.
[**] Estimated by linear interpolation of the 2005 and 2010 levels of ageing-related expenditure.
[***] Required increase in revenue or reduction in non-ageing-related primary expenditure.
Sources: European Commission (2005a and 2006), own calculations.

In order to assess the appropriateness of actually implementing the fiscal policy suggested by the RPB3 indicator, it is helpful to look at the (steady-state) debt ratios that it generates in 2050. Only for France and Germany these are in the [0-0.6] interval although Austria would only marginally exceed the 60 per cent of GDP limit. Italy would end up with a steady-state debt ratio of some 94 per cent of GDP (and a matching “excessive” deficit of 3.4 per cent of GDP). Hence, this strategy might be unsustainable as it leads to a persistent violation of EU fiscal rules. Adjusting the budget in line with the S3 indicator would lead to (in some cases large) net assets in the other countries which suggests that it could be too ambitious.

The results for RPB4 are somewhat similar to the ones for RPB3. Austria is obviously again the country with the smallest required fiscal effort (although the latter remains slightly positive even taking into account the projected decline of ageing-related expenditure up to 2015 in Austria). Luxembourg and Portugal face the most important fiscal challenge. Compared to the S3 indicator, S4 is much higher in Austria and Italy (reflecting the fact that S3 generates high steady-state debt ratios for those countries), roughly the same in France and Germany and lower for all other countries. All in all, implementation properties are better than for S3. Debt ratios in 2050 are below 60 per cent of GDP for all countries. Seven countries would still end up with net financial assets in 2050 but the level of those assets would be much lower than if S3 adjustment were to be implemented and asset and debt ratios would further converge to zero if the balanced budget is maintained in the post-2050 period.

It could be argued that the requirement of a balanced budget in 2050 is too strict as, for countries with a low public debt and high potential growth, the reformed Stability and Growth Pact allows structural deficits up to 1 per cent of GDP as medium-term objectives. Hence, a variant of the aforementioned RPB4 and S4 indicators, say $RPB4^{MTO}$ and $S4^{MTO}$, could consider the requirement of posting the medium-term objective rather than a balanced budget in 2050.

Member States should define these medium-term objectives themselves in their stability (or convergence) programmes while the Council may invite them to adjust their programmes if it considers that the medium-term objective should be strengthened. However, Member States may present more ambitious medium-term objectives than implied by the aforementioned criteria related to public debt and potential growth if they feel their circumstances call for it. At the time of writing it was not fully clear what the minimum requirements were for the medium-term objective of each Member States.

For illustrative purposes, $RPB4^{MTO}$ and $S4^{MTO}$ indicators were calculated taking into account the lowest possible medium-term objective, *i.e.* a deficit of 1 per cent of GDP, for all countries. Despite the weaker 2050 objective, consolidation requirements remain substantial for some countries (especially Luxembourg and Portugal) while four countries would still end up with – relatively – important net assets in 2050 although the latter would be declining if the budget balance remains constant in the post-2050 period.

Table 4

RPB4 and S4 Indicators* for Euro-area Countries
(percent of GDP)

Country	RPB4	by	2007 Primary Surplus	S4	Change in Ageing-related Expenditure**	Required Fiscal Effort***		2050 Debt
						Total	Per Year	
	(1)		(2)	(3)=(1)–(2)	(4)	(5)=(3)+(4)		
Belgium	6.2	2010	3.4	2.8	–0.1	2.7	0.9	–9.3
Germany	4.3	2015	–0.4	4.7	–1.1	3.6	0.4	1.5
Spain	6.3	2015	1.2	5.1	–0.3	4.8	0.6	–64.1
France	3.3	2010	–0.7	4.0	0.1	4.1	1.4	9.1
Italy	4.2	2015	0.3	3.9	–0.4	3.5	0.4	39.3
Ireland	5.5	2010	0.9	4.6	0.1	4.7	1.6	–58.3
Luxembourg	7.5	2010	–2.0	9.5	–0.1	9.4	3.1	–38.6
Netherlands	4.9	2010	1.0	3.9	0.1	4.0	1.3	–6.6
Austria	2.5	2015	1.4	1.1	–0.6	0.5	0.1	26.7
Portugal	6.9	2010	–1.6	8.5	0.0	8.5	2.8	–53.8
Finland	4.5	2010	3.6	0.9	0.2	1.2	0.4	–11.1

* Pre-ageing primary balance (RPB4) or increase in the primary balance (S4) required to generate a balanced budget in 2050 taking into account the budgetary impact of ageing up to 2050.

** Estimated by linear interpolation of the 2005 and 2010 levels of ageing-related expenditure.

*** Required increase in revenue or reduction in non-ageing-related primary expenditure.

Sources: European Commission (2005a and 2006), own calculations.

4. Policy implications: an application to Belgium, Spain and Italy

The above calculations suggest that in all euro-area countries, except Austria, current fiscal policies are not sustainable. Hence, an - in most cases - important fiscal adjustment will be required in the following years. However, the timing of this effort needn't be the same for all countries as ageing-related cost pressures materialise earlier in some countries than in others. In addition, as shown by the calculations presented in the previous section, restoring fiscal sustainability before ageing costs start to rise – *i.e.* pre-emptively financing the budgetary costs caused by ageing – will require substantial consolidation efforts and lead to the creation of a relatively important net asset position in certain countries. This raises the question whether such a "pre-funding" policy is actually appropriate or whether it wouldn't be preferable to only take consolidation measures if and when spending pressures actually materialise. In addition, it is widely recognised that pre-funding through increased fiscal consolidation is only one aspect of a multi-pronged strategy to deal with population ageing that should also include efforts geared towards increasing the employment rate and productivity and directly curbing unsustainable expenditure trends in pension and health care systems.

The extent to which long-term cost pressures, such as those related to ageing, should be reflected already in medium-term budgetary objectives, *i.e.* the extent of pre-funding of estimated ageing costs, is the subject of debate. The Code of Conduct for the reformed Stability and Growth Pact (Ecofin Council, 2005b) explicitly indicates that increasing implicit liabilities due to ageing should not yet be taken into account when setting the new medium-term objectives for fiscal policy until "criteria and modalities" (for doing so) "are appropriately established". In March 2005 the Council has invited the European Commission to report on progress achieved towards the methodology for completing the analysis by incorporating such liabilities (ECOFIN Council, 2005a). In this context, Coeuré and Pisani-Ferry (2005) propose country-specific deficit targets that are based upon objectives for the net value of the government taking into account long-term budgetary projections but apply a 50 per cent "haircut" to the estimated ageing costs. However, no specific reasons are given for the size of the extra discount on ageing costs.

A key issue in this connection is the fact that different extents of pre-funding obviously imply different burdens for different generations. This is important as policies might be assessed as inappropriate if they lead to an inequitable burden sharing between generations. Hence, this section will shift the focus to "fairness" considerations and try to gauge whether a more gradual financing of the ageing costs is not more equitable than full pre-funding.

For this purpose, the method suggested by Langenus and Eugène (2005) is applied here to three different countries. The analysis is based upon a stylised technical exercise comparing the implications of different budgetary strategies for the evolution of the monetary contribution to the government's primary balance of the average worker over time. Workers typically contribute more to the primary

Table 5

RPB4^{MTO} and S4^{MTO} Indicators[*] for Euro-area Countries
(percent of GDP)

Country	RPB4^{MTO} (1)	by	2007 Primary Surplus (2)	S4^{MTO} (3)=(1)–(2)	Change in Ageing-Related Expenditure[**] (4)	Required Fiscal Effort[***] Total (5)=(3)+(4)	Required Fiscal Effort[***] Per Year	2050 Debt
Belgium	5.9	2010	3.4	2.5	–0.1	2.4	0.8	7.3
Germany	3.9	2015	–0.4	4.3	–1.1	3.2	0.4	17.9
Spain	6.0	2015	1.2	4.8	–0.3	4.5	0.6	–47.3
France	3.0	2010	–0.7	3.8	0.1	3.8	1.3	25.4
Italy	3.9	2015	0.3	3.6	–0.4	3.2	0.4	55.5
Ireland	5.1	2010	0.9	4.2	0.1	4.3	1.4	–42.2
Luxembourg	6.8	2010	–2.0	8.8	–0.1	8.7	2.9	–22.3
Netherlands	4.6	2010	1.0	3.6	0.1	3.7	1.2	9.1
Austria	2.2	2015	1.4	0.8	–0.6	0.2	0.0	42.7
Portugal	6.6	2010	–1.6	8.2	0.0	8.2	2.7	–37.6
Finland	4.2	2010	3.6	0.6	0.2	0.9	0.3	5.3

[*] Pre-ageing primary balance (RPB4MTO) or increase in the primary balance (S4MTO) required to generate a 1 per cent of GDP deficit in 2050 taking into account the budgetary impact of ageing up to 2050.
[**] Estimated by linear interpolation of the 2005 and 2010 levels of ageing-related expenditure.
[***] Required increase in revenue or reduction in non-ageing-related primary expenditure.
Sources: European Commission (2005a and 2006), own calculations.

balance in a given year than non-workers, e.g. because they pay more taxes and receive less transfers from the government (no unemployment benefits or pensions and less health care).

In order to calculate the contribution of an average worker to the government's primary balance for a given base year a number of extremely simplifying assumptions were used. First, pensions, expenditure for long-term care and unemployment benefits were entirely allocated to the group of non-workers. Second, health care spending and current taxes on income and wealth are distributed between workers and non-workers using the ratio between the *per capita* contribution of a worker and that of a non-worker found by Langenus and Eugène (2005) for Belgium.[11] Third, all social contributions are allocated to workers. Finally, all other budgetary items - such as consumption taxes, government investment and government consumption excluding health care – are distributed proportionally between workers and non-workers. It should be stressed that this only gives a very rough approximation of the actual contribution of an average worker and the figure resulting from this exercise only serves as a point of comparison for the changes in this level projected for later years.

The latter are determined on the basis of the following assumptions. First, as workers are thought not to benefit directly from government expenditure for pensions, long-term care and unemployment benefits, the changes projected in the 2006 AWG report for these budgetary items are allocated to the group of non-workers. Second, health care consumption for the average worker is assumed to grow in line with GDP and the remaining increase in health care spending projected by the AWG is allocated to non-workers. Third, both workers and non-workers are assumed to benefit proportionally from government spending on education,[12] for which the 2006 AWG report projects a decline for all euro-area countries in the 2005-50 period, and other primary expenditure which is assumed to remain constant relative to GDP. Fourth, the contribution of an average non-worker to government revenue is assumed to grow in line with GDP.[13] Finally, the contribution of an average worker to the government's primary balance is adjusted in order to meet the primary balance targets implied by the budgetary strategy considered.

This is a necessarily simplifying framework. It is based upon a very rough allocation of budgetary items to workers and non-workers and disregards, for

[11] An average worker is assumed to pay about 10.25 times more current taxes on income and wealth than an average non-worker while workers would on average consume some 55 per cent less government-paid health care services than non-workers.

[12] For this assumption, in particular, other options could have been chosen. Rather than assuming that society as a whole – including pensioners – ultimately reap the benefits of better education, one could also argue that only parents with children in school benefit from education. Hence, a more than proportionate share of this expenditure should be allocated to workers as they are more likely to have children in school. However, the exact assumptions on the distribution of education expenditure do not have a significant impact on the comparison of different budgetary strategies on the basis of the required contributions from workers to government's primary balance.

[13] Note that this assumption could imply bigger outlays for pensioners relative to their income, especially if individual pension entitlements are not fully adjusted to wages.

instance, the fact that workers might be hurt more than proportionally by the likely decline in family allowances (following the substantial reduction in the number of young people projected in the 2006 AWG report). More importantly, it assumes that budgetary means to finance ageing costs can only be extracted from workers and excludes the possibility, for instance, that the required budgetary adjustment may imply a larger contribution from non-workers (in particular the retired older generations), e.g. through an increase in taxes such as VAT and excise duties or a reduction in expenditure such as public investment to which they contribute in a proportional way.[14] Finally, this technical exercise disregards any impact of changing tax levels on activity growth.

The time horizon over which the evolution of the contribution of an average worker to the government's primary balance will be assessed, is the 2005-2100 period. For the years up to 2050, the macroeconomic parameters are those assumed in the 2006 AWG report and briefly discussed in the previous section. Beyond the 2050 horizon, both the size and the composition of the populations are assumed to remain constant – with employment rates also staying at their 2050 level – while labour productivity and, hence, real GDP, would grow by 1.7 per cent for all countries as is the case for labour productivity in the 2030-50 period as projected in the 2006 AWG report. As in the previous section, the Autumn 2005 projections of the European Commission will be used for the years 2006 and 2007 and the implicit interest rate on government debt is assumed to remain constant and deficit-debt adjustments to be zero after 2007 while yearly inflation would work out at 2 per cent throughout the 2008-2100 period.

In the remainder of this section different budgetary strategies will be compared on the basis of the time profile that they generate for the contribution to the primary balance of an average worker. This approach differs from a fully-fledged general accounting exercise as contributions to the government's primary balance are measured and compared for individual years rather than over the total lifetime of subsequent and unborn generations.[15] Notwithstanding the partial nature of this analysis, it may shed some light on the intergenerational fairness of different budgetary strategies. Intergenerational fairness is defined here as a situation in which successive generations of workers contribute roughly the same amount, corrected for nominal wage growth such that this concept can be thought of as a contribution out of a constant wage, to the government's primary balance.[16]

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[14] However, making the retired or older generations pay for ageing-related cost pressures would obviously be tantamount to directly curbing the rise of ageing-related expenditure (e.g., by reducing individual pension entitlements).

[15] In addition, the assumption on the financing of the required fiscal adjustment is different: while in the classical generational accounting set-up the adjustment does not affect presently-living generations, this is not the case here as generations of future workers can obviously already be born today.

[16] This approach is conceptually close to the one proposed by Oksanen (2003) but differs from other fairness concepts that look at after-transfer income. In the approach followed here substantial differences in the net contribution to the primary balance across working generations would be considered unfair even if the after-transfer income levels remain relatively constant.

The analysis is performed for three different countries: Belgium – with a high but falling public debt, a roughly balanced budget and important ageing costs; Italy – with a high public debt, a high deficit but less important and later ageing-related cost pressures; and Spain – with a low public debt, a roughly balanced budget but important ageing costs. For each country, the full pre-funding strategy in line with the S4 indicator introduced in the previous section is compared with alternative budgetary strategies. In order to make the budgetary strategies considered as comparable as possible, all of them are calibrated to generate zero public debt at the end of the period.

As indicated by the RPB4 indicator, full pre-funding would require a primary surplus of slightly more than 6 per cent of GDP by 2010 in Belgium. This surplus still significantly exceeded that level throughout the 1998-2001 period (reaching 7.1 per cent of GDP in 2001) but has been gradually reduced since and worked out at some 4.5 per cent of GDP in 2005. If, as projected by the European Commission (2005a), the primary surplus ratio would shed another percentage point in the 2006-07 period, then full pre-funding would require a rather steep increase – by some 0.9 per cent of GDP a year – in the three following years. This budgetary effort would turn the small budgetary deficit that is projected to appear in 2006 and 2007 to a surplus of some 3 per cent of GDP by 2010 and significantly speed up the reduction in public debt.

When ageing costs start to rise from 2010 onwards, the primary balance gradually worsens to a deficit of close to 0.5 per cent of GDP by 2050. The overall budget balance still improves to some 3.7 per cent in the 2015-20 period due to the continued drop in interest charges but then falls to zero by 2050 with a zero public debt by 2100 implying a slight deficit in the 2050-2100 period. Public debt would be paid off completely by 2025 and net assets, reaching a maximum of some 13 per cent of GDP in the 2035-40 period, would be built up afterwards.

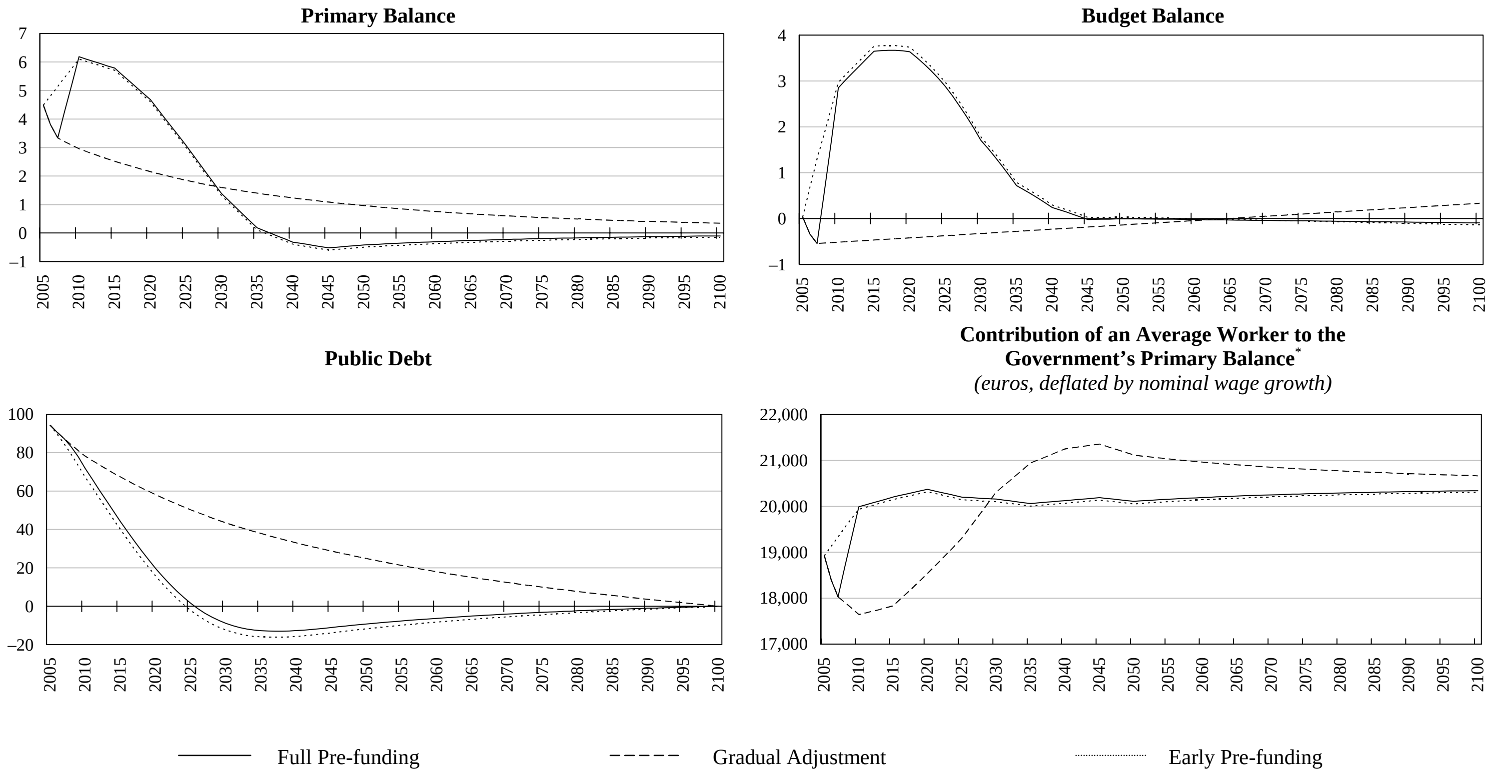
This budgetary path implies a (further) reduction of the contribution of the average worker to the government's primary balance, corrected for nominal wage growth, in 2006 and 2007. However, this contribution then has to increase again to meet the 2010 pre-funding target. After 2010 the burden on successive generations of average workers would remain relatively constant. Overall, the maximum difference in the burden of successive working generations, expressed in contributions out of a constant 2005 wage, is less than 2,350 EUR and pertains to the 2007 and 2020 generations.

An alternative budgetary strategy could consist in a much more gradual adjustment of the budgetary balance after 2007 towards a level in 2100 that would be sufficient to pay off all debt by that year. This would allow a further gradual decline in the primary surplus to some 0.3 per cent of GDP by 2100. More importantly, this strategy might seem more appealing than the full pre-funding option as it would produce the same debt ratio in 2100 without the relatively important fiscal adjustment in the coming years and the creation of net assets. However, the implied time profile for the average worker's contribution to the government's primary balance seems much less equitable. The contribution would

Figure 2

Assessment of Alternative Budgetary Strategies: Belgium

(percent of GDP, unless indicated otherwise)



* Standard deviations: 369.73 (full pre-funding); 1133.04 (gradual adjustment); 218.10 (early pre-funding).
Sources: European Commission (2005a and 2006), own calculations.

decrease significantly until 2010 but would have to be increased steeply thereafter in order to finance the ageing costs. From 2030 onwards, workers would have to contribute (much) more to the primary surplus than in the full pre-funding strategy. The maximum difference in their burden measured for different years is much higher – some 3,700 EUR between the 2010 and 2045 generations – than in the latter strategy.

Finally, one might also consider a strategy, say the early pre-funding one, that starts the required adjustment towards the 2010 target in 2006 already. The primary surplus would then have to be hiked by a more limited 0.3 per cent of GDP per annum. This would avoid the reduction in the net fiscal burden of an average worker in 2006 and 2007 that would have to be clawed back afterwards. All in all, the time profile of the burden of the average worker would be even flatter than in the full pre-funding strategy from 2008 onwards. Hence, starting the adjustment towards a sustainable fiscal position immediately – rather than delaying it by a further two years – seems to be preferable from an intergenerational fairness point of view.

In Italy ageing-related cost pressures are projected to materialise later and to have a much smaller budgetary impact than in Belgium. For this country, the full pre-funding strategy described by the RPB4 indicator implies a primary surplus of 4.2 per cent of GDP by 2015. Similarly to the situation that prevailed in Belgium, the Italian primary surplus already significantly exceeded that level throughout the 1995-2000 period. However, from 2001 onwards it has dropped significantly. Taking into account the projected further fall of this surplus in the 2006-07 period (European Commission, 2005), it would have to be increased by about 0.5 per cent of GDP in every year from 2008 until 2015 in order to reach the 2015 pre-funding target. This would gradually reduce the deficit – which would still exceed the 3 per cent of GDP level until 2010 however – and lead to a government budget including interest charges that is almost balanced in 2015.

Ageing would then erode the primary surplus until 2040 but the public debt ratio would continue to decline to less than 40 per cent in the middle of the century. In order to pay off the entire debt by 2100 a gradual improvement in the budget balance, to 0.4 per cent of GDP in that year is required. Unlike in Belgium, public debt would not become negative in the period considered.

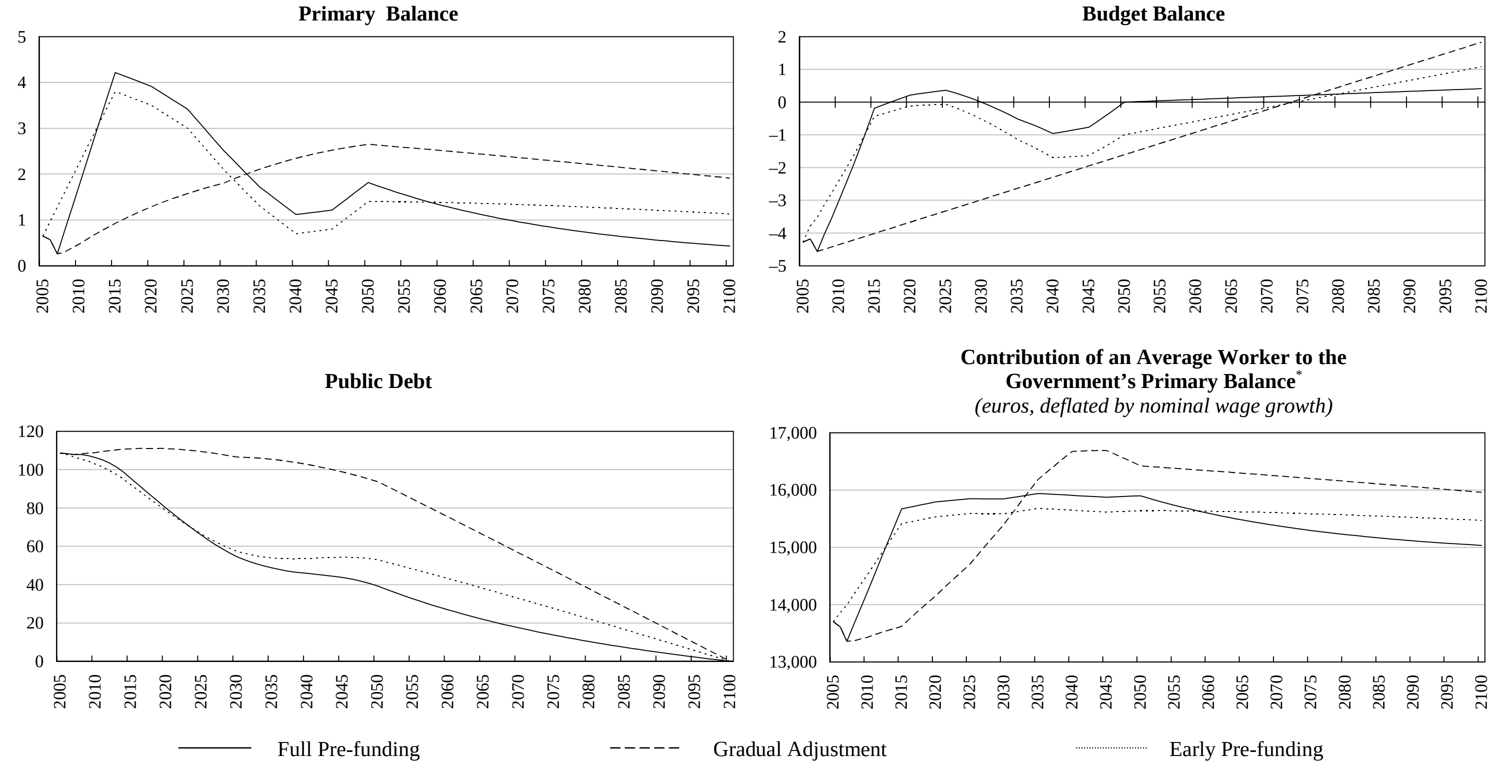
The contribution of an average worker to GDP would decrease in 2006 and 2007 and rise rather sharply in the 2008-15 period. Afterwards it would remain in a narrow band before declining significantly from 2050 onwards. Over the whole period the maximum difference is between the 2007 and 2035 generations and amounts to close to 2,600 EUR out of a constant wage.

An alternative budgetary strategy consists in reimbursing public debt by 2100 in a more gradual way and implies a slow but continuous improvement in the budget balance from a deficit of 4.6 per cent of GDP, as forecast by the European Commission (2005a) for 2007, to a surplus of 1.8 per cent of GDP at the end of the century. The fiscal burden of an average worker would have to increase from 2008 onwards but the hike is much less steep than in the full pre-funding strategy.

Figure 3

Assessment of Alternative Budgetary Strategies: Italy

(percent of GDP, unless indicated otherwise)



[*] Standard deviations: 548.79 (full pre-funding); 1038.56 (gradual adjustment); 387.89 (early pre-funding).

Sources: European Commission (2005a and 2006), own calculations.

However, the increase lasts longer and is larger and all generations from 2034 onwards will face a larger fiscal burden than in the pre-funding strategy. The maximum difference in the burden for an average worker – working out at more than 3,300 EUR between the 2007 and the 2045 generations – significantly exceeds that in the pre-funding strategy. Hence, the more gradual strategy seems less equitable as it shifts too much of the adjustment burden to distant generations.

Finally, a third alternative strategy could explicitly target a flatter profile for the fiscal burden of the average worker than the one generated by the full pre-funding strategy. This implies avoiding the decline in the 2006-07 period and beyond the 2050 horizon. One way to achieve this is to start the adjustment process in 2005 already and to target a 1 per cent of GDP deficit – the limit for Member States' medium-term objectives – in 2050 rather than a balanced budget. This strategy, say the early MTO pre-funding, would imply a more gradual and less important increase in the primary surplus of some 0.3 per cent of GDP a year from 2006 onwards to a level of 3.8 per cent of GDP by 2015. The budget deficit would drop to just above the 3 per cent of GDP reference value in 2008, continue to decline to close to zero in 2025 but then widen again before reaching the 1 per cent of GDP target in 2050. After that, it has to be gradually turned into a surplus of roughly the same size by the end of the century in order for public debt to paid off completely by that time.

The maximum difference between the contributions of different generations of average workers to the government's primary balance is the one between the 2005 and 2035 generations, working out at less than 2,000 EUR, *i.e.* much less than in the two previous strategies. Hence, all in all, an earlier but more partial pre-funding strategy could be the most equitable choice for the design of fiscal policy in Italy.

Together with Portugal and Luxembourg Spain is among the euro-area countries that would be hit most by population ageing. As suggested by the RPB4 indicator, full pre-funding in Spain would require a primary surplus of 6.3 per cent of GDP, a level which is unprecedented in recent Spanish fiscal history. Taking into account the significant fall in this surplus projected by the European Commission (2005) for the 2006-07 period it would have to be increased by 0.6 per cent of GDP in each of the eight following years. This would create an overall budget surplus of 5.7 per cent of GDP and bring about an accelerated debt reduction.

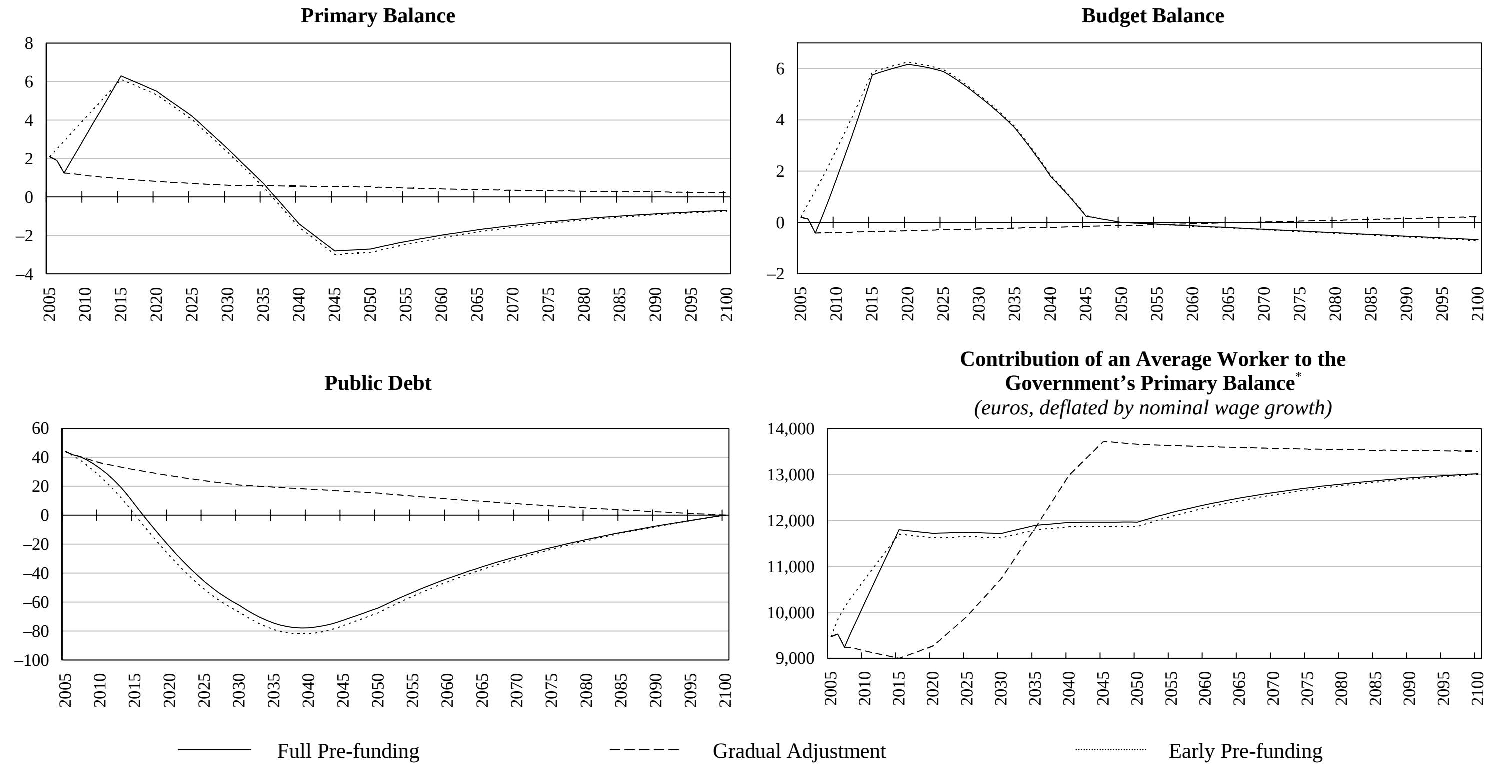
As of 2015 the primary surplus would decline due to the impact of ageing but the public debt ratio would continue to fall and, as of 2017, net assets would be created that would reach a maximum level of close to 78 per cent of GDP around 2040. The latter would then be gradually reduced to zero by 2100 as the budget balance would worsen from a surplus of more than 6 per cent of GDP around 2020 to a small deficit of some 0.7 per cent of GDP at the end of the century.

This budgetary strategy would require a substantial hike in the contribution of the average worker to the government's primary balance in the 2008-15 period (following a minor decrease in 2007). Afterwards the fiscal burden of the average worker would slowly drift further upwards. Over the whole period, the maximum

Figure 4

Assessment of Alternative Budgetary Strategies: Spain

(percent of GDP, unless indicated otherwise)



[*] Standard deviations: 819.99 (full pre-funding); 1809.85 (gradual adjustment); 719.97 (early pre-funding).
Sources: European Commission (2005a and 2006), own calculations.

difference works out at some 3,780 EUR out of a constant wage and pertains to the 2007 and 2100 generations.

As in Belgium and Italy, an alternative fiscal strategy could be considered that would gradually reduce the debt ratio to zero by 2100 without creating net assets in the intermediate years. This would imply a very slow continuous improvement in the budget balance from a deficit of 0.4 per cent of GDP in 2007, as projected by the European Commission (2005a), to a small surplus of 0.2 per cent of GDP in 2100. This strategy would allow the fiscal burden for the average worker to decline in the coming years. However, between 2015 and 2045 this burden wouldhave to be increased substantially. After 2045 it would drop marginally. The maximum difference in the contribution of an average worker to the government's primary balance is between the 2015 and 2045 generations and works out at 4,725 EUR, *i.e.* significantly more than in the full pre-funding strategy. Hence, while the gradual adjustment strategy may appear more reasonable as it avoids the creation of important net government assets, it seems less equitable as a more than fair share of the burden of financing the ageing costs is shifted to future generations.

Finally, an early pre-funding strategy, similar to the one considered for Belgium, could start the adjustment to the 2015 primary surplus target already in 2006. This would allow the required fiscal effort to be spread over a longer period such that the primary surplus would have to be increased by some 0.4 per cent of GDP a year in the 2006-15 period. The development of the budget balance and public debt is similar to the one in the full pre-funding strategy. The fiscal burden of the average worker increases earlier but less than in the latter strategy. The maximum difference in this indicator is still 3,535 EUR, only slightly less than in the benchmark pre-funding strategy.

All in all, the adjustment effort in Spain is much higher than in Belgium and in Italy. Even full pre-funding strategies still seem to imply an inequitably large fiscal burden for distant generations. This suggests that the group of non-workers should contribute more to the financing of ageing-related cost pressures.

5. Concluding remarks

Mainly due to the growing concerns about the potentially large budgetary impact of population ageing, the sustainability of public finances has become a key issue in fiscal surveillance. While a number of different theoretical specifications are proposed in the literature depending on which public debt ratio is deemed sustainable, the general intuition is that sustainable policies can in principle be continued indefinitely.

The empirical research on fiscal sustainability consists in both backward-looking and forward-looking approaches. The backward-looking studies provide valuable indications about the extent to which fiscal policy has been constrained in the past by the government's intertemporal budget constraint but regime changes can never be excluded and the assessment of the current sustainability of public finances typically requires a forward-looking approach. The latter studies aim at quantifying the budgetary impact of ageing, detecting sustainability problems by assessing deficit-debt dynamics and, in the case of the synthetic indicators and generational accounting, measuring the sustainability gaps.

For the EU Member States, the European Commission now routinely calculates the S1 and S2 sustainability indicators based upon the projected ageing costs and the requirement of a 60 per cent of GDP debt ratio by 2050 and compliance with the government's intertemporal budget constraint respectively. In this paper two alternative sustainability indicators – S3 and S4 and the corresponding required primary balances – are proposed. They quantify the fiscal effort that would be needed in order to fully pre-fund the budgetary costs of ageing and generate a debt-stabilising budget balance or a balanced budget in 2050.

A number of conclusions can be drawn from the empirical part of the paper. First, taking into account the most recent projections of the Ageing Working Group (European Commission, 2006), public finances seem to be unsustainable in all euro-area countries except for Austria.[17] This implies that, given the present macroeconomic and demographic outlook, fiscal adjustments will be needed to deal with population ageing. Second, as measured by the sustainability gaps calculated in this paper, the magnitude of these required adjustments varies greatly across euro-area countries. They are particularly sizeable in Luxembourg and Portugal but much smaller in Finland. Third, implementing this required adjustment in the coming years before ageing-related expenditure starts to rise significantly, *i.e.* pre-funding the ageing costs, would lead to the reimbursement of public debt and the creation of net government financial assets in a number of countries.

This raises the question whether such a policy would actually be appropriate or to what extent medium-term objectives for fiscal policy should already take into account the estimated ageing costs, an issue which is important in the context of the reformed Stability and Growth Pact. The ECOFIN Council (2005a) has suggested that these medium-term objectives should not only depend on government debt and potential growth but also on the size of the implicit liabilities related to ageing.

In this paper it is stressed that different budgetary strategies, *i.e.* different degrees of pre-funding, have different implications for the fiscal burden of subsequent generations of workers. This is illustrated for Belgium, Italy and Spain. This analysis shows that, while full pre-funding may require a relatively important fiscal effort in the coming years, it generally implies a more even distribution of the fiscal burden across generations than a more gradual adjustment strategy. More specifically, gradualism comes at a cost: postponing the required adjustment only increases the fiscal burden for future generations. Against this background, some pre-funding of ageing costs seems appropriate and for some governments this might imply targeting budgetary surpluses rather than balanced budgets or small deficits in

[17] No reasonable assessment could be made for Greece as AWG projections of pension expenditure are currently not available for that country.

the medium term. This is especially the case for countries like Belgium where settling for a roughly balanced budget in the coming years would imply that the budgetary room created by favourable debt dynamics is used for policy loosening that will have to be turned back in later years.

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PROJECTIONS OF OECD HEALTH AND LONG-TERM CARE PUBLIC EXPENDITURES

Joaquim Oliveira Martins,[*] Christine de la Maisonneuve[*] and Simen Bjørnerud[**]

This paper proposes a comprehensive framework for projecting public health and long-term care expenditures. Notably, it considers the impact of demographic and non-demographic effects for both health and long-term care. Compared with other studies, the paper extends the demographic drivers by incorporating death-related costs and the health status of the population. Concerning non-demographic drivers, for health care the projection method accounts for income elasticity and a residual effect of technology and relative prices. For long-term care, the effects of increased labour participation, reducing informal care, and wage inflation are taken into account. Following this approach, public health and long-term care expenditure are projected for all OECD countries for the years 2025 and 2050. Alternative scenarios are simulated, in particular a "cost-pressure" and "cost-containment" scenario, together with sensitivity analysis. Depending on the scenarios, the total health and long-term care spending is projected to increase on average across OECD countries in the range of 3.5 to 6 percentage points of GDP for the period 2005-2050.

1. Motivation and main findings

1. Public spending on health and long-term care is a major source of fiscal pressures in most OECD countries, amounting to, on average, some 7 per cent of GDP in 2005. Evolution has been uneven over time: following rapid growth during the 1970s, public spending slowed down for several decades. However, a recent acceleration (Figure 1) has raised concern about likely future trends.

2. This paper attempts to respond to these concerns by considering a number of factors likely to drive public spending on health and long-term care over the period to 2050.[1] In projecting drivers of this spending, two important distinctions are made:

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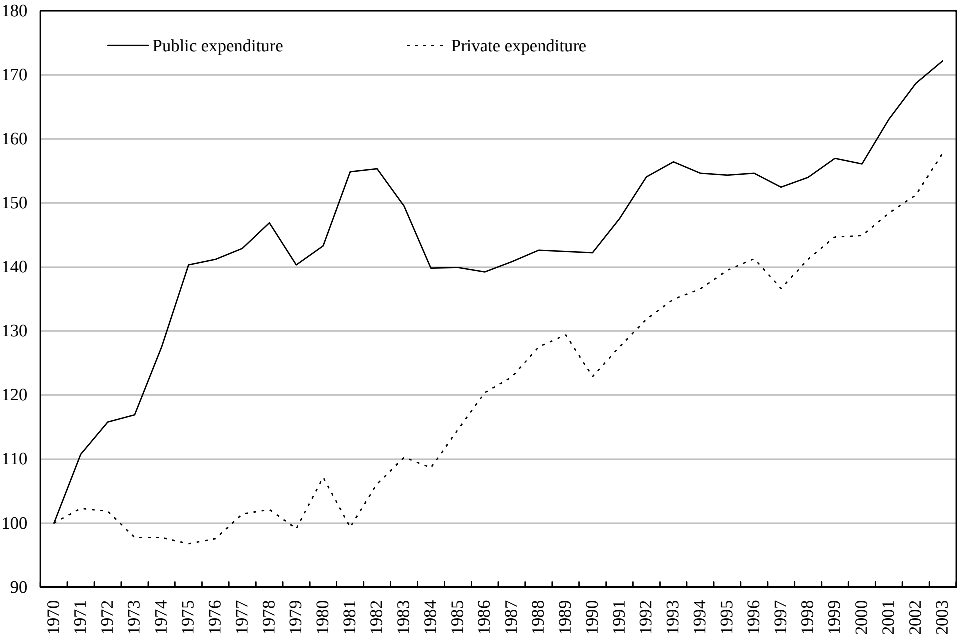
We received useful comments from Jean-Philippe Cotis, Jorgen Elmeskov, Mike Feiner, Vincent Koen, Gaetan Lafortune, Giuseppe Nicoletti and Peter Scherer, as well as other OECD colleagues. The work also benefited from discussions in the context of the Ageing Working Group of the European Commission, in particular Henri Bogaert, Declan Costello, Michel Englert and Bartosz Przywara.

1 This paper only deals with public spending. Private spending added another 2 per cent of GDP on average to expenditure on health and long-term care in 2005. While it could be argued that private and public

(continues)

Figure 1

Evolution of Public and Private OECD Health Spending*
(index 1970 = 100)(percent of GDP)



* Unweighted average of available OECD countries.
Source: OECD Health Database (2005).

- Expenditures on long-term care and on health care (both preventive and acute) are examined separately,
- For both health and long-term care, the impacts of ageing and non-demographic factors are brought separately into the analysis.

3. The projections rely on a uniform cross-country framework, in contrast with an earlier OECD exercise.[2] The latter essentially gathered country-specific projections, provided by national authorities, produced on the basis of an agreed set of macroeconomic and demographic assumptions. The current projections are more homogeneous, but at the cost of simplifying the description of national health and long-term care arrangements. The main purpose is to bring out in a stylised and tractable way the key mechanisms at work. The inherent uncertainties surrounding this approach are addressed by analysing the sensitivity of the projection results to changes in the assumptions concerning the main drivers of expenditure.

expenditures are not separable, it is implicitly assumed here that private health spending arises from individual choices and, therefore, could be treated like any other consumption item.

2 For details on this earlier project see Dang *et al.* (2001).

4. In broad terms, the principal forces driving these projections are (see main text for detail):

- *Health care, demographic factors:* a rising share of older age groups in the population will put upward pressure on costs because health costs rise with age. However, the average cost per individual in older age groups should fall over time for two reasons:
  - Longevity gains are assumed to translate into additional years of good health ("healthy ageing); and
  - Major health costs come at the end of life. Insofar as increasing longevity means that more individuals "exit" an age group by living into an older group (rather than "exit" by dying), average costs of the group in question will fall.
- *Health care, non-demographic factors:* health care costs have typically grown faster than income (even as incomes have increased). This is generally held to be due to the effect of technology and relative-price movements in the supply of health services. Disentangling these factors is beyond the scope of current analysis and indeed is dealt with only modestly in the literature. Hence, two scenarios are assumed in the projections here:
  - A "cost pressures" scenario in which it is assumed that, for given demography, expenditures grow 1 per cent per annum faster than income. This corresponds to observed trends over the past two decades.
  - A "cost-containment" scenario in which (unspecified) policy action is assumed to curb this "extra" expenditure growth such that it is eliminated by the end of the projection period (2050).
- *Long-term care, demographic factors:* dependency on long-term care will tend to rise as the share of old people in the population increase. This effect is mitigated somewhat by the likelihood that the share of dependents per older age group will fall as longevity increases due to "healthy ageing".
- *Long-term care, non demographic factors:* expenditures are likely to be pushed up by a possible "cost disease" effect, *i.e.* the relative price of long-term care increasing in line with average productivity growth in the economy because the scope for productivity gains in long-term care is more limited.[3] This effect is assumed to be fully operative in the "cost pressure" scenario but to be partially mitigated[4] by (unspecified) policy action in the "cost containment" scenario.

5. As noted, two main sets of scenarios were simulated, one in which no policy action is assumed, the "cost pressures" scenario, and a "cost-containment scenario" that embodies the assumed effects of policies curbing expenditure growth. As mentioned above, these policies are not modelled explicitly. Finally, sensitivity tests were carried out to assess the robustness of the results to key assumptions.

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3 Note that empirical evidence on the income elasticity of long-term care spending simply does not exist, and in most scenarios it is assumed to be zero.

4 It is arbitrarily assumed that the relative price changes by only half of productivity growth elsewhere in the economy.

Table 1

Public Health and Long-term Care Spending

(percent of GDP)

Country	Health care			Long term care			Total		
		2050			2050			2050	
	2005	Cost-pressure	Cost-containment	2005	Cost-pressure	Cost-containment	2005	Cost-pressure	Cost-containment
Australia	5.6	9.7	7.9	0.9	2.9	2.0	6.5	12.6	9.9
Austria	3.8	7.6	5.7	1.3	3.3	2.5	5.1	10.9	8.2
Belgium	5.7	9.0	7.2	1.5	3.4	2.6	7.2	12.4	9.8
Canada	6.2	10.2	8.4	1.2	3.2	2.4	7.3	13.5	10.8
Czech Republic	7.0	11.2	9.4	0.4	2.0	1.3	7.4	13.2	10.7
Denmark	5.3	8.8	7.0	2.6	4.1	3.3	7.9	12.9	10.3
Finland	3.4	7.0	5.2	2.9	5.2	4.2	6.2	12.2	9.3
France	7.0	10.6	8.7	1.1	2.8	2.0	8.1	13.4	10.8
Germany	7.8	11.4	9.6	1.0	2.9	2.2	8.8	14.3	11.8
Greece	4.9	8.7	6.9	0.2	2.8	2.0	5.0	11.6	8.9
Hungary	6.7	10.3	8.5	0.3	2.4	1.0	7.0	12.6	9.5
Iceland	6.8	10.7	8.9	2.9	4.4	3.4	9.6	15.2	12.3
Ireland	5.9	10.0	8.2	0.7	4.6	3.2	6.7	14.5	11.3
Italy	6.0	9.7	7.9	0.6	3.5	2.8	6.6	13.2	10.7
Japan	6.0	10.3	8.5	0.9	3.1	2.4	6.9	13.4	10.9
Korea	3.0	7.8	6.0	0.3	4.1	3.1	3.3	11.9	9.1
Luxembourg	6.1	9.9	8.0	0.7	3.8	2.6	6.8	13.7	10.6
Mexico	3.0	7.5	5.7	0.1	4.2	3.0	3.1	11.7	8.7
Netherlands	5.1	8.9	7.0	1.7	3.7	2.9	6.8	12.5	9.9
New Zealand	6.0	10.1	8.3	0.5	2.4	1.7	6.4	12.6	10.0
Norway	7.3	10.7	8.9	2.6	4.3	3.5	9.9	15.0	12.4
Poland	4.4	8.5	6.7	0.5	3.7	1.8	4.9	12.2	8.5
Portugal	6.7	10.9	9.1	0.2	2.2	1.3	6.9	13.1	10.4
Slovak Republic	5.1	9.7	7.9	0.3	2.6	1.5	5.4	12.3	9.4
Spain	5.5	9.6	7.8	0.2	2.6	1.9	5.6	12.1	9.6
Sweden	5.3	8.5	6.7	3.3	4.3	3.4	8.6	12.9	10.1
Switzerland	6.2	9.6	7.8	1.2	2.6	1.9	7.4	12.3	9.7
Turkey	5.9	9.9	8.1	0.1	1.8	0.8	6.0	11.7	8.9
United Kingdom	6.1	9.7	7.9	1.1	3.0	2.1	7.2	12.7	10.0
United States	6.3	9.7	7.9	0.9	2.7	1.8	7.2	12.4	9.7
Average	**5.7**	**9.6**	**7.7**	**1.1**	**3.3**	**2.4**	**6.7**	**12.8**	**10.1**

Source: Secretariat calculations.

6. The projections for health and long-term care expenditures yield the following stylised results (Table 1):

- In the "cost-pressure" scenario average health and long-term care spending across OECD countries is projected to almost double from close to 7 per cent of GDP in 2005 to some 13 per cent by 2050.
- In the "cost-containment" scenario, average expenditures would still reach around 10 per cent of GDP by 2050,[5] or an increase of 3½ percentage points of GDP.
- Non-demographic factors (including effects from technology and relative prices) play a significant role in upwards pressure on long-term care expenditures, and indeed are the most important driver of the increase in health-care expenditure.

7. These average results hide striking differences across countries (Figure 2). In the cost-containment scenario, a group of countries stands out with increases of health and long-term care spending at or above four percentage points of GDP, over the period 2005-50. It includes rapidly ageing countries (Italy, Japan, Spain), countries that will experience a dramatic change in their population structure (Korea, Mexico, Slovak Republic), and countries with currently low labour participation, which may face a substantial increase in the demand for *formal* long-term care (Italy, Ireland, Spain). In contrast, Sweden is in the lowest range with an increase below two percentage points of GDP. This country is in a mature phase of its ageing process and already spends a relatively high share of GDP on health and long-term care.

8. Despite the uncertainties, sensitivity analysis suggests the results are fairly robust in key respects. For example, under the assumption of "healthy ageing" changes in longevity will have only a modest effect on spending. However, the projections for spending on long-term care are sensitive to the future development of participation rates for the working-age population because higher participation reduces the capacity for "informal" care. An alternative scenario, where participation rates in countries where they are currently low converge towards levels in high-participation countries, has spending on long-term care rising by an additional 1-2 per cent of GDP on average, but much more in some countries.[6]

9. The paper follows the structure displayed in Figure 3. It begins with health care expenditure, decomposing demographic and non-demographic expenditure

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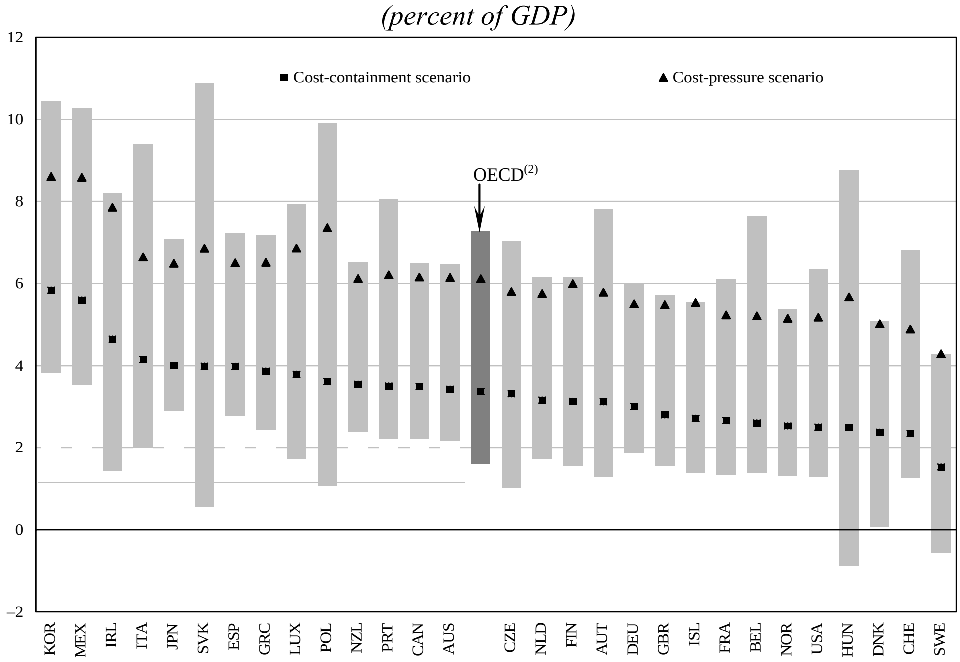
5 As a comparison, on the basis of pure demographic effects, Dang *et al.* (2001) concluded that the expenditure on health and long-term care for a group of OECD countries would increase from 6 per cent of GDP in 2000 to 9 to 9½ per cent of GDP in 2050. A similar study by the EC-Economic Policy Committee (2001), focusing on the EU15 area, calculated that the expenditure on health and long-term care would increase from 6½ per cent in 2000 to 8½ to 9 per cent in 2050. Calculated in the same way, the ageing effect was estimated to be of comparable size also in Canada (Health Canada, 2001). These orders of magnitude are comparable with the results of the present study, but the underlying drivers are rather different. For an update of the assumptions and projection methodologies see EC-Economic Policy Committee (2005).

6 However, higher participation rates are likely to have positive effects on public budgets which, depending on how they come about, may more than offset the effect via long-term care spending.

Figure 2

Total Increase in Health and Long-term Care Spending, 2005-50[1]
(percent of GDP)



(1) The vertical bars correspond to the range of the alternative scenarios, including sensitivity analysis. Countries are ranked by the increase of expenditures between 2005 and 2050 in the cost-containment scenario. Turkey was not included because data limitations made it impossible to calculate one of the scenarios.
(2) OECD average excluding Turkey.

Source: OECD calculations.

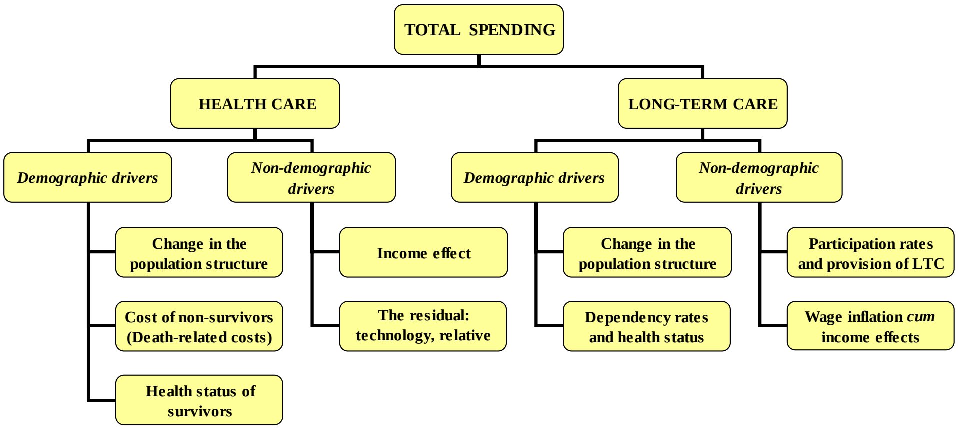
drivers, discusses the main mechanisms at work in each case, and describes the projection framework. Alternative projection scenarios are then presented, followed by a discussion of the sensitivity of the results to key assumptions. The same sequence applies to long-term care expenditures.

2. Health care

10. Looking at the recent past, expenditures on health care have increased in terms of their share in GDP. Given that pure demographic factors have so far been weak, this upward trend in spending is probably due to the increased diffusion of technology and relative price changes. Two important questions are then: how will these typically non-demographic drivers behave in the future and will the projected change in demographic trends create additional expenditure pressures?

Figure 3

Drivers of Total Health and Long-term Care Spending: Key Components



2.1 *Projecting demographic drivers of expenditure*

11. While the effect of ageing on public health expenditures per capita has been weak in the past,[7] it is commonly expected that it will increase in the future. This assessment is based on the combined effect of the projected increase in the share of old people and the tendency for health expenditures per capita to increase with age.[8]

12. In this study expenditure profiles are a central piece of the projection framework (Figure 4). Average health expenditures by age group are relatively high for young children; they decrease and remain stable for most of the prime-age period, and then start to increase rapidly at older ages.[9]

13. For any given year, the population can be divided into two segments: the survivors and the non-survivors. Each of these segments of the population has a

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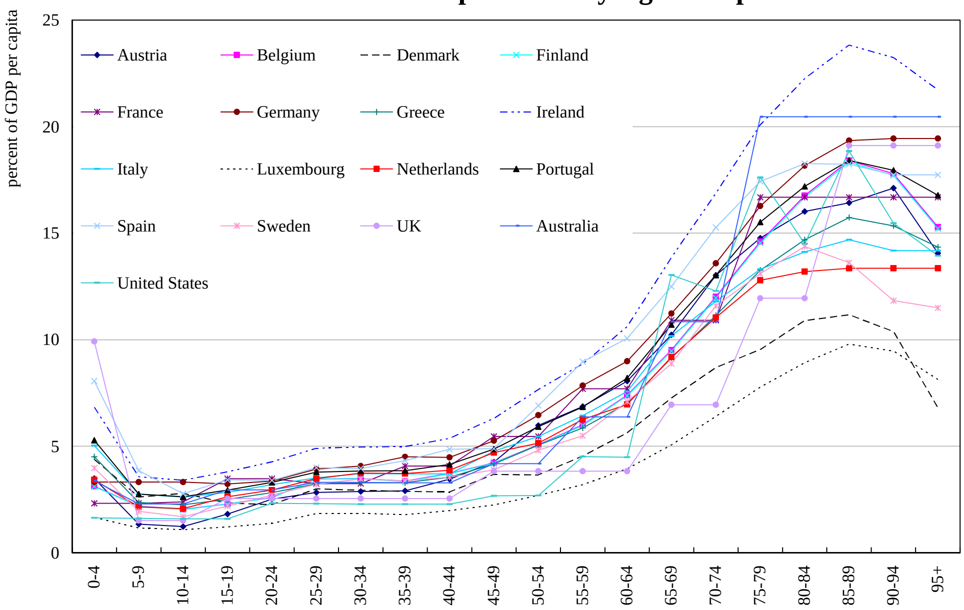
[7] See Culyer (1990), Gerdtham *et al.*, (1992), Hitiris and Posnett (1992), Zewifel *et al.* (1999), Richardson and Roberston (1999), Moise and Jacobzone (2003) and Jönsson and Eckerlund (2003).

[8] Across all health expenditure types, expenditure on those aged over 65 is around four times higher than on those under 65. The ratio rises to between six to nine times higher for the older groups (Productivity Commission, 2005; OECD Health Database, 2005).

[9] The data is based on the EU-AGIR Project; see Westerhout and Pellikaan (2005). The complete expenditure profiles were only available for a subset of OECD countries. A number of different adjustments and estimations were made in order to derive these curves for other OECD countries. Moreover, for some countries only total costs were available and thus health care had to be separated from long-term care. For 12 countries, the data were simply not available. In this case, the expenditure curves were estimated by adjusting expenditures as a spline function of age, based on available data, and were calibrated on the basis of total health expenditures derived from OECD (2005a). These estimation procedures are described in detail in OECD(2006), Annex 2A.

Figure 4

Public Health Care Expenditure by Age Groups*



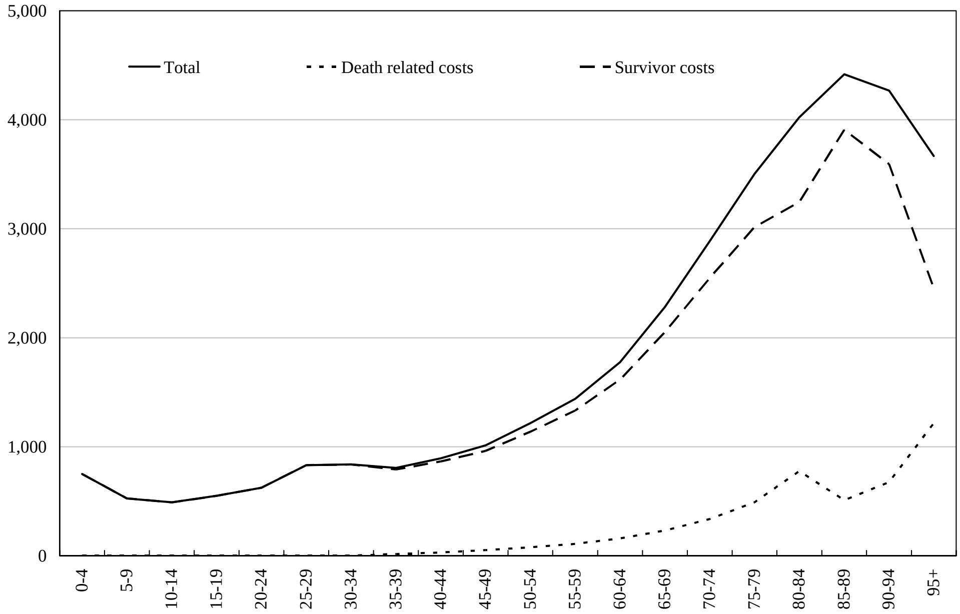
* Expenditure per capita in each age group divided GDP per capita.
Source: ENPRI-AGIR, national authorities and Secretariat calculations.

specific cost curve. The *non-survivors'* cost curve can be estimated by multiplying the estimated costs of death by age group by the number of deaths per age group. In line with evidence that health costs are concentrated in the proximity to death (*i.e.*, they are "death-related"; Seshamani and Gray, 2004; Batljan and Lagergren, 2004), the cost of death was proxied by the health expenditure per capita for the oldest age group (95+) multiplied by a factor (equal to 4 for an individual between 0 to 59 years old and declining linearly to 1 afterwards). The *survivors*' cost curve can then be derived from the difference between the total cost curve and the non-survivor curve (see OECD, 2006, Annex A2). An example of this split is given for one country, Finland, in Figure 5. Using this framework, health expenditures for survivors and non-survivors can be projected separately in a more meaningful way.

14. The shape of the aggregate cost curves can be explained by movements across age groups in health care expenditures for these two segments of the population. Indeed, the upward shape of the average cost curve reflects the fact that mortality rates are higher for older age groups. At the same time, the fact that the cost curves tend to peak and then decline at very old ages can be explained by considerations related to the cost of death. While the probability of dying increases with age, the costs of death tend to decline steadily after young and prime ages (Aprile, 2004).

Figure 5

Finland – Breakdown of the Health Care Cost Curve*
(dollars per capita)



* Expenditure per capita in each age group.
Source: ENPRI-AGIR and Secretariat calculations.

Finally, the little spike in health expenditures at the youngest age is related in part to infant mortality being higher than prime-age mortality.

15. Noteworthy, the death-related costs hypothesis has logical implications for the health status of *survivors*. In the extreme case where health costs are only death-related, there are only two outcomes: an individual either dies or survives in good health. To be consistent over time the projected increase in life expectancy must be accompanied by an equivalent gain in the numbers of years spent in good health. Otherwise, an increasing share of the population living in "bad health" would emerge. Average health care costs would then cease to be mainly driven by the costs of death, as initially assumed.

16. Thus, the death-related costs hypothesis implies that longevity gains are translated into years in good health. Under this "healthy ageing" scenario, the cost curve for *survivors* is allowed to shift rightwards, progressively postponing the age-related increases in expenditure.[10] This development tends to reduce costs compared

[10] In contrast, in a "pure demographic" approach to health care expenditures, the cost curves would not shift rightwards with ageing, reflecting the implicit assumption of unchanged health status at any given age. *(continues)*

with a situation in which life expectancy would not increase. Other health status scenarios have been envisaged in previous research (see Box 1) and the projections in this paper test the sensitivity of the results to these alternative assumptions.

17. As regards *non-survivors*, two different demographic effects are at play. On the one hand, the number of deaths is set to rise due to the *transitory* effect of the post-war baby-boom. On the other hand, if mortality falls over time, due to a *permanent* increase in longevity, fewer will be at the very end of life in each given year, mitigating health care costs.[11] The total effect on public health care expenditures will depend on the relative size of these effects.

Box 1
Longevity and health status scenarios

Different health status scenarios have been envisaged in the literature. In an "expansion of morbidity" scenario (Grunenberg, 1977), the share of life spent in bad health would increase as life expectancy increases, while a "compression of morbidity" scenario (Fries, 1980) would mean the opposite. Currently, equilibrium between longevity and morbidity is observed in many OECD countries. Accordingly, and striking a compromise between the expansion and compression scenarios, Manton (1982) put forward the "dynamic equilibrium" hypothesis where longevity gains are translated one-to-one into years in good health (hereafter, referred as "healthy ageing").

In this context, Michel and Robine (2004) proposed a general approach to explain why countries may shift from an expansion to a contraction of morbidity regime, or achieve a balanced equilibrium between longevity gains and the reduction of morbidity. They identified several factors at work: i) an increase in the survival rates of sick persons which would explain the expansion in morbidity; ii) a control of the progression of chronic diseases which would explain a subtle equilibrium between the fall in mortality and the increase in disability; iii) an improvement in the health status and health behaviour of the new cohorts of old people which would explain the compression of morbidity, and eventually; iv) the emergence of very old and frail populations which would explain a new expansion in morbidity. Depending on the relative size of each of these factors, countries could evolve from one morbidity regime to another.

When the cost curves stay put in presence of longevity gains, the share of life lived in "bad health" increases when life expectancy increases.

11 See for example Fuchs (1984), Zwiefel *et al.* (1999), Jacobzone (2003) and Gray (2004).

2.2 Projecting non-demographic drivers of expenditure

18. Income growth is certainly the main non-demographic driver of expenditures, although the vast literature on this topic is still somewhat inconclusive on the precise value of the income elasticity (see OECD, 2006, Annex 2B). Two insights can, nevertheless, be drawn. First, income elasticity tends to increase with the level of aggregation, implying that health care is both "an individual necessity and a national luxury" (Getzen, 2000). Second, without reliable price data for health-related goods and services, the high income elasticities (above unity) often found in macro studies may result from the failure to control for true price effects. In this context, the most reasonable approach seems to assume unitary income elasticity and, subsequently, to test the sensitivity of the projections to this assumption.

19. After controlling for demographic and income effects, a residual expenditure growth can be derived. Between 1981 and 2002 (Table 2), public health spending grew on average by 3.6 per cent per year for OECD countries,[12] of which 0.3 percentage point was accounted by pure demographic effects[13] and 2.3 percentage points by income effects (assuming unitary income elasticity). Thus, the residual growth can be estimated at around 1 per cent per year. Over an extended sample, 1970-2002, the residual growth would much higher to reach 1.5 per cent per annum (Table 3). This difference reflects the implementation of cost-containment policies over part of the 1980s and the 1990s that curbed the strong residual growth of the 1970s (Box 2).

20. What are the factors underlying this residual expenditure growth? The main culprits seem to be technology and relative prices.[14] Indeed, the gains in health status discussed above do not only arise from improvements in lifestyle (Sheehan, 2002; Cutler, 2001), but also from advances in medical treatment/technology. The latter, however, do not come free of economic cost. Technical progress can be cost-saving and reduce the relative price of health products and services, but its impact on expenditure will depend on the price elasticity of the demand for health care. If it is high, a fall in prices will induce a more than proportionate rise in demand, increasing expenditures.[15] Even if prices do not fall, new technologies may increase

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[12] This estimate was carried out for total health spending given that the split between health care and long-term care expenditures is not available in time series for historical data. Given the low share of public long-term care expenditure to GDP in 2000 (typically below 1 per cent of GDP; OECD, 2005b), this approximation of the residual growth seems reasonable.

[13] To simplify calculations, the effect of past ageing does not incorporate "healthy longevity" and "death-related cost" as is done in the projections. In any event, the ageing effect was small and would have even been even smaller if a more sophisticated method had been applied. If anything, ceteris paribus, ignoring these past factors is likely to have lead to a downward bias in the estimated residual.

[14] See Fuchs (1972) and Mushkin and Landefeld (1979). More recently, there has been a renewal of interest in this approach, see Newhouse (1992), KPMG Consulting (2001), Wanless (2001), Productivity Commission (2005a-b).

[15] For example, Dormont and Huber (2005) found that in France the unit price of certain surgical treatments, such as cataract, decreased whereas the frequency of the treatments increased significantly. Such effects can explain much of the recent upward shift in the health care cost curves in France.

Table 2

Decomposing Growth in Public Health Spending,* 1981-2002**

	Health spending	Age effect	Income effect***	Residual
Australia (1981-2001)	3.6	0.4	1.8	1.4
Austria	2.2	0.1	2.1	0.0
Belgium (1995-2002)	2.9	0.4	1.7	0.6
Canada	2.6	0.4	1.7	0.6
Czech Republic (1993-2002)	2.7	0.4	2.8	–0.4
Denmark	1.3	0.1	1.7	–0.5
Finland	2.6	0.3	2.1	0.2
France	2.8	0.2	1.6	1.0
Germany	2.2	0.2	1.2	1.0
Greece (1987-2002)	3.4	0.4	1.3	0.8
Hungary (1991-2002)	1.5	0.3	2.8	–1.5
Iceland	3.5	0.1	1.5	1.9
Ireland	3.9	0.1	4.9	–1.0
Italy (1988-2002)	2.1	0.7	1.7	–0.1
Japan (1981-2001)	3.8	0.4	2.2	1.1
Korea (1982-2002)	10.1	1.4	6.1	2.4
Luxembourg (1981-2002)	3.8	0.0	3.9	–0.1
Mexico (1990-2002)	4.5	0.7	0.5	2.4
Netherlands (1981-2002)	2.6	0.3	1.9	0.3
New Zealand	2.7	0.2	1.5	1.0
Norway	4.0	0.1	2.5	1.5
Poland (1990-2002)	3.1	0.5	3.2	–0.6
Portugal	5.9	0.4	2.6	2.8
Slovak Republic (1997-2002)	2.1	0.5	4.2	–1.5
Spain	3.4	0.3	2.3	0.8
Sweden	1.5	0.1	1.7	–0.4
Switzerland (1985-2002)	3.8	0.2	0.8	2.9
Turkey (1984-2002)	11.0	0.3	2.3	8.3
United Kingdom	3.4	0.2	2.3	1.0
United States	4.7	0.1	2.0	2.6
Average	**3.6**	**0.3**	**2.3**	**1.0**

* Total public health spending per capita.
** Or the longest overlapping period available.
*** Assuming an income elasticity of health expenditure equal to 1.

Source: OECD Health Database (2004), ENPRI-AGIR and Secretariat calculations.

Table 3

Decomposing Growth in Public Health Spending,* 1970-2002**

	Health spending	Age effect	Income effect ***	Residual
Australia (1971-2001)	4.0	0.5	1.7	1.7
Austria	4.2	0.2	2.5	1.5
Belgium (1995-2002)	2.9	0.4	2.2	0.6
Canada	3.1	0.6	2.1	0.4
Czech Republic (1993-2002)	2.7	0.4	2.8	–0.4
Denmark (1971-2002)	1.9	0.2	1.6	0.1
Finland	3.4	0.6	2.4	0.5
France	3.9	0.3	1.9	1.6
Germany	3.7	0.3	1.6	1.9
Greece (1987-2002)	3.4	0.4	2.1	0.8
Hungary (1991-2002)	1.5	0.3	2.8	–1.5
Iceland	6.1	0.1	2.7	3.2
Ireland	5.3	0.0	4.4	0.9
Italy (1988-2002)	2.1	0.7	2.2	–0.1
Japan (1970-2001)	4.9	0.6	2.6	1.8
Korea (1982-2002)	10.1	1.4	6.0	2.4
Luxembourg (1975-2002)	4.2	0.0	3.3	0.7
Mexico (1990-2002)	4.5	0.7	1.7	2.4
Netherlands (1972-2002)	3.3	0.4	2.0	0.9
New Zealand	2.9	0.2	1.2	1.4
Norway	5.4	0.1	3.0	2.2
Poland (1990-2002)	3.1	0.5	3.2	–0.6
Portugal	8.0	0.5	2.9	4.4
Slovak Republic (1997-2002)	2.1	0.5	4.2	–1.5
Spain	5.4	0.4	2.4	2.5
Sweden	2.5	0.3	1.6	0.7
Switzerland (1985-2002)	3.8	0.2	0.9	2.9
Turkey (1984-2002)	11.6	0.3	2.1	8.3
United Kingdom	3.8	0.1	2.1	1.5
United States	5.1	0.3	2.1	2.7
Average	**4.3**	**0.4**	**2.5**	**1.5**

* Total public health spending per capita.
** Or the longest overlapping period available.
*** Assuming an income elasticity of health expenditure equal to 1.

Source: OECD Health Database (2004), ENPRI-AGIR and Secretariat calculations.

demand by increasing the variety and quality of products.[16,17]

21. In projecting public health care expenditures, two alternative scenarios were envisaged for the future: one in which the residual effect of technology and prices continues to rise at the historical rate and another in which this rate declines over time due to cost containment policies. Should the country-specific historical growth rates in the residual be used to project expenditures? There are least two reasons for questioning this choice. First, in countries where cost-containment policies have resulted in a low or negative residual (e.g., Austria, Denmark, Ireland, Italy, Sweden) there could be a trend reversal, e.g. because new personnel has to be attracted or run-down facilities renewed. Second, in countries where the residual growth was very high (e.g., Portugal, Turkey, United States) it may seem likely that cost-containment policies will be implemented in the future. These effects would lead to a certain cross-country convergence of the expenditure residual over time. Therefore, in most of the projection scenarios, an OECD *average* residual was preferred to project expenditures.

Box 2

Cost-containment policies in OECD countries: An overview*

Faced with unsustainable growth in health care spending over the 1960s and 1970s, governments initially aimed at containing it through various kinds of macroeconomic restrictions. These policies often created allocative problems of their own. Wage and price controls had negative consequences on the supply of health while top-down spending constraints also discouraged providers to increase output or to enhance productivity.

More recently, the focus turned to more efficient provision of care. Nonetheless, while spending growth has slowed considerably over the past two

16 This is equivalent to say that the "true" relative price of health care *vis-à-vis* all other goods in the economy decreases. Consider for example the case of a demand for variety model with a CES utility function: $U = \sum_i x_i^{(\sigma-1)/\sigma}$, where $\sigma > 1$ is the elasticity of substitution among products. To simplify, let us assume price symmetry ($p_i = p$, $\forall_i$). The true composite price index is then equal to $P^* = n^{(1-\sigma)} p$. With two types of composite goods, say health (H) and all other goods (O), the true relative price would be: $P^*_H / P^*_O = (n_H / n_O)^{(1-\sigma)} (p_H / p_O)$. Thus, even if the usual price ratio (p_H / p_O) remains constant, the "true" relative price P^*_H / P^*_O would decrease when the pace of product creation in the health sector is much faster than in the rest of the economy.

17 Some governments are attempting to introduce such quality adjustments in the measure of output (and hence prices) of public services. See Grice (2005) for a discussion on this point based on the Atkinson Review, prepared for the UK Office for National Statistics.

decades, studies using statistical tests of the impact of budgetary caps or other policies to limit spending provide little evidence of a strong impact. In some cases, the reduction of health care costs has been achieved by transferring spending to other areas, such as long-term care. Supporting this view is the fact that countries that have been most effective at controlling health care spending are also the ones where long-term care expenditures have increased most rapidly.

Macroeconomic cost-containment initiatives

Wage controls have been used in public integrated systems in both the hospital and the ambulatory sector where health care personnel are paid on a salary basis (Denmark (hospitals), Finland, Ireland (hospitals), Spain, Sweden and the United Kingdom (hospitals)). Such policies were part of a broader public sector restraint rather than specific to the health sector.

Price controls have been widely used, particularly in areas where governments set prices administratively or have oversight on prices agreed between health care purchasers and providers. A number of countries have set fees directly (e.g., Australia, Belgium, France, Japan, Luxembourg and Canada). In others, prices have been automatically adjusted to offset volume overrun so as not to exceed a fixed budget ceiling (e.g., Germany (ambulatory care), Austria (hospital care), Hungary (outpatient care), and recent Belgium reforms). Administrative price setting has probably been most widespread for pharmaceutical drugs.

Limits in most countries on entry to medical schools are an important factor affecting the growth of the number of medical professionals. The number of new doctors per capita has slowed as a result. There have also been reductions in support staff (Canada, Sweden). Policies to restrain supply have actually led to supply shortages in, for example, Canada, the United Kingdom and Denmark and waiting lists are a common feature across OECD countries. In countries like Finland, France and Korea an upward pressure on wages has unfolded.

Hospital supply policies have encouraged a reduction in the number of beds per capita and concentrated acute care in larger hospital units so as to achieve economies of scale and scope. Nonetheless, the level of acute-care beds per capita remains relatively high in some countries (such as Austria, the Czech Republic, Germany, Hungary and the Slovak Republic).

Budgetary caps or controls have been a widely used instrument for controlling expenditure. In general, policies to control and reshape supply and to cap spending in the hospital sector appear to have been more successful than for ambulatory care or pharmaceutical drugs. Spending control through budgetary caps also appears to have been most successful in countries such as Denmark, Ireland, New Zealand and the United Kingdom where integrated models of health-care financing and supply are (or were) the rule and in mainly single-payer countries, such as Canada, where health-care budgets are generally explicitly set through the budget process.

Cost sharing has been an increasingly common feature over the 1980s and, particularly, the 1990s. Greater cost-sharing has mainly affected pharmaceuticals, while patient payments for inpatient and doctors visits have been less widespread (Sweden, Italy, France). This is presumably connected to the higher price elasticity for pharmaceutical drugs than for ambulatory and, particularly, for hospital care.

Improving cost-efficiency at the micro level

Ambulatory care is of key importance to the overall efficiency and effectiveness of health-care systems; it usually is the place where contact between patient and health care personnel is first established and ambulatory care is generally less expensive than hospital care. The gate-keeping role of general practitioners (GPs) has been encouraged in some countries (United Kingdom, New Zealand, Norway, United States and France). In Eastern European countries, the ambulatory sector has been shifted from the public sector to private practitioners in the course of the 1990s and, in some cases, they are now paid on a capitation basis.

Hospital sector reforms concern first and foremost the separation of purchasers and providers within public integrated systems. Purchasers/funders of health care are responsible to the budgetary authorities for cost control and to patients for the quality and accessibility of care. A significant number of countries with integrated systems have now moved in this direction (Australia, United Kingdom, New Zealand, Sweden, Italy, Portugal and, more recently, Greece). More active purchasing has also occurred in countries with public contract models (Germany, Belgium). The role of purchasers has been enhanced in the United States. The contracting out of selected activities has increased, where these can be provided more cheaply externally. Finally, a limited number of countries (the United States, the United Kingdom, Sweden, the Czech Republic and New Zealand) have experimented with greater competition among hospitals as a means of inducing improvement in efficiency, quality, and responsiveness.

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[*] This Box is based on and draws extensively on Docteur and Oxley (2003).

2.3 Combining demographic and non-demographic drivers

22. To sum up, defining HE, Y and N as real health care expenditures, real income and population, respectively; and, ε the income elasticity of health expenditures, the growth of health expenditures can be decomposed as follows:

$$\Delta \log\left(\frac{HE}{N}\right) = \Delta \log(adjusted\ age\ factor) + \varepsilon \cdot \Delta \log\left(\frac{Y}{N}\right) + \Delta \log(residual) \quad (1)$$

or expressed in share of expenditure to GDP:

$$\Delta \log\left(\frac{HE}{Y}\right) = \Delta \log(adjusted\ age\ factor) + (\varepsilon - 1) \cdot \Delta \log\left(\frac{Y}{N}\right) + \Delta \log(residual) \quad (2)$$

23. The mechanical effect of population ageing on expenditures can be interpreted as first moving up along the cost curve, assuming that the age profile of expenditures remain constant over time (Figure 6, Panel 1). This age factor is then adjusted by incorporating the healthy longevity hypothesis, corresponding to a rightward shift of the cost curve (Figure 6, Panel 2).[18] As mentioned above, this shift implies that older people still cost more than the young, but at progressively older ages. Finally, the cost curve may shift upwards (Figure 6, Panel 3) due to non-demographic drivers (income and the residual).

24. Once the total logarithmic growth rates are estimated for each country, the projection framework computes the changes in expenditure shares to GDP considering a common starting point. The latter is computed as the cross-country average share of public health care spending in GDP in 2005, thus can be viewed as a sort of OECD representative country. The changes in expenditure calculated from this common base are then added to the country-specific initial shares to obtain future projected ratios of expenditure to GDP. This method has two advantages. Over the long run, it makes the projections more comparable across countries, as the effects of the different mechanisms at work during the projection period are isolated from the impact of the initial conditions.[19] Moreover, it allows a certain catch-up across countries in the ratios of public health care expenditures to GDP.

25. Additional exogenous assumptions underlying the projections for both health and long term care are listed in Box 3 (more details are also provided in OECD, 2006, Annex 2B).

2.4 Alternative scenarios for OECD countries

26. The framework described above was used to project expenditures over the period 2005-50. In the main scenarios, the income elasticity is set to one, thus

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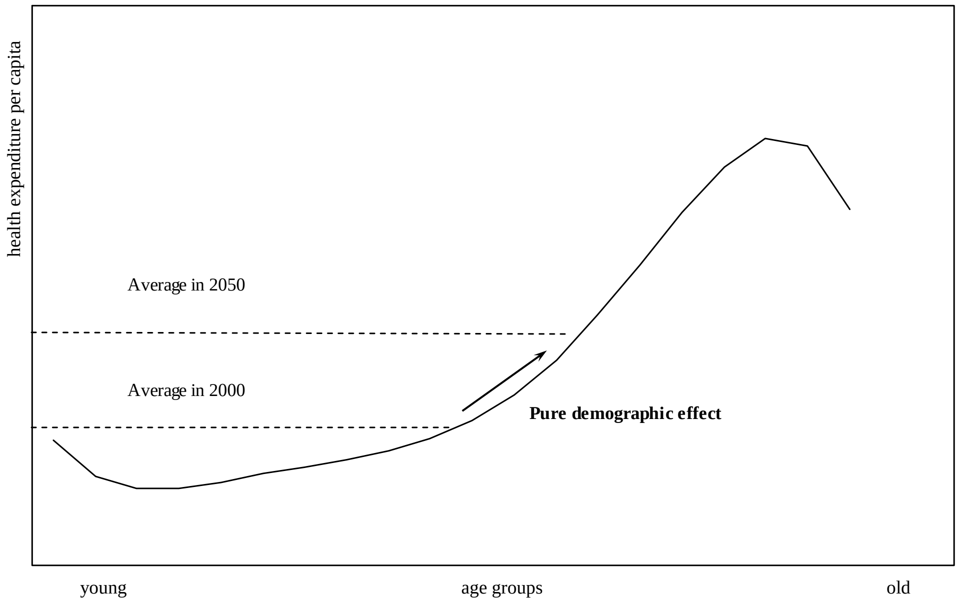
[18] See OECD (2006), Annex 2A for more details.

[19] Without this specification, spending patterns of countries with equivalent expenditure drivers would diverge in terms of share of expenditure to GDP merely due to different initial expenditure to GDP ratios.

Figure 6

Shifts in Expenditure Profiles, Ageing and Non-ageing Effects
(1) Pure Ageing Effect



(2) Ageing Effect Adjusted for Death-related Costs and Healthy Longevity

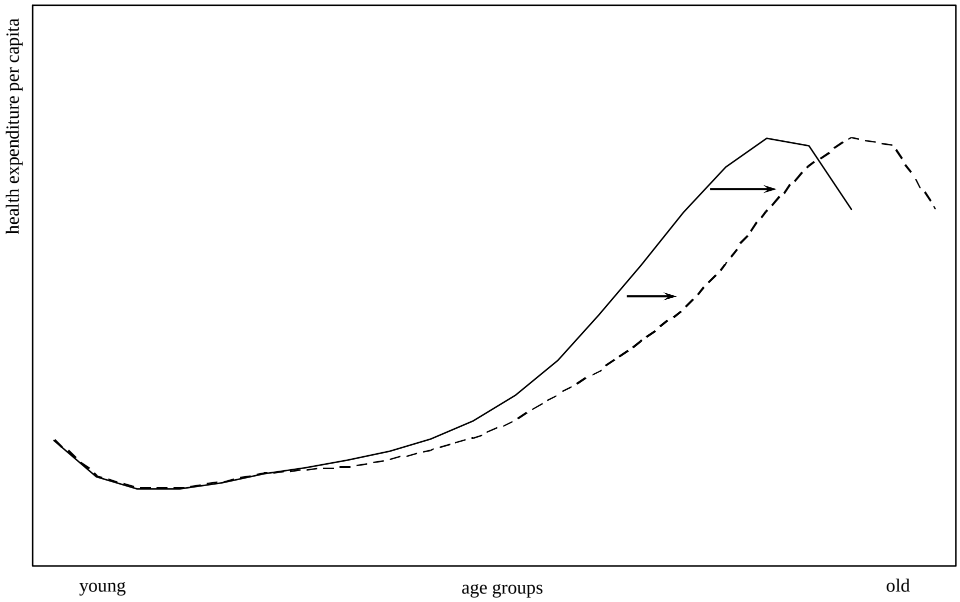
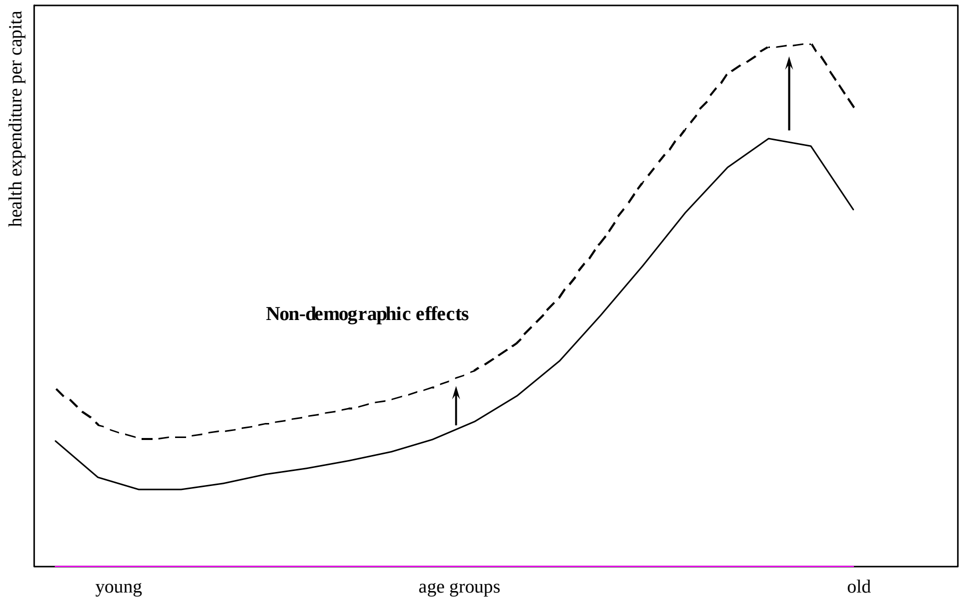


Figure 6 (continued)

Shifts in Expenditure Profiles, Ageing and Non-ageing Effects
(3) Non-ageing Drivers



income effects are not creating additional pressures in terms of expenditure shares to GDP. The main assumptions underlying each projection scenario are listed in Table 4.

2.4.1 Demographic effects

27. As discussed above, demographic effects on public health care expenditures can be decomposed into the health care costs for survivors, the adjustment for "healthy ageing" and the death-related costs, as shown in Panel A of Figure 7. The pure ageing effect can be quite large in some countries, but it tends to be compensated by a better health status. The death-related costs account only for a small fraction of the increase in expenditures as a share of GDP. In level terms, they increase from around 5 per cent of total health care spending in 2005 to 7 per cent by 2050.

28. The total effect of demographics on health care expenditures displays a wide cross-country dispersion. It ranges from virtually zero in Sweden to 1.6 percentage points of GDP for Korea. This can be related to differences in evolving population structures, as displayed by the changes in old-age dependency ratios (Panel B of Figure 7).

Box 3

Exogenous variables and assumptions underlying the projections

The projections require a set of exogenous data, as follows:

(1) Population projections (*N*). The population projections were gathered by the OECD Directorate on Employment, Labour and Social Affairs, directly from national sources. Given that the underlying assumptions on fertility and life expectancy are not necessarily uniform across countries (see Oliveira Martins *et al.*, 2005 for a discussion), this paper also uses a population maquette (Gonand, 2005) to test the sensitivity of the results to uniform longevity assumptions for a selected group of countries.

(2) Labour force projections (*L/N*) rely on previous OECD work (Burniaux *et al.*, 2003). These projections are constructed in the basis of a, so-called, cohort approach. They correspond to a baseline scenario, *i.e.* the impact of current policies is assumed to influence labour participation over the next decades, but no additional assumptions are made concerning future policy changes.

(3) Labour productivity (*Y/L*) growth is assumed to converge linearly from the initial rate (1995-2003) to 1.75 per cent per year by 2030 in all countries, except former transition countries and Mexico where it converges only by 2050.

The projected GDP per capita is directly derived from the above exogenous variables ($Y/N = Y/L \times L/N$). This simple framework is not supposed to capture in the best way productivity differentials across countries, but to isolate, as far as possible, the effect of ageing and other demographic factors on the projections.

29. However, on average, the demographic effect only accounts for a small increase in expenditure, from 5.7 per cent in 2005 to 6.3 per cent by 2050, or 0.6 percentage points of GDP (Table 5). Admittedly, the "healthy ageing" assumption may render the simulation of demographic effects relatively optimistic, but this is in line with observed patterns of health status regimes in many OECD countries. For some countries, such as Australia, the healthy ageing hypothesis may seem less plausible in view of past trends and, therefore, the sensitivity of the results to this assumption was tested below.

Table 4

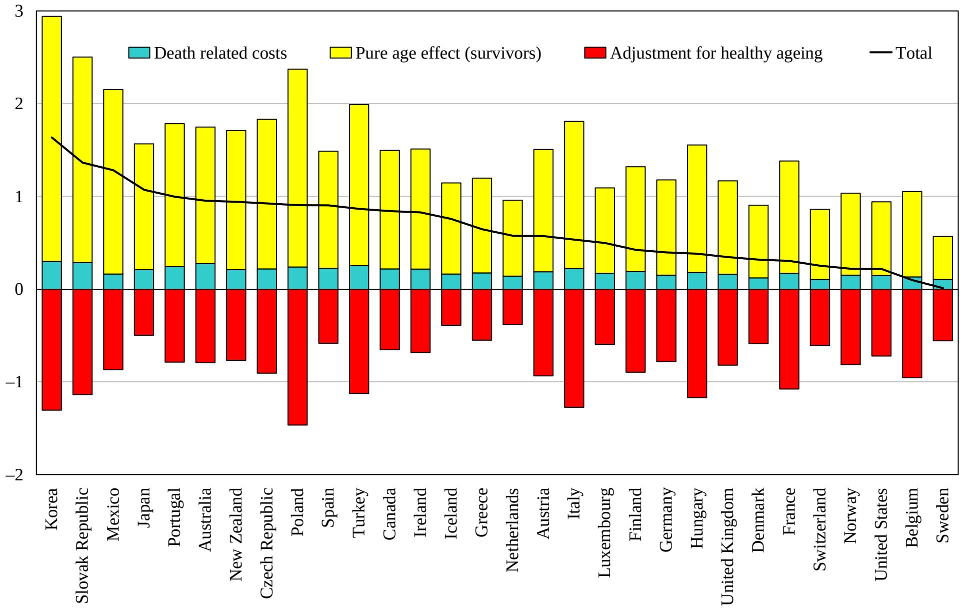
Assumptions Underlying the Alternative Projection Scenarios: Health Care

Scenarios	Health Status	Income elasticity	Expenditure residual
Demographic effect	Healthy ageing: longevity gains are translated into equivalent additional years in good health	Income elasticity is equal to 1	n.a.
Cost-pressure scenario	Healthy ageing: longevity gains are translated into equivalent additional years in good health	Income elasticity is equal to 1	**The expenditure residual grows at 1 per cent per year over the projection period**
Cost-containment scenario	Healthy ageing: longevity gains are translated into equivalent additional years in good health	Income elasticity is equal to 1	Residual growth is equal to 1 per cent in 2005 and converges to 0 by 2050 (transversality condition)
Country-specific residuals	Healthy ageing: longevity gains are translated into equivalent additional years in good health	Income elasticity is equal to 1	**Residual growth is country-specific and converges to 0 by 2050 (transversality condition)**
Income elasticity = 0.8	Healthy ageing: longevity gains are translated into equivalent additional years in good health	**Income elasticity is equal to 0.8**	Residual growth is equal to 1 per cent in 2005 and converges to 0 by 2050 (transversality condition)
Income elasticity = 1.2	Healthy ageing: longevity gains are translated into equivalent additional years in good health	**Income elasticity is equal to 1.2**	Residual growth is equal to 1 per cent in 2005 and converges to 0 by 2050 (transversality condition)
Residuals at 1.5 per cent	Healthy ageing: longevity gains are translated into equivalent additional years in good health	Income elasticity is equal to 1	**Residual growth is equal to 1.5 per cent in 2005 and converges to 0 by 2050 (transversality condition)**
Compression of morbidity	**Longevity gains are doubled into additional years in good health**	Income elasticity is equal to 1	Residual growth is equal to 1 per cent in 2005 and converges to 0 by 2050 (transversality condition)
Expansion of morbidity	**No healthy ageing adjustment, *i.e.* longevity gains do not translate into additional years in good health**	Income elasticity is equal to 1	Residual growth is equal to 1 per cent in 2005 and converges to 0 by 2050 (transversality condition)

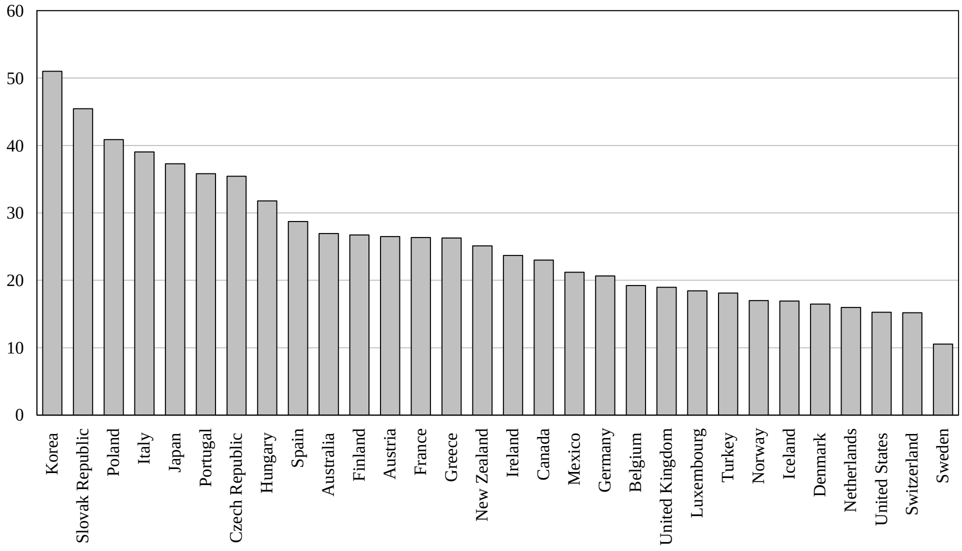
NB: The key assumption changed in each scenario is in bold.

Figure 7

Demographic Effects on Health Care Expenditure, 2005-2050
A. Increase in Public Health Care Expenditure
(percent of GDP)



B. Increase in the Old-age Dependency Ratio between 2005 and 2050*



* Ratio of population aged 65 and over to population aged 15-64.
Source: Secretariat calculations.

Table 5

Projection Scenarios for Public Health Care Expenditure*

(percent of GDP)

Country	2005 **	Demographic effect	Cost-pressure	Cost-containment	Country-specific residuals	Income elasticity=0.8	Income elasticity=1.2	Residuals at 1.5%	Compression of morbidity	Expansion of morbidity
					Sensitivity analysis					
		2050								
Australia	5.6	6.5	9.7	7.9	8.5	7.1	8.9	8.7	7.1	8.7
Austria	3.8	4.4	7.6	5.7	4.4	5.0	6.6	6.6	5.0	6.7
Belgium	5.7	5.8	9.0	7.2	6.7	6.4	8.1	8.0	6.4	8.2
Canada	6.2	7.0	10.2	8.4	7.8	7.6	9.3	9.2	7.9	9.1
Czech Republic	7.0	8.0	11.2	9.4	7.5	8.9	9.9	10.2	8.5	10.3
Denmark	5.3	5.6	8.8	7.0	5.1	6.2	7.9	7.8	6.4	7.6
Finland	3.4	3.8	7.0	5.2	4.1	4.3	6.3	6.0	4.4	6.1
France	7.0	7.3	10.6	8.7	8.7	8.1	9.5	9.6	7.8	9.8
Germany	7.8	8.2	11.4	9.6	9.6	8.9	10.3	10.4	9.0	10.4
Greece	4.9	5.5	8.7	6.9	6.6	6.1	7.9	7.7	6.4	7.5
Hungary	6.7	7.1	10.3	8.5	5.4	7.5	9.6	9.3	7.6	9.6
Iceland	6.8	7.5	10.7	8.9	10.5	7.9	10.1	9.7	8.5	9.3
Ireland	5.9	6.8	10.0	8.2	5.6	6.9	9.8	9.0	7.7	8.8
Italy	6.0	6.5	9.7	7.9	6.4	7.3	8.6	8.7	6.8	9.2
Japan	6.0	7.1	10.3	8.5	8.7	7.9	9.1	9.3	7.9	9.0
Korea	3.0	4.6	7.8	6.0	8.6	5.3	6.9	6.8	4.8	7.3
Luxembourg	6.1	6.6	9.9	8.0	6.6	6.9	9.4	8.9	7.5	8.6
Mexico	3.0	4.3	7.5	5.7	8.3	4.4	7.3	6.5	4.9	6.5
Netherlands	5.1	5.7	8.9	7.0	6.1	6.3	8.0	7.9	6.8	7.4
New Zealand	6.0	6.9	10.1	8.3	8.4	7.6	9.1	9.1	7.7	9.1
Norway	7.3	7.5	10.7	8.9	9.6	8.1	9.8	9.7	8.1	9.7
Poland	4.4	5.3	8.5	6.7	4.6	5.5	8.2	7.5	5.5	8.2
Portugal	6.7	7.7	10.9	9.1	12.6	8.3	10.1	9.9	8.4	9.9
Slovak Republic	5.1	6.5	9.7	7.9	4.9	7.2	8.6	8.7	6.8	9.0
Spain	5.5	6.4	9.6	7.8	7.5	7.1	8.5	8.6	7.2	8.3
Sweden	5.3	5.3	8.5	6.7	4.9	5.9	7.7	7.5	6.3	7.3
Switzerland	6.2	6.4	9.6	7.8	11.4	7.1	8.6	8.6	7.4	8.4
Turkey	5.9	6.7	9.9	8.1	n.a	7.3	9.1	8.9	7.3	9.2
United Kingdom	6.1	6.5	9.7	7.9	7.9	7.1	8.8	8.7	7.1	8.7
United States	6.3	6.5	9.7	7.9	10.8	7.1	8.9	8.7	7.3	8.6
Average	**5.7**	**6.3**	**9.6**	**7.7**	**7.5**	**6.9**	**8.7**	**8.5**	**7.0**	**8.5**

* For the definition of the different scenarios see Table 4.
** Estimates, taking into account the observed expenditure growth between 2000 and 2003 (or 2002 if not available).
Source: Secretariat calculations.

2.4.2 A cost pressure scenario

30. In this scenario it is assumed that, on top of the demographic effects and income effects, the expenditure residual continues to grow at 1 per cent per year over the projection period. This induces a substantial increase in the health expenditures, averaging nearly 4 percentage points of GDP from 2005-2050. In most countries, health care expenditures would then approach or exceed 10 per cent of GDP by the end of the projection period.

31. While these figures may be useful as a benchmark, they do not seem very plausible. It is unlikely that public health care expenditures to GDP could continue to grow at such constant rate, without limit. A long-run convergence (or transversality) condition is therefore considered in the next scenario.

2.4.3 A cost-containment scenario

32. In the "cost-containment" scenario it is assumed that residual expenditure growth converges to zero by 2050,[20] implicitly meaning that policies are effective in controlling expenditure growth driven by some of the non-demographic factors. These policies have been already enacted in the past (see Box 2 above) and could progressively rein in the expenditure residual, for example by ensuring that future technology improvements are mainly used in a cost-saving way. In the absence of additional ageing effects, this would imply that public health care expenditure and income would evolve in parallel over the very long-run.[21]

33. Under this rather optimistic scenario, public health care expenditures in the OECD area would still increase on average by two percentage points between 2005 and 2050, from 5.6 to 7.7 per cent of GDP (Table 5). Large increases (above 2.5 percentage points of GDP) by 2050 are found (in descending order) in Korea, Slovak Republic, Mexico and Japan. Most of these countries are experiencing a rapid demographic change induced by the sharp fall in fertility rates.

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[20] This is roughly equivalent to assuming that the residual grows at a constant rate of ½ per cent per year.

[21] This convergence assumption (or transversality condition) may appear controversial in view of past experience. The assumption is justified by the fact that the expenditure growth has to be financed by the public purse. Under perfect health market conditions, a continuing increase in the share of income going to health care spending could reflect individual preferences. But the health care market is not perfect and governments are footing most of the bill. Thus, rapid growth of the share of health care spending in income would have to be compensated by reductions in other public spending items, which may be difficult to achieve, and/or increased health care charges for individuals. Such cost sharing has already been introduced in most countries. Similar transversality conditions have also been imposed in other projection exercises. For example, Englert (2004) assumes that income elasticity ultimately converges to one. For symmetry, negative residuals are assumed to increase towards zero over the projection period, in the scenario with country-specific residuals.

2.5 Sensitivity analysis

34. In the sensitivity analysis, a number of parameters were changed compared with the "cost-containment scenario": the size of the income elasticity, the magnitude of the residual, as well as factors underlying health status scenarios and demographic projections. Overall, the previous results seem relatively robust, as these alternative simulations do not change qualitatively the picture emerging from the comparison of the "cost-pressure" and "cost-containment" scenarios discussed above.

2.5.1 Residuals, income elasticity and different health scenarios

35. Unsurprisingly, applying country-specific growth rates of the residual component[22] would significantly affect spending patterns of individual OECD countries (Table 5). Korea, Mexico, Portugal, Switzerland, the United States would record significant increases (above two percentage points of GDP) compared with the "cost-containment" scenario.[23] If anything, this scenario illustrates the unsustainability of current health expenditure trends in some OECD countries. In contrast, in countries where recent cost-containment policies were successful, the projected expenditure shares would tend to be more moderate than in the cost-containment scenario (e.g., Denmark, Sweden). Other countries would display large decreases in expenditures because the effect of past residual growth resulting from idiosyncratic conditions, such as the scaling back of former welfare systems during economic transition (Czech Republic, Hungary, Poland and Slovak Republic), would be prolonged in the future.

36. To assess sensitivity to income elasticity, projections were run with elasticities below and above unity (0.8 and 1.2, respectively), while keeping the residual as in the cost-containment scenario.[24] Under these alternative scenarios, average OECD public health care expenditure shares would range from around 7 to 8.7 per cent of GDP. The countries with the largest projected GDP per capita growth (e.g. Ireland, Mexico, Poland) are obviously the most affected by changes in income elasticity.

37. As discussed above, the residual was derived from trends observed over the two past decades, a period characterised by efforts to contain costs. Assuming that the residual would grow at 1.5 per cent per year (as observed on average over the past three decades), but that it would still decline to zero over the projection period, would induce an average increase of less than one percentage point of GDP compared with the cost-containment scenario.

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[22] Note that the residual is still assumed to converge towards zero over the projection period.

[23] Given the very high historical growth rate of the residual for Turkey, this country was excluded from this simulation as it produced rather implausible shares of health care expenditures to GDP by 2050.

[24] Note that when the chosen income elasticity is assumed to be changed both in the past and in the future, applying sub-unity elasticity would increase the residual when explaining past data. This means, when projecting, that the drag on expenditure growth from lower income elasticity would be offset by a higher residual, and vice versa. By construction, such scenarios would not produce very different results.

38. Sensitivity to alternative health regimes was also explored. In a “compression of morbidity” scenario the shift in the cost curves is twice the adjustment applied in the “healthy ageing” regime. Alternatively, a regime of “expansion of morbidity” corresponds to a scenario where longevity gains are not translated into "healthy ageing". Under these scenarios, average health expenditures by 2050 range from 7 to 8.5 per cent of GDP. This shows that alternative health regimes matter for projecting future expenditure trends, but their impact is smaller than non-demographic effects.

2.5.2 Alternative population projections

39. As noted in Box 3, national population projections are not based on harmonised assumptions across countries. In particular, projected longevity gains can differ widely and, on average, are also lower than observed in the past decades. Accordingly, an alternative scenario was tested where longevity is assumed to increase uniformly across countries by two years per decade, in line with past trends. These alternative population projections were derived from a stylised demographic *maquette*, mimicking national projections (see Gonand, 2005).

40. The simulations were carried out for five large OECD countries (France, Germany, Italy, Japan and United States). Taking again the “cost-containment” scenario as a benchmark, the implied deviations are relatively modest (on average an increase in expenditures below ½ percentage point of GDP, see Table 6). This could be expected in a world of “healthy ageing”. Indeed, a framework were demographic effects are not adjusted to healthy ageing would be much more sensitive to underlying idiosyncrasies in national population projections. Nonetheless, the joint effect of an “expansion of morbidity” assumption and higher longevity gains would generate a sharp increase in expenditures, of around 1½ percentage points, compared with the “cost-containment” scenario. This stresses the important fact that it is not longevity or health status *per se* that could induce expenditure pressures, but rather their interaction.

3. Long-term care

41. Long-term care (hereafter, LTC) differs from health care. While health care services aim at changing a health condition (from unwell to well), long-term care merely aims at making the current condition (unwell) more bearable. Individuals need LTC due to disability, chronic condition, trauma, or illness, which limit their ability to carry out basic self care or personal tasks that must be performed every day. Such activities are defined as activities of daily living, ADLs (eating, dressing, bathing, getting in and out of bed, toileting and continence) or instrumental activities of daily living, IADLs (preparing own meals, cleaning, laundry, taking medication, getting to places beyond walking distance, shopping, managing money affairs and using the telephone/Internet). A person is dependent if he or she has limitations in ADLs and IADLs.

Table 6

Sensitivity Analysis of Health Care Expenditure to Population Projections Assuming Longevity Gains of 2 Years per Decade
(percent of GDP)

Country	2005*	Healthy ageing 2050	Expansion of morbidity
France	7.0	8.8	9.8
Germany	7.8	9.6	10.7
Italy	6.0	8.1	9.2
Japan	6.0	8.4	9.5
United States	6.3	7.7	8.6
Average	**6.6**	**8.5**	**9.6**

* Estimates, taking into account the observed expenditure growth between 2000 and 2003 (or 2002 if not available).
Source: Secretariat calculations.

42. At around 1-2 per cent of GDP, the importance of current public long-term care spending is limited compared with health care. Still, as LTC spending is heavily concentrated among the elderly (Wittenberg *et al.*, 2002), the projected demographic change suggests that its share in the economy is likely to increase. As for health care, the expenditure profiles constitute the foundation of the projection framework. In contrast with health care, the cost curves for LTC are basically close to zero up to age 60-65, and then increase sharply and monotonically, with different slopes across countries (Figure 8). These characteristics stem from different features, such as the mix between (expensive) formal and (inexpensive) informal care and the current prevalence of dependency (disability status).[25]

3.1 Projecting demographic drivers of expenditure

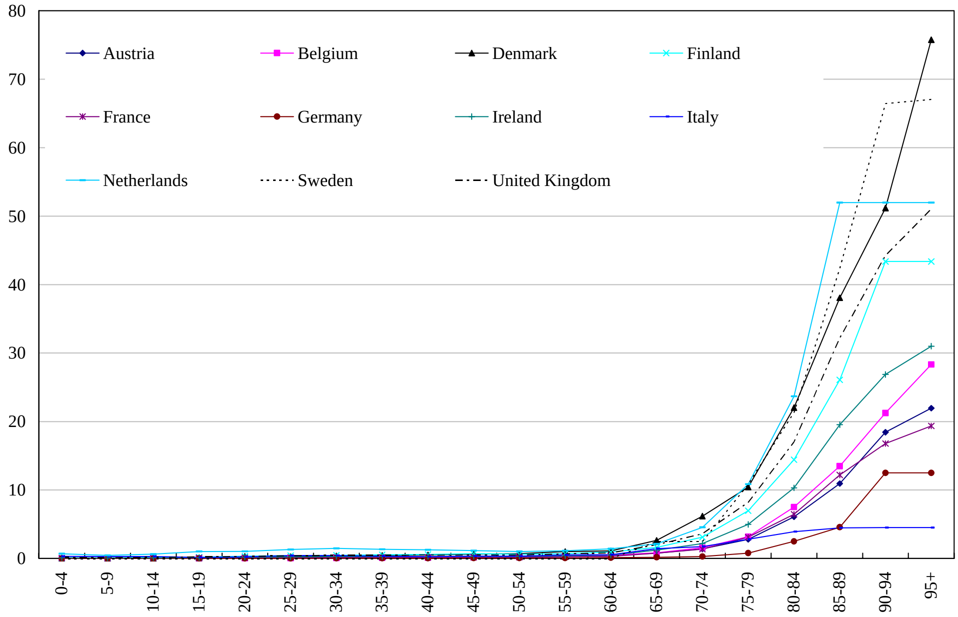
43. Whereas health care projections distinguished between survivors and non-survivors, the LTC projections split each age group into *dependants* and

[25] For comprehensive discussions of long-term care, see for example OECD (2005b), Lundsgaard (2005), Karlsson *et al.* (2004), Comas-Herrera *et al.* (2003), Norton (2000) and Wittenberg *et al.* (1998). Interesting UK case studies are Davies *et al.* (1990) and Evandrou *et al.* (1998). As an indication of the potential spending pressures, the average cost per year of institutional long-term care for old persons in France is currently at 35,000 € per dependant, and in the range of 40,000-75,000 US$ per dependant for the United States (Taleyson, 2003).

Figure 8

Public Long-term Care Expenditure by Age Group*

(percent of GDP per capita)



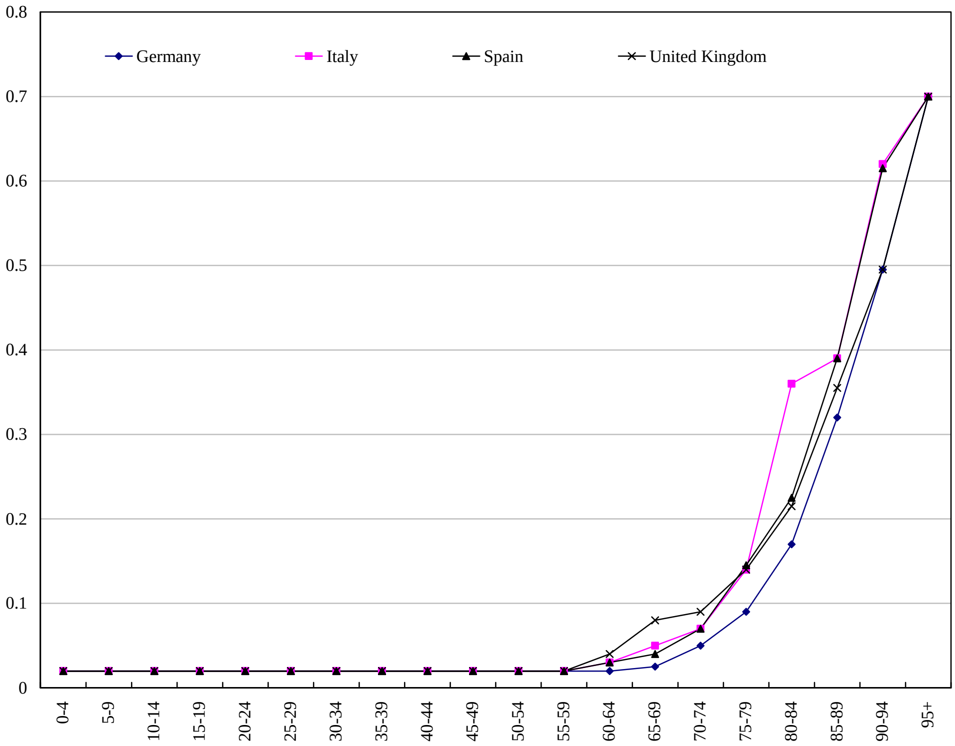
* Expenditure per capita in each age group divided by GDP per capita.
Source: ENPRI-AGIR and Secretariat calculations.

non-dependants.[26] Deriving the cost of LTC *per dependant* requires an estimate of the prevalence of dependency by age group. Unfortunately, one of the most comprehensive study in this area (Comas-Herrera *et al.*, 2003) provides dependency figures only for Germany, Italy, Spain, and the United Kingdom. Nonetheless, it can be observed that the shape of the dependency ratios by age is similar in these four countries (Figure 9). This suggests that, as a first approximation, dependency ratios could be assumed to be broadly uniform across countries. For the purpose of projecting expenditure, this has also the advantage of eliminating current differences in prevalence of dependency across age groups as a possible cause for future different increases in LTC expenditures. Put differently, the projections become less sensitive to initial conditions. Along these lines, the original expenditure profiles were divided by the average cross-country dependency ratio in order to derive the LTC expenditures per dependant person (Figure 10).

[26] Indeed, even if the unit costs of long-term care per dependant are equal in, say, countries A and B, the cost curves by age group would still differ if the share of dependants in each age group is different in each country.

Figure 9

Prevalence of Dependency by Age Group*

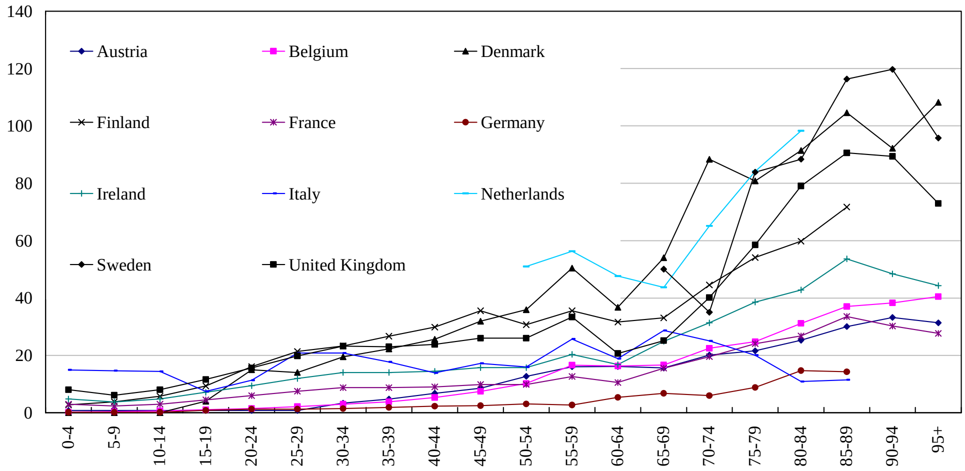


* Dependency is defined as the inability to accomplish one or several Activities of Daily Living (see text).
Source: Comas-Herrera *et al.* (2003) and Secretariat calculations.

44. There is a great deal of uncertainty about the extent to which disability has changed over time or could change for future generations (see Box 4). Internationally-comparable data in this area is also limited (Lagergren and Batljan, 2000; Jacobzone *et al.*, 2000; Wittenberg *et al.*, 2001). Moreover, disability is not necessarily translated into dependency, as the technical progress could help a disable person to work and take part in everyday life. Despite hard evidence on these phenomena, this paper assumes that the prevalence of dependency improves as life expectancy increases. However, while for health care "healthy ageing" implied that every year gained in longevity is one in good health, the assumption for dependency is not as sanguine. One could argue that for the oldest old, where dependency is most prevalent, the potential for experiencing complete healthy longevity gains is decreasing. Accordingly, the "healthy ageing" hypothesis for long-term care was (arbitrarily) assumed to be that only *half* of the longevity gains are translated into a reduction in dependency. Alternative scenarios allow testing the sensitivity of the results to this assumption.

Figure 10

Adjusted Long-term Care Expenditure per Dependant
(percent of GDP per capita)



Source: ENPRI-AGIR and Secretariat calculations.

Box 4
Has disability fallen over time?

Answering this question is not easy because consistent cross-country data on disability rates simply do not exist. Disability is usually measured through the inability of performing one or more Activities of Daily Living (ADL). Evidence for some OECD countries suggests that the share of the severely disabled has fallen over time, while no conclusion could be reached concerning the evolution of moderate disability. Studies on the United States, for which more data are available, show that disability rates may have declined somewhat among the oldest but have increased among younger age groups, a phenomenon that is often linked to obesity trends (cf. Rand Research Bulletin, 2004).

Nonetheless, downward trends in disability may not be accompanied by a lower pressure on expenditures. On the contrary, increased spending on health care is rather the precondition for lower disability (Lichtenberg and Virabhak, 2002; Lichtenberg, 2003; Jacobzone, 2003). Indeed, helping a chronically-ill person to be autonomous may require access to the high-cost technical frontier in bio-tech/drugs.

3.2 Projecting non-demographic drivers of expenditure

45. The main non-demographic driver of LTC expenditure is related to the relative shares of *informal*[27] and *formal* care and their evolution over time.[28] While the bulk of LTC is provided informally throughout the OECD area, it is relatively more important in southern European or lower income countries. As labour force participation is projected to increase in the future, concerns are expressed that informal care will have to be substituted by more expensive formal care, adding to the fiscal burden alongside the projected greying of the population (OECD, 2005b; Comas-Herrera *et al.,* 2005).[29]

46. Wage trends among staff providing LTC would also be a significant driver of costs. Data from a UK study shows that staff costs in public sector homes accounted for 85 per cent of total unit costs (Netten *et al.,* 1998). Similarly, a study in Germany found that staff costs accounted for between 70 and 90 per cent of total unit cost of nursing homes (Reinhold, 2001).

47. LTC is highly labour intensive, but the room for productivity gains is probably limited. Therefore, it could be exposed to a "cost disease" or Baumol (1967, 1993)'s effect. In short, this implies that relative prices of LTC *vis-à-vis* other goods and services in the economy tend to rise, reflecting the negative productivity differential and equalisation of wages across sectors. With a price-inelastic demand, the share of LTC expenditure in GDP would tend to increase over time. A possible way to capture this effect is to assume that unit costs rise in line with average earnings of care staff or a measure of wage inflation in the economy (Comas-Herrera *et al.*, 2003).

48. It is plausible that income growth could push up LTC expenditure, although empirical evidence on the income elasticity of LTC expenditure is just not available. Considering that LTC can be characterised as a necessity, the income elasticity could be probably small or close to zero, though it could be expected that with the

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27 Most informal care is provided by partners or children. To be considered informal, the provision of care cannot be paid for as if purchasing a service. However, an informal care giver may receive income transfers conditioned on his/her provision of informal care and possibly, in practice, some informal payment from the person receiving care. On the other hand, formal care is provided by care assistants who are paid for providing care under some form of employment contract. It includes care provided in institutions as well as care provided at home. The difference between formal and informal care is first of all not about the type of care, but who provides it (Lundsgaard, 2005).

28 Due to lack of sufficiently comparable information across countries, this paper does not incorporate another important distinction, which is the subdivision of formal care into institutional care and care delivered to the patient's home. There are indeed fundamental differences between countries in the way they organise their formal LTC. Institutional LTC is particularly widespread in the Nordic countries. Norway and Sweden stand out with substantially higher LTC spending than any other country due to generous services (single rooms and well-equipped housing infrastructure) provided for residents in nursing homes (OECD, 2005b). Whether this organisation is adopted by other countries or a (cheaper) ambulatory help-at-home strategy is pursued could have important consequences for public expenditures.

29 There are indications that the proportion of older people living alone increased up to the early 1990s, although trends appear to have changed since (Tomassini *et al.*, 2004 and Borsch-Suppan, 2005).

development of long-term care services a demand for higher quality services could also develop.

49. In order to assess the impact of these different drivers on the observed differences of LTC costs per dependant across countries, a simple econometric model was specified:[30]

$$Log\left(\frac{LTC}{ND}\right) = \alpha + \beta_1 \cdot Age + \beta_2 \cdot Z + \beta_3 \cdot W + u \qquad (3)$$

where *LTC* is total long-term care expenditure, *ND*, the number of dependants, *Age* is the central point in each age bracket (2, 7, 12, …, 97), *Z* a proxy capturing the provision of informal care and *W* a proxy for the other effects (relative prices and/or income). The model was estimated using a panel of eleven EU countries by twenty age groups. Following several alternative specification tests (not reported here), the availability of informal care appeared to be best proxied by the participation ratio of the population aged 50-64. The level of GDP per capita was included but it did not appear significant, suggesting that the income elasticity could indeed be small. Given the reduced size of the country cross-section and collinearity problems, it was not possible to test for relative price effects. The equation was first estimated with country-fixed effects (Table 7). In the final specification, the fixed-effects were replaced by the participation ratio of people aged 50-64. The estimates of the age and old-age participation coefficients are robust across different specifications and display the expected sign.

3.3 Combining demographic and non-demographic drivers

50. Combining the different drivers, the logarithmic growth of long-term care expenditures to GDP can be decomposed as follows:

$$\Delta\log\left(\frac{LTC}{Y}\right) = \Delta\log(\mathit{adjusted\,age\,factor}) + (\varphi - 1)\cdot\Delta\log\left(\frac{Y}{N}\right) + \gamma\cdot\Delta\log(\mathit{Baumol\ effect}) + \Delta\log(\mathit{effect\ of\ participation}) \qquad (4)$$

where Y and N are income and population, as defined previously; φ is the income elasticity of LTC expenditures and γ the elasticity characterising the "Baumol effect", *i.e.* the extent to which an increase of average labour productivity in the economy (a proxy for wage growth) is translated into an increase of LTC costs per dependant.

51. Using this framework, the drivers are allowed to operate in several ways (see OECD, 2006, Annex 2A for further details). On demographics, it was assumed that

30 Given that the shape of the expenditure curves by age is close to an exponential function, a log-level specification was used.

Table 7

Econometric Estimates of Long-term Care Costs per Dependant

Log of long-term care cost per dependant	**Fixed effects**	**Robust OLS with age-invariant explanatory variables**	
Age	0.0335*** (0.0014)	0.0348*** (0.0025)	0.0345*** (0.0023)
Participation ratio of people aged 50-64		0.0394*** (0.0054)	0.0378*** (0.0066)
GDP per capita			0.0748 (0.0509)
Constant	6.433*** (0.079)	4.217*** (0.380)	2.356* (1.317)
Number of countries	11		
Number of age groups	20		
Number of observations	185		
R-squared	0.77 (within)	0.62	0.62

Note: *** significant at 1% and * significant at 10%.
Standard errors in parentheses.

half of the projected longevity gains translated into years with lower dependency. This is accomplished by shifting the dependency curve rightwards accordingly.[31]

52. On non-demographics, the cost curve per dependant is assumed to shift upwards due to the increase of the average labour productivity in the economy, thus embodying an implicit “cost-disease”. In most scenarios, the elasticity of this "Baumol effect" (γ) was assumed to be 0.5, probably a mild view on the extent to which the productivity of LTC services could under-perform relatively to the rest of the economy. The income elasticity was assumed in general to be zero, implying that income growth tends to drive down LTC expenditures as a share of GDP. This set of assumptions could be viewed as a relatively optimistic.

[31] Note that this method differs somewhat from what was presented earlier for health care expenditures, where the cost profile for survivors was shifted directly in line with projected longevity gains. Here the cost profile is shifted indirectly through the shift in dependency rates.

53. The second non-demographic effect is related to the participation rate of people aged 50-64, proxying the supply of informal care. Using the econometric model (3), increasing labour market participation trends induce an additional upward shift in the LTC cost curve. The baseline projections on participation rates were derived from Burniaux *et al.*(2003). These projections rely on a cohort-based approach; however, the last cohort used to project participation is the one entering the labour market in year 2000. The behaviour of subsequent cohorts remains unchanged thereafter. The latter could lead to a somewhat subdued projection of future increases in participation rates, especially in countries where these rates were well below average for cohorts entering the labour market in year 2000.

3.4 Alternative scenarios for OECD countries

54. The framework described above was used to project expenditures over the period 2005-50, under a range of scenarios similar to the approach followed for the health care projections. The main assumptions underlying each scenario are listed in Table 8.

3.4.1 Demographic effects

55. The first simulation corresponds to demographic effects (Table 9). On average, LTC expenditures reach 2.3 per cent of GDP by 2050 or an increase of 1.2 percentage points of GDP compared with 2005. Due to the sharp increase in dependency ratios with age, demographic effects contribute to a relatively much larger increase in LTC expenditures than the one observed for health care. Very large impacts of demographics on LTC expenditures (with increases from 2 to above 4 percentage points of GDP) are found in fast-ageing countries, such as Korea, Slovak Republic, Poland, Czech Republic, Poland, Turkey and Japan.

3.4.2 A cost-pressure scenario

56. This scenario assumes a “full Baumol” effect, implying that LTC costs per dependant increase in line with overall labour productivity. Due to the steady increase in relative prices, LTC expenditures would reach 3.3 per cent of GDP by 2050, or an increase of 2.2 percentage points of GDP compared to 2005.

3.4.3 A cost-containment scenario

57. In this case it is assumed that policies are able to “contain” the cost pressures associated with the Baumol effect. It is difficult to give a clear interpretation for this policy lever, but in practical terms it means that governments would deploy a continuous effort to generate productivity gains and/or contain upward pressures on wages of staff providing long-term care. In this scenario, the supply of informal care would also continue to be relatively abundant because mild increases in the

Table 8

Assumptions Underlying the Alternative Projection Scenarios: Long-term Care

Scenarios	**Health Status**	**Participation rates (proxy for availability of informal care)**	**Income and 'cost disease' effects**
Demographic effect	Healthy ageing: the prevalence of dependency per age is shifted by ½ year every 10 years (approximately half of the projected longevity gains)	n.a.	Long-term care costs per dependent increase by *half* of average labour productivity (partial Baumol effect) Income elasticity equal to zero
Cost-pressure scenario	Healthy ageing: the prevalence of dependency per age is shifted by ½ year every 10 years	Participation rates of people aged 50-64 increase in line with baseline labour force projections	**Long-term care costs per dependent increase in line with average labour productivity (full Baumol effect)** Income elasticity equal to zero
Cost-containment scenario	Healthy ageing: the prevalence of dependency per age is shifted by ½ year every 10 years	Participation rates of people aged 50-64 increase in line with baseline labour force projections	Long-term care costs per dependent increase by *half* of average labour productivity (partial Baumol effect) Income elasticity equal to zero
Unitary income elasticity	Healthy ageing: the prevalence of dependency per age is shifted by ½ year every 10 years	Participation rates of people aged 50-64 increase in line with baseline labour force projections	Long-term care costs per dependent increase by *half* of average labour productivity (partial Baumol effect) **Income elasticity equal to one**
Compression of disability	**The prevalence of dependency per age is shifted by 1 year every 10 years**	Participation rates of people aged 50-64 increase in line with baseline labour force projections	Long-term care costs per dependent increase by *half* of average labour productivity (partial Baumol effect) Income elasticity equal to zero
Expansion of disability	**No healthy ageing adjustment, *i.e.* the prevalence of dependency remains constant over time**	Participation rates of people aged 50-64 increase in line with baseline labour force projections	Long-term care costs per dependent increase by *half* of average labour productivity (partial Baumol effect) Income elasticity equal to zero
Increase in dependency	Healthy ageing: the prevalence of dependency per age is shifted by ½ year every 10 years, but **dependency rates are assumed to increase by 0.5% per year**	Participation rates of people aged 50-64 increase in line with baseline labour force projections	Long-term care costs per dependent increase by *half* of average labour productivity (partial Baumol effect) Income elasticity equal to zero
Increased participation	Healthy ageing: the prevalence of dependency per age is shifted by ½ year every 10 years	**Participation rates of people aged 50-64 converge to at least 70% by 2050 in all countries**	Long-term care costs per dependent increase by *half* of average labour productivity (partial Baumol effect) Income elasticity equal to zero

NB: The key assumption changed in each scenario is in bold.

Table 9

Projection Scenarios for Public Long-term Care Expenditure*

(percent of GDP)

Country	2005 **	Demographic effect	Cost-pressure	Cost-containment	Sensitivity analysis				
					Unitary income elasticity	Compression of disability	Expansion of disability	Increase in dependency	Increased participation
		2050							
Australia	0.9	2.2	2.9	2.0	2.6	1.5	2.4	3.1	3.2
Austria	1.3	2.5	3.3	2.5	3.0	2.0	2.9	3.6	5.4
Belgium	1.5	2.4	3.4	2.6	3.2	2.2	3.1	3.7	5.9
Canada	1.2	2.3	3.2	2.4	3.0	1.9	2.9	3.6	2.9
Czech Republic	0.4	2.0	2.0	1.3	1.7	0.9	1.8	2.4	3.2
Denmark	2.6	3.3	4.1	3.3	3.9	2.9	3.7	4.2	3.5
Finland	2.9	4.3	5.2	4.2	4.8	3.7	4.6	5.4	4.9
France	1.1	2.3	2.8	2.0	2.5	1.6	2.4	3.0	3.7
Germany	1.0	1.9	2.9	2.2	2.7	1.7	2.7	3.4	3.2
Greece	0.2	1.0	2.8	2.0	2.6	1.4	2.6	3.5	3.0
Hungary	0.3	1.5	2.4	1.0	1.6	0.6	1.3	1.8	5.4
Iceland	2.9	3.5	4.4	3.4	4.1	3.1	3.8	4.3	3.5
Ireland	0.7	1.7	4.6	3.2	3.9	2.5	3.9	4.9	3.7
Italy	0.6	2.0	3.5	2.8	3.3	2.2	3.5	4.5	6.3
Japan	0.9	2.3	3.1	2.4	2.8	1.9	2.9	3.7	2.3
Korea	0.3	4.1	4.1	3.1	3.7	2.3	3.9	5.1	5.1
Luxembourg	0.7	1.6	3.8	2.6	3.3	2.0	3.1	4.0	4.9
Mexico	0.1	2.0	4.2	3.0	3.8	2.2	3.9	5.1	3.7
Netherlands	1.7	2.4	3.7	2.9	3.5	2.4	3.4	4.1	3.9
New Zealand	0.5	2.0	2.4	1.7	2.2	1.2	2.1	2.8	2.1
Norway	2.6	3.3	4.3	3.5	4.1	3.1	3.9	4.5	3.6
Poland	0.5	2.6	3.7	1.8	2.5	1.3	2.2	2.8	6.2
Portugal	0.2	1.3	2.2	1.3	1.9	0.8	1.8	2.4	2.1
Slovak Republic	0.3	2.6	2.6	1.5	2.0	1.1	2.0	2.6	6.6
Spain	0.2	1.0	2.6	1.9	2.3	1.3	2.4	3.3	3.0
Sweden	3.3	3.6	4.3	3.4	4.0	3.2	3.6	4.0	3.6
Switzerland	1.2	1.7	2.6	1.9	2.4	1.5	2.3	2.8	1.9
Turkey	0.1	1.8	1.8	0.8	1.4	0.5	1.2	1.7	6.8
United Kingdom	1.1	2.1	3.0	2.1	2.7	1.7	2.6	3.2	2.6
United States	0.9	1.8	2.7	1.8	2.4	1.4	2.2	2.8	1.9
Average	**1.1**	**2.3**	**3.3**	**2.4**	**2.9**	**1.9**	**2.8**	**3.5**	**3.9**

* For the definition of the different scenarios see Table 8.

** Estimates, taking into account the observed expenditure growth between 2000 and 2003 (or 2002 if not available).

Source: Secretariat calculations.

participation ratios are combined with an increase of the population in the group of 50-64 years old due to the ageing trends. Despite these optimistic assumptions, average LTC expenditures would still more than double from the current base to reach 2.4 per cent of GDP by 2050. Much larger effects are found in countries, such as Greece, Italy, Ireland and Spain where the participation ratios of those aged 50-64 are projected to increase significantly or in countries facing strong demographic pressures, as noted previously.

3.5 Sensitivity analysis

58. Given the data uncertainties, sensitivity analysis is particularly important concerning LTC projections. A first scenario captures the possibility of higher income effects. Arbitrarily, it was assumed that the income elasticity is unitary. This would add around ½ percentage points of expenditure to GDP by 2050 compared to the cost-containment scenario.

59. As noted above, future developments in the prevalence of dependency are hard to predict. A "compression of disability" scenario was tested, where the dependency curve is shifted to the right twice as fast as longevity gains. This would reduce LTC expenditures by around ½ percentage point of GDP for the OECD group compared with "cost-containment" scenario. In an "expansion of disability" scenario, the dependency rates remain constant as life expectancy increases and the effect would be symmetrically opposite.

60. Another alternative scenario captures a possible autonomous increase in the dependency rate by 0.5 per cent per year. This could be interpreted as a conservative estimate of the impact of the worrying obesity trends on dependency.[32] On average LTC expenditures would reach 3.5 per cent of GDP by 2050, or a significant shift of more than 1 percentage point of GDP compared to the cost-containment case.

61. In an "increased participation" scenario, the availability of informal care is dramatically reduced by assuming that all countries converge towards an old-age participation ratio of at least 70 per cent by 2050 (countries having already a participation ratio above that level were supposed to follow their country-specific pattern). This is well above the baseline labour participation projections and would lead to average LTC costs roughly at 4 per cent of GDP by 2050, or an additional expenditure of 1.5 percentage points of GDP compared to the cost-containment scenario. The most significant increases would occur in countries where old-age participation ratios are currently particularly low (e.g., Austria, France, Italy, Turkey and former transition countries).

62. The comparison between this scenario and the cost-containment one gives a sense of the trade-offs involved with policies aiming at increasing participation

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[32] Sturm *et al.* (2004) argue that if current trends in obesity continue, disability rates will increase by 1 per cent a year more in the 50-59 age group than if there were no further weight gains. See also Olshansky *et al.* (2005) for a discussion on the effect of obesity trends on life expectancy.

rates, on the one hand, and the objective of containing future LTC expenditures, on the other hand. In this context, competing demands on the age group 50-64 could be particularly strong.

63. Finally, the sensitivity to alternative population projections was also tested for five OECD countries (France, Germany, Italy, Japan and the United States). Under the "healthy ageing" assumption (*i.e.* the dependency curves are shifted by half of the increase in life expectancy), higher longevity gains (two years per decade) *per se* do not have a strong impact on expenditures. Average expenditure for the five OECD countries is projected to be around 2.8 per cent of GDP by 2050. In contrast, a scenario where higher longevity gains are coupled with an "expansion of disability" would push average LTC expenditures to above 4 per cent of GDP by 2050.

Table 10

Sensitivity Analysis of Long-term Care Expenditure to Population Projections Assuming Longevity Gains of 2 Years per Decade

(percent of GDP)

Country		**Healthy ageing**	**Expansion of disability**
	2005*	2050	
France	1.1	2.2	3.1
Germany	1.0	3.0	4.4
Italy	0.6	3.5	5.3
Japan	0.9	3.6	5.2
United States	0.9	1.7	2.6
Average	**0.9**	**2.8**	**4.1**

* Estimates, taking into account the observed expenditure growth between 2000 and 2003 (or 2002 if not available).
Source: Secretariat calculations.

64. To sum-up, the sensitivity analysis showed that the long-term care projections presented here seem relatively robust to alternative specifications of the income elasticity, health status and longevity assumptions. In contrast, increased dependency associated with obesity trends or lower provision of informal care could have a much stronger impact on expenditures. A combination of these negative factors would obviously generate a rather gloomy perspective for public budgets.

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MEASURING SOCIAL SECURITY'S FINANCIAL OUTLOOK WITHIN AN AGING SOCIETY

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1. Introduction

The U.S. Social Security program provides an important "first pillar" of retirement income. Policymakers and the media, therefore, pay considerable attention to the financial viability of the program. Each year, the Social Security trustees release a report that summarizes the financial position of the Social Security program. Among other measures, the report draws attention to the program's "crossover date" (the year the program's benefit outlays will begin exceeding its tax receipts), the date of "trust fund exhaustion", and the present value of the program's financial shortfalls over the next seventy-five years.[1]

These measures have two problems. First, they create a misleading impression of the program's financial outlook. Second, they are biased against potential reforms that could improve the program's finances.

Fortunately, the trustees have recently adopted new accounting measures that deal with both problems. These measures reveal an $11.1 trillion present-value shortfall, which equals about 3.5 per cent of the present value of all future taxable

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This article was originally published in *Daedalus*, journal of the American Academy of Arts and Sciences, Winter 2006, Volume 135, Number 1. The opinions and conclusions expressed are solely those of the authors and do not represent the opinions or policy of SSA, any agency of the federal government, or the Cato Institute. We thank Felicitie Bell of the SSA for providing demographic projections and related underlying assumptions, and Howell Jackson, James Lockhart, William Niskanen, Peter Orzag and Peter Van Doren for useful comments.

[1] Present values summarize a sequence of financial shortfalls in one number by applying a discount factor to future shortfalls and taking their sum. The further in the future that a shortfall occurs, the larger the discount factor applied. This is done to place dollars accruing at different points in time on an equal valuation scale. In financial matters, discount factors are usually of the form [1/(1 + *r*)]*t*. Here, *r* is an annual interest rate that signifies the "time value of money". If investing $1 earns interest of 5 cents per year, the value $1 available today is the same as $1.05 available next year. Similarly, the value of $1 available next year equals $[1/(1.05)] today, which is less than $1: That's the amount needed today to obtain $1 tomorrow including accrued interest. The discount factor applied to dollars accruing after *t* years is, therefore, [1/(1.05)]*t* (where *r* = 0.05). The "present value" of all future financial shortfalls is the sum of those shortfalls taken after each is discounted according to the number of years in the future that it occurs. When calculating the present value of projected shortfalls for government programs, the appropriate interest rate to use is the "government's interest rate" – the market rate that it must pay lenders to obtain funds. For Social Security, the annual inflation adjusted interest rate used in recent years by the program's trustees equals 3.1 per cent.

payrolls. Unfortunately, because these new measures are buried in the trustees' report, they have received only scant consideration from policymakers and the media. The newer measures should receive greater attention. Indeed, were these new measures taken more seriously, reforming Social Security and Medicare could reemerge as the top policy priority that it deserves to be.

Social Security covers almost the entire U.S. population, providing participants and their spouses with retirement, disability, and other benefits during different stages of life. Social Security is currently the largest single outlay in the U.S. federal budget; many consider it one of the most successful programs in U.S. history. Although Social Security, on average, replaces only about 40 per cent of a worker's annual earnings before retirement, it provides an important "first pillar" of retirement income. Indeed, for poorer retirees, Social Security replaces 90 per cent or more of their previous earnings. Social Security is often credited with reducing poverty among the elderly in the United States.[2]

Participation in Social Security is mandatory for most occupations.[3] Social Security is financed by a 12.4 per cent payroll tax on covered earnings up to $94,200, but it increases each year with the economy-wide average wage. Employer and employee split this tax evenly. Participants become "fully insured" after they have worked in a covered job for forty calendar quarters and earned more than a predetermined wage. Fully insured participants, however, do not acquire a contractual right to specific amounts of benefits.[4] Instead, they earn a non-contractual right to benefits that are governed by the laws in effect when they become eligible to receive benefits. These laws as well as the benefit formula are subject to change by Congress.

Social Security's benefit formula is similar to a private-sector "defined benefit" plan's, where a specific formula applied to a retiree's wage history determines his or her benefits.[5] In contrast, voluntary tax-favored "defined contribution" retirement plans – 401(k), 403(b), Keogh, and others – generate retirement income based directly on a person's previous contributions and subsequent market investment returns.

Whereas previous contributions "fully fund" withdrawals from voluntary tax-favored retirement plans, Social Security operated mostly on a "pay-as-you-go" basis between the 1940s and the early 1980s: payroll tax revenue collected each year was paid out almost immediately as benefits rather than saved, thereby producing rates of return on previous contributions in excess of the risk-adjusted rates of return

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2 Engelhardt, G. and J. Gruber (2004), "Social Security and the Evolution of Elderly Poverty", National Bureau of Economic Research, Working Paper, No. 10466, May.

3 A notable exception includes state workers who are covered by state pension programs.

4 See the U.S. Supreme Court case, Nestor vs. Flemming, 363 U.S. 603 (1960).

5 One major difference is that a person's Social Security benefit is based on many more years of earnings throughout his or her lifetime than the benefits most private-sector defined benefit plans pay.

that those contributions could have earned in financial markets.[6] For those who retired shortly after Social Security began, this financing structure meant that they received more benefits from Social Security in present value than they had paid in payroll taxes. These windfalls occurred each time that Congress expanded Social Security's coverage and benefits, after 1950 until well into the 1970s.[7]

Unfortunately, the windfalls awarded to prior generations of retirees do not come for free: future generations must pay for them by receiving lower rates of return on their payroll taxes compared to the rates they could have earned if they had invested their contributions in government bonds instead. In fact, *all* future generations are worse off.[8]

2. Building the trust fund

During the early 1980s, the independent Office of the Actuary at the Social Security Administration projected that revenues would fall short of benefit outlays during the early part of the twenty-first century, largely because of the baby boom generation's retirement. Although this generation enlarged the labor force considerably (in part through the greater participation of women in the workforce) and made significant contributions over the past several decades, its members will soon retire, substantially reducing the number of workers available to finance their Social Security and Medicare benefits through payroll and other taxes. As Figure 1 shows, today there are almost five people of working age – between age 20 and 64 – for each retiree age 65 and older. By 2030, the number of people of working age per retiree will decline to less than three; by 2080, the ratio will fall to about two.

Recognizing these future demographic changes, Congress amended the Social Security Act in 1983 in an attempt to increase the system's cash flow over the next seventy-five years. Those amendments approved payroll tax hikes, subjected the Social Security benefits of those with other income sources to income taxation, and scheduled a gradual increase in the full retirement age from 65 to 67 beginning in 2003. Since 1983, these changes have generated surpluses in the Social Security trust fund, which currently holds $1.7 trillion in Treasury IOUs.

Despite these reforms, Social Security remains mostly pay-as-you-go. And though $1.7 trillion sounds like a lot, it is insufficient to pay current retirees their

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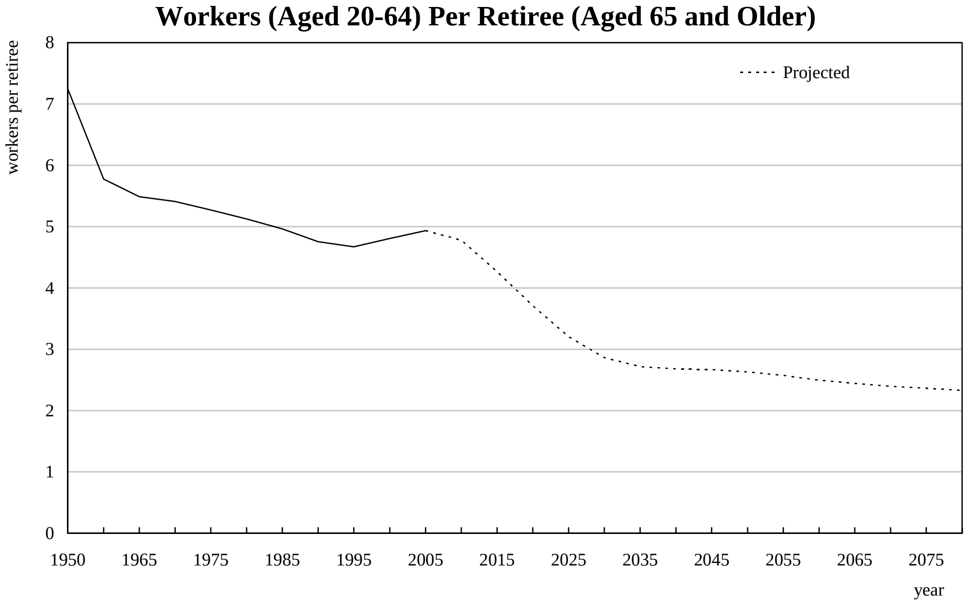
6 Liemer, D.R. (1994), "Cohort-specific Measures of Lifetime Net Social Security Transfers", Social Security Administration, Office of Research and Statistics, Working Paper, No. 59, February.

7 Geanakoplos, J., O.S. Mitchell and Stephen P. Zeldes (1998), "Would a Privatized Social Security System Really Pay a Higher Rate of Return?", in R.D. Arnold, M.J. Graetz and A.H. Munnell (eds.), *Framing the Social Security Debate: Values, Politics and Economics*, Washington, D.C., National Academy of Social Insurance, pp. 137-57.

8 Breyer, F. (1989), "On the Intergenerational Pareto Efficiency of Pay-as-you-go Financed Pension Systems", *Journal of Institutional and Theoretical Economics*, No. 145, pp. 643-58. Assuming that the growth rate of the economy is less than the interest rate, the so-called dynamic efficiency condition, the present value of the gains and losses across all past, current, and future generations is exactly zero.

Figure 1



Source: Social Security Administration.

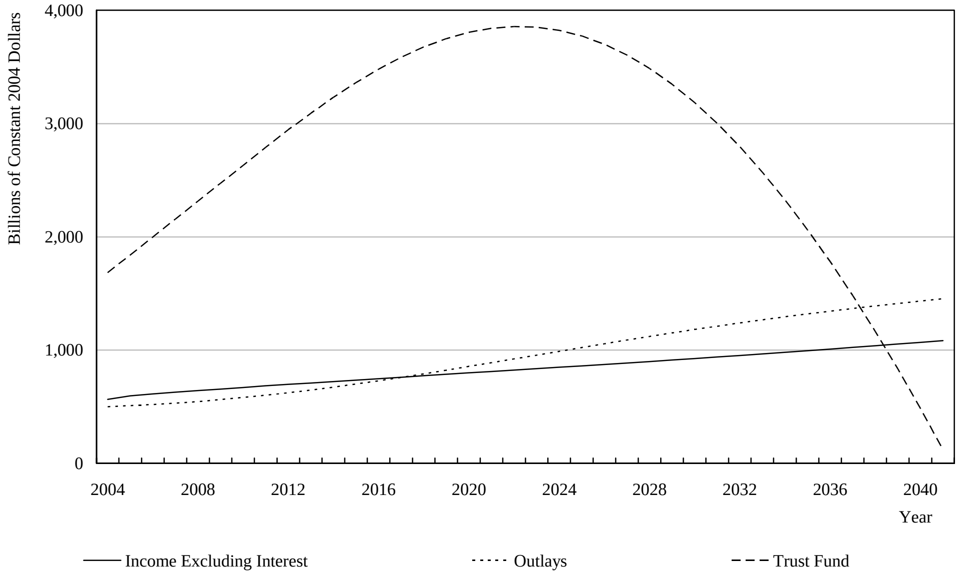
scheduled benefits for more than three years. Had the 1983 Amendments "fully funded" the Social Security system instead, the trust fund would hold about $13.7 trillion today. Contributions by past and current generations would have been enough to cover their own benefits, and future generations would not have to shoulder any of the burden.

3. Future shortfalls projected – again

At the time, many thought that the 1983 amendments had resolved Social Security's financial shortfalls for the subsequent seventy-five years. But soon thereafter projected seventy-five-year imbalances began appearing again. As shown in Figure 2, payroll tax surpluses will probably continue until 2017 – the so-called crossover date – after which projected benefits will exceed revenues. The trust fund will continue increasing because of interest income accruals through 2027, after which it is projected to decline gradually and be exhausted by 2041. The Social Security trustees estimate that the *present value* of benefits, scheduled under current law, over the next seventy-five years will exceed by $4 trillion the *present value* of its payroll tax revenues plus the *current* value of the trust fund's Treasury securities (see footnote 2).

Figure 2

Social Security's (OASDI) Revenues and Outlays



Source: Social Security Administration.

In other words, only if the government immediately deposited an additional $4 trillion into the trust fund, by increasing taxes or reducing spending, would it be able to pay current-law benefits over the next seventy-five years. An infusion of money into the trust fund would also increase public and national saving if it were not re-borrowed and spent on other government programs – a topic of recent debate.[9] Were the new monies spent entirely on other programs, the government's overall capacity to pay future Social Security benefits would not improve even though the value of Treasury securities in the trust fund would increase.

The "moving window" phenomenon partially explains why the seventy-five-year imbalances reappeared after 1983. In 1983, the projected seventy-five-year window ended in 2057; today it ends in 2079. Simply moving the seventy-five-year window to cover the years 2058 through 2079 – when cash-flow shortfalls are projected to accrue – created most of the recent $4 trillion imbalance. In other words, because the measures of the system's solvency used in 1983 were based on a limited time horizon, policymakers back then failed to include the

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9 Diamond, P. (2003), "Social Security, the Government Budget and National Savings", unpublished mimeo, MIT, March 24; Nataraj, S. and J. Shoven (2004), "Has the Unified Budget Undermined The Federal Government Trust Funds?", mimeo, Stanford University; and Smetters, K. (2004), "Is the Social Security Trust Fund a Store of Value?", *American Economic Review*, Papers and Proceedings, Vol. 94, No. 2, p. 176-81, May.

Table 1

Unfunded OASDI Obligations

(present values as of January 1, 2005; amounts in trillion dollars)

Unfunded obligations through 2079[(a)]	$4.0
Unfunded obligations after 2079[(b)]	7.1
Equals Total Unfunded Obligations (Open-Group Obligations)	**11.1**
Unfunded obligations attributable to past and current participants (Closed-Group Obligations)[(c)]	12.0
Unfunded obligations attributable to future participants[(d)]	–0.9
Equals Total Unfunded Obligations (Open-Group Obligations)	**11.1**

(a) Present value of future costs less future taxes through 2079, reduced by the amount of trust fund assets at the beginning of 2005.
(b) Present value of future costs less future taxes after 2079.
(c) This concept is also referred to as the closed group unfunded obligation. It is equal to the present value of benefits paid to current and past generations less the taxes and the value of the trust fund.
(d) People age 14 and below in 2005.
Source: 2005 Social Security Trustees Report, Table IV.B6 and IV.B7.

additional adjustments to taxes and benefits necessary to achieve a sustainable Social Security system. Unfortunately, their failure means that we must make even larger adjustments in the future.

The same limited perspective on the system's financial condition is again hampering reform efforts today. Indeed, the problem of a "moving window" implies that reforms that make the system solvent over the next seventy-five years will just falter again as the window moves forward into the future. As shown in the first panel in Table 1, the *2005 Social Security Trustees Report* projects an *additional* $7.1 trillion imbalance in present value (as of 2004) *after* the year 2079.

Adding the $7.1 trillion imbalance after the year 2079 to the $4 trillion imbalance projected through 2079 produces a present-value imbalance of $11.1 trillion, which is equal to about 3.5 per cent of the present value of all future taxable payroll revenue.[10] Barring any reform this year, this $11.1 trillion imbalance will only grow with interest, just like any regular "debt rollover". Indeed, according to

[10] Social Security's projected shortfalls could also be represented as a share of the present value of future projected GDP. But we think that representation is quite misleading since the government taxes only between 50 and 60 per cent of GDP (the payroll tax applies to an even smaller portion) and will likely continue to do so in the future. An even more misleading statistic is to state only the seventy-five-year shortfall in present value relative to GDP.

the trustees, this imbalance will increase by about $600 billion over just a single year if we do not take legislative action.[11] To be sure, the economy also expands over time and so this $600 billion figure only tells part of the story. Still, even relative to the present value of all future payrolls, Social Security's problems will grow worse over time. And when added to Medicare's shortfalls – about seven times larger than Social Security's[12] – the imbalance grows by almost 2 per cent of the present value of all future covered payroll for every five years that we delay fundamental reforms. In other words, for every five years that we do not enact policy reform, we would have to permanently increase taxes by an additional 2 per cent of taxable payrolls, or reduce outlays by the same amount. The cost of delaying Social Security reforms is, therefore, enormous.

4. Measuring sustainability

Whereas *solvency* typically refers to the government's ability to pay benefits over the next seventy-five years, *sustainability* refers to its ability to pay benefits into the indefinite future. A Social Security reform that achieves solvency over a limited horizon, but not sustainability, will soon fail to achieve even solvency as the window moves forward to include future years. However, a sustainable reform will also be solvent. Under Social Security's current projections, achieving sustainability is harder than achieving solvency: an additional $7.1 trillion in tax and benefit adjustments is necessary to address the shortfalls accruing after 2079.

The government routinely uses an *ad hoc* measure of sustainability that asks whether the system satisfies two conditions.[13] First, is the Social Security system *solvent*? That is, can Social Security afford to pay current-law benefits over the next seventy-five years with current-law tax revenues over the next seventy-five years plus the current trust fund value? Second, is the trust fund projected to be increasing in size toward the end of the seventy-five-year window? Social Security is deemed "sustainable" if both conditions are met.

This *ad hoc* measure of sustainability assumes that the trust fund will continue to increase in size *after* the seventy-fifth year. This assumption is often invalid. For example, the recent reform plan by Peter Diamond and Peter Orszag[14] appears sustainable under this *ad hoc* approach. However, under this plan, we must continue to raise payroll tax rates after the seventy-fifth year in order to pay

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11 Social Security Trustees, *2005 Social Security Trustees Report*, Section IV.B.5.a.

12 Gokhale, J. and K. Smetters (forthcoming, 2006), "Fiscal and Generational Imbalances: An Update," in J.M. Poterba (ed.), *Tax Policy and the Economy*, Vol. 20, Cambridge (Mass.), MIT Press.

13 See, for example, President's Commission to Strengthen Social Security (2001), *Strengthening Social Security and Creating Personal Wealth for All Americans*, Washington (D.C.), pp. 68-71; Council of Economic Advisors (2004), *2004 Economic Report of the President*, Washington (D.C.), p. 139; Social Security Trustees (2004), *2004 Social Security Trustees Report*, Washington (D.C.), Section IV.B.5.a.

14 Diamond, P. and P. Orszag, *Saving Social Security: A Balanced Approach*, Washington (D.C.), Brookings Institution Press.

present-law projected benefits and prevent the trust fund from disappearing. Without raising taxes, we would eventually exhaust the trust fund.[15]

Conversely, a reform might not appear sustainable under the *ad hoc* measure even though it fully eliminates the current $11.1 trillion present-value imbalance. For example, Model 2 of the President's Commission to Strengthen Social Security[16] is not projected to achieve solvency over the first seventy-five years – the first condition for sustainability under the *ad hoc* measure – without general revenue transfers from the U.S. Treasury. However, if we maintained its reform measures beyond the seventy-fifth year, Model 2 would more than eliminate the existing $11.1 trillion imbalance even without general revenue transfers. That is, Model 2's cost savings after the seventy-fifth year would more than offset, in present value, the shortfalls projected during the first seventy-five years.

5. Bias in policymaking

The traditional *ad hoc* measure of sustainability, therefore, has serious shortcomings.[17] But the most important weakness of this and other traditional measures of Social Security's finances is that they introduce a bias in policymaking. In particular, reforms that could reduce Social Security's $11.1 trillion imbalance – and improve Social Security's sustainability – often worsen each of the more traditional measures, including the trust fund exhaustion date, the crossover date, and the seventy-five-year imbalance.

Consider the "actuarially fair carve-out". This reform is very similar to the plan President Bush is now advocating, which allows participants to "carve out" some of their payroll taxes and deposit them into a personal account that would later augment their traditional benefit, much like 401(k)s and IRAs.[18] Since these participants would be contributing less to the traditional system, their traditional benefit would also be reduced by an "actuarially fair" amount equal to one dollar in present value for each dollar carved out.

This reform would have no impact on the $11.1 trillion imbalance. Each dollar that the government loses in payroll contributions would be fully offset by a dollar that the government saves in present value of future benefit payments. Furthermore, unless capital markets responded in an uninformed manner (discussed in more detail later), this reform would not affect wages, interest rates, or Gross

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15 Ibid. Diamond and Orszag, however, advocate continuing to increase payroll tax rates after the seventy-fifth year.

16 President's Commission to Strengthen Social Security, *Strengthening Social Security*, pp. 68-71.

17 Additional criticisms can be found in Jackson, H. (2004), "Accounting for Social Security and Its Reform", *Harvard Journal on Legislation*, Vol. 41, No. 1, pp. 59-225, Winter.

18 Technically, President Bush's plan is not quite actuarially fair because his benefit-offset rate does not adjust for pre-retirement mortality; it is also tied to expected Treasury yields instead of actual yields. The first issue is of second-order importance as pre-retirement mortality will be low in the future. The second issue is easily correctable.

Domestic Product (GDP) in any year. Neither would this reform change the net lifetime resources available to any household born at any time. In economic terms, this reform would be fully neutral.

Still, under this reform, all three measures traditionally used to judge Social Security's viability – the trust fund exhaustion date, the crossover date when costs exceed income, and the seventy-five-year imbalance – would worsen. We would exhaust the trust fund earlier because of the short-run decline in payroll contributions; similarly, the crossover date would occur sooner. The seventy-five-year imbalance would also appear larger because much of the lost tax revenue would show up inside the seventy-five-year window while a larger portion of the future reduction in benefits would fall beyond the seventy-five-year window.

Now let's modify the example to consider a "carve-out with a haircut". Under this approach, we would reduce a participant's traditional Social Security benefit by *more* than a dollar, say $1.10, for every dollar carved out and deposited into a personal account. A worker might be willing to take this "haircut" on future benefits in order to obtain greater ownership and control over his or her retirement resources.

In this case, we would *reduce* the $11.1 trillion imbalance since the government saves more on benefit payments in present value than it loses in contributions. Still, if policymakers focused only on the traditional measures of Social Security's finances to judge this reform plan,[19] they might reject it even though it would improve Social Security's financial outlook. The improvement in Social Security's financial outlook – as reflected by its reduced present value of unfunded obligations – should exert salutary effects on the economy immediately, and not eventually. In particular, private agents' economic decisions would no longer be distorted by the expectation of higher future costs of resolving Social Security's financial problems.

Thus, the traditional measures are not very revealing of the program's true financial status, and worse, they are biased against reforms that could reduce Social Security's $11.1 trillion imbalance. Unfortunately, these measures often influence the design of reform plans. For example, in Model 2 of the President's 2001 Commission to Strengthen Social Security, participants are allowed to carve out 4 per cent of payroll, up to a maximum of $1,000 per year (wage indexed over time).[20] The Commission imposed the $1,000 ceiling to prevent the Social Security system from "losing" too much money over the projected seventy-five-year horizon. Restricted to that horizon, the Commission did not take into account the large cost savings that would begin accruing *after* the seventy-fifth year. If participants were allowed to make even higher contributions to their personal accounts, Model 2 would more easily eliminate the entire $11.1 trillion imbalance.

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[19] Technically, whether the seventy-five-year imbalance would get better or worse would depend on the timing of the haircut. In any case, the seventy-five-year imbalance measure would fail to capture many of the benefit reductions after the seventy-fifth year.

[20] Wage indexing the $1,000 contribution limit means that the limit increases with annual growth in average, economy-wide wages.

6. New accounting measures

Beginning with the *2003 Social Security Trustees Report* and the *2004 Medicare Report*, two new measures have emerged that provide greater insight into the financial status of both programs. The Social Security Advisory Board's Technical Panel on Assumptions and Methods, which is composed of leading economists and actuaries outside of the Social Security Administration, have also recently endorsed these new measures.[21] Indeed, these measures correspond to the way that economists have thought about Social Security's finances for many years.[22]

The first measure is sometimes called the "open-group unfunded obligation". It is the sum of benefits that all *past, present, and future generations*, or "groups", have received (and are projected to receive) in present value less the amount of taxes they have paid (and are projected to pay). We can also calculate it as the present value of all projected Social Security benefits minus the present value of all projected payroll taxes and the current value of the trust fund.

The open-group unfunded obligation reveals the extent to which the current Social Security program is unsustainable. That is, it shows Social Security's financial imbalance arising from all generations – past, present, and future. Table 1 shows that based on calculations provided by the independent Office of the Actuary at the Social Security Administration, the trustees estimate the open-group obligations at $11.1 trillion in present value. In other words, in order to make Social Security sustainable, we must reduce scheduled benefits and/or increase taxes so that the sum of cost savings and new revenues total $11.1 trillion in present value.

The second measure is sometimes called the "closed-group unfunded obligation". It shows the amount of Social Security's $11.1 trillion imbalance arising from providing benefits to *past and present* generations (those age 15 and older up to those who are deceased as of 2005) in excess of their payroll taxes in present value. Unlike the open-group obligation, this calculation is "closed" to, or does not include, future generations.

Based on calculations provided again by the Office of the Actuary, the trustees estimate that past and current generations will receive about $12 trillion more in benefits in present value than they will pay in taxes (see Table 1). In contrast, future generations (those age 14 and younger in 2005 as well as the unborn)

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[21] See *The 2003 Technical Panel on Assumptions and Methods Report,* available at: http://www.ssab.gov/NEW/documents/2003TechnicalPanelRept.pdf

[22] See, for example, Auerbach, A. (1994), "The U.S. Fiscal Problem: Where We Are, How We Got Here, and Where We Are Going", in S. Fischer and J. Rotemberg (eds.), *National Bureau of Economic Research Macroeconomics Annual*, Cambridge (Mass.), National Bureau of Economic Research; Gokhale, J. and K. Smetters (2003), *Fiscal and Generational Imbalances: New Budget Measures for New Budget Priorities*, Washington (D.C.), American Enterprise Institute Press; Auerbach, A., W. Gale and P. Orszag (2004), "Sources of the Long-term Fiscal Gap", *Tax Notes*, No. 103, pp. 1049-59; Gramlich, E. (2004), "Rules for Assessing Social Security Reform", Remarks to the Retirement Research Consortium Annual Conference, August 12; Rettenmaier, A. and T. Saving (2004), *The 2004 Medicare and Social Security Trustees Reports*, National Center for Policy Analysis, Policy Report, No. 266, June.

are projected to receive $0.9 trillion *less* in benefits than they will pay in taxes (see Table 1). The "overpayment" by future generations, though, is still not enough to pay for the "overhang" of $12 trillion they are projected to inherit from past and current generations under current law. Either future generations will have to pay an additional $11.1 trillion in present value or generations alive today will have to make this sacrifice, or a combination of both.

The open-group and closed-group measures are robust to the criticisms that apply to traditional measures of Social Security's finances. For example, both measures correctly identify the economic as well as intergenerational neutralities of the "actuarially fair carve-out" discussed earlier. In the case of a "carve out with a haircut", the open-group and closed-group measures both improve (they are both smaller), corresponding to a move toward sustainability and smaller burdens on future generations. In contrast, the traditional measures such as the trust fund exhaustion date and crossover date incorrectly show a deterioration of Social Security's finances in both instances.

6.1 Usefulness of the closed group measure

Although the usefulness of the closed-group measure in determining sustainability is not as widely understood as the open-group measure's, the closed-group measure is vital to comprehending Social Security's impact on the economy. Some people believe that the closed-group measure is mostly meaningful in the context of a "fully funded" system.[23] Under full funding, each generation would pay for its own benefits and so, the closed-group obligation would be zero.

But the closed-group measure is a very important statistic even in a pay-as-you-go system for two key reasons. First, it indicates the extent to which any reform will reshuffle fiscal burdens across generations. For example, suppose Social Security benefits were increased and this increase were financed on a strict pay-as-you-go basis by raising payroll taxes. This policy change would not have any impact on the open-group measure or the traditional measures. But the closed-group measure would grow larger because this reform would transfer wealth from future generations to current generations. Current generations would gain from this policy change since they will receive more in benefits in present value than they paid in taxes; indeed, current *retirees* would receive additional benefits for free. But future generations would pay for this windfall by receiving a benefit less valuable than the additional taxes they paid in present value. The closed-group measure, which shows the net gain to past and current generations, would become larger, thereby clearly indicating the extent of this intergenerational transfer.

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[23] Goss, S. (1999), "Measuring Solvency in the Social Security System", in O.S. Mitchell *et al.* (eds.), *Prospects for Social Security Reform*, Philadelphia, University of Pennsylvania Press, pp. 16-36. An equally plausible story is that policymakers allowed Social Security to become mostly pay-as-you-go over time because the burdens being placed on future generations were not easily observable under traditional measures.

Second, the closed-group measure reveals how much pay-as-you-go financing may “crowd out” private saving and, hence, increase interest rates, lower wages, and reduce the nation’s GDP.[24] Consider again a pay-as-you-go financed increase in benefits. Because this reform transfers resources from future to current generations, it reduces the amount of money today’s generations must save for their own retirement. This reform, therefore, could *permanently* reduce the economy’s level of capital.[25]

The Congressional Budget Office estimates that every dollar transferred from future to current generations reduces private savings by zero to fifty cents.[26] Although the wide range of this estimate suggests considerable uncertainty, it follows that Social Security may have reduced the U.S. capital stock by as much as \$6 trillion and reduced GDP by as much as \$1.1 trillion.[27] Nonetheless, the traditional measures as well as the open-group measure do not indicate these large macroeconomic effects. Presumably, any discussion of Social Security reform would want to take into account the impact of a reform on the economy. Although Social Security has had many successes, its potentially large deleterious effect on capital stock and national output deserves more attention in the debate over Social Security reform.

6.2 Long run versus short run

Because the open-group measure extends the traditional seventy-five-year imbalance measure beyond the seventy-fifth year, one might at first be tempted to argue that the open-group measure places too much emphasis on Social Security’s long-run finances. In other words, one could imagine a hypothetical “reform” that does nothing to fix Social Security’s finances during the first seventy-five years but enacts large reforms after the seventy-fifth year in order to eliminate Social Security’s \$11.1 trillion imbalance.

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24 Feldstein, M. (1974), “Social Security, Induced Retirement, and Aggregate Capital Accumulation”, *Journal of Political Economy*, Vol. 82, No. 5, pp. 905-26, September-October. Feldstein is the first to analyze the empirical issue of Social Security financing’s impact on private saving.

25 The Ricardian equivalence hypothesis, however, argues that parents might leave a larger bequest in response to a transfer from their children, thereby leaving national saving unchanged. Barro, R.J. (1974), “Are Government Bonds Net Wealth?”, *Journal of Political Economy*, Vol. 82, No. 6, pp. 1095-117, November-December. Altonji *et al.*’s empirical tests, however, reject this hypothesis. Altonji, G.J., F. Hayashi and L.J. Kotlikoff (1992), “Is the Extended Family Altruistically Linked? Direct Tests Using Micro Data”, *American Economic Review*, Vol. 82, No. 5, pp. 1177-98. Consistently, Gokhale *et al.* trace a large share of the secular decline in U.S. national saving during the last several decades to the fiscal transfers from workers to retirees. Gokhale, J., L.J. Kotlikoff and J. Sabelhaus (1996), “Understanding the Postwar Decline in U.S. Saving: A Cohort Analysis”, Brooking Papers on Economic Activity, Winter.

26 Congressional Budget Office (1998), “Social Security and Private Saving: A Review of the Literature”, Congressional Budget Office Paper, July.

27 The calculated reduction in GDP assumes Cobb-Douglas production with inelastic labor supply, a net-of-depreciation capital share of 0.25, and a current capital-output ratio of 3. The calculation also assumes that the private-saving offset is constant at fifty cents for each dollar of closed-group obligation.

This potential criticism, however, is misplaced since it forgets the fact that the $11.1 trillion open-group obligation is in terms of *present value*. Besides adjusting for inflation, the present-value calculation adjusts for the real interest costs that we save from paying obligations sooner rather than later. For example, increasing payroll taxes by one dollar today would reduce the open-group obligation by, of course, one dollar. But if we postponed this one-dollar tax increase (still measured in 2004 inflation-adjusted dollars) in one hundred years we would reduce the $11.1 trillion open-group obligation by only 4.7 cents in today's dollars.[28] Delaying the one-dollar tax increase 150 years would reduce the unfunded obligations by only one cent. Attempting to postpone reforms would just mean enacting unrealistically large reforms later on.

The closed-group obligation measure reflects the amount of projected overspending on past and current generations. Thus, a policy that lets current generations "off the hook" produces a larger closed-group obligation than a reform that requires current generations to bear more of the costs.

Rather than drawing "too much" attention to the long run, the open-group and closed-group obligation measures remove the biases, embedded in the traditional measures, against reforms that could improve Social Security's long-run financial outlook. These newer measures focus attention on the true magnitude of the reforms needed to place Social Security on a sustainable path and, hence, reveal the urgent need for action. Social Security's $11.1 trillion open-group unfunded obligation is almost *three times* as large as the amount the seventy-five-year imbalance measure indicates, *despite* the fact that the present-value calculation considerably reduces the weight placed on shortfalls that accrue after the seventy-fifth year.

Robert Myers, who was chief actuary of the Social Security Administration from 1947 to 1979, points out that before 1965 Social Security actuaries routinely relied on measures looking beyond seventy-five years. In 1965, however, Social Security's actuaries and policymakers began focusing on seventy-five-year shortfalls because then, unlike today, extending the financial projections beyond seventy five years made very little difference to the program's financial outlook. However, Mr. Myers always thought that truncating measures at seventy-five years was never right in theory because of the moving-window problem: "I'm still an 'infinity' guy, because even if you have a seventy-five-year period, every year you do a new valuation you have some slippage".[29] This slippage is especially acute today, with over two-thirds of the $11.1 trillion shortfall lying outside of the seventy-five-year window.

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28 This calculation uses an inflation-adjusted interest rate of 3.1 per cent, the rate the trustees use to calculate the $11.1 trillion unfunded obligations.

29 Myers, R. (1995), "Oral History Overview", at www.ssa.gov/history/myersorl.html (accessed September 28, 2005).

6.3 Sensitivity to assumptions

Critics also charge that present-value estimates beyond seventy-five years are sensitive to underlying demographic and economic assumptions.[30] Of course, uncertainty should only *enhance* the desire to seek remedies rather than to ignore the expected problem.[31]

Furthermore, different interest rate and productivity assumptions and different demographic projections do not greatly affect the size of the policy changes – either tax increases or benefit cuts – needed to reduce Social Security's imbalance.[32] Although changes in these underlying assumptions will alter the present value of the imbalance, the present value of Social Security's tax base and future benefits also move almost proportionally and in the same direction. As a result, the increases in tax rates or cuts in benefit rates required to eliminate Social Security's current fiscal imbalance exhibit much smaller sensitivity to parametric changes in economic and demographic assumptions.

7. Reaction of capital markets to social security reform

President Bush's plan for personal accounts would create additional government debt while simultaneously reducing Social Security's unfunded future outlays. Government debt would increase as households could divert some of their payroll taxes to their personal accounts, thereby reducing government revenue. Future Social Security outlays would also decline however, under the President's actuarially fair carve out because the government could reduce benefit payments by one dollar in present value for each dollar placed into a personal account.

From an economic perspective, one dollar of government debt is not very different than one dollar of federal unfunded obligations. Both represent a dollar the government owes. Hence, real interest rates should not rise in response to the President's plan because investors should be indifferent between the two under reasonable circumstances.[33]

Legally, however, debt held by the public is a legal *liability* that the government must honor unless it declares bankruptcy.[34] Social Security and Medicare benefits, on the other hand, are only *obligations* of the government, which an act of Congress can alter. In practice, therefore, capital market participants may

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30 See, for example, Congressional Budget Office (2004), "Measures of the U.S. Government's Fiscal Position Under Current Law", Congressional Budget Office Paper, August.

31 This fact holds under any standard preference toward risk that exhibits a prudence motive.

32 Gokhale, J. and K. Smetters, *Fiscal and Generational Imbalances*, cited above.

33 Technically speaking, the new government debt must have the same stochastic properties as Social Security benefits, including sensitivity to inflation and changes in the average wage in the economy.

34 Of course, in practice, the government can use inflation to reduce the real value of nominally-denominated debt. The government would have to declare bankruptcy, however, to avoid paying off inflation-protected instruments.

be discounting future Social Security benefits at a higher rate than the yield on Treasury securities because the capital market participants think that the government might pay only a portion of its present-law Social Security obligations in the future. Replacing a dollar in present value of future Social Security benefits with a dollar of explicit debt, therefore, could negatively affect how investors perceive the outlook of the federal government's finances.

However, the government is not necessarily more likely to pay explicit debt liabilities in real terms than Social Security obligations. Indeed, the opposite is also conceivable: most explicit debt is not protected against inflation. So, faster inflation compounded over time could easily erode the value of the government's payments to bondholders. In contrast, the Social Security benefits of retirees and others, once determined, are fully protected against inflation, and will likely remain so well into the future. Moreover, even if policymakers believed that market participants discount future Social Security benefits by, say, 10 per cent above the government's discount rate then policymakers could offer a "carve-out with a 10 per cent haircut" to avoid disrupting capital markets.

8. Conclusion

The Social Security program provides an important source of income for most of the nation's retirees, but the program's long-term viability is in serious doubt unless a fundamental reform is undertaken – either by increasing taxes or by reducing the growth rate of benefits. Unfortunately, the traditional accounting measures used by policymakers and the media convey very little about the true magnitude of the financial problem facing Social Security. Those measures are also biased against reforms that could reduce Social Security's imbalance.

Fortunately, the Social Security trustees have begun to include new measures of Social Security's financial outlook, beginning with their 2003 report and continuing with the 2004 and 2005 reports – measures that fully convey the dimensions of Social Security's financial hole. The independent panel of experts appointed by the Social Security Advisory Board has endorsed these measures but, unfortunately, policymakers and the media are not paying sufficient attention to these new measures. We argue that these measures deserve much more careful consideration.

PENSION EXPENDITURE PROJECTIONS, PENSION LIABILITIES AND EUROPEAN UNION FISCAL RULES

Daniele Franco, Maria Rosaria Marino and Stefania Zotteri[*]

The 2005 reform of the Stability and Growth Pact has amplified the role of government debt and long-term fiscal sustainability in the surveillance of budgetary positions in the European Union (EU). Some aspects of the reform are still to be fully defined, including the role of implicit liabilities. This paper explores two main possibilities for accounting for such liabilities: using long-term expenditure projections and referring to estimates of the amount of pension liabilities. With reference to the former, the paper examines the pension expenditure projections available for EU countries and their use in the assessment of fiscal sustainability. While acknowledging the progress in the availability and quality of projections, the paper notes that their comparability is still unsatisfactory. Any mechanical use of existing pension expenditure projections should therefore be avoided. As to pension liabilities, the paper examines the main definitions and their potential role in the EU fiscal framework. It argues that pension liabilities may bring a clearer understanding of the impact of fiscal policies, may provide a measure of the cost of terminating pay-as-you-go pension schemes and may be useful for the measurement of deficits computed on an accrual basis. However, the level of pension liabilities does not provide indications concerning the sustainability of pension schemes and their effects on public budgets. Therefore, pension liabilities should not be added to conventional debt. Overall, the paper argues that both pension expenditure projections and estimates of pension liabilities can complement the current deficit and debt indicators. The paper concludes by pointing to the need to improve some technical and organisational aspects concerning age-related expenditure projections, such as the independence of forecasters, the transparency of projections and the degree of homogeneity in methods.

1. Introduction[1]

The search for rules and procedures that ensure sound budgetary positions has been at the core of the development of the fiscal framework of the European Economic Monetary Union (EMU). Since the early 1990s budgetary discipline has been recognised as an essential condition for the success of EMU. In 1992 the Treaty of Maastricht set the deficit and debt conditions for access to EMU. The

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The views expressed in this paper are those of the authors and do not commit the Banca d'Italia.

[1] Preliminary drafts of this paper have been presented at the international workshop on "The Balance Sheet of Social Security Pensions" organised by the Hitotsubashi University – Tokyo, 1-2 November, 2004 and at the 16th Congress of Belgian French speaking Economists – Mons, 16-17 February, 2005.

Stability and Growth Pact (SGP), adopted by the European Council in Amsterdam in June 1997, complemented the Treaty with a view to reconcile permanent restraint of deficit and debt levels with margins for fiscal stabilisation policies.

In recent years, several institutions and academics have suggested to assign a greater and more explicit role to long-term sustainability in the EMU framework. In particular, it has been suggested to consider the effects of population ageing on public finances. The 2005 revision of the SGP has moved in this direction: implicit liabilities have to be taken into account in setting medium-term budgetary objectives; major structural reforms with long-term fiscal benefits have to be taken into consideration both when defining the adjustment path towards the medium-term objective and when considering temporary deviations from the target.

Future expenditure trends can be integrated into fiscal sustainability analysis in many ways. This paper aims at contributing to the current debate by exploring the role of pension expenditure projections and of pay-as-you-go pension (PAYG) liabilities.

The paper notes that sustainability issues should be primarily addressed by considering the projections concerning the pension expenditure-to-GDP ratio and the contribution rate that assures the cash balance of pension schemes. However, in view of the still unsatisfactory comparability of pension expenditure projections (both across countries and across research centres), the paper suggests to avoid any mechanical use of existing projections. It also suggests to improve some technical and organisational aspects concerning age-related expenditure projections, such as the independence of forecasters, the transparency of projections and the degree of homogeneity in the methods used.

A more radical solution would require assimilating PAYG pension liabilities to public debt, considering social security contributions as loans to public pension schemes and pension spending as loan repayments. After having examined the different definitions of pension liabilities and their economic implications, the paper argues that the level of pension liabilities does not provide indications concerning the sustainability of current pension policies and the effects of pension schemes on public budgets. Therefore, the paper argues that pension liabilities should not be added up to conventional debt. Moreover, current estimates of pension liabilities present the same problems affecting the quality and comparability of pension expenditure projections.[2]

Rather, the paper suggests complementing the current deficit and debt indicators with additional indicators concerning future budgetary developments and a broader definition of public sector liabilities. In this context, estimates of pension liabilities may represent a useful complement to conventional fiscal indicators. They

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2 Along these lines, Holzmann *et al.* (2004) underlines the need for providing estimates of pension liabilities which are homogeneous across countries, with reference to less developed countries. The paper also provides a standardised estimate of a measure of gross accrued-to-date liabilities for a group of low- and middle-income countries.

may bring a clearer understanding of the impact of fiscal policies, may provide a measure of the cost of terminating PAYG pension schemes and may be useful for the measurement of deficits computed on accrual basis.

Section 2 briefly surveys the approach to fiscal sustainability taken by the European Union (EU). Section 3 examines the pension expenditure projections available in EU countries. Section 4 considers the different definitions of pension liabilities, the information that they provide and overviews the existing estimates. Section 5 compares pension expenditure projections and pension liabilities in view of the assessment of fiscal sustainability in the EU framework. Section 6 highlights further progress needed in both pension expenditure projections and pension liabilities estimates. Section 7 concludes.

2. Fiscal sustainability in the EU

2.1 The EU approach to sustainability

Fiscal soundness is the main objective of the European fiscal rules.[3] In defining a fiscal framework aimed at safeguarding the credibility of the single monetary authority and at avoiding monetary policy to be overburdened in its pursuit of price stability, the EU was confronted with several problems.[4]

First, while the intuition is clear (a sustainable policy must ultimately avoid insolvency), the analytical and operational definition of sustainability is not straightforward. Economic theory has proposed different conditions for sustainability (from a non ever-rising tax rate to an inter-temporal discounted budget constraint). Even if we agree that in order to be sustainable the debt-to-GDP ratio must be stable, we have no indication as to which stable level is sustainable. To assess the maximum sustainable debt level one should consider the interaction of public finance and the economy (and there is not an agreed upon theory on that). Moreover, difficulties arise also with regards to the definition of the variables to be used in the analysis (should gross or net debt be used? how should the deficit be measured?).

Second, the rules were to be applied to a group of countries, each retaining fiscal sovereignty. A general commitment to carry out sound fiscal policies was not sufficient. Monetary stability represents a public good to which all governments contribute by maintaining sustainable budgetary positions. As with all public goods, there is an incentive for each government to exploit the benefits accruing from the discipline of others without contributing itself. This creates a double cost for the other governments: the free-rider's excessive indebtedness can put pressure on interest rates to rise and can also result in bankruptcies requiring bail-outs.

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[3] The rationale for EMU rules is discussed, e.g., in Buti and Sapir (1998), Brunila *et al.* (2002) and Buti and Franco (2005).

[4] Balassone and Franco (2000a, 2001).

Third, in the early 1990s the deficit and debt positions differed significantly across EU countries. Some countries were clearly in unsustainable fiscal positions, with high and rising debt and deficit ratios and large expected expenditure increases. In order to induce a sharp change in the budgetary policies of these countries, tight numerical parameters were required. Since it was politically difficult to differentiate the conditions set for accession to EMU from those envisaged to be a permanent feature of the Union's fiscal framework,[5] the former substantially affected the latter.

When confronted with these difficulties, the EU adopted a pragmatic approach. The Treaty of Maastricht defines sustainability as non-violation of arbitrarily predetermined parametric standards, which are 3 and 60 per cent of GDP for deficit and debt respectively.[6] The Treaty makes no distinction between current outlays and investment.[7] The deficit ceiling is reminiscent of the constant deficit assumption analysed by Domar (1944). Apparently conscious of the partial equilibrium nature of Domar's results, the debt ceiling avoids convergence to high levels of debt.

Later on, the SGP introduced a medium-term target of a position "close to balance or in surplus" thus tightening the deficit rule while also trying to reconcile it with counter-cyclical fiscal policy.[8] The equilibrium value of the debt ratio depends on the numerical definition of this position which, in turn, is to be determined so as to allow enough room for stabilisation policy while avoiding breaching the 3 per cent deficit threshold during cyclical downturns.

The implied policy stance may often be tighter than what is needed for sustainability by whatever definition.[9] If EU countries stick to the close-to-balance guideline, they will converge to equilibrium debt levels much below the 60 per cent threshold. Some countries might even converge to negative debt levels. One may question whether a theory-based benchmark, if available, would have implied these results. No definition of fiscal sustainability actually envisages the abolition of public debt.

The debt and deficit indicators relevant for the European fiscal rules take into account the need to ensure comparability of national statistics and to allow a regular surveillance process. Methodological choices were made with pragmatism. The sector of reference is general government, as defined in the European System of Accounts (ESA) under the responsibility of Eurostat. Debt and deficit are

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5 This was due, *inter alia*, to the possibility of other countries joining EMU at a later stage. Moreover, it was clear that the reduction of debt to acceptable levels required long periods of fiscal restraint.

6 Article 121 requires "the sustainability of the government financial position" for a country's eligibility to EMU. Article 104 defines the criteria to evaluate sustainability by means of reference values for deficit- and debt-to-GDP ratios. The economic rationale of the parameters has indeed been questioned. See Buiter *et al*. (1993) and Eichengreen and Von Hagen (1996) for a discussion.

7 However Article 104 includes capital outlays among the relevant factors for the assessment of member states' budgetary positions.

8 Leeftink (2000) tests for the consistency of the two objectives.

9 See Pasinetti (1997), Kinnunen and Kuoppamaki (1998) and Balassone and Monacelli (2000).

respectively defined as the total of gross general government liabilities at nominal (face) value and as the balance of non-financial transactions (as defined in ESA) of general government.[10]

Reference to a common protocol is obviously helpful for international comparison. Using definitions in line with those adopted by national statistical offices makes immediately available past data and allows to base forecasts on the most detailed databases.[11]

2.2 Assessing fiscal sustainability in the EU

The EU fiscal framework does not make long-term sustainability indicators unnecessary. Due to, *inter alia*, demographic changes, compliance over the short and medium term does not necessarily ensure compliance over the long term. There is a need for indicators highlighting prospective deviations and measuring their size and timing.

The issue of long-term sustainability has gradually gained importance in the assessment and design of fiscal policy. In a report on the coordination of economic policies addressed to the European Council held in December 1999, the Ecofin noted the need for an explicit reference to the sustainability of public finances in the EU budgetary surveillance. The Ecofin called for a broadening of the issues covered by the Stability and Convergence programmes to medium- and long-term sustainability problems. Subsequently, in many occasions the European Council highlighted the population ageing problem and, in particular, its implications for maintaining adequate and sustainable pensions.[12] In particular, in March 2001 the European Council held in Stockholm established a three-pronged strategy to tackle the budgetary implications of ageing population. The strategy envisages raising employment rates (especially amongst women and older workers), reducing public debt and reforming pensions and health-care systems.

The Council also agreed that long-term fiscal sustainability should be regularly reviewed. The review would be done under the Broad economic policy guidelines and in the Stability and Convergence programmes presented each year by member states. This decision extended the framework of the EU multilateral surveillance and introduced a specific commitment for the Commission to examine the long-term sustainability of public finances.

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[10] For an extensive analysis see Mink and Rodriguez-Vives (2004). Some problematic aspects are examined in Balassone *et al.* (2005).

[11] The choice of a gross measure for debt also depends on data availability: data on assets are not always available and their quality is often poor. However, these solutions come at a cost. The definitions adopted for debt and deficit are not consistent (*i.e.* the ESA deficit does not coincide with the change in debt). In particular, with the adoption of the 1995 version of the ESA, deficit figures are based on accrual accounting.

[12] The European Council held in Lisbon in March 2000 stressed the need to study the future evolution of social protection from a long-term perspective, with a particular attention to the sustainability of pensions.

In view of the lack of a consensus on the definition of sustainability of public finances, in its assessments of the Stability and Convergence programmes, the European Commission follows a pragmatic approach. It addresses three policy questions:

(i) Given the projected budgetary implications of population ageing, will the budgetary requirements of the Maastricht Treaty be respected on the basis of current policies?

(ii) Are the medium-term budgetary targets outlined in the programmes compatible with an improvement of the sustainability of public finances?

(iii) What are the main policy challenges facing member states and what reforms should be envisaged?

In November 2002, the European Commission (2002) suggested that sustainability concerns should be explicitly taken into account when assessing the budgetary positions of member states under the SGP.[13] In addition, the assessment of the sustainability of public finances – as part of the Stability and Convergence programmes – should be upgraded, with firm policy conclusions as to whether the budgetary policies are ambitious enough to meet the challenge posed by ageing populations.

The European Commission (2004a) explored different approaches to attach greater weight to public debt in budgetary surveillance. In September 2004, in launching its initiative for reforming the SGP, the European Commission (2004b) suggested to place a greater focus on debt in the budgetary surveillance, to give more consideration to implicit and contingent government liabilities[14] and to consider the risks to sustainability in defining the medium-term target and the adjustment path towards this target.

In March 2005, in reforming the SGP, the European Council decided that implicit liabilities, related to increasing expenditures in the light of ageing populations, should also be taken into account in setting the medium-term budgetary objectives as soon as the criteria and modalities for doing so are appropriately established. In this regards, the Council requested the Commission to report by the end of 2006 on the progress achieved towards the methodology for incorporating implicit liabilities.[15] The Council stressed that fiscal policy cannot be expected to cope with the full structural effects of demographic ageing in the short term and invited member states to implement structural reforms. It was also agreed that medium-term budgetary objectives should be revised when a major reform with a

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[13] To this end, greater weight should be attached to government debt ratios in the budgetary surveillance process. More specifically, the debt criterion set by the Treaty of Maastricht should be made operational.

[14] A contingent liability can be defined as a public sector action that determines a cash expenditure only if and when a certain event takes place.

[15] Until the criteria and modalities to take into account implicit liabilities are established, the Council agreed that medium-term objectives could be differentiated among countries taking into consideration the current government debt-to-GDP ratio and potential growth, while preserving sufficient safety margin against breaching the 3 per cent threshold for the deficit-to-GDP ratio.

verifiable positive impact on the long-term sustainability of public finances is implemented and in any case every four years, in order to reflect developments in government debt, potential growth and fiscal sustainability.

When the criteria and modalities to take into account implicit liabilities are established, the definition of the medium-term budgetary objectives will be reviewed in order to take into account such implicit liabilities. There are several ways in which more attention can be placed on the factors that may influence the medium- and long-term debt dynamics. This paper explores two main possibilities: the use of pension expenditure projections made at the EU level by each member state and the use of pension liabilities.

3. Pension expenditure projections in the EU

This section examines the pension expenditure projections available for EU countries, at both the national and the sovranational level, their use in the EU fiscal framework and some problematic aspects concerning their quality and comparability.

3.1 Pension expenditure projections in the EU

All EU countries have developed models for projecting pension spending. Till the mid-1990s the availability of projections in EU countries was very uneven and their quality was sometimes unsatisfactory.[16] The development of better forecasting models has been boosted by the decision to start joint projection exercises at the EU level (Franco and Marino, 2003 and 2004).

Projections are usually made for periods of 30 to 50 years, although occasionally they extend to 75 years. Trends in expenditure items are generally evaluated in terms of their ratios to GDP or in terms of some synthetic indicator (as the equilibrium contributory rate). National projections primarily cover first pillar pension schemes, including private and public sector employees and self-employed workers. Belgium, Denmark, Finland, Ireland and Sweden have in their projections a full coverage of all social benefits, both in cash and in kind. This allows them to have a broad picture of the impact of ageing on the expenditure side of public finance.

Differences across countries also concern the institutions which are actually running the forecasts. In particular, the forecasting process may involve officially or unofficially several actors: social partners, independent experts, social security institutions and *ad hoc* public bodies (committees, working groups, etc.).[17] In most

[16] Franco and Munzi (1996) review the projections available at the national level in the EU15 member states in the mid-1990s.

[17] This is, for instance, the case of Austria, Belgium, France, Germany and Portugal.

countries the assessment of long-term sustainability of public finances is conducted primary by Ministries of Finance or Economy but there are cases where the Social or Labour Ministries or other public institutions are involved.

In EU countries long-term projections are used to set up budgetary medium-term targets,[18] to plan major reforms with an impact on budgetary positions, to project the debt profile and to assess the long-term sustainability of public finances.

Projections typically include a baseline scenario which assumes the continuation of current policies and, in particular, of the current social insurance legislation (in terms of eligibility conditions and benefits) and alternative scenarios for relevant economic and demographic variables (low and high levels of population, productivity growth, unemployment rate, interest rates). These exercises may also seek to evaluate the impact of specific policy adjustments or of alternative policy assumptions (e.g., changing the age of pension eligibility).

Finally, projections are usually deterministic, implying that even when accompanied by stress tests, they confer no sense of the likelihood of any specific scenario taken into consideration. Sometimes, one observes a pairing of assumptions that might yield the most optimistic or pessimistic case but that may be unlikely to occur together.

After some technical work carried out by the Commission (Franco and Munzi, 1996 and 1997), in 1999 a technical working group – the Ageing Working Group (AGW) – was set up by the Economic Policy Committee of the EU in order to examine the economic and budgetary implications of ageing populations and provide expenditure projections (AGW projections are included in Economic Policy Committee's reports; see Box 1).[19] The AWG provides projections of public expenditure on pensions, health care, long-term care, education and unemployment transfers and a number of indicators of long-term fiscal sustainability. The projections involve the use of the forecasting models developed by national authorities[20] but are based on common demographic forecasts and assumptions on key economic parameters such as labour market developments, productivity growth and real interest rates. The projection exercises increase the comparability of national forecasts, though leaving responsibility for the projections to the national authorities, which have the best institutional and statistical knowledge.

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[18] This is the case of Belgium, Denmark, Finland, the Netherlands and Sweden. In particular, Belgium and Finland set medium-term targets which have to be consistent with a budgetary path that ensures long-term sustainability, taking into account the likely impact of ageing.

[19] The AWG includes experts from national administrations, the European Commission, the European Central Bank, IMF and the OECD.

[20] Common models developed by the European Commission in a close cooperation with the Economic Policy Committee and the AWG are instead used for health care, long-term care, education and unemployment transfers projections. They cannot completely model the institutional arrangements and policies existing at the national level.

The AWG exercises refer to a current policy scenario, which does not necessarily represent what member states consider to be the most likely scenario but rather the consensus reached in the group as to what would constitute a prudent and reasonable starting point. Moreover, the exercise is run under the assumption of no behavioural response by economic agents. The AWG estimates are based on demographic projections prepared by Eurostat on the basis of assumptions regarding fertility rates, life expectancy and migration.[21] Long-run projections for social expenditure are heavily influenced also by assumptions on labour market developments and other macroeconomic variables.[22]

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21 Economic Policy Committee and European Commission (2006) refer to Eurostat (2005). In the baseline scenario the fertility rate is expected to increase in all countries except France, Ireland and Malta. For the EU25 it would increase from 1.48 in 2004 to 1.60 by 2030 and remain constant thereafter. This level is well below the replacement rate needed to stabilize population. Life expectancy at birth is projected to increase by around 6 years by 2050. Life expectancy in the EU10 is expected to remain below the EU15 average. The inward migration will only partially offset these trends. The projections indicate a dramatic change in the age structure of the population.

22 In Economic Policy Committee and European Commission (2006) labour force projections are based on an age-cohort methodology developed by the OECD and refined by the European Commission and the AWG. This methodology takes explicitly into consideration the evolution of lifetime participation profiles. In particular, it is based on the computation of the probability of labour market entry and exit of each available cohort. The labour force projections are obtained combining those for activity rates with those for the working-age population. The overall labour force of the EU25 is projected to increase by 5 per cent between 2003 and 2025 and to decline afterwards by 12 per cent. These changes are driven by the female labour supply that increases during the period 2003-25 and declines afterwards. Participation rates in the EU25 countries are expected to increase by around 6 percentage points (to 75.2 per cent) over the period 2003-50. The employment rate is projected to rise in the first part of the projection exercise: from 63 per cent in 2003 to 67 in 2010 and reach the Lisbon target for the employment rate (70 per cent) in 2020, as a consequence of the sharp rise in female and older workers employment rates. Thereafter, the demographic effects of an ageing population outweigh this pattern. On the basis of these employment trends and of the agreed assumptions on productivity, the potential GDP growth is projected to decline in the EU25 from 2.4 per cent in the period 2004-10 to 1.2 per cent in the period 2031-50. The fall is much stronger in the EU10, where the growth rate is expected to decline from 4.3 to 0.9 per cent. In the EU15, the annual average growth rate would decline from 2.2 to 1.3 per cent. Unemployment rates in the EU25 are assumed to fall from 9.3 per cent in 2003, to 7.8 per cent in 2010, to 6.1 per cent in 2025 and to stay constant thereafter. The fall is stronger in the EU10: from 14.8 per cent in 2003 to 6.6 per cent in 2025 and onwards.

Box 1
Coordinated expenditure projection exercises promoted by the European Commission

The Economic Policy Committee (2000) projects the pension expenditure-to-GDP ratio to rise over the coming decades in all EU countries but the United Kingdom. In some countries, the rise is significant. Expenditure peaks are reached at different times. In particular, in the majority of countries the effects of ageing will add 3 to 5 percentage points of GDP to pension expenditure: Austria (3.1 per cent by 2030), Belgium (3.7 per cent, peaking in 2040), Denmark (4.5 per cent, by 2030), Finland (4.7 per cent, by 2040), France (3.9 per cent, by 2030), Germany (4.3 per cent, by 2050 or after), and Ireland (4.4 per cent, by 2050 or after). In some countries the upward pressure is even higher: the Netherlands (6.2 per cent, by 2040), Spain (8.3 per cent, by 2050), and Portugal (6.2 per cent, by 2030).

The projected changes in pension spending have been decomposed according to four driving explanatory factors: the population ageing effect, which measures the changes in the ratio of persons aged 55 over the population aged 15 to 54; the employment effect, which indicates the changes in the share of population in working age (15 to 64) that is employed; the eligibility effect, which measures the share of the population aged 55 and over that receive a pension; the benefit effect, which captures changes in the average pension relative to output per worker. Sensitivity tests were carried out to gauge the impact of changes in various parameters, *i.e.* population, participation rate, employment rate, productivity rate and interest rate. A policy simulation based upon the successful implementation of the Lisbon strategy was also carried out compared with the "current policy scenario".

The Economic Policy Committee's (2001) report builds upon the previous one: for some countries the data provided have been supplemented and in some cases updated to incorporate the impact of recent reforms.[*] Notwithstanding these changes, the Economic Policy Committee (2001) confirms the previous results. The projections show that for the EU as a whole, public pension spending is expected to peak in 2040 at 13.6 per cent of GDP from 10.4 per cent in 2000. It should be noted that the projection exercise has only considered pension expenditures and not revenues to pension systems, although some member states did report such data.

According to the Economic Policy Committee (2003), the ageing of populations will lead to an increase in public spending (including not only pensions but also other age related items) ranging from 0.6 per cent of GDP in the UK to 13.0 in Greece. Most of the increase will derive from pensions, health and long-term care spending, whereas savings stemming from education and unemployment benefits will be limited. In particular, public spending on pensions is projected to increase by between 3 and 5 percentage points of GDP, largely driven by the increase in the old-age dependency ratios. Reforms in the 1990s, especially the indexation of entitlements to prices and extension of assessment periods, appear to have mitigated the expenditure increases in some countries. Demographic changes would lead to a rise in public spending on health and long-term care by between 1.5 and 4 percentage points of GDP up to 2050. However, there are upside and downside risks to these projections as the impact of non-demographic factors was not explicitly modelled. Public expenditure in education is expected to decline in the next 50 years, but significant savings are projected only in some countries. Using the labour force assumptions, unemployment benefit spending will show very modest decreases in most member states.

Economic Policy Committee and European Commission (2006) extends the projections to EU25 (Table 1). Between 2004 and 2050 public spending is expected to increase by about 4 percentage points of GDP in the EU15 and by 1.5 points in the new EU countries (EU10). This latter result is driven by the sharp drop in public pension spending in Poland, due to the switch from public pension schemes to private funded schemes. If this is not taken into account, public spending would increase by 5 percentage points in EU10. As for previous analyses, most of the increase stems from pension expenditure (Table 2), which is expected to increase by 2.3 percentage points of GDP, largely driven by the rise in the old-dependency ratio. This is expected to double in the next five decades, reaching 51 per cent in 2050.

Pension outlays are projected to increase in all EU15 countries except Austria where a reform was enacted in 2000. The largest increases are foreseen for Portugal (9.7 percentage points of GDP), Luxembourg (7.4 points), Spain (7.1 points) and Ireland (6.4 points). Very small increases are instead projected for Italy and Sweden because of the reforms implemented in the 1990s. In the EU10 pension expenditure would first decrease by 1 percentage point between 2004 and 2030 and would rise thereafter by 1.3 points. Overall, between 2004 and 2050 pension outlays are projected to increase by 0.3 points of GDP, with large difference among countries. If adjusted for some risk factors, projections indicate increase in pension outlays as severe as in EU15.

Population ageing together with other non-demographic factors would also determine an increase in public expenditure on health care (1.5 percentage points of GDP over the projection period) and on long-term care (between 0.5 and 1 percentage points). Public expenditure in education is expected to decline in all countries over the next 50 years, but significant savings are projected only in some countries. Using the labour force assumptions, unemployment benefit spending is expected to fall in EU25 from about 1 per cent of GDP in 2002-03 to 0.6 in 2025-2050.

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[*] For a summary description of recent reforms, see European Commission (2000a), Economic Policy Committee (2003), Franco and Marino (2003) and Economic Policy Committee and European Commission (2006). The reforms regarded indexing (Germany and Italy), the reference period for calculating the pension benefits (Spain), the retirement age for women (Austria, Belgium, Germany and the United Kingdom) and the requirements for early retirement eligibility (Austria, Denmark, Germany, Italy and Spain).

3.2 From expenditure projections to sustainability analysis

The expenditure projections provided by the AWG are used for developing sustainability indicators which provide a quantitative estimate of the budgetary adjustments required for a member state to ensure sustainable public finances and compliance with the SGP. The starting point is given either by today general government accounts or by the forecast accounts at the end of the period considered in the Stability and Convergence programmes. The initial non-pension primary expenditure and revenue are kept constant over time while the pension expenditure developments are projected on the basis of a set of assumptions on demographics, labour participation rates and other relevant variables. Given certain assumptions concerning GDP growth and interest rates, the increase in the spending ratio is used to project the primary balance and debt dynamics.

These computations are used for estimating tax gaps (also called "sustainability gaps"), *i.e.* the difference between the current tax ratio and the constant ratio that would be needed over the projection period to achieve a pre-determined budgetary target at a specified date in the future. Since the choice of both the targeted debt ratio and the length of the projection period is arbitrary, the European Commission calculates two different tax gaps, covering a range of definitions of sustainability used in the literature, and another synthetic indicator, which gives indications for medium-term policy-making:[23]

- the first tax gap measures the difference between the current tax ratio and the constant tax ratio required to reach a 60 per cent debt-to-GDP ratio in 2050 (*S1*);
- the second tax gap draws from the economic literature based on the present value budget constraint. It indicates the change in tax revenue as a share of GDP that would guarantee the respect of the government intertemporal budget constraint. In this case there is no target for the debt level but it will converge towards a relatively low level. Furthermore, there is no cut-off date and this requires the assumption that age-related expenditures remain constant as a ratio to GDP at the level projected for 2050 (*S2*);
- the third indicator specifies the average required primary balance to be maintained over the first five years of projections after the end of the programme period (*required primary balance*).

These indicators are calculated for two scenarios: the programme scenario and "current year" scenario, where the starting point is the current budgetary position. The latter scenario shows the long-term impact on debt developments, and consequently on the sustainability of public finances, of a failure to achieve the "close to balance or in surplus" requirement of the SGP for those countries still in deficit.

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[23] European Commission (2004a and 2005).

Table 1

Total Age-related Public Spending between 2004 and 2050[*]
(percent of GDP)

	2004	2010	2015	2020	2025	2030	2040	2050	Overall change
Belgium	25.4	25.1	25.5	26.6	28.2	29.9	31.6	31.7	6.3
Denmark	26.8	27.0	27.9	28.6	29.5	30.8	32.1	31.6	4.8
Germany[**]	23.7	22.5	22.2	22.9	23.8	24.7	25.7	26.4	2.7
Greece	8.9	8.7	8.7	8.7	8.9	9.1	9.7	10.2	1.2
Spain	20.1	19.7	19.6	20.4	21.7	23.4	27.3	28.6	8.5
France	26.7	26.7	26.9	27.6	28.1	28.6	29.6	29.6	2.9
Ireland	15.5	15.4	16.3	17.1	18.0	18.8	20.7	23.3	7.8
Italy	26.2	25.7	25.6	25.9	26.4	27.3	28.7	28.0	1.7
Luxembourg	19.5	19.4	20.5	21.6	23.5	25.0	27.4	27.8	8.2
Netherlands	20.9	20.6	21.5	22.4	23.4	24.7	26.2	25.8	5.0
Austria	25.2	24.2	24.0	24.2	25.2	26.0	26.1	25.3	0.2
Portugal	23.8	24.2	24.9	26.3	27.1	28.0	31.1	33.6	9.7
Finland	25.4	25.6	26.5	27.7	28.8	30.1	30.7	30.6	5.2
Sweden	29.6	28.2	28.3	28.6	29.5	30.9	31.9	31.8	2.2
UK	19.6	19.4	19.5	19.9	20.7	21.8	22.9	23.6	4.0
EU15	**23.5**	**22.9**	**23.0**	**23.5**	**24.4**	**25.4**	**26.8**	**27.2**	**3.7**
Cyprus	16.4	16.5	16.7	17.6	18.8	20.5	23.4	28.2	11.8
Czech Rep.	19.3	18.8	18.6	19.2	20.0	21.0	24.1	26.4	7.2
Estonia	17.1	16.5	15.4	15.1	15.0	14.8	14.3	14.4	–2.7
Hungary	20.7	21.0	21.3	22.3	22.9	23.5	26.4	27.7	7.0
Lithuania	16.0	15.3	14.8	15.1	15.7	16.3	16.8	17.4	1.4
Latvia	17.5	14.6	14.1	14.6	15.5	16.0	16.2	16.2	–1.3
Malta	18.2	19.1	19.7	20.4	20.5	20.0	19.2	18.5	0.3
Poland	23.7	20.2	18.1	17.9	17.7	17.6	17.3	17.0	–6.7
Slovak Rep.	16.2	15.4	14.9	15.3	15.8	16.5	17.7	19.1	2.9
Slovenia	24.2	24.0	24.5	25.5	27.0	28.6	31.7	33.8	9.7
EU10	**21.1**	**19.4**	**18.4**	**18.7**	**19.0**	**19.4**	**20.5**	**21.4**	**0.2**
EU25	**23.4**	**22.7**	**22.7**	**23.2**	**24.0**	**24.9**	**26.4**	**26.8**	**3.4**

Note: 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".

[*] It includes outlays for pensions, health care, long-term care, education and unemployment transfers. Total expenditure for Greece does not include pension and long-term care expenditure. Total expenditure for France, Portugal, Cyprus, Estonia and Hungary does not include long-term care.

[**] The projection results for public spending on long-term care does not reflect current legislation where benefit levels are fixed. A scenario which comes closer to the current setting of legislation projects that public spending would remain constant as a share of GDP over the projection period.

Source: Economic Policy Committee and European Commission (2006).

Table 2

Total Pension Expenditure Between 2004 and 2050
(percent of GDP)

	2004	2010	2015	2020	2025	2030	2040	2050	Overall change
Belgium	10.4	10.4	11.0	12.1	13.4	14.7	15.7	15.5	5.1
Denmark	9.5	10.1	10.8	11.3	12.0	12.8	13.5	12.8	3.3
Germany	11.4	10.5	10.5	11.0	11.6	12.3	12.8	13.1	1.7
Greece	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Spain	8.6	8.9	8.8	9.3	10.4	11.8	15.2	15.7	7.1
France	12.8	12.9	13.2	13.7	14.0	14.3	15.0	14.8	2.0
Ireland	3.6	3.8	4.1	4.5	5.0	5.5	6.8	8.4	4.8
Italy	14.2	14.0	13.8	14.0	14.4	15.0	15.9	14.7	0.4
Luxembourg	10.0	9.8	10.9	11.9	13.7	15.0	17.0	17.4	7.4
Netherlands	7.7	7.6	8.3	9.0	9.7	10.7	11.7	11.2	3.5
Austria	13.4	12.8	12.7	12.8	13.5	14.0	13.4	12.2	–1.2
Portugal	11.1	11.9	12.6	14.1	15.0	16.0	18.8	20.8	9.7
Finland	10.7	11.2	12.0	12.9	13.5	14.0	13.8	13.7	3.1
Sweden	10.6	10.1	10.3	10.4	10.7	11.1	11.6	11.2	0.6
UK	6.6	6.6	6.7	6.9	7.3	7.9	8.4	8.6	2.0
EU 15*	**10.6**	**10.3**	**10.4**	**10.8**	**11.3**	**12.0**	**12.9**	**12.8**	**2.2**
Czech Rep.	8.5	8.2	8.2	8.4	8.9	9.6	12.2	14.0	5.6
Estonia	6.7	6.8	6.0	5.4	5.1	4.7	4.4	4.2	–2.5
Cyprus	4.0	4.8	5.7	6.7	7.7	8.6	10.2	14.4	10.5
Latvia	6.8	4.9	4.6	4.9	5.3	5.6	5.9	5.6	–1.2
Lithuania	6.7	6.6	6.6	7.0	7.6	7.9	8.2	8.6	1.8
Hungary	10.4	11.1	11.6	12.5	13.0	13.5	16.0	17.1	6.7
Malta	7.4	8.8	9.8	10.2	10.0	9.1	7.9	7.0	–0.4
Poland	13.9	11.3	9.8	9.7	9.5	9.2	8.6	8.0	–5.9
Slovenia	11.0	11.1	11.6	12.3	13.3	14.4	16.8	18.3	7.3
Slovak Rep.	7.2	6.7	6.6	7.0	7.3	7.7	8.2	9.0	1.8
EU 10	**10.8**	**9.7**	**9.1**	**9.4**	**9.6**	**9.7**	**10.5**	**11.0**	**0.2**
EU 25*	**10.6**	**10.3**	**10.4**	**10.7**	**11.2**	**11.9**	**12.7**	**12.7**	**2.1**

Note: figures refer to the baseline projections.
* Excluding Greece. The Greek authorities have agreed to provide pension projections in 2006.

Source: Economic Policy Committee and European Commission (2006).

In the assessment of sustainability on the basis of the 2004 updates of the Stability and Convergence programmes the European Commission for the first time corrected budgetary figures not only for the cycle but also for one-off measures.[24] Furthermore, for the analysis it used an adjusted gross debt measure which takes into account the financial position of public pension funds that are created to be exclusively used to cover future pension-related public expenditures.

3.3 Problems with EU pension projections

The joint projections exercises carried out by the AWG represent an important step forward. First, they make sure that all EU countries regularly produce pension expenditure projections. Second, the need to regularly update and discuss the projections in a multinational context and to respect some agreed guidelines provides an incentive to produce unbiased forecasts. Third, the common demographic and economic assumptions increase the comparability of outcomes.

However, there are still a number of shortcomings. Differences in modelling approaches, coverage of projections and the significant margin left to national authorities to fix underlying economic assumptions make the results not strictly comparable. The information made public is often not sufficient for a full assessment of the forecasting exercises and for conducting alternative exercises. Moreover, the institutions responsible for making the projections are often those responsible for designing social policy. This may affect both the availability and the substance of the forecasts and of the information.

4. The role of pension liabilities

This section explores the potential role of PAYG pension liabilities in the EU fiscal framework. A radical solution would imply assimilating pension liabilities to conventional public debt. This would also require a change in the computation of the budget balance: social contributions would be considered as loans to public pension schemes and pension spending as loan repayments.

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[24] On the basis of the 2004 updates of the Stability and Convergence programmes, the European Commission (2005) estimates that even assuming that all EU countries achieve their medium-term budgetary targets there is a risk of unsustainable public finances in about half of them. Debt developments for most countries follow a U-shaped pattern: in the coming twenty or fifteen-twenty years debt levels are projected to decrease as a consequence of the maintaining of balanced budget positions but this trend would start to reverse once the budgetary impact of ageing starts to prevail, with the largest increase in most countries expected between 2030 and 2050. The risk of unsustainable public finances increases considerably if countries do not reach a budget position of close to balance or in surplus. This is shown by comparing the projected debt levels under the "programme scenario" with the "2004 scenario". This is true for the majority of EU countries and especially for those who had a high cyclically-adjusted deficit in 2004. The sustainability gap under the "programme scenario" indicates that an additional permanent budgetary adjustment of more than 2 percentage points of GDP is needed in several countries, suggesting that there could be risks for sustainability even if the planned consolidation takes place.

4.1 How to define pension liabilities

Any PAYG pension scheme gives rise to unfunded liabilities.[25] Within these schemes each generation provides the resources for paying the pensions to the previous generation and later receives pensions financed by younger workers. Therefore, at any point in time there exist a number of retired citizens who are entitled to a pension for the remaining part of their life (and sometimes also of the life of their widowed spouse) and a number of working citizens who can claim a right to a pension either in the near or in the distant future.

There exist three main definitions of pension liabilities (Castellino, 1985; see also Box 2):

1) *Accrued-to-date liabilities*: these represent the present value of pensions to be paid in the future on the basis of accrued rights; neither the future contributions of existing workers, nor the accrual of new rights by them are considered.
2) *Current workers and pensioners' net liabilities*: in this case it is assumed that pension schemes continue their "existence until the last contributor dies, while no new entrants are allowed";[26] both the future contributions of existing members and their new rights are therefore allowed for under current rules.[27]
3) *Open-system net liabilities*: these also include the present value of contributions and pensions of new workers under current rules; the range of options extends from including only children not yet in the labour force to an infinite perspective.

The three pension liabilities definitions share the pensioners' liabilities component, but differ as to the workers' component. More specifically, the first definition includes only the present value of accrued-to-date benefits of present workers. The second one also refers to the future contributions and the future benefits of present workers. The last definition also considers the benefits and contributions of people who have not yet entered the labour market.

In other words, the last two definitions differ from the first one because they also account for new expected net rights of a closed and of an open system, respectively. Therefore, these indicators can play a role in the assessment of the perspectives of pension schemes. Moreover, as new net pension rights can be estimated for different generations of born and unborn citizens, they can be useful in assessing the role of the public sector in determining the distribution of resources.

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[25] A PAYG scheme is "a pension finance arrangement whereby current liabilities are met from current contributions, and no fund is accumulated in advance to meet future needs" (Dilnot *et al.* 1994, p. 212). The debt arises with the creation of the PAYG pension scheme, when a generation of elderly citizens receives a pension without having paid any previous contribution or when the contributions do not guarantee an adequate pension.

[26] Van den Noord and Herd (1993).

[27] This definition corresponds to the concept of "net social security wealth" developed by Feldstein (1974) and frequently referred to in the debate concerning the effects of social security on saving decisions.

Box 2
The valuation of pension liabilities

This Box formalises in an extremely simplified way the key equations for representing the three pension liabilities definitions reported above. Disability pensions and survivor pension are not accounted for. It has to be noted that the equations which follow should be considered as applying to each single pension scheme existing in a country, since pension schemes usually have different features and rules (regarding age, sex, wage, contributory periods, etc.). The differentiation of rules for males and females is also not considered.

The valuation of accrued-to-date liabilities

Accrued-to-date liabilities represent the present value of pensions to be paid in the future on the basis of accrued rights. They include both present pensioners liabilities (*LP*) and present workers ones (*LW*).

In principle, the pension liabilities pertaining to each pensioner of age a are as follows:

$$LP_a = \sum_{i=a}^{\infty} \frac{B_i S_i}{(1+r)^{i-a}}$$

where B_i represents the average pension in year i, S_i represents his probability to be alive in year i, r is the discount rate. By assuming that the pension increases at a constant rate (p) and given the present average pension (B_a) one obtains:

$$LP_a = B_a \sum_{i=a}^{\infty} S_i \left(\frac{1+p}{1+r} \right)^{i-a}$$

The total present value of pensions existing in year t is the following:

$$LP(t) = \sum_{j=\underline{J}}^{\infty} N_j^P \, B_j^P \sum_{i=t}^{\infty} S_{i,j}^P \left(\frac{1+p}{1+r} \right)^{i-t}$$

where $\underline{j}$ is the minimum pension age, $N^P{}_j$ is the number of pensioners of age j in year t, $B^p{}_j$ is the average pension paid to pensioners of age j in year t and $S^P{}_{i,j}$ is the probability to be alive in year i for pensioners of age j in year t.

Along the same lines, the present value of workers' liabilities (*LW*) can be computed.

$$LW1(t) = \sum_{j=\underline{J}}^{\infty} N_j^w \left[B_j^w \sum_{i=t}^{\infty} Q_{i,j} \, S_{i,j}^w \left(\frac{1+p}{1+r} \right)^{i-t} \right]$$

where $N^w{}_j$ is the number of workers of age j in year t, $B^w{}_j$ is the average pension paid at retirement to workers of age j in year t computed on the basis of contributions already paid, $Q_{i,j}$ is the probability of receiving a pension at t for workers of age j in year t, $S^{w}{}_{i,j}$ is the probability to be alive in year i for a worker of age j in year t.

The valuation of current workers and pensioners' net liabilities

These represent accrued-to-date liabilities of workers and pensioners plus the present value of the rights present workers will acquire in the future net of future contribution of present workers.

While accrued pensioners liabilities are as before, the workers component also takes into account the present value of the rights that present workers will acquired in the future (WFB, workers' future benefits) net of the future contribution of present workers (WFC, workers' future contributions):

$$LW2(t) = LW1(t) + WFB(t) - WFC(t) =$$

$$= LW1(t) + \sum_{j=\underline{J}}^{\infty} N_j^w \left[BF_j^w \sum_{i=t}^{\infty} Q_{i,j}\, S_{i,j}^w \left(\frac{1+p}{1+r}\right)^{i-t} - C \sum_{i=t}^{\infty} R_{i,j}\, Y_{i,j} \left(\frac{1+p}{1+r}\right)^{i-t} \right]$$

where $BF^{w}{}_{j}$ is the average pension paid at retirement to workers of age j in year t computed on the basis of contributions to be paid in the future, C is the contributory rate on labour income, $R_{i,j}$ is the probability of working in year I for workers of age j in year t and $Y_{i,j}$ is the labour income in year i of a worker of age j in year t.

The valuation of open-system net liabilities

These include the present value of accrued and future rights of present workers and pensioners and the present value of pensions of new workers net of the present value of their future contributions.

While accrued pensioners liabilities and the net liabilities concerning present workers is as in the second definition of liabilities, one has also to consider the present value of the pensions of new workers (FWB, future workers' benefits) net of the present value of their future contributions (FWC, future workers' contributions). In case only children living at t are considered:

$$LWN(t) = FWB(t) - FWC(t) =$$

$$= \sum_{j=\underline{l}}^{\bar{j}} N_j^C \left[B_j^C \sum_{i=t}^{\infty} V_{i,j}\, S_{i,j}^C \left(\frac{1+p}{1+r}\right)^{i-t} - C^C \sum_{i=t}^{\infty} K_{i,j}\, Y_{i,j}^C \left(\frac{1+p}{1+r}\right)^{i-t} \right]$$

where $N^c{}_j$ is the number of children of age j in year t, $B^c{}_j$ is the average pension paid at retirement to children of age j in year t computed on the basis of full working life, $V_{i,j}$ is the probability of receiving a pension at t for children of age j in year t, $S^c{}_{i,j}$ is the probability to be alive in year i for a children of age j in year t, C^c is the contributory rate on labour income, $K_{i,j}$ is the probability of working in year i for children of age j in year t, $Y^c{}_{i,j}$ is the labour income in year i of a children of age j in year t and $\bar{J}$ is the age at which individuals enter the labour force.

So overall (actual and future) workers' liabilities under this definition are as follows:

$$\begin{aligned} \mathrm{LW3(t)} &= \mathrm{LW2(t)} + \mathrm{LWN(t)} = \\ &= \mathrm{LW1(t)} + [\mathrm{WFB(t)} - \mathrm{WFC(t)}] + [\mathrm{FWB(t)} - \mathrm{FWC(t)}] \end{aligned}$$

Estimates of pension liabilities require detailed information about the specific pension rules of each country and about the features of workers and pensioners with respect to age, sex, wage and contributory periods. These estimates depend on several assumptions on mortality rates, activity rates, wage and price trends. The discount rate of future contributions and benefits play also a crucial role. In addition, the last two definitions of pension liabilities require an assessment of the expected value of future contributions.[28] In countries where pensions are included in the personal income tax base, liabilities should be net of the presumed taxes levied on them.[29] This requires an estimate of the average tax rate on pensions. In this regard, it has to be considered that even assuming the stability of the present rate structure in real terms,[30] the average tax rate on pensions is likely to change over time since the ratio of pension to other income may change. In countries where

[28] In the case of public pension schemes, this may raise some methodological problems. In some countries current pensions are fully financed by specific contributions to pension schemes. Future contributions can thus be assessed on the basis of present contribution rates. In other countries current pensions are partly financed by government out of general tax revenues. In this case, if future revenues are assessed only on the basis of the contribution rate earmarked to pension schemes, there is a tendency to overestimate liabilities. It would thus be advisable to try to assess future revenues on the basis of the present contributory rate to pension schemes plus the resources that government allocates to pension schemes in the base year. This solution raises a further problem if the government runs a deficit and pension spending is de facto partly financed via borrowing. In order to avoid overestimating future revenues, present recourse to borrowing should be excluded.

[29] No such adjustment is necessary for conventional public debt, since no tax is levied on public bonds when they are refunded.

[30] Tax rates are adjusted to income changes in order to keep the tax to income ratio constant.

public pension schemes are fully or partially funded, liabilities should be computed net of pension fund assets.

4.2 Accrued liabilities

Among the three definitions of pension liabilities, that of accrued-to-date liabilities is the only one that can be assimilated to conventional public debt.

Present pensioners and workers' liabilities and open-system liabilities include pension rights that are yet to accrue. Strictly speaking, these pension rights should not even be called liabilities, but potential liabilities. They cannot therefore be assimilated to conventional public debt, which is a backward-looking statistic.

This section examines the indications provided by accrued liabilities and their possible role in the EU fiscal framework.

4.2.1 Accrued liabilities and the sustainability of PAYG schemes

The information that pension liabilities provide can be better understood by considering two stylised cases: the first takes a macro perspective; the second case takes a micro perspective and highlights the effects of demographic changes. The former is considered in what follows. The latter is analysed in Box 3, where also a numerical example is considered.

Let us consider a steady state situation where the ratio of any expenditure to GDP is constant over time. Suppose there are two countries (A and B) in which, *ceteris paribus*, PAYG pension spending is respectively X and aX per cent of GDP (where $a > 1$). Overall public spending is the same in both countries because country A devotes $(a-1)X$ per cent of GDP more spending than country B to non-pension programmes. Country A and country B devote on a permanent basis revenues amounting respectively to X and aX of GDP to their PAYG schemes. In the steady state, the ratio of accrued-to-date liabilities to GDP is given by the discounted value of the ratios of future pension spending to GDP and so the latter is proportional to pension spending as a share of GDP. This means that, notwithstanding the same underlying sustainability circumstances (*i.e.* both countries devote enough revenue to financing pensions so as to exactly match pension expenditure), country B pension liabilities are a times those of country A.

Therefore, the size of unfunded pension liabilities does not indicate that PAYG systems are unbalanced or will be unbalanced in the future.

Overall, both the example which considers the economy from the macro perspective and Box 3 make it clear that the ratio of accrued pension liabilities to GDP is not a measure of pension schemes sustainability or, more generally, of public finances sustainability. A high liabilities-to-GDP ratio does not necessarily imply an imbalance in the PAYG pension schemes or in the budget. Nor does it imply that an imbalance will occur in the future. The size of the liabilities depends on the decision concerning the benefits and eligibility criteria of PAYG schemes, but it does not provide any information on whether the PAYG system is unbalanced or will be unbalanced in the future.

Any judgement about the sustainability of pension schemes requires estimates about the resources available to pay for the accrued pensions, namely about the evolution of employment and per capita income. Accrued-to-date liabilities do not include such estimates. All one can say is that the larger the ratio of pension rights to GDP, the higher the share of future public resources committed to pension expenditure and the higher the risk that, if GDP growth is not adequate, some adjustment will become necessary (in terms of higher tax rates, of repudiation of pension rights, etc.). Some pension schemes include mechanisms that automatically adjust contributions or benefits to the new developments.

It can be argued that a country relying only on PAYG schemes can be in a worse position than a country relying both on PAYG and funded schemes in terms of risk differentiation and the absorption of shocks. However, neither theory nor experience support the view that the recourse to PAYG schemes rather than to funded schemes necessarily implies less sound public finances.[31]

On the other hand, accrued rights measure the cost of closing down a PAYG scheme when fully complying with present rules concerning benefits (World Bank, 1994): if there is a switch from a PAYG system to a funded system and all new contributions are paid into the new system, accrued rights measure the amount of resources which have to be financed out of general taxation.

4.2.2 Accrued liabilities and public debt

With reference to accrued-to-date liabilities, it can be argued that "from the worker's point of view, social security "tax" contributions are, in most respects, equivalent to the purchase of a government liability" (Kotlikoff, 1984, p. 567).[32]

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31 The PAYG versus funding argument is very complex and is beyond the scope of this paper. See, for instance, the papers in OECD (1992).

32 According to Bohn (1992, p. 4), "One should distinguish between a social-security system in its start-up phase, where the first generation of participants receive substantial "unearned" benefits, and a more mature system. Since promises to make gift are generally unenforceable, the benefits promised in the start-up phase cannot be considered government liabilities. On the other hand, it is difficult to imagine that a government could cancel the social-security benefits of retirees who have made social security contributions throughout their life". This distinction, although appealing, is not easily applied.

Box 3
Pension liabilities and sustainability: is there a link?

We consider a very simplified economy in the steady state with a constant population structure. We show that the ratios to GDP of both accrued liabilities and pension expenditure are constant over time. As long as the contributory rate is higher than the pension expenditure ratio this system is sustainable.

We then introduce a demographic shock in the system. The shock will be such that the ratio of liabilities to GDP will be the same as before, but the expenditure ratio will increase over time till above the contributory rate. Therefore, the shock will lead the system to be unbalanced.

This means that, for a given ratio of accrued-to-date liabilities to GDP, a country can be on either a sustainable or an unsustainable path.

The steady state

Assume that the interest rate is equal to the rate of growth of the amount paid to each pensioner (which is constant so that discounting cancels out; $p = r$ according to the notation used in Box 2). Moreover, assume that pensions accrue at a constant rate during working years (each worker accrues a fraction of the pension p which is inversely proportional to the expected length of the retirement period). GDP is given by the sum of workers' product (which coincide with their wage w).

The timing in such an economy is as follows: individuals do not work until they reach a certain age WA (working age), then they work till they reach age RA (retirement age) and they benefit from a pension till they reach age DA (death age). This timing is the same for every individual. Population does not grow over time: the birth rate and the death rate are the same so that the number of pensioners and that of workers are both constant over time.

The ratio of accrued-to-date pension liabilities to GDP at time t is as follows (see Box 2 and take into account the simplifying assumptions mentioned above):

$$\frac{L(t)}{Y(t)} = \frac{LP(t) + LW1(t)}{Y(t)} =$$

$$= \frac{\sum_{a=RA}^{DA} N_a^P (DA - a)\, p + \sum_{b=WA}^{RA} N_b^W \frac{(b - WA)}{(RA - WA)} (DA - RA)\, p}{N^W w} =$$

$$= \frac{p}{w} \frac{\left(\sum_{a=RA}^{DA} N_a^P (DA - a) + \sum_{b=WA}^{RA} N_b^W \frac{(b - WA)}{(RA - WA)} (DA - RA) \right)}{N^W}$$

This means that the ratio of accrued-to-date pension liabilities to GDP at time t is given by the ratio of the average per capita benefit to the average per capita wage (which is also the average per capita GDP) times the ratio to the number of workers of the sum of the number of pensioners, weighted for their life expectancy, and the number of workers, weighted for their expected life as pensioners times their share of working life already worked. Given the assumptions on the demographic developments of this economy this ratio is constant over time and depends on the decision concerning the retirement age. The higher retirement age is, the smaller pension liabilities are.

In this context also the pensions' expenditure-to-GDP ratio is constant:

$$\frac{P(t)}{Y(t)} = \frac{P}{Y} = \frac{\text{pension expenditure}}{\text{GDP}} = \frac{N^P p}{N^w w} = \frac{N^P}{N^w}\frac{p}{w}$$

As long as the ratio of pension expenditure to GDP is less than or equal to the contributory rate *c* (constant), the system is balanced.

If we compare pension liabilities to pension expenditure, we get:

$$\frac{L/Y}{P/Y} = \frac{\frac{p}{w}\frac{\left(\sum_{a=RA}^{DA} N_a^P(DA-a) + \sum_{b=WA}^{RA} N_b^W \frac{(b-WA)}{(RA-WA)}(DA-RA)\right)}{N^W}}{\frac{p}{w}\frac{N^P}{N^W}} =$$

$$= \frac{\sum_{a=RA}^{DA} N_a^P(DA-a) + \sum_{b=WA}^{RA} N_b^W \frac{(b-WA)}{(RA-WA)}(DA-RA)}{N^P}$$

So, the ratio between liabilities and pension expenditure does not depend either on the average pension or on the average wage. It depends on the ratio to the number of pensioners of the sum of the number of pensioners, weighted for their life expectancy, and the number of workers, weighted for their expected life as pensioners times their share of working life already worked. In other words, for any given p/w, the ratio depends on the structure of population.

The shock

Suppose that a "demographic shock" occurs: there are more workers than in the steady state (the baby-boom generation enters the labour force). Assume that this increase in the workforce does not change the ratio of accrued-to-date liabilities to GDP. This is possible as long as the new workers imply a proportional increase in accrued liabilities and in overall gross domestic product. If the demographic shock implies an increase in the number of just-entered workers (*i.e.* an increase in the number of workers of age $WA + 1$) then, given that in the steady state the number of workers of age $WA + 1$ was N_{WA+1}, after the shock the number of workers of age $WA + 1$ is N'_{WA+1} where $N'_{WA+1} = \alpha N_{WA+1}$ and $\alpha > 1$. Therefore, after the shock the ratio of accrued liabilities to GDP can be written as follows:

$$\frac{L(s)}{Y(s)} = \frac{L + (\alpha - 1)N_{WA+1}\frac{(DA - RA)}{(RA - WA)}p}{Y + (\alpha - 1)N_{WA+1}w}$$

where s refers to the period when the shock occurs and L and Y are the steady state values of liabilities and GDP, respectively. Therefore, if:

$$\begin{cases} (\alpha - 1)N_{WA+1}\frac{(DA - RA)}{(RA - WA)}p = kL \\ (\alpha - 1)N_{WA+1}w = kY \end{cases}$$

where k is a positive constant, then the increase in the workforce leaves the ratio of accrued liabilities to GDP unchanged. Obviously there is an infinite number of k values for which the system is satisfied. Moreover, the system is satisfied (*i.e.* the demographic shock can leave the liabilities-to-GDP ratio unchanged) as long as the ratio of the retirement period to the working period, weighted by the ratio of the average pension to the average wage, is equal to that of the steady state liability-to-GDP ratio:

$$\frac{p\,(DA - RA)}{w\,(RA - WA)} = \frac{L}{Y}$$

In the shock-period the system is still balanced. Indeed, the pension expenditure ratio-to-GDP is lower than in the steady state (the number of pensioners is the same as before while GDP is higher) while the contributory rate is as before.

Nevertheless over time, as the baby-boom generation retires (*i.e.* at time $s + [RA - (WA + 1)]$, the system will become unbalanced. Indeed at that time, while GDP will return to the steady state value, the pension expenditure will be higher than in the steady state (*i.e.* $[N^P_{SS} + (\alpha - 1)N^{WA+1}_s]p$, where N^P_{SS} is the pensioners number in the steady state and $(\alpha - 1)N^{WA+1}_s$ is the number of baby-boom pensioners, *i.e.* the additional workers as compared to the steady state which entered in the labour force at the time the shock s occurred). As c is not likely to be high enough, the system will be unbalanced, *i.e.* the pension expenditure to GDP ratio will exceed the contributory rate:

$$\frac{P(s + [RA\text{-}(WA + 1)])}{Y(s + [RA\text{-}(WA + 1)])} = \frac{P(s + [RA\text{-}(WA + 1)])}{Y(t)} = \frac{[N^P + (\alpha - 1)N^{WA+1}_s]\,p}{N^w w} > c$$

Therefore, the ratio of accrued liabilities to GDP does not imply anything in terms of sustainability: the steady state economy and the after-shock economy share the same liability-to-GDP ratio but have completely different perspectives in terms of sustainability of the pension system.

A numerical example

Suppose we have a steady state economy with the following population structure. There are four citizens: one is 10 years old, one is 30, one is 50, and one is 70. Assume that every citizen works from age 20 to age 60 so that the second and the third citizens work; their gross income is €100 each. The oldest citizen is retired; his pension is €40. Suppose GDP is equal to the sum of workers' product (€200). The contributory rate on workers' income, which corresponds to the ratio of pension expenditure on GDP, is 20 per cent. Assume that incomes and pensions grow at a constant rate and that this rate is equal to the interest rate.(1) Also assume that pensions accrue at a constant rate during working years (with a present value of €1 per year), that everyone lives 80 years.

The retired citizen accrued rights amount at €400 (€40 times 10 years of expected life); the two workers' accrued rights amount to €800 (€10 times 20 years of expected life in retirement for the first worker and €30 times 20 years for the second worker). Altogether, pension liabilities amount to 6 times GDP. As the contributory rate is set to remain stable at 20 per cent and the ratio of pension expenditure to GDP is not going to exceed 20 per cent over time, the system is balanced.

Now, suppose that there is a demographic shock: the baby boom generation enters the labour market so that the economy is as before, but there are two more people. More specifically, workers aged 50 are now three. Pension liabilities and GDP are, respectively, €2.400 (€30 times 20 years of expected life in retirement times two in addition to the previous €1.200) and €400 (since there are four workers); the ratio between the two is, as in the steady state, equal to 6. Pension expenditure is presently 10 per cent of GDP but in 10-years time it will rise to 60 per cent and become unsustainable, given the 20 per cent contributory rate.

Therefore the steady state economy and the post-shock economy share the same ratio of accrued-to-date liabilities to GDP but they are very different in terms of sustainability, *i.e.* perspective pension developments which depend on their demographic structure.

(1) In many countries, pensions are indexed to price dynamics. Therefore, the assumption that relates them to wage dynamics tends to overestimate pension expenditure. On the other hand, in many countries there are rules that work the opposite way. For instance, pensions are frequently based on the wages earned in the latter part of working life, which are often higher than the average real wage earned during the whole life.

Nevertheless, accrued pension rights differ in many ways from conventional public debt (see also Rizzo, 1985 and Bohn, 1992).

First of all, while the timing of the repayment of public bonds as well as the amount to be paid to the holders are fixed in advance, those of pension liabilities are uncertain.[33] Indeed, they depend on decisions made by the holders of the entitlements (concerning, for instance, the age of retirement, where some flexibility is allowed) and on various types of events (those concerning the length of life, wage and price dynamics, etc.).

Second, pension rights are not embodied in formal contracts. The debtor can modify both the timing and the amount of the payment. While failure to repay financial liabilities may give rise to legal claims and political reactions, the repudiation of PAYG pension liabilities may raise only the latter.[34] Pension liabilities can be reduced by changing benefit rules: major pension reforms have reduced the future entitlements of current workers and pensioners. Indexation mechanisms, retirement ages, eligibility rules and other aspects of the pension system have been frequently modified in recent years in developed countries.[35] Consequently it would be erroneous to assume that pension programs represent a firm legal or moral commitment.[36]

Moreover, while public bonds are usually bought freely on the market by individuals or companies, the acquisition of pension rights is usually compulsory. This means that a large pension-debt does not determine any direct pressure on the financial markets.[37] It also implies that the debt is automatically renewed.

Finally, pension rights are not tradable. This implies that changes in the relative yield and the relative risk of pension rights as compared to those of other assets have no effect on financial markets. It also implies less protection for pension-right holders than for bond holders. Bohn (1992, p. 45) notes that: “For government debt, any attempt to default – outright or through inflation – would imply undesirable market disruptions. Such “protection” against default does not exist for social-security claims. In addition, non tradability implies that

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33 For a general analysis of government contingent liabilities see Towe (1991).

34 On the political-economy of support to pension expenditure see Buchanan (1983), Rizzo (1985) and Tabellini (1990).

35 The Italian pension reform of 1992 provides a clear case: about 25 per cent of the pension-debt was wiped out at a time when public finances were considered to be in a very critical situation.

36 One should nevertheless consider that the implementation of large cuts in pension rights may obviously raise political reactions and that these reactions are likely to increase with the gradual shift of political power towards the older generations. As Börsh-Supan (1991, pp. 129-30) notes: “In West Germany after 2020 the majority of the voters will be pensioners and workers who will become retired within the next 10 years. We then risk facing a typical free-rider situation as the older generation can outvote the younger generation in determining their retirement income as well as the rate of social security taxes the younger generation has to pay”.

37 Large future pension expenditure may obviously influence the attitude towards public bonds, but this is an indirect effect.

social-security claims could be altered selectively, taking individual characteristics (e.g., income, demographics) into account".

4.2.3 EMU debt: accrued pension liabilities and fiscal policy assessment

The previous sub-section has pointed to the differences between accrued pension liabilities and public debt. In the EMU framework the inclusion of pension liabilities in the public debt definition would raise additional problems.

First, conventional public debt can be measured rather precisely and unambiguously at any point in time. Pension liabilities are uncertain and depend on the specific assumptions adopted upon a variety of factors, such as life expectancy, price and wage trends. Present value calculations are extremely sensitive to changes in assumptions.[38] This is particularly problematic in a context where figures are to be provided for 25 countries.

Second, as pension rights are acquired compulsorily and are not tradable, they produce no direct effect on financial markets. The inclusion of pension liabilities in the debt and deficit measures would obscure the pressure of the public sector on financial markets.[39]

Third, the inclusion of pension liabilities in the public debt definition would either require an analogous change in the deficit definition or enlarge the degree of incoherence between the two indicators European fiscal rules refer to. Let us consider the first case. Currently, contributions are recorded as government revenue and pensions as payments to retirees. The change would imply that contributions are classified as loans to the public sector, which would not be taken into account in computing the deficit indicator (Oksanen, 2004). Pensions would be considered as loan repayment. In this accounting system, an increase in contribution rates would, *ceteris paribus*, have no effect either on current or future deficits.[40] Any increase in the benefits promised for the future would increase current deficit (and leave future ones unchanged). These changes would blur any indications concerning the impact of the fiscal policies of each country on the euro-area fiscal stance. Although

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[38] As Boskin *et al.* (1987, p. 45) point out, referring to the USA: "Moving all of the economic and demographic projections from intermediate to either optimistic or pessimistic (assumptions) results in a change which is larger than the privately held national debt". The effects on deficit estimates would even be relatively larger.

[39] The case of Italy may again be relevant. Despite the fact that the 1992 reform wiped out pension liabilities equal to Italian conventional debt, the role of the public sector in the financial markets have not changed significantly.

[40] It has also been suggested that part of the repayment be considered an implicit interest payment. This solution is supported by Kotlikoff (1984). Towe (1991, p. 117) notes that "proponents of this system do not address the issue of decomposing benefit payments into "principal" and "interest". Presumably, actuarial criteria could be applied". In this case, the impact of changes in current contribution rates would depend on the link between contributions and benefits.

pension liabilities surely affect consumption and saving decisions,[41] the magnitude of the impact is not necessarily equal to that of public financial liabilities. Pension rights holders may have limited foresight, may not trust present or future government's ability to deliver the full pension they are entitled to under present rules, may be cash-constrained, may live in a world with imperfect capital markets. The inclusion of pension rights in debt and deficit statistics on a one-to-one basis might, therefore, lead to an erroneous estimate of the impact of fiscal policy.[42]

Fourth, the addition of pension liabilities to conventional public debt would lead to misleading indications of the effects of changes in interest rates on public expenditure perspectives and budgetary sustainability. Since accrued pension liabilities are negatively related to the level of the interest rate, any increase in this level would automatically reduce total debt. This development can look like an improvement however it might correspond to an actual worsening of budgetary conditions due to the increase in interest expenditure.

Fifth, the inclusion of pension liabilities in debt and deficit statistics would obviously influence international comparisons of public finance data. The amount of the total public debt would depend on the structure of the pension system. More specifically, the countries relying on PAYG schemes would record a higher debt than those relying on funding. But one can wonder why pension expenditure should be treated differently as compared to other types of expenditure. To some extent, all spending programmes create implicit contracts containing future liabilities. On this point Brittan (1993) takes a radical view: "The fallacy of such estimates (of pension liabilities) is to treat pension commitments differently from other forms of public spending. The PAYG schemes, from which the scare stories stem, are based on each generation of workers paying through taxes and contributions sufficient to cover the cost of pensions for those already retired. Thus, pensions are, like any other form of rising public expenditure, to be met from higher tax revenue or social security contributions, or reduced spending elsewhere".[43]

Finally, the inclusion of pension liabilities in the public debt definition, by making citizens' entitlements more explicit, might produce negative effects on the pension reforms needed to ensure fiscal sustainability in several European countries.[44]

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[41] As to savings, see for instance Rossi and Visco (1994) who suggest that the growth of PAYG schemes' liabilities contributed substantially to the decline in Italian saving ratio between the 1960s and the 1980s.

[42] This point is extensively examined in Mackenzie (1989).

[43] Penner (1982, p. 234) notes that: "One might argue that the degree of political commitment to future pensions is somewhat stronger than to other entitlements in that pension benefits seem much harder to cut than other entitlements. But neither are cut very often, and this is admittedly a weak argument". See also Kuné (1996).

[44] Boskin (1982, p. 300) notes that: "I would not wish to have the current rules and regulations of the social insurance program cemented into a unified capital account of the government as if we had issued explicit long-term contractual debt obligations, that is, I do not want to enshrine pay-as-you-go financing of these programs and government activities at current projected levels".

4.3 New net liabilities and the sustainability of PAYG schemes

Present pensioners and workers' liabilities and open-system liabilities include net pension rights that are yet to accrue. Strictly speaking, these pension rights should not even be called liabilities but potential liabilities. They cannot therefore be in any way assimilated to conventional public debt, which is a backward looking indicator.

As already mentioned, new expected rights may play a role in the assessment of the perspectives of pension schemes. Future rights are positive when the discounted flow of benefits is higher than the discounted flow of contributions; they are negative when the former flow is smaller than the latter. We now turn to the possible economic and sustainability implications of positive and negative net future rights.

In a "pure" PAYG system in any period the total amount of pensions paid out is given by the total amount of contributions:

$$\mathrm{p\,N^{P} = c\,w\,N^{w}}$$

where p is the average pension, N^P represents the number of pensioners, c is the contribution rate levied on wages, w is the average wage and N^w represents the number of workers.

If *c* is constant over time, *w*, N^P and N^w dynamics are exogenous and p is adjusted in each period of time in order to balance expenditures with revenues (*i.e.* there is a "pure" PAYG system), it can be shown that the rate of return on contributions (*rc*) is approximately equal to the sum of the rates of growth of per capita wages ($\dot{w}$) and of the number of workers ($\dot{n}_{\mathrm{w}}$; Aaron, 1966).

$$rc = \dot{w} + \dot{n}_{\mathrm{w}}$$

To grasp the intuition underlying this result, one can consider of a two-period economy with overlapping generations. In the first period individuals work and pay contributions. In the second period individuals get a pension. Overall pension expenditure in each period is equal to the contributions paid in the same period by the generation which is currently working. Pensioners get a pension which depends on the number of working individuals and on the wage of those individuals. Therefore, the return on the contributions paid in the previous period by today's pensioners depends on the growth rate of the number of workers and on the growth rate of wages. A "pure" PAYG pension policy is sustainable, in the sense that it does not require any change in rules, as long as $rc = \dot{w} + \dot{n}_{\mathrm{w}}$.

In practice, most PAYG systems are not "pure" systems, *i.e.* p is not adjusted in each period of time in order to balance expenditures with revenues. In other words, rc is not necessarily equal to $\dot{w} + \dot{n}_{\mathrm{w}}$.

Net pension rights are positive if the implicit return on contribution is greater than the return rate assumed as a benchmark (*i.e.* if $rc > \bar{r}$) but the sign of net pension rights does not convey any information on whether or not there is an imbalance in the PAYG scheme. The amount of pension rights does not provide any information on whether the rate of return on contributions is either larger or smaller then the sum of the rate of growth of per capita wages and of the rate of growth of the number of workers (*i.e.* whether $rc > \dot{w} + \dot{n}_{\mathrm{w}}$ or $rc < \dot{w} + \dot{n}_{\mathrm{w}}$) which is the relevant aspect in assessing the need to modify pension policy.

The sign and the dimension of pension rights crucially depend on the choice of $\bar{r}$, which is rather arbitrary. If $\bar{r}$ is very high, even a scheme where rc is much higher than $\dot{w} + \dot{n}_{\mathrm{w}}$ would show negative net rights. Conversely, if $\bar{r}$ is very low, even a scheme where rc is much lower than $\dot{w} + \dot{n}_{\mathrm{w}}$ would show positive net rights.

In conclusion, positive net rights do not imply that the pension system is presently unbalanced in cash terms or that it will become unbalanced over time. Neither do they imply that some adjustment will have to take place in the future. On the other hand, there may exist circumstances in which even with null or negative new expected rights the pension system can exert large cash pressure on the budget.

It would be more relevant to provide estimates of rc and to compare them with present and future values of $\dot{w} + \dot{n}_{\mathrm{w}}$: this is precisely the indication provided by the equilibrium contributory rate. Unless one assumes that a certain rate of return on contributions represents a normative benchmark for the assessment of PAYG schemes, any comparison between *rc* and an arbitrary r does not lead very far.

Had estimates of new net rights been carried out in the 1960s and the 1970s, they would have probably shown large positive values because in many countries *rc* was higher than it is now. The large positive values would have implicitly signalled that citizens were granted very high returns on contributions and that these returns were unlikely to be continuously matched by a high level of $\dot{w} + \dot{n}_{\mathrm{w}}$. The availability and the diffusion of estimates might have limited the tendency to improve pension benefits and might have accelerated the reform of pension schemes. Recent estimates, that take the reforms of the 1980s and the 1990s into account, are apparently less worrying. Van den Noord and Herd (1993) record negative or nearly null new net rights in four out of the seven countries that they consider. In spite of that, due to the decline in $\dot{w} + \dot{n}_{\mathrm{w}}$, the situation of pension systems is still worrying: a declining number of new workers is being called to service a large accrued debt.

In a way, estimates of future net rights were not available when they were mostly needed. Now that they are available, it is apparent that in many countries the problem does not lie in avoiding that future net rights have positive values but in cutting accrued rights and in getting new generations of workers to accept negative net rights.

4.4 Estimates of pension liabilities

Estimates of pension liabilities are subject to measurement errors and to misinterpretation, as the projections for pension expenditure. They are based on specific assumptions concerning a variety of factors, such as future labour force participation rates, retirement behaviour, unemployment, prices and earnings. As for demographic calculations, forecasts rely on techniques for projecting future pension payments from available data on current and past trends. Estimates can be based on administrative data concerning the work history of individuals or on panel data tracking the economic activity of successive cohorts of individuals.

The first international comparisons of pension liabilities were provided in 1989 by Hagemann and Nicoletti and in 1993 by Van den Noord and Herd and by Kuné *et al*. The first and the second papers were prepared within the OECD, the third within ABP.[45] Hagemann and Nicoletti (1989) refer to pension scheme accounts in 1985; the other authors refer to 1990 accounts. The countries considered do not coincide. Only Germany is considered in all three papers. Before examining the data it is necessary to consider some methodological issues.

The studies are based on a highly simplified methodology. In Van den Noord and Herd (1993) for each country a "full pension" (which is actually an average pension) is computed dividing total public expenditure on pensions by the number of beneficiaries. The present value of current benefits is estimated on the basis of the full pension, of mortality rates and of a discount rate. Pensions are supposed to be held constant in real terms. The paper shows that estimated pension liabilities on average are about twice as large as conventional debt; future pension rights are projected to generate liabilities amounting to 3.5 times the GDP, almost twice as much as the level of liabilities associated with existing entitlements. Furthermore, countries with high debt-to-GDP ratio also tend to have high pension liabilities to GDP ratio.

In estimating the pension rights of current workers, Van den Noord and Herd (1993) assume that in each country the standard retirement age is 60, and the number of years of contributions required for a full pension is 40. They also assume that pension entitlements accrue at a constant rate of 1/8 of the full pension every five-contribution years. Present workers are grouped in eight five-year brackets. The members of each bracket are assumed to be entitled to the same pension rights. During working life, pension entitlements are projected to grow at the same rate as projected real earnings and real output per worker. This means that the ratio of the average new

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45 ABP (Algemeen Burgerlijk Pensioenfonds) is the pension fund of the Dutch public employees. The paper was prepared for CEPS Working Party on "Financing Retirement Provision in Europe".

pension to real earnings per worker is held constant. An exception is made for Canada and the United Kingdom "where pension rates undergo a structural upgrading".[46]

Kuné *et al*. (1993) follow broadly the same lines. Standard retirement age is nevertheless assumed to be 65, and no structural upgrading is considered. In Van den Noord and Herd (1993) the different PAYG schemes existing in each country are considered as a single "average" system; in Kuné *et al*. (1993) the present value of pension rights is estimated separately for public sector and private sector workers.

In Van den Noord and Herd (1993) the discount rate is 4 per cent in real terms in the period 1990-2010; after that, it gradually declines reaching 3 per cent in 2050. An alternative projection with a discount rate 1.5 per cent higher than in the baseline is also presented. In Hagemann and Nicoletti (1989) the discount rate is set at 2 per cent for Germany, Sweden and the US and at 3.5 per cent for Japan. In Kuné *et al.* (1993) the discount rate is 4 per cent for the whole projection period.

In all the papers some assumptions are clearly unsatisfactory.

- In many countries younger pensioners, who obviously live longer, receive, on average, higher pensions than older ones. The assumption that pension level is uniform tends to underestimate the present value of current pensioners' rights. Besides, the use of the current average pension as the term of reference for the level of future pensions may lead to erroneous estimates. Estimates may turn out too low if pension levels undergo a structural upgrading, and too high if rules concerning the level of new pensions have been tightened.
- In some countries (like Germany and Italy up to 1992) pensions are also indexed to real wage increases. Holding pensions constant in real terms determines an underestimate of liabilities.[47]
- Hagemann and Nicoletti (1989) and Van den Noord and Herd (1993) do not provide separate estimates for public and private sector workers. This may lead to some underestimation of liabilities since in many countries in the last decades public employment has grown faster than total employment and public employees usually have better retirement rules.
- Kuné *et al*. (1993) do not take into account that some pension systems may not yet have reached maturity (*i.e.*, that the ratio of average new pensions to average earnings may increase over time). Hagemann and Nicoletti (1989) consider structural upgrading for Japan and Sweden. Van den Noord and Herd (1993) consider it for Canada and the UK.[48]

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[46] Structural upgrading may depend on younger generations of citizens retiring with longer contributory periods or with more favourable rules concerning the determination of the pension paid.

[47] Van den Noord and Herd (1994) provide an estimate of the pension liabilities of the seven major western countries under the assumption that all pension benefits after retirement are indexed to earnings. Accrued pension liabilities are 10 to 20 per cent higher than in the case of price indexation.

[48] According to OECD (1988b) only one quarter of the increase in the ratio of public pension expenditure to GDP between 1960 and 1985 in OECD countries may be attributed to demographic changes.

Table 3

Public Pension Liabilities: Present Value of Accrued Rights
(percent of 1990 GDP)

Country	Van den Noord and Herd (1993)[*]					Kuné *et al.* (1993)		
	Gross Liabilities			Existing assets	Net liabilities	Gross liabilities		
	Retired	Work-force	Total			Civil Servants	Non Civil Servants	Total
Belgium						30	38	68
Denmark						0	69	69
Germany	54	103	157	-	157	50	72	122
Greece						16	102	118
Spain						13	96	109
France	77	139	216	-	216	31	38	69
Ireland						8	46	54
Italy**	94	148	242	-	242	29	78	107
	(94)	(165)	(259)		(259)			
Luxembourg						25	113	138
Netherlands						0	137	137
Portugal						16	80	96
UK	58	81	139	-	139	0	42	42
USA	42	70	113	23	89			
Japan	51	112	163	18	144			
Canada	42	71	113	8	105			

[*] Data for Canada and the UK have been updated as in Van den Noord and Herd (1994).
[**] Figures in brackets are estimates of liabilities before the 1992 pension reform.

Source: Franco (1995).

Table 3 presents the estimates of accrued pension liabilities according to Van den Noord and Herd (1993) and Kuné *et al.* (1993). The data concerning the four major EU member states show that estimates vary considerably: UK's liability ranges between 42 and 139 per cent of GDP, France's between 69 and 216. Van den Noord and Herd (1993) provide the highest estimates and Kuné *et al*. (1993) the lowest. The ranking of the four countries is very different: Germany comes first according to Kuné *et al.* (1993) and third according to Van den Noord and Herd (1993).

Furthermore, in the estimates by Van den Noord and Herd (1993) pensioners' rights represent 30 to 40 per cent of total rights. In the estimates by Kuné *et al.* (1993) civil servants' rights represent 40 per cent of total pension rights in Belgium, France and Germany. It is a much higher percentage than their incidence in the labour force. This supports the view that pension liabilities ought to be estimated separately for all the major schemes with different rules existing in any country.

Table 4 shows some estimates of current workers and pensioners' net liabilities and open-system net liabilities. It should be noted that Kuné *et al.* (1993) do not take into account the future flow of contributions to PAYG schemes. This tends to overestimate pension liabilities. Van den Noord and Herd (1993) assume that in five of the seven countries considered (Canada, France, Germany, Italy and the United Kingdom) contributions to PAYG schemes are going to be equal – in GDP terms – to pension expenditure in 1990. This means that no part of 1990 public budget deficits is attributed to public pension schemes. Therefore, future liabilities of pension schemes are underestimated. For the two remaining countries, contributions are computed at present rates. The latter methodology is also applied by Hagemann and Nicoletti (1989).[49]

Van den Noord and Herd (1993) provide estimates regarding present workers, children not yet in the workforce and unborn citizens. According to the paper, a "positive number in such an account implies a net debt of the government to a specific generation, and hence a net transfer of wealth to that generation. Similarly, a negative number represents a net debt of a particular generation to the government and hence a net transfer of wealth from that generation" (p. 54).

According to these estimates, in Canada and Japan rights for new generations are accruing faster than contributions. Some adjustment to contribution rates or benefit rules would therefore be necessary in order to avoid new transfers of resources to pensioners. In France and Germany "accruals of contributions would broadly match new accruals of pension rights (while leaving the existing accruals unfinanced)".[50] In Italy, the United Kingdom and the United States future generations have already "been called to transfer wealth to current generations". This does not imply that in the latter countries there is scope for improving benefits or for cutting contribution rates.

Hagemann and Nicoletti (1989) provide an estimate of the unfunded pension liabilities of all individuals aged 17 to 90 years in 1985. The results should be comparable with the sum of Van den Noord and Herd (1993) accrued rights and new net rights of the present workforce. Again, the estimates differ a lot: 355 per cent of GDP in Hagemann and Nicoletti (1989) as against 149 per cent in Van den Noord and Herd (1993) for Germany, 158 per cent as against 91 per cent for the

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49 As to the USA, legislated future increases contribution rates are taken into account.

50 But this would not matter as long as the PAYG systems were not terminated.

Table 4

Public Pension Liabilities: Present Value of Future Pension Entitlements

(percent of 1990 GDP)

Country	Hagemann and Nicoletti (1989)*	Van den Noord and Herd (1993)**					Kuné *et al.* (1993)		
	Total net rights in 1985-2060	Accrued rights	New net rights of present workforce	Net rights of children not yet in the workforce	Net rights of unborn generations	Total	Accrued rights	New gross rights of existing citizens	Total
Belgium							68	44	112
Denmark							69	28	97
Germany	355	157	–8	–2	13	160	122	57	179
Greece							118	78	196
Spain							109	74	183
France		216	–16	–7	23	216	69	37	106
Ireland							54	49	103
Italy***		242	–60	–36	–45	101	107	77	184
		(259)	(–22)	(–11)	(8)	(223)			
Luxembourg							138	99	237
Netherlands							137	73	210
Portugal							96	71	167
UK		139	–23	–12	–3	100	42	28	70
USA	158	112	–21	–14	–11	66			
Japan	217	163	10	8	38	218			
Canada		105	16	14	57	191			

* Percent of 1985 GDP.
** Data for Canada and the UK have been updated as in Van den Noord and Herd (1994).
*** Figures in brackets are estimates of liabilities before the 1992 pension reform.

Table 5

Public Pension Liabilities: National Studies

Country	Paper	Definition	Liabilities/GDP	In Year
Italy	Castellino (1985)	L^1	317	1983
	Beltrametti (1993)	L^2	153	1961
			303	1971
			317	1981
			368	1991
	Beltrametti (1994)	L^2	389*	1992
		L^2	278**	1992
USA	Feldstein (1974)	L^2	71	1960
			111	1970
	Bohn (1992)	L^1	50-90***+27****	1989
UK	Hills (1984)	L^1	198/214	1982

* Before 1992 pension reform.
** After 1992 pension reform.
*** Social Security.
**** Civil Service and Military.
L^1 = Accrued to date liabilities.
L^2 = Current workers' and pensioners' liabilities.

USA, 217 per cent as against 173 per cent for Japan. A part of the difference surely depends on the assumptions about the discount rate. In the case of Germany it may also depend on the different methodologies used in estimating future contributions.

The different solutions adopted by Van den Noord and Herd (1993) and Kuné *et al*. (1993) for evaluating future contributions also explain the different results in Table 3 and Table 4.

Table 5 reports the results of some estimates of pension liabilities carried out at national level in more analytical terms.[51] The estimates concerning Italy and the UK are rather larger than those presented in Tables 3 and 4.[52] In the case of Italy

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[51] Some papers providing estimates for Argentina, Chile, China, Colombia and Turkey are indicated in World Bank (1994).

[52] The gross liabilities of Italian pension schemes have been estimated also by Pench (1993), who discounts the flow of expected pension expenditure up to the year 2025. The paper aims at evaluating the permanent (seignorage-adjusted) primary surplus excluding pensions required to ensure fiscal policy sustainability; for that reason it does not deduct future contributions from future expenditure.

there is a huge difference in the estimates of liabilities existing before the 1992 pension reform and in the estimates of the effects of the reform.[53]

National studies show that in some countries the ratio of pension liabilities to GDP has grown considerably during the last decades; accordingly, in these countries, economic deficits have been much larger than conventional cash flow deficits. The inclusion of the change in liabilities in deficit statistics would have increased the Italian deficit by 11 points of GDP every year between 1971 and 1981 and by 5 points every year between 1981 and 1991.

Chand and Jaeger (1996) estimate discounted net pension liabilities, defined as current accrued rights of pensioners and workers plus the prospective liabilities that will be accumulated in the future. Furthermore, the paper estimates the primary balance required to finance these projected pension liabilities (Table 6).

According to the paper, net pension liabilities range from 5 per cent of GDP for the United Kingdom to about 110 per cent of GDP for France, Germany and Japan. The authors add these liabilities to the net public debt and argue that if "one judges the sustainability of a nation's fiscal stance in terms of the conventional criterion of stabilising net public debt at its current levels, it would appear that the present fiscal stance of Italy and Germany are sustainable: their projected primary balances in 1995 exceed the amounts needed to stabilise the ratio of net public debt (excluding pension liabilities) to GDP" (p. 16). Given that the assumed interest rates are higher than projected real growth rates; primary surplus has to be high enough to offset the growth in debt ratio due to interest rates. "However, if account is taken of the projected buildup in net pension debt, and the sustainability criterion is modified to include as well the prevention of any buildup of pension debts, primary surpluses would have to be even higher" (p. 16).

Disney (2001) criticises the methodology adopted by Chand and Jaeger because they put together calculations on an accrual basis (column 1) with projections (column 2) and cash flows (column 3). The projected net liabilities incorporate future flows of contributions that will generate further liabilities. Moreover, instead of solving for the equilibrium PAYG contribution rate required to finance future expenditures, the rate is arbitrarily fixed at its current level, which may not be sustainable. This generates an arbitrary net pension liability, which is then added to an existing one (net public debt). Finally, the "sustainable" primary balance is added to a cash flow measure (the current budget balance) to generate a fiscal adjustment. Thus, Disney suggests a different method: one should begin with net public debt and add to it a net pension liability based on accrued-to-date pension liabilities and then find the primary balance required to service such a resulting debt.

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[53] The results of Van den Noord and Herd (1993) concerning Italy largely depend on the overestimation of future contribution and on the underestimation of benefits arising from the assumption considered above. They also contrast with those of other studies concerning the perspectives of the Italian pension system, INPS (1993), Ragioneria Generale dello Stato (1994), Castellino (1994).

Table 6

Net Pension Liabilities and Sustainability of Fiscal Stance

(percent of GDP)

Country	Net public debt, end 1994* (1)	Net pension liability 1995-2050** (2)	Sustainable primary balance to stabilise debt (1+2) (3)	Primary balance 1995 (4)	Adjustment to primary balance for fiscal sustainability (3–4) (5)
United States	63.3	25.7	1.9	0.4	1.5
Japan	33.2	106.8	3.6	–0.2	3.8
Germany	52.5	110.7	4.5	2.4	2.1
France	42.4	113.6	4.0	–0.3	4.3
Italy	112.9	75.5	4.6	3.3	1.3
UK	37.7	4.6	0.8	0.4	0.4
Canada	71.6	67.8	4.7	0.2	4.5
Sweden	54.5	20.4	1.0	–5.1	6.1

* Adjusted for net assets of public pension funds at the end of 1994. Estimate of net public det for Germany includes unification debt as of the end of 1994.

** Net present value of difference between projected primary expenditure and revenue of public pension fund during 1995-2050, adjusted for net asset position of public pension systems at the end of 1994.

Source: Chand and Jaeger (1996).

Frederiksen (2001) aims at estimating the immediate and permanent adjustment of the primary surplus required to forestall the need for further future changes in fiscal policy. He follows two approaches. The first one consists in a comparison between the actual pattern of fiscal consolidation (basically, the actual structural deficit) and the required pattern of consolidation. The latter reflect the need to offset the projected future decrease in the primary surplus due to greater age related spending, as estimated by the AWG.

In the second approach, Frederiksen compares the actual structural primary surplus with the "required" primary surplus. The latter is measured estimating the interest burden both on the explicit net debt and on the implicit debt reflecting the future budgetary consequences of current legislation. In 2000, in the nineteen countries considered the ratio of government net explicit liabilities to GDP amounted on average to 46 per cent. The implicit liabilities amounted to 194 per cent of GDP. This implies that, according to OECD estimates, the "official" net debt amounted to only one-fifth of the overall debt burden.

The two approaches should give the same results to the extent that the assumed constant interest rate is a good proxy of the return on current government financial assets and liabilities.[54] The average improvement of the primary balance required for the nineteen countries is actually the same (2.3 per cent of GDP) but there are some significant differences across countries.

Frederiksen (2001) reports the changes in the pension expenditure-to-GDP ratio and the total amount of implicit liabilities (which are based on the open system methodology). The relative position of most countries remains the same either when countries are ranked on the basis of the changes in ratio of pension expenditure to GDP or on the basis of implicit liabilities. The countries with highest expenditure growth are those with the greatest liabilities. Exceptions are represented by Australia, Denmark, Germany, the Netherlands, Portugal and Sweden (Table 7).

On the contrary, the ranking of countries in terms of the current spending levels (OECD, 2001) does not correspond to their ranking in terms of implicit liabilities. One can expect that countries with the highest pension expenditure-to-GDP ratios have the greatest accrued liabilities, but they do not necessarily have the greatest open system liabilities.

This survey clearly indicates that there is considerable uncertainty concerning the size of pension liabilities and that different definitions of liabilities point to very different assessments of country positions.

[54] The main assumptions are a nominal GDP growth rate of 4 per cent and a nominal rate of interest equal to 6 per cent. Consequently, the growth-adjusted rate of return is 2 per cent.

Table 7

Pension Expenditures and Implicit Liabilities in Frederiksen (2001)

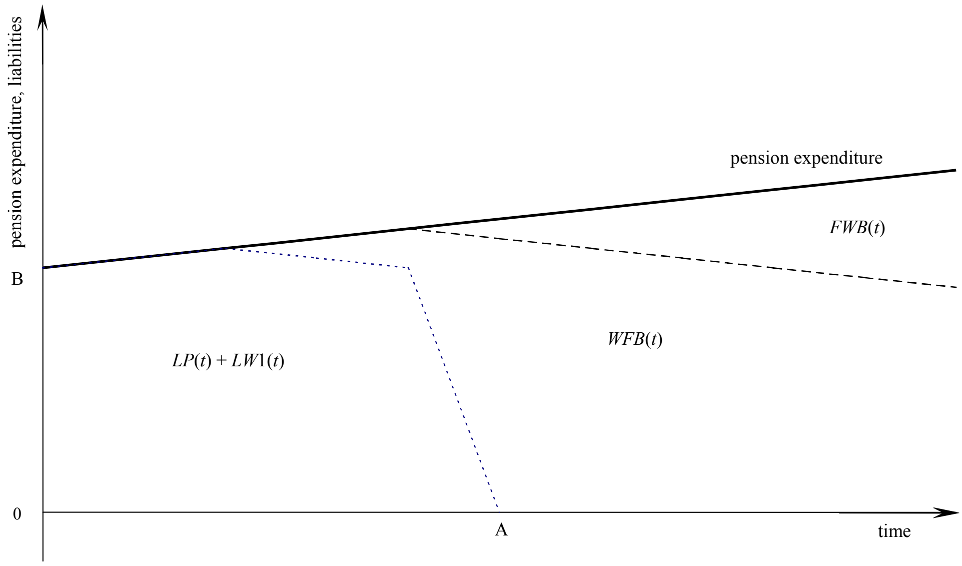
(percent of GDP in 2001)

Country	Ranking for changes in pensions to GDP ratio	Changes in pension expenditure	Ranking for implicit liabilities	Implicit liabilities
Australia	15	1.8	10	227
Austria	12	2.5	13	207
Belgium	11	3.5	12	212
Canada	3	5.8	2	379
Denmark	13	2.3	16	143
Finland	6	4.7	4	371
France	10	3.9	8	237
Germany	5	5.0	14	180
Greece	9	4.0	9	229
Ireland	7	4.4	6	270
Italy	18	0.0	17	79
Japan	17	0.7	18	77
Netherlands	4	5.3	7	247
Norway	1	9.6	1	895
Portugal	8	4.2	15	170
Spain	2	8.0	3	375
Sweden	16	1.3	5	293
UK	19	–0.6	19	71
United States	14	2.1	11	223

Source: calculations based on Frederiksen (2001).

Figure 1

Expenditure Projections and Pension Liabilities



5. Expenditure projections versus liabilities

Expenditure projections and estimates of liabilities provide different indications concerning the future of pension schemes. Expenditure projections are a flow concept. They do not require any discounting but they must be compared with a relevant scale factor, *i.e.* a relevant denominator. Liabilities are a stock concept. They are computed by discounting future flows.

Expenditure projections and liabilities refer to different future flows. In terms of the definition developed in Section 4, expenditure projections imply taking into account:

(a) all the accrued liabilities of pensioners and workers,

(b) the gross liabilities of current workers (*i.e.* the gross value of the workers' component of the second liabilities definition) and

(c) the gross liabilities of perspective workers (*i.e.* the gross value of the perspective workers' component of the third liabilities definition).

Figure 1 qualitatively depicts the relationship between pension expenditure projections and the various definitions of pension liabilities, where liabilities are as defined in Box 2 (accrued-to-date liabilities are given by $LP(t) + LW1(t)$; future gross benefits of current and perspective workers are $WFB(t)$ and $FWB(t)$, respectively). In particular, at a given point in time (time A) accrued-to date liabilities are going to die out as the last pensioner exits the system; later on workers' future benefits will start to decline while, in the case of open systems, liabilities will keep growing.

To better understand the relationship between pension liabilities and pension expenditure it would be advisable to distinguish between expenditure components, *i.e.* between expenditure relating to accrued liabilities, to future liabilities of current workers and to future liabilities of perspective workers. The composition of pension expenditure projections can provide information on the feasibility of pension reforms: the larger the accrued component the less likely reforms are and, if implemented, less likely reforms are to be effective (as they are likely to deal with the not-yet-accrued-component).

In addition it could also be advisable to compute not only expenditure projections but also liabilities projections, especially with reference to the accrued-to-date definition. Indeed, the stability of such projections can indicate that the system is not likely to run into problems. The opposite holds, if such projections are on an increasing path.

Consequently, it would be useful to have information concerning all the three liabilities' definitions as they provide different types of hints.

Which is the most appropriate way of dealing with expenditure projections or which is the most appropriate definition of pension liabilities depend on the issue to be examined.

5.1 Evaluating the overall impact of ageing

Although pension schemes are likely to exert the greatest strains on developed countries' budgets in the next few decades, a wider approach is required in the assessment of the effects of ageing. Demographic changes will actually influence most expenditure items: population ageing will increase health care expenditure since the consumption of services raises steeply with age; it will also increase the demand for some social services; the decline in the number of young people will reduce education expenditure; the decline in total population growth, and in some countries the decline of total population, might reduce the requirements for capital expenditure.

Fiscal sustainability should be assessed with an accounting framework that considers all budgetary items (Auerbach *et al.*, 1991 and Kotlikoff, 1992). Pension expenditure projections can be easily combined with projections for other budgetary items. On the contrary, referring to liabilities rather than to spending would be problematic with reference to health, long-term care, welfare and education outlays.

Moreover, netting out of earmarked contributions is not relevant when assessing the overall sustainability of fiscal policy. It discriminates against systems which finance pension expenditure not only via contributions but also via general taxation.[55]

5.2 Evaluating the sustainability of pension schemes

The pension expenditure-to-GDP ratio and the contribution rate that assure the cash balance of pension schemes give straightforward indications concerning sustainability. On the other hand, neither the size of accrued liabilities nor those of present pensioners' and workers' liabilities and open system liabilities indicate whether the schemes are sustainable (see Section 4).

Moreover, age-related expenditure projections can provide more intuitive indications than liabilities measures and are less sensitive to underlying assumptions. Small changes in starting conditions and assumptions can determine large shifts of pension liabilities (Economic Policy Committee, 2003). Moreover, as all liabilities' measures are a stock measure based on present value calculations they share the drawback of being highly sensitive to changes in the discount rate. Moving to flow variables can allow to get rid of this latter problem.

However, liability measures can provide other types of information. Accrued liabilities indicate the cost of closing the scheme. Open-system liabilities, which include new net expected pension rights, provide a measure of the difference between the implicit return on contributions to PAYG schemes and some rate of return assumed as a benchmark.

Estimates of new net rights do not provide any measure of present and future cash imbalances, nor do they provide information on the need to adjust contribution rates or benefit rules, or on pressures on the budget.

5.3 Trading future reforms with higher current deficits

Within the debate on the reform of the SGP, several proposals have aimed at making fiscal soundness compatible with the implementation of structural reforms. The revised Pact allows member states to temporary deviate from the appropriate adjustment path towards the medium-term budgetary objective or from the objective itself in case major structural reforms are implemented. Particular attention is given to pension reforms: the size of the deviation should take into account the up-front budgetary costs associated with the implementation of reforms of publicly managed schemes.

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55 The Congressional Budget Office (2004) stresses that "the term "unfunded liability" has been used to refer to a gap between the government's projected financial commitment under a particular program and the revenues that are expected to be available to fund that commitment. But no government obligation can be truly considered "unfunded" because of the US government's sovereign power to tax – which is the ultimate resource to meet its obligations".

This means "trading" a temporary worsening in today's fiscal balance for a reduction in future deficit and debt via a reform of the pension system: once a country had put structural reforms into effect, the medium-term target would be modified accordingly.

Suppose that a country is allowed to worsen its deficit at time t in the face of commitments to reduce its debt below a certain threshold by time $t + T$ via a pension reform. The assessment of this "trade" could be dealt with in two ways.

First, as debt in each period is the previous period debt plus current deficit, one can estimate the reduction in pension expenditure due to the reform, the corresponding improvement in future deficits and the new debt development path which guarantees a certain debt level at time $t + T$.

Alternatively, one can estimate the change in future liabilities due to the reform (*i.e.* the discounted flow of changes in pension spending). Nevertheless, this second solution is not easy to deal with as it is not straightforward to assess the relationship between deficit, conventional debt and pension liabilities. Therefore, referring to pension expenditure rather than to pension liabilities seems more intuitive and easier to implement.

5.4 Evaluating the impact of pension wealth

Pension liabilities can be more effectively used to evaluate the fiscal impact on consumption and saving ratios of deficits in accrual terms and of the economic balance of pension schemes.

As present pensioners' and workers' liabilities basically correspond to social security wealth, they are relevant for the assessment of fiscal effects on saving decisions. Furthermore, they highlight the future cost of present pension policies and they may reduce the incentive "for fiscal authorities to substitute away from cash to non-cash activities as a means of circumventing constraints on the overall cash-based deficit or expenditure" (Towe, 1991; p. 126).

6. Further progress is needed

A broad assessment of fiscal sustainability in EU countries requires complementing the current deficit and debt indicators with forward-looking indicators. In this context, estimates of the impact of the pension system on the budget are necessary. This can be achieved either via projections of future pension spending or via estimates of pension liabilities. In the previous Sections we have examined the different properties of the two indicators and have argued that the use of expenditure projections or of the different definitions of pension liabilities depend on the issue to be examined. We have also underlined that pension expenditure projections seem the most appropriate tool for sustainability analysis.

As noted in Section 3, the availability and quality of pension expenditure projections in the EU have greatly improved but there remain significant problems that hampers their use in assessing fiscal sustainability. In particular, projection comparability among EU countries is still unsatisfactory. Furthermore, progress is still required both in the organisation of projections and in their technical features both at the national and at the EU level.

Improvements in the quality of pension expenditure projections would also enhance the quality of estimates of pension liabilities.

6.1 Organisation aspects

In a rapidly changing demographic context, where reforms of social policies continue to be politically problematic, more attention needs to be paid to the way in which projections are organised, in particular to the attribution of responsibilities, to the accountability requirements and to the frequency and transparency of the exercises. The availability of accurate long-term projections is a necessary condition for the efficient design of social policy.

Projections indicating a significant increase in future spending necessarily trigger discussion of reform. By contrast, the lack of projections can allow reforms to be avoided or deferred. In the end, only if the public opinion has sufficient awareness of future long-term obligations will reform be politically feasible (Boeri *et al.*, 2000).

In light of the greater role that long-term sustainability is going to play in the EU fiscal framework, in principle the most appropriate solution would be to assign the responsibility for pension expenditure and pension liabilities estimates to a unique institution at the EU level. This solution, which would ensure the full comparability of national projections, raises two problems. First, it would require that all EU countries agree on a common method and accept a certain loss of sovereignty. Second, on a more technical ground, a unified forecasting authority and a common method may imply losses in terms of details and quality of projections. This problem can be dealt with only if a close link is established between the new institution and the national authorities in order to allow the former from benefit of the expertise of the latter.

An alternative solution would be that of retaining the current responsibility of national institutions while strengthening the coordination concerning the organisation of projections. This is the approach followed so far at the EU level. Tighter common guidelines and greater peer pressure would increase comparability and transparency.[56] Additional efforts need to be made in eliminating differences in coverage, models and techniques. Adjustments for individual country specific

[56] A step in this direction has been realised with the 2005 projection exercise of the AWG.

circumstances should be kept to a minimum. Allowed differences should be explained in detail and motivated.[57]

The following general points apply to both organisational scenarios.

6.1.1 Responsibility and accountability for the exercises

Both expenditure projections and pension liability estimates should be detached from policy considerations and from country specific interests. The agencies assigned to produce forecasts should not be those responsible for fiscal and social policy. Ideally, forecasts should be assigned to a technical agency that answers directly to Parliament.

An alternative solution would be the coexistence of a number of different public and private forecasting institutions. In this case, no monopoly on data should be allowed and the costs of running forecasting models should be lowered. This could be achieved by requiring the public agencies that hold data to make them promptly available to all interested parties. Forecasting models developed in the public sector should be made available to all possible users.

6.1.2 Frequency of projections

Forecasts should be made on a regular basis (for instance every two or three years), not in connection with political evaluation of the effects of specific reforms.[58] This would enhance the credibility of projections.

6.1.3 Transparency

Repetition of forecasting exercises inevitably means the revision of previous results. This may be due to changes in the demographic and economic framework or to changes in the model.[59] Every exercise should have a detailed discussion of the reasons for the revision.[60] This enhances transparency and heightens the incentive for accurate projections.

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57 In this respect, the latest AWG projection exercise could represent an example. All adjustments made in the common assumptions to take into consideration national diversities have been explained in detail in Economic Policy Committee and European Commission (2006).

58 Castellino (1997) underscores the importance of repeating forecasting exercises.

59 Fornero (1997) suggests running the models "backwards" to see whether, using the actual values of the demographic and economic variables, they accurately "predict" spending.

60 Economic Policy Committee and European Commission (2006) contains a comparison between the results of the 2005 and 2001 projections for the EU15 countries. In many cases, the differences can be attributed to a broader coverage of pensions, changes in population projections or to major pension reforms enacted since 2001.

The results of the projections should be released in the form of analytical papers that allow for an assessment of the underlying assumptions and that include tests of sensitivity to demographic, economic and behavioural variables. The reports should provide detailed information about different indicators. For instance, in the case of pension expenditure, both the ratio of outlays to GDP and the equilibrium contribution rate should be provided. There should be detailed projections on the number of pensioners and the size of the average pension, broken down by type of pension and category of worker. In a system in which public pensions also include income support to unemployed in working age, the preparation of consolidated accounts of social spending by age-groups would help to isolate and evaluate the functions actually performed by the pension system. Estimates of pension liabilities should also be provided, in particular concerning accrued liabilities.

6.2 Technical aspects

The quality of pension expenditure projections has greatly improved in recent years. However, further progress is required in a number of areas.

6.2.1 Coverage

Projections, as well as estimates of liabilities, should cover all pension schemes.[61] In order to evaluate the overall effects of ageing, projections should cover also the other age-related public expenditure items, such as health, long-term care and education. In addition, one should aim at projecting also other expenditure items and revenue, in order to allow an assessment of the overall sustainability of the public finances.

6.2.2 Methodology

Projections should be based on demographic scenarios prepared, for the sake of comparability, by Eurostat with the involvement of national statistical institutes. They should cover a sufficiently long period (at least 50 years) so as to let the size and age structure of the population to converge towards a new equilibrium level and to allow all persons currently in the labour force to retire. However, projections should also consider the non-demographic factors affecting pension spending, such as the composition of the workforce and the retirement decisions of individuals.[62]

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[61] The pension projection exercise reported in Economic Policy Committee and European Commission (2006) covers nearly all public pension schemes including old-age provisions for civil servants. Countries with statutory private pension schemes have provided data for these schemes and some other provided data for private occupational pension schemes.

[62] Additional efforts should be made in modelling public spending on health and long-term care taking into account also non-demographic factors (past expenditure trends, “death-related” costs, the degree of institutionalised provision of long-term care and the change in the health care status of older people). Some progresses in this direction have been made with the 2005 projection exercise conducted by AWG.

6.2.3 Dealing with uncertainty

Forecasting models are generally deterministic and the assumptions concerning demographic and economic variables are often based on their own past dynamics. This mainly reflects the difficulty of handling models that must consider many economic, demographic and behavioural factors and yet produce results quite quickly. Estimates are generally based on scenario analysis.[63] The issue of evaluating uncertainty can be tackled in different ways. One can associate probabilities to forecast ranges stemming from alternative scenarios (Technical Panel on Assumptions and Methods, 1999). One can also use stochastic simulations assigning a probability to an arbitrarily large sample of input combinations, solve for the system's finances under each set of paths and then use the probability associated with each set of inputs to create a probability distribution for the outputs.[64]

6.2.4 The data

It is important that the data on which projections are based are frequently and regularly updated and promptly made available to forecasters. In particular, given the rapid evolution of family structures, the probabilities of the main family events need regular revisions. For instance, it would be useful to have a protocol whereby the institutions supplying the data needed for forecasting pledge to release them regularly. These factors must necessarily be considered in assessing the effects of changes in the role of the social protection system and in estimating the associated spending.

6.2.5 The underlying assumptions

Every forecast is based on a large number of assumptions concerning demographic trends, economic variables and individual behaviour. It is obviously important that the projection reports make these assumptions explicit and describe their margin of uncertainty. Moreover, the reports should consider whether the simplifying assumptions ordinarily used in all projections are effectively justified. In age-related expenditure forecasts, for example, there should be greater attention to

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63 This is only a first step towards a determination of the uncertainty in the estimates since projections do not usually incorporate any overall measures of probability for the input scenarios and therefore it is not possible to evaluate the likelihood of the results. This approach allows evaluating how results would be affected if all the values for inputs moved in the same direction even though remaining plausible. The high and low estimates serve as boundaries.

64 In stochastic models, inputs take values based on random variables and final forecasts result from the application of Monte Carlo simulations (Meyerson and Sabelhouse, 2000; Congressional Budget Office, 2003). A stochastic approach solves some of the problems set out above but may complicate the forecasting process. It requires simulating several demographic processes for each year in the forecast concerning, e.g., births, deaths, marriages, divorces and migration. This may require developing a model for each of these processes and relate them with one another or develop a unique model containing all details at the cost of a higher simplification of reality.

analysis of the main demographic and behavioural variables by cohort, to avoid simplistic assumptions producing unrealistic spending forecasts.[65] In particular, one would need a careful evaluation of the estimates of survival for the very old (over 80), since it has been observed that those now available tend to overestimate mortality (Caselli, 1996, and National Research Council, 2001). The assumptions concerning family events (marriage, age and status of survivors, etc.) and individuals' behavioural choices need to be set out in detail. It would be helpful to have a breakdown by age, sex and year of forecast of assumptions on the retirement probability of individuals in the retirement age bracket.

6.2.6 The labour market

The level of pension spending depends on the evolution of the labour market. The equilibrium contribution rate critically depends on it. The key factors are the participation rates of older workers and of women.[66] Spending forecasts should be based on studies concerning, for instance, the incentives to retire provided by social security rules, workers' retirement choices and the present and future health conditions of elderly citizens.[67] Forecasts should be able to use data on career histories, earnings and marital status of individuals. The need to consider the retirement behaviour of individuals is accentuated by the tendency to allow individuals to freely decide their retirement age within a certain age bracket.[68]

6.2.7 Living standards

Projections should provide the information needed to evaluate the overall standard of living of the elderly. In particular, they should specify the size of public pensions paid to various groups of citizens according to age, sex, place of residence and family status.[69] The data on public pensions should be supplemented by those on private pension plans and other incomes to produce an assessment of the overall economic situation of retirees. Obviously, public pension programmes interact with

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[65] In order to limit the gap between forecasts and outcomes, Lacasse (1994), Reynauld and Vidal (1994) and Strobel (1994) stress the importance of a correct identification of potential beneficiaries of the social programmes and of the study of their behaviour, since individuals may change their behaviour as a response to policy changes.

[66] The importance of this is underscored in OECD (1995a and 1995b) and is made plain in the exercises conducted for Economic Policy Committee (2000) with reference to the "Lisbon Scenario". See also European Commission (2000b). The question is also examined in Visco (2001).

[67] This will require the formation of data banks which follow the evolution of various cohorts over time. On this see National Research Council (2001). Jimeno (2000) notes that without data on the employment and earnings history of individuals it is hard to evaluate the effects of reforms.

[68] Peracchi *et al.* (2001) emphasise the importance of longitudinal surveys providing demographic and economic information.

[69] For a study along these lines see Sartor (2001), who gives estimates of the equilibrium contribution rate for private sector employees and of the average pension of different age cohorts. Sartor used sample data and relates the results for the pension system to a generational accounting exercise.

public action in other areas of social protection.[70] A reduction in public retirement provisions not offset by an increase in other incomes could trigger stronger demand for action and also for certain types of health care services. Only if these aspects are taken into account can one truly judge the social sustainability of social security rules or reforms. Studies of the overall economic situation of retirees, which requires microsimulation models, could be performed less frequently than spending projections and could be assigned to different agencies.

7. Conclusions

A growing concern about the sustainability of pension systems, health expenditure growth and rising welfare spending have urged many governments to produce long-term projections. In the last two decades, the latter have assumed an important role in the fiscal policy debate and in the formulation of public policy.

The procedures by which projections are forged and the content of projections are essential elements in social policy management and even more for pension policy. With the 2005 reform of the SGP, they are also relevant in the surveillance of budgetary positions in the EU.

Over recent years the availability and quality of long-term pension expenditure projections has been largely improved and resources assigned to them have been substantially increased. Projections are now available for all EU countries. Progress has been achieved in the comparability of national exercises.

Three main trends characterise the European scene as regards the long-term analysis of public budgets:

- the rapid spread of projection exercises to all countries and a tendency to conduct them on a regular basis, not contingent on reform proposals;
- the increasingly close linkage of the analysis of pension spending to the sustainability of public finances as a whole (the dynamics of pension expenditure is examined together with that of other items connected with demographic changes and with the dynamics of the budget balance and the public debt);
- the awareness that trends in pension spending, through their impact on the budget balance, have repercussions at EU level and, hence, the need for internationally comparable projections and for systematic monitoring of spending in each country.

However, the organisation, comparability and quality of projections still present several limitations. The national institutions assigned to make the projections are often those responsible for designing social policy, which may affect both the availability and the substance of the forecasts. National projections are produced with different models and coverage is not homogeneous. The information

[70] This is taken into consideration in OECD (1999).

made public is often not sufficient for an adequate assessment of the forecasting exercises and for conducting alternative exercises.

Further efforts should therefore be devoted to pension projections both at the national and the EU level.

An appropriate measurement at the EU level requires not only common assumptions, but also common forecasting procedures and coverage. This requires further integration among national forecasting institutions.

Forecasts should cover a well-defined and long projection period and should be made on a regular basis. There is need for a detailed description of the assumptions and the results. Changes with respect to previous exercises should be explained. Furthermore, forecasts should be assigned to a technical agency that is not involved in the design of pension policy. Alternatively, projections should be carried out by a number of different public and private forecasting institutions. The data on which projections are based should be frequently updated and promptly made available to forecasters. The projection reports should specify all the underlying assumptions and allow a detailed assessment of the results.

The pension-projection results should be expressed both in terms of expenditure-to-GDP ratios and equilibrium contributory rate and in terms of accrued liabilities.

The assessment of the sustainability of pension systems and the pressure of pension schemes on the budgets should primarily refer to expenditure-to-GDP ratios and equilibrium contributory rates. Pension liabilities should not be included in the deficit and debt measures used in evaluating current fiscal policy.

Estimates of pension liabilities may nevertheless represent a useful complement to conventional debt and deficit measures. They bring a clearer understanding of fiscal impact on consumption and saving ratios, and of some aspects of the economic situation of PAYG schemes. Namely, accrued liabilities are useful for the measurement of economic deficits. They also provide a measure of the cost of terminating PAYG pension schemes. Present pensioners' and workers' liabilities, which correspond to social security wealth, are relevant for the assessment of fiscal effects on saving decisions.

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AGEING IN THE NETHERLANDS: ANALYSING POLICY RESPONSES WITH AN AGE MODEL

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Understanding the behaviour of economic agents is as important as understanding fiscal institutions. Our model integrates the generational-accounting approach with an applied-general equilibrium setup. The recognition of economic behaviour improves our assessment of the intergenerational consequences of government policies; accounting for fiscal institutions improves our projections of future economic developments.

This paper illustrates the benefits from an integrated approach by presenting projections and policy simulations. Two analytical simulations demonstrate the working of the model. A third simulation shows the economic and intergenerational effects of a much discussed policy reform, i.e. *a gradual increase of the official retirement age.*

1. Introduction

Since their introduction in the early nineties (Auerbach *et al.*, 1991), generational-accounting (GA) models have been quite successful. As they make so few specific assumptions, they can be applied in a variety of circumstances. Indeed, GA models are nowadays applied worldwide by researchers to assess the stance and intergenerational implications of fiscal policies in their countries (Auerbach *et al*., 1999), Raffelhueschen, 1999a, 1999b).

One reason for their success may be that generational-accounting models allow for an assessment of both the sustainability as well as the generational impact of fiscal policies, two issues that are highly relevant for fiscal policy-making. By focussing on the future, they are perfectly well suited to analyze the implications of trends that have a long-term nature, as for example the ageing of the population. When it comes to the analysis of policy reforms, generational-accounting models are less suited, however. Indeed, by abstracting from any kind of economic behaviour on the part of economic agents, they may give false answers to questions about the incidence of taxation (Haveman, 1994, Buiter, 1995). Similarly, due to their neglect of economic behaviour, GA models are not very well suited to simulate the effects of policy reforms.

In another field, we have witnessed the birth of several applied general equilibrium (AGE) models which are constructed precisely for simulating the effects of policy reforms (Auerbach and Kotlikoff, 1987, Altig *et al.*, 2001, Bovenberg and

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The views expressed in this paper are not necessarily those of CPB.

Knaap, 2005). Most of these models that focus on ageing populations distinguish between different generations, allowing them to focus on the effects of policies on different generations. When it comes to making future projections and assessing fiscal sustainability, models of this class seem less suited, however. The reason is not so much fundamental, but more practical. Applied general-equilibrium model often lack the kind of institutional details that may be particularly relevant for predicting the likely future behaviour of the economy.

This paper uses an applied-general equilibrium model that is based on a generational accounting model, named GAMMA (Generational Accounting Model with Maximizing Agents). It combines age profiles of different expenditure and tax items with demographic projections like generational-accounting models do. However, unlike these models, it accounts for changes in age profiles that result from future trends. As Bovenberg and ter Rele (2000) have shown, it is particularly relevant to account for likely changes of labour market participation rates and for the increasing scope (maturing) of pension schemes. In addition, GAMMA endogenizes the age profiles of various tax items. Indeed, the age profiles of labour income taxes, consumption taxes, taxes on pension income and taxes on corporate income all relate to the corresponding tax bases. Policy reforms that affect these tax bases may change these age profiles as well.

Our approach also extends the scope of generational accounting. Where GA calculations tend to focus on the transfers to and from the public sector, our model also accounts for the development of income that is earned in the private sector. This is important in these cases in which policy reforms affect not only net benefits from the public sector, but also the development of labour and capital income.

By combining the best of the AGE and GA worlds, GAMMA can be used for both projections and simulations. This is illustrated in this paper by presenting a baseline projection and the effects of a number of policy reforms.[1] The projection assesses the sustainability of current fiscal policies in the Netherlands. The simulations show how different policy reforms that improve fiscal sustainability, differ in terms of effects upon the Dutch economy, upon different generations and upon the time path of the government deficit and the government debt.

The structure of the paper is as follows. Section 2 describes the applied-general equilibrium model ands its relation with the underlying GA model. Section 3 discusses the projections in the field of demography and labour market participation rates. Section 4 describes the implications of our baseline projection for the economy and different generations. Section 5 discusses a number of policy reforms

[1] This paper draws heavily from a recently published study on the impact of ageing on Dutch public finances (Van Ewijk *et al.*, 2006). This study, which can be downloaded from www.cpb.nl, is input into the process that guides policy-making for the coming government period, 2007-11. In particular, the coming government will be advised on government debt policies by a committee that uses the CPB study as a quantitative background. This study contains many more projections than contained in this paper. Indeed, this paper presents only a baseline scenario and three policy variants; the background study adds eight alternative scenarios and three alternative policy variants.

that restore the sustainability of fiscal policies. Section 6 contains concluding comments.

2. The applied general-equilibrium model

As explained above, our model is based on the GA approach, but extends this by incorporating economic behaviour. This section discusses first the AGE part, in particular the behaviour of households, firms and pension funds. Next, the section discusses the GA part, *i.e.* the various age profiles and the definition of lifetime welfare.

2.1 The AGE part

2.1.1 General characteristics

GAMMA can be characterized as an applied general equilibrium model of the Dutch economy with overlapping generations of households. The model describes in detail the government sector and the pension sector, and comprises a comprehensive set of generational accounts for all current and future generations. GAMMA goes beyond the traditional generational accounting framework, however, by incorporating economic behaviour of households, firms and pension funds. Households decide on labour supply and private saving, firms decide on demand for labour and capital, and pension funds decide on pension contributions and benefit levels. Agents are rational and forward looking, and optimise in a consistent microeconomic framework. GAMMA thus allows for welfare analysis of policy reforms. A caveat is that GAMMA assumes perfect labour and capital markets. GAMMA is therefore not equipped to describe short- and medium-term dynamics.

GAMMA attaches the following features to the Dutch economy. First, the Dutch economy is small relative to the outside world. Domestic policies do not affect the interest rate, which is determined on world capital markets. Second, the goods produced at home are perfect substitutes to those produced abroad: prices are given and terms-of-trade effects are absent. This fits in with the long-term horizon of the model. Third, the model is deterministic. Lifetime uncertainty is recognised, but perfect capital markets enable households to insure against longevity risk.

Finally, the model assumes that agents are rational and forward-looking. They take into account the future consequences of their decisions. In the context of the long-term analysis, this is the only way to ensure consistency in behaviour, from a microeconomic and macroeconomic point of view. It is a prerequisite for meaningful welfare analysis, and yields plausible predictions for behaviour on a macroeconomic level.

2.1.2 Households

According to life-cycle theory, households rationally choose levels of current and future consumption and labour supply (leisure) on the basis of total wealth. The latter is defined as the sum of financial wealth and human wealth (the discounted value of potential[2] future labour and pension income). The adopted utility function implies that labour supply and its complement, leisure, depend on the marginal reward of labour (the price of leisure) only; leisure does not depend on total wealth. Leisure will be fixed unless its price changes. According to the life-cycle model, households smooth utility of consumption and leisure over their life cycle. Hence, as long as there is no change in the price of leisure, households will smooth consumption of goods. Every household is represented by a finitely lived adult. Longevity risk is assumed to be diversified; each household receives an annuity from a life insurance company in return for bequeathing the company its remaining assets upon decease. The tilt of the consumption path thus depends only on the difference between the interest rate and the rate of time preference.

GAMMA accounts for the fact that consumption profiles over the life cycle are hump-shaped. This can be explained by household composition and age-related preferences. For instance, households with children tend to consume more than is predicted by the pure life-cycle model. Taking account of these types of age effects, the life-cycle model in GAMMA is made consistent with the data (Blundell *et al.*, 1994, De Ree and Alessie, 2005).

GAMMA also accounts for the increase in labour market participation rates that are predicted in field studies. This is done by making the preference for leisure time-varying and calibrating it such as to produce the outside predictions. Note that this approach leaves intact the price sensitivity of labour supply.

Both taxes and pension contributions may affect labour supply. As labour supply depends on net wages, both the tax on labour income and that on consumption reduce labour supply. On average, participation in second-pillar pension schemes increases the labour supply. This effect is due to the implicit government subsidies in pensions: pensions are taxed at a lower rate than labour income, and pension savings are exempted from the capital tax.[3] As participation in pension funds is mandatory, this pension subsidy acts as a subsidy on labour supply.

2.1.3 Firms

Firms are assumed to operate in competitive markets where prices equal world market prices. The cost of capital is given by world market prices and the tax regime. As a corollary, taxes are fully shifted to labour. Indeed, in a small open economy, it is the net wage rate that has to accommodate changes in the tax rate.

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2 Potential labour income is defined as income with labour time equal to the total available time.

3 See Westerhout *et al.* (2004) for a more comprehensive treatment of this issue.

Table 1

Parameters Gamma

Rate of labour-augmenting technological progress *(percent)*	1.7
Substitution elasticity between labour and capital	0.5
Rate of time preference *(percent)*	1.3
Intertemporal substitution elasticity	0.5
Real rate of return	3.0
Substitution elasticity between leisure and labour supply	0.25

Production takes place with labour and capital according to a CES production function. Apart from their productivity, labour supplied by households of different ages is homogeneous. Labour productivity grows at a given rate in time. Capital adjusts without any delay. Wage accommodation thus also takes place immediately.

2.1.4 Pension funds

The Netherlands has a three-pillar scheme. The first pillar consists of public basic pensions. The public pension scheme is part of the public sector in GAMMA. The second pillar consists of private supplementary pensions. Pension contributions are deductible, while pensions are taxed. The difference between the tax rate on labour income and pensions implies an implicit subsidy, which stimulates labour market participation. The pension scheme contains defined-benefit elements. Hence, contributions may exceed the accrual of pension rights, and therefore may act as a tax on labour supply. The level of pension benefits is related to average wages earned over the working period. Furthermore, pensions are indexed to prices and partly to wages, reflecting the situation for the average Dutch pension fund.

2.1.5 Parameter values

The most important parameters of GAMMA are summarised in Table 1. The values of the parameters are based on the evidence produced by national and international research. This is discussed in more detail in Van Ewijk *et al.* (2006).

2.2 The generational-accounting block

2.2.1 Expenditures

We distinguish two types of primary government expenditures, age-related expenditures and non-age-related expenditures. Age-related expenditures consist of expenditures of which the benefits can be attributed to individual beneficiaries. This category consists of expenditures on social security, health care and education, and totals about 26 per cent of GDP. Non-age-related expenditures consist of the expenditures that cannot be that easily attributed to individual beneficiaries. This category, which includes expenditure on defence, general government, transfers abroad and subsidies, amounts to around 19 per cent of GDP.

2.2.2 Age-related expenditures

For the first category, future expenditures are constructed by assuming that – apart from indexation to productivity in the private sector – age-specific benefits per person from these expenditures remain unchanged. Average public expenditures related to a person of a certain age (e.g. a 30- or 70-year old) will thus increase each year at the rate of labour productivity growth.

There are three exceptions to this. The first concerns disability benefits. To derive the future numbers of beneficiaries, we include the effects of a number of recent policy measures that field studies predict will curb the inflow into these schemes. The second exception relates to unemployment benefits. Here, we take account of the effect of the business cycle in the first years of the projection. The third exception concerns health care expenditure. Here, we follow an extended procedure in order to account for death-related costs, similar to the one adopted in Van Ewijk *et al.* (2000) and Westerhout and Pellikaan (2005).

2.2.3 Non-age-related expenditures

The second type of expenditure consists of the expenditures that cannot be that easily attributed to individual beneficiaries. For these expenditure items we assume a "flat" age profile, entailing an equal benefit for each individual. This is obviously an arbitrary assumption, but better alternatives seem to be lacking. The aggregate growth rates of these items are assumed to correspond to the aggregate growth rate of GDP. The rationale for this may be that expenditure on these items is closely linked to the size of production in the economy – and GDP may be considered as the best measure for this concept. Again, this assumption is somewhat arbitrary.

2.2.4 Revenues

Government revenues consist of direct taxes, social security contributions, indirect and other taxes, corporate taxes and revenues from government assets (including natural gas). The model distinguishes direct taxes from various sources (*e.g.* taxes levied on labour income, pension income and private asset holdings). This makes it possible to account for trends such as the rise of labour market participation and the maturing of the pension system. Apart from the impact of specific trends (see below), the projections of labour income taxes, social security contributions and taxes on private wealth are based on the evolution of income and savings as predicted by GAMMA's lifecycle model. The projection of indirect and other taxes is split up into the part related to consumer spending and the part levied on investments. Revenues from natural (gas) resources follow a time path that deviates strongly from that of taxes. Due to the depletion of gas reserves these revenues are projected to decline from its current level of 1.6 per cent of GDP to zero in 2050.

2.2.5 Net benefits

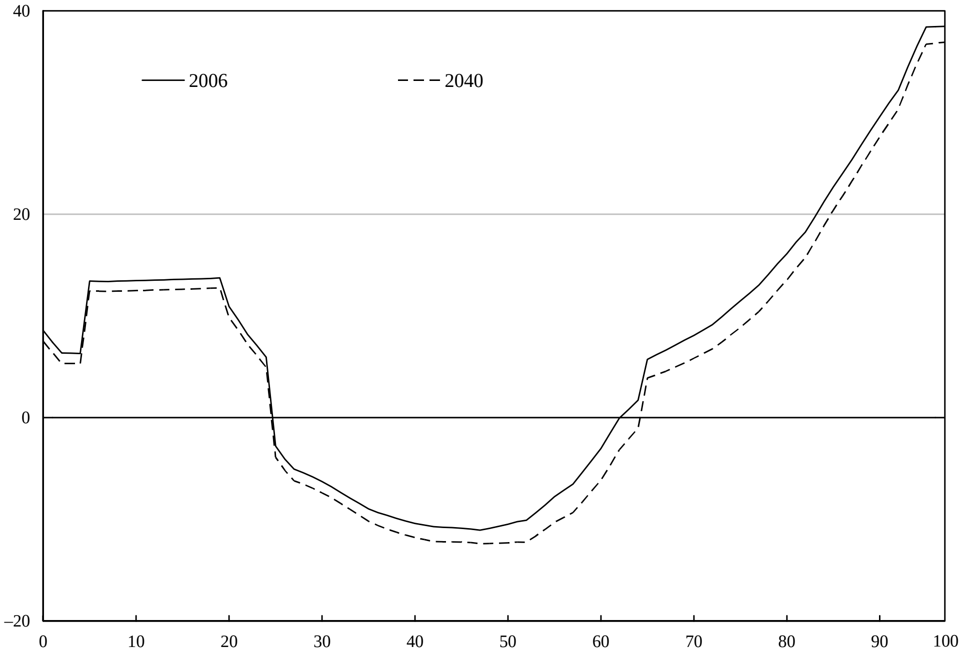
Figure 1 shows the age profile of the (average) net benefit from the public sector, where net benefit is defined as benefit minus costs. It turns out that the young and the elderly are net beneficiaries of the government. The middle-aged are net contributors. This pattern of intergenerational redistribution through the public sector is common in GA studies. Similar to Figure 1, we could draw a figure reflecting the net benefit from the second-pillar pension scheme. We would then see negative net benefits during the period in which people pay contributions to the pension scheme and positive net benefits during the period they are retired.

Importantly, our approach allows the age profile of net benefits to change over time. As explained above, the age profiles of expenditure on disability benefits, expenditure on unemployment benefits and health care expenditure will change over time due to reforms in disability schemes, business-cycle considerations and death-related costs respectively. But also the age profiles of tax items may change over time. In particular, the age profiles of the labour income tax and the consumption tax may change because of increasing labour market participation. Moreover, the age profile of net benefits from the supplementary pension scheme will change because of maturing of the pension scheme. For illustration, Figure 1 also shows the age profile of net benefits from the public sector in 2040. Comparison of the 2006 age profile and the 2040 age profile (corrected for the productivity growth in 2006-40) show that important shifts are expected to occur; the main characteristics of the age profile of net benefits remain unchanged, however.

There are four reasons for the downward shift of the age profile of net benefits. The first is the projected future rise of labour market participation (see Section 3), which raises taxes paid by the active population. The second lies in the maturing of pension funds (see above). This raises tax revenues from pension income and shifts down the profile for the age group older than 65. The third is due to our assumption that the output gap, which is estimated to be negative in the base year, will vanish in four years time. This bolsters tax revenues and reduces expenditure on unemployment benefits. After four years this factor is projected to lift the government balance by 1.4 per cent of GDP. The fourth reason relates to the way non-age related expenditure is extrapolated in this paper (see above). By linking it to GDP, and therefore to the size of the workforce, the rising number of inactive people due to the ageing of the population pushes down per capita benefits from this part of government expenditure.

Figure 1

Age Profile of Net Benefits, 2006



Due to the extension of the GA approach with economic behaviour, this paper can focus on the concept of lifetime welfare. This lifetime welfare is defined as the sum of three components. The first is the present value of the income that the members of the generation earn during their lifetime (*i.e.* their human wealth). The second and third components of lifetime welfare are equal to the present value of the net benefits from the government and pensions funds, respectively. As usual, we chart lifetime welfare and its components only for the future generations (*i.e.* those born in 2006 and later); for generations already alive at present, GAMMA can only be used to calculate welfare over their remaining lives. It should be noted that, in measuring lifetime welfare, no value is attributed to people's leisure time.

3. Inputs for the projection

The projection part of the analysis draws on a host of assumptions. Important is that we take the real interest rate to be constant at a level of 3 per cent and that we assume that there is labour-augmenting technical progress of 1.7 per cent per year. This section discusses two assumptions that are highly relevant for the projection exercise, *i.e.* the assumption on demographic developments and that on the development of labour market participation rates.

Table 2

Population and Its Composition in 2006-2100*

	2006	**2020**	**2040**	**2060**	**2100**
Age group			*(thousands)*		
0-19	3976	3752	3831	3824	3940
20-64	10036	9828	9188	9513	9694
65+	*2345*	*3244*	*3983*	*3557*	*3841*
Total	16358	16825	17003	16895	17462
Elderly dependency ratio	23.4%	33.0%	43.4%	37.4%	39.6%

* The data apply to the end of the year.

3.1 Demography

The demographic projection employs the most recent baseline projection of Statistics Netherlands. This is based on projected fertility rates, mortality rates and immigration patterns. The baseline demographic scenario assumes that the fertility rate is about 1.75 over the whole period, and that net immigration increases from its current negative value of around 2,000 annually to a structural level of 30,000. Mortality rates continue to decrease in the future, especially at older ages. As a result, life expectancy will also increase. Life expectancy at birth will increase from its present level of 76.7 years to 79.6 years for males in the period 2005-2050. Similarly, life expectancy at birth for females will increase from its present level of 81.2 years to 82.6 years in 2050. In the space of 45 years, average life expectancy will thus increase by a good two years. The gain is concentrated at higher ages: life expectancy at the age of 65 will increase with about 1.5 years.

Table 2 provides an overview of the change in the age composition of the population that is brought about by these developments. The elderly dependency ratio, defined as the number of 65+ as a percentage of the 20 to 64-year olds, is projected to rise from 23.4 in 2006 to 43.4 per cent in 2040. After 2040, it stabilises at a more-or-less constant level of around 39 per cent. The total population will grow to just over 17 million in 2040, and after a dip around 2060, will rise further to 17.5 million in 2100.

3.2 Labour market participation

In the last two decades, labour force participation has increased markedly. This trend is expected to continue in years to come, although at a somewhat lower

Table 3

Decomposition of the Change in Labour Participation
(percent of population aged 20 to 64 years)

	2005	**2005-20**	**2005-50**
Level (in ultimate year)	72.1	75.6	74.9
Demography		–1.7	–1.2
Participation men 20-54 years of age		0.7	0.5
Participation men 55-64 years of age		0.5	0.3
Participation women 20-54 years of age		1.5	1.1
Participation women 55-64 years of age		2.5	2.1
Total change (in years)		3.5	2.8

rate. Participation is projected to rise by 3.5 percentage points in the period until 2020 and 2.8 percentage points in the period until 2050. Measured in full-time equivalents, the rise will be less – mainly due to a higher incidence of part-time work.

As appears from Table 3, the principal determinants of future labour force participation are demographic changes and the continuing rise in the participation rate of women. The continuing increase in female participation rates occurs as older cohorts of women with relatively low participation rates will be replaced by younger cohorts with higher participation rates. Aside from this so-called "cohort effect", trends of emancipation and individualisation will lead to an increase in female labour force participation. The current projection assumes that female participation rates in the Netherlands will move towards those of Swedish women, such that by 2020 about half of the difference between both countries will have disappeared. The rationale for this partial convergence is that additional policy measures would be needed for further convergence – and such policy measures are assumed to be absent in our projection.

Another important change lies in the ageing of the population. As can be read from Table 3, this effect reduces the participation rate with 1 to 2 percentage points. In the third place, policy measures introduced recently will have an effect on the development of future labour force participation. For the period 2020-50, a modest decline is foreseen in the aggregate labour participation rate, of 0.6 per cent; behind this decline is a rising share of non-western immigrants, with relatively low participation rates.

4. A projection of public finances

4.1 Budgetary developments

Table 4 presents how public finances develop in our baseline projection in the period 2006-2100. In the period up to 2040 the ageing of the population exerts an upward pressure on public expenditure by raising the costs of public pensions and health care by 4.1 and 4.3 per cent of GDP respectively. In addition, natural gas revenues will decrease in this period by 1.5 per cent of GDP as a result of the depletion of gas reserves.

At the same time however, there are alleviating factors. First, tax revenues will increase through rising pension incomes that are subject to income taxation. First- plus second-pillar pension incomes will rise in the period till 2040 by 8.5 per cent of GDP (from 9.0 to 17.5 per cent of GDP). This raises tax revenues from this source (both direct and indirect) by 4.1 per cent of GDP. Second, expenditure on disability schemes is expected to fall considerably due to policy reforms in recent years.

On balance however, the burdening factors outweigh the alleviating factors. After an initial improvement due to cyclical factors, the primary balance deteriorates after 2011 as ageing and the decline of revenues from natural gas hit the budget. This eventually translates into an explosion of debt levels and interest payments. This in turn illustrates that government finances are currently on an unsustainable path and measures are required to render public finances sustainable.

Hence, there is a sustainability gap. It can be calculated that total debt (the sum of the statutory debt and the implicit debt due to ageing and declining gas revenues) is about 2 times GDP. The corresponding sustainability gap amounts to 2.6 per cent of GDP. The latter means that a permanent reduction in material government consumption by 2.6 per cent of GDP as from 2006 would suffice to fully restore fiscal sustainability.[4] Pursuing this policy reform would improve government balances which in turn would reduce debt and interest payments and make it possible to cover the future costs of ageing.

Table 5 shows how public finances, if made sustainable in this way, are affected if a permanent reduction in material government consumption is adopted to achieve fiscal sustainability. Primary expenditure is reduced by 2.6 per cent of GDP and the primary balance improves accordingly. As a result, the EMU balance improves. Next, the ratio of debt to GDP shows a sharp decline and eventually becomes negative. The burden of interest payments develops accordingly. Eventually, government balances and debt levels stabilise at a constant ratio relative to GDP.

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4 Note that this sustainability measure is different from the one proposed in Auerbach *et al.* (1999). That measure assumes that the sustainability gap is closed by payments by future generations only; ours spreads out the cost of adjustment over the currently living as well. We consider our measure more transparent than theirs. Furthermore, our measure might be easier to translate into policy measures since it does not require policies to differentiate policy measures with respect to age.

Table 4

Public Finances without Budgetary Measures in the Baseline Projection
(percent of GDP)

	2006	**2011**	**2020**	**2040**	**2060**	**2100**
Expenditure						
Social security	12.0	12.4	13.5	15.5	14.5	14.9
public pensions	4.7	5.3	6.6	8.8	7.8	8.2
Disability benefits	2.0	2.1	1.9	1.6	1.6	1.6
unemployment benefits	1.2	1.0	1.0	1.0	1.0	1.0
other benefits	4.1	4.0	4.0	4.1	4.1	4.1
Healthcare	8.8	9.3	10.3	13.1	12.5	12.6
Education	5.4	5.5	5.4	5.8	5.7	5.8
Other expenditure excluding	19.2	18.5	18.4	18.2	18.3	18.3
Primary expenditure	45.3	45.7	47.8	52.5	51.0	51.5
Interest payments	2.5	2.0	1.5	2.5	4.2	7.2
Total	47.8	47.7	49.3	55.0	55.2	58.7
Revenues						
Income tax and social security contributions	21.8	23.1	23.7	25.3	24.9	25.2
of which on pension income	1.8	1.9	2.5	3.6	3.4	3.6
Indirect and other taxation	14.9	15.6	15.9	17.3	16.7	16,8
of which on consumption by population aged 65 and older	1.9	2.2	2.9	4.2	3.6	3.7
Corporate income tax	2.6	2.6	2.5	2.4	2.3	2.3
Natural gas revenues	1.6	1.2	0.8	0.1	0.0	0.0
Other income	5.2	5.3	5.2	4.9	4.7	4.4
Total	46.1	47.9	48.1	50.0	48.6	48.8
EMU balance	–1.7	0.2	–1.1	–5.1	–6.6	–9.9
Primary EMU balance	0.7	2.2	0.4	–2.6	–2.4	–2.7
EMU debt*	54.4	47.7	41.0	74.5	126.4	213.3

* Value at the end of the year.

Table 5

Public Finances on the Basis of Sustainable Policies in the Sustainable Baseline Projection
(percent of GDP)

	2006	2011	2020	2040	2060	2100
Expenditure						
Primary expenditure	42.7	43.1	45.2	50.0	48.4	49.0
Interest payments	2.5	1.5	0.1	–0.7	–0.4	–0.4
Total	45.2	44.6	45.3	49.3	48.0	48.6
Revenues	46.1	47.9	48.1	50.0	48.6	48.8
EMU balance	1.0	3.3	2.9	0.6	0.7	0.2
Primary EMU balance	3.4	4.8	3.0	–0.0	0.2	–0.2
EMU debt*	51.7	31.6	0.6	–19.4	–12.9	–10.2

* Value at the end of the year.

4.2 Generational accounting

Table 6 shows that total lifetime welfare for someone born in 2006 is almost 850 000 euro in the sustainable baseline projection. By far the largest part of lifetime welfare (92.8 per cent) is derived from income earned during that person's lifetime. The remainder roughly coincides with the balance of net benefits from the government (7.3 per cent of lifetime welfare). The net benefits from the pension fund sector are negligible (–0.2 per cent of lifetime welfare).

Generations born after 2006 can expect higher lifetime welfare owing to the growth in labour productivity. Table 6 illustrates this for cohorts born in 2020, 2040, 2060 and 2100, respectively. Thus, the present value of the three components of lifetime welfare for people born in 2020 is (on their date of birth, in 2006 prices) over 200,000 euros higher than for people born in 2006. Each of the three components of lifetime welfare accounts for approximately the same share in lifetime welfare for people born after 2006 as for people born in 2006. The assumption that the government will realise sustainable public finances in 2006 is relevant here. Should the government defer the measures required to realise sustainable public finances, the net benefits from the government would be higher for people who are born before the government takes such measures. The same benefits will in that case thus be lower for people born after the government has started to implement reforms that realise sustainability.

Table 6

Generational Accounting on the Basis of Sustainable Policies

	Generations born in:			
	2006	**2020**	**2040**	**2060**
Lifetime income *(in percent of lifetime welfare)*	92.8	93.2	93.3	93.4
Net benefits from the government *(in percent of lifetime welfare)*	7.3	6.9	6.6	6.5
Net benefits from pension funds *(in percent of lifetime welfare)*	–0.2	–0.1	0.0	0.1
Lifetime welfare* (1,000 euro)	843.8	1062.4	1488.5	2087.7

* In 2006 prices.

As mentioned above, the concept of lifetime welfare does not attach value to leisure time. Therefore, our calculations underestimate the growth of net benefits from the public sector that is due to increasing longevity (that exceeds the increase of labour market participation).

Table 6 illustrates that future generations can expect net benefits from the government. In other words, the present value of the government expenditure attributable to them – over their entire lifetime – is greater than the present value of the tax and social security contributions they pay over their entire lifetime. The net benefits that future generations will receive from the government are essentially an inheritance that is handed down from their ancestors. For each generation, that inheritance consists of the wealth of the government on the date of birth plus net contributions to the government (during the remainder of their lifetime) from people already alive on that generation's date of birth. Assuming that the real return on government financial wealth exceeds economic growth, every generation can receive positive net benefits from the government while still leaving behind for the next generations an 'inheritance' that has grown with GDP.

5. Policy variants

The previous section used only one of the many possible instruments of government policy to render sustainable public finances, *i.e.* material government consumption, and assumed that the policy was implemented immediately. This chapter explores a number of alternative ways of achieving sustainability. We present a measure that (in contrast to government consumption) exerts behavioural feedback effects on labour supply and private saving, a measure that is implemented with a delay rather than immediately, and a policy of gradually increasing the retirement age. The first two of these variants show how large the required measures must be if an alternative policy direction is chosen to close the financing gap. The third variant assesses the effect on sustainability of an often discussed policy reform which may be an evident response to the costs of ageing in the light of the increase in life expectancy in the coming decades. We focus on economic, budgetary and intergenerational effects: employment and output, the key indicators of public finances (*viz*. the sustainable primary government balance) and the lifetime welfare effects across cohorts.

This section first shows how the policy adjustments that are necessary to render public finances sustainable affect the welfare of average members of each cohort (generation). Policy options to achieve sustainability are then discussed in more detail by comparing their economic, budgetary and intergenerational effects.

5.1 How does achieving sustainability affect the welfare of cohorts

To understand the effects of policies, we can examine their consequences on the welfare of separate cohorts. This section facilitates this process by showing how the lifetime welfare of an average member of each cohort is affected by various ways in which the government can achieve sustainability. The policy options are compared to a situation in which policies are not adjusted (and are thus unsustainable).

Similar to Section 4 (where levels of lifetime welfare are calculated) the measurement of lifetime welfare spans the full (remaining) lifetime. Comparability of the net benefits of unborn generations is obtained by adjusting their net benefits by a factor that corresponds to the difference in lifetime income.

The first component, the changes in primary income, can in a way be interpreted as the efficiency gain or loss due to the policy change (although any changes in leisure time are not included). In addition to our benchmark policies of adjusting material public consumption, we select three policy options for achieving sustainability:

1) raising indirect taxes in 2006. This variant introduces behavioural feedbacks, mainly by a reduction in labour supply. Another difference is that its annual incidence across age groups (its ‘age profile’) is not flat, as in the benchmark variant, but follows the pattern of private spending through life.
2) reducing government consumption in 2040 rather than in 2006. This variant is chosen to represent the effects of a delay of adjustment.
3) raising the retirement age by two years. This variant targets the costs of adjustment at the elderly. In 2015, the age of retirement is raised by one year to 66, followed by a further rise to 67 in 2025. This measure turns out not to bridge the full financing gap. The remaining part of it is closed by raising government consumption in 2006.

Figure 2

Lifetime Welfare Effects of Achieving Sustainability on Cohorts

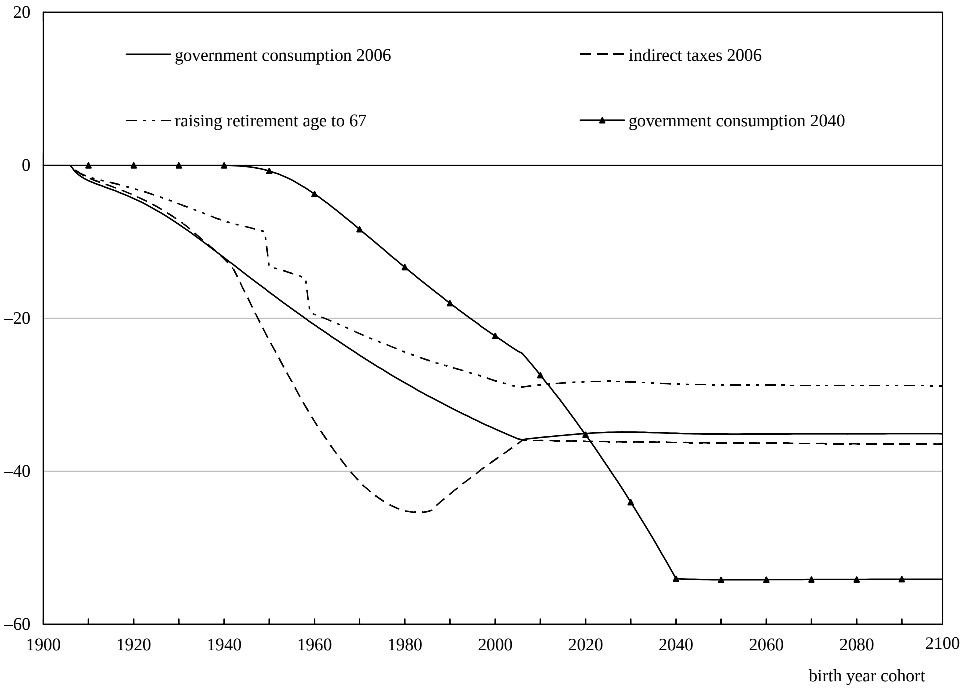


Figure 2 shows how the lifetime welfare of cohorts is affected in the four policy variants. The cohorts included in the figure are classified according to their birth year, ranging from birth year 1906 (the oldest of the currently living) to birth year 2100. In all variants, it is costly to restore fiscal sustainability. Hence, cohorts see their lifetime welfare decrease or remain constant in all variants. In addition, the costs of the adjustment generally rise the younger is the cohort involved. Apart from the delay variant, the costs of adjustment increase up to 30 to 40 thousand euros in present-value terms, and stabilise at that level for the yet-unborn generations (when corrected for their higher lifetime income). These maximum levels correspond to 3.3 to 4.5 per cent of lifetime welfare. In the delay variant, the elderly obviously escape the costs of adjustment. This variant, however, increases the costs for the unborn cohorts to a (income-corrected) level of 55 thousand euros (which corresponds to 6.5 per cent of lifetime welfare).

5.2 Comparing alternative ways to realise sustainable public finances

We now turn to an analysis of the economic, budgetary and intergenerational effects of the policy options outlined above for achieving sustainability. The approach is to compare the policies with the benchmark variant.

Table 7

Effects of Realising Sustainable Public Finances in 2006 by Raising Indirect Taxes, Compared to Reducing Government Consumption

	2011	**2020**	**2040**	**2060**	**2100**
(percent of GDP)					
Government consumption	2.6	2.6	2.6	2.6	2.6
Income taxes	–0.4	–0.4	–0.4	–0.4	–0.4
Indirect and other taxes	2.0	2.1	2.3	2.3	2.3
Primary EMU balance	–0.5	–0.3	0.1	0.1	0.1
EMU balance	–0.7	–0.6	–0.3	–0.4	–0.4
Government debt	3.6	7.6	10.2	9.9	10.6
(percent)					
Employment (in full time equivalents)	–0.8	–0.8	–0.8	–0.8	–0.8
GDP at base prices	–0.8	–0.8	–0.8	–0.8	–0.8

5.2.1 Raising indirect taxes

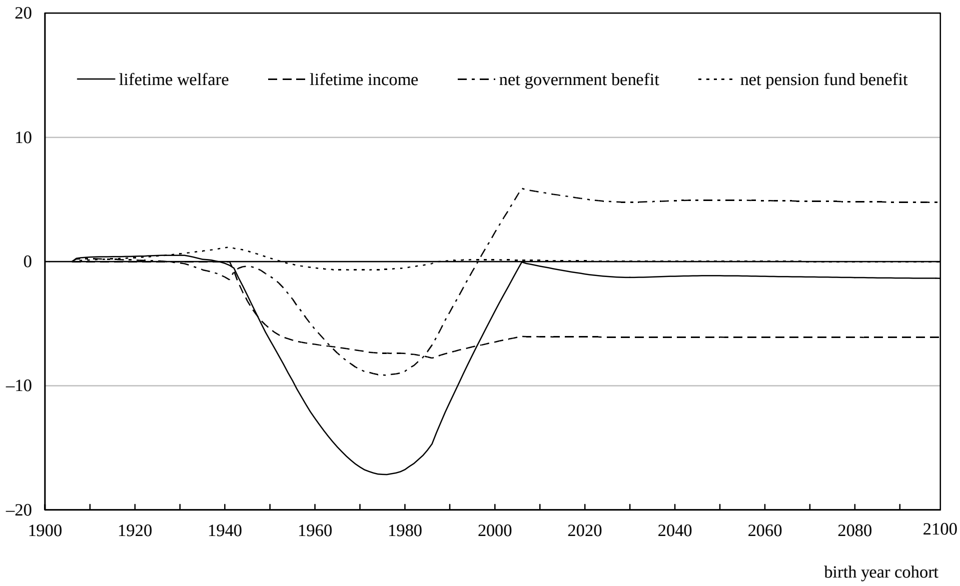
Table 7 shows the effects of an increase in indirect taxation in 2006. This variant obviates the need for a curtailment of material government consumption by 2.6 per cent of GDP from 2006. The primary EMU balance is 0.5 per cent of GDP lower in 2011. In this case, attaining sustainable public finances in the near term requires a less demanding target for the primary EMU balance in 2011, because revenues from an increase in indirect taxation will grow in the future under the influence of ageing. The impact of ageing thus "lifts" the share of consumption in GDP in the next few decades. The primary EMU balance will therefore improve to a greater extent, over time, in this variant than in the baseline projection in which sustainable public finances are realised by a reduction in material government consumption.

Unlike curtailment of public consumption, indirect taxation produces behavioural effects. Indeed, a higher tax rate on consumption acts as a disincentive to the supply of labour. This variant therefore produces an adverse effect on employment and output. This hampers the attainment of sustainable public finances. Indeed, the fall in GDP decreases the revenues from income taxation. It means that a more substantial change in tax rates is required in order to achieve fiscal sustainability.

Figure 3 shows how this alternative affects cohorts. The figure presents the effects on not only lifetime welfare, but also its three components. Figure 3 shows that the policy change reduces lifetime primary income for each cohort born

Figure 3

Effects on Cohorts of Raising Indirect Taxes Compared to the Effects of Reducing Government Consumption



after 1942. This results from the detrimental effects on employment that were mentioned above. The distributional effects by the public sector show significant changes. Older cohorts are affected negatively because their contribution to consumption tax revenues is higher than their share in the benefits of material public consumption. Overall, lifetime welfare declines for all cohorts younger than 65. The costs, in the form of higher tax payments and lower labour income, clearly outweigh the benefits from higher public consumption.

Note that in this comparison of sustainable policy options, the changes in net benefits from the public sector and pension funds are purely the result of distributional effects, as the sum of net benefits from these sectors of the economy add up to zero. Therefore, changes in benefits cancel out across cohorts. The zero-sum property does not imply that changes of policies of the government or pension funds cannot have efficiency effects. To the contrary, policy changes may have serious efficiency effects, which will be reflected in primary incomes.

5.2.2 Delaying budgetary adjustment

This section explores a variant in which the achievement of fiscal sustainability is postponed to 2040. Like in the benchmark variant, public consumption is the instrument that is used to close the sustainability gap. Postponement increases the policy adjustment that is required to achieve fiscal

Table 8

Effects of Delaying the Realisation of Sustainable Government Finances by Reducing Government Consumption from 2006 to 2040

	2011	2020	2040	2060	2100
(percent of GDP)					
Government consumption	2.6	2.6	–1.4	–1.4	–1.4
Income taxes	0.0	0.0	0.0	0.0	0.0
Indirect and other taxes	0.0	0.0	0.0	0.0	0.0
Primary EMU balance	–2.6	–2.6	1.4	1.4	1.4
EMU balance	–3.2	–4.5	–4.2	–4.1	–4.1
Government debt	16.3	43.1	113.9	113.3	112.2
(percent)					
Employment (in full-time equivalents)	0.0	0.0	0.0	0.0	0.0
GDP at base prices	0.0	0.0	0.0	0.0	0.0

sustainability from 2.6 of GDP to 4.0 per cent of GDP, an increase of 1.4 percentage points of GDP (see Table 8).

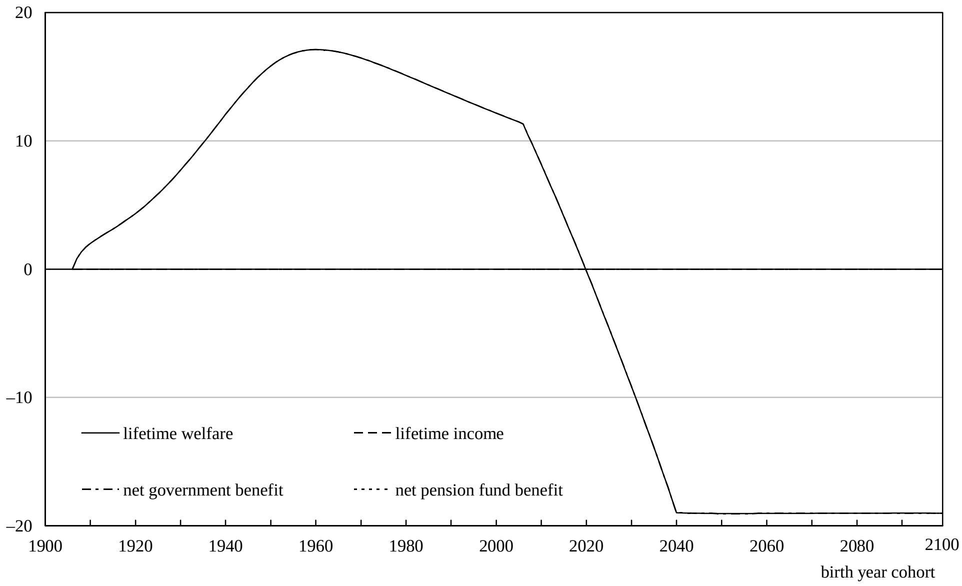
The effects of a delay on separate cohorts (see Figure 4) follow the expected pattern. Lifetime incomes do not change, since changes in government consumption do not affect employment. Substantial distributional effects occur, however, via the government. The elderly obviously benefit from the delay of adjustment. However, also groups that are faced with the increased size of the measure over a significant part of their lives benefit from the delay, as the short-term benefit turns out to outweigh the long-term burden involved in the higher requirement for budgetary adjustment. Even the unborn cohorts up to birth year 2020 benefit from the delay. Later born cohorts will have to pick up the bill. The costs of the delay for the cohorts born after 2040 amount to a sizable 19,000 euros (income corrected) – or 2.3 per cent of their lifetime welfare.

5.2.3 *Raising the retirement age*

This variant assumes that the age at which peoples' entitlement to a public pension and supplementary pension commences is raised in two steps, by a total of two years, to the age of 67. These calculations assume a one-year step-up of the

Figure 4

Effects on Cohorts of Delaying the Reduction of Government Consumption to 2040



retirement age in both 2015 and 2025.[5] We assume that, to the extent sustainability is not realised by this measure, the remaining gap will be covered by a reduction of government consumption in 2006.

We assume that the rates of labour participation after the increase in the retirement age for the groups aged 65 and 66 are the same as that for the group aged 64. The projection features participation rates for this group of 10 and 11 per cent, respectively, in 2014 and 2024. These figures are somewhat higher than their counterpart in 2006 (8 per cent), but low when compared to the average rate of labour market participation. This explains why the effects of increasing the retirement age on labour supply are limited.

The increase in the retirement age means that the reduction in material government consumption can be limited. Table 9 shows that it is 2.0 percentage points, which is 0.6 percentage points smaller than in the baseline projection. Fewer measures are now required for realising sustainable public finances – since the higher retirement age results in a smaller increase in spending on public pensions in the coming decades, coupled with higher government revenues as employment and output are boosted.

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5 If a greater number of steps is assumed for bringing the retirement age up from 65 to 67, as is the case in the United States and Germany, the effects to be expected are roughly comparable.

Table 9

Effects of Raising the Retirement Age in 2015 and 2025 to the Age of Subsequently 66 and 67 Years if Sustainable Government Finances Are Realised from 2006 through a Reduction of Government Consumption

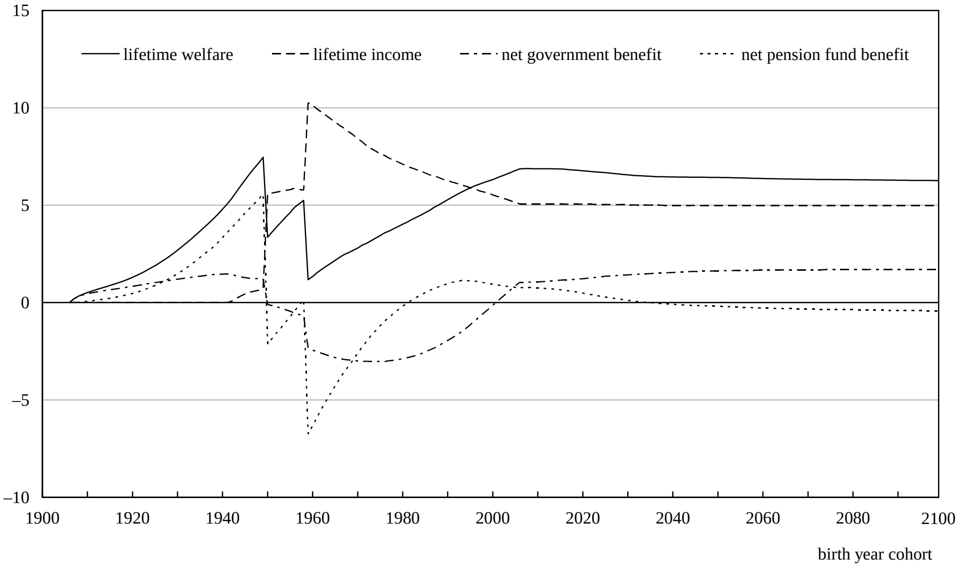
	2011	2020	2040	2060	2100
(percent of GDP)					
Government consumption	0.6	0.6	0.6	0.6	0.6
Income taxes	0.2	0.4	0.3	0.2	0.2
Indirect and other taxes	–0.2	–0.1	–0.2	–0.2	–0.2
Primary EMU balance	–0.7	–0.1	0.1	0.1	0.1
EMU balance	–0.9	–0.5	–0.2	–0.3	–0.3
Government debt	4.4	7.6	7.1	5.9	5.9
(percent)					
Employment (in full-time equivalents)	0.0	0.4	0.7	0.7	0.7
GDP at base prices	0.0	0.5	0.8	0.9	0.9

The increase in employment in this variant is smaller than the increase of the labour supply of the group aged 65 and over, since the higher retirement age results in a greater tax wedge. Lower pension benefits and contributions reduce the extent to which workers can benefit from tax facilities on pension savings. This makes it less attractive to work. This effect is quite small, however. This can be derived from the negligible impact on employment in 2011, before the rise in retirement age takes effect.

Figure 5 shows that primary incomes increase for all cohorts younger than birth year 1942. This is mainly a result of the lengthened stay in the workforce by those who are currently active at the age of 64. The distributional effects through pension funds are at first sight somewhat counterintuitive. It turns out that the rise of retirement age benefits the elderly (see the cohort older than birth year 1942). This is explained by the fact that these cohorts escape the consequences of the rise in the retirement age. Moreover, the elderly even benefit from the rise because it reduces pension-fund liabilities, thereby improving the funding ratios of pension funds. This reduces the need to limit the indexation of pensions. The full burden is borne by the age groups that do face the direct consequences of the higher retirement age, but have a part of their careers behind them in which the pension premiums they contributed to pension funds were in accordance with the lower retirement age. The distributional effects through the government sector are relatively small. The elderly benefit because they are not faced with the higher retirement age, whereas they do benefit from the smaller reduction in government consumption. The middle-aged

Figure 5

Effects on Cohorts of Raising the Retirement Age by Two Years (see text)



and younger groups carry the burden of this policy change. These groups are fully confronted with the higher retirement age. The net benefits (which are very small) for the newborns and unborn cohorts reflect the net effect of the difference in age targeting between the increase of retirement age (the elderly) and the offsetting government consumption (all age groups equally). The lifetime welfare effects are positive for all groups. Generally, this results from the prevalence of the increases in primary lifetime incomes.

6. Conclusions

In our view, understanding the behaviour of economic agents is as important as understanding fiscal institutions. Our model integrates the generational-accounting approach with an applied-general equilibrium setup. The recognition of economic behaviour improves our assessment of the intergenerational consequences of government policies; accounting for fiscal institutions improves our projections of future economic developments.

This paper illustrates the benefits from an integrated approach by presenting projections and policy simulations. The two analytical simulations demonstrate most clearly the working of the model. The more realistic simulation of a gradual increase of the official retirement age shows how our model can be put into practice. It is this line that we want to explore further in future work.

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NOTHING VENTURED, NOTHING GAINED: THE LONG-RUN FISCAL REWARD OF STRUCTURAL REFORMS

Peter Höller and Claude Giorno[*]

The recent reform of the Stability and Growth Pact provides more leeway for EU governments to temporarily breach the 3 per cent deficit limit if this facilitates the implementation of initially expensive reforms. But the implementation of this principle is not obvious as budgets would need to specify the initial and multi-annual budgetary cost and benefit profile of reforms. Budgets should also be explicit about the fiscal cost of inaction to allow a balanced judgment of countries' trade-offs between the various options available. This paper first assesses the information requirements to implement this new form of flexibility built into the Stability and Growth Pact. It then provides simulation exercises to highlight the positive budgetary effects of coordinated structural reforms in the euro area as well as the need for an adequate monetary policy response to make sure that demand adjusts to the improved supply conditions swiftly. The budgetary gains would still depend on the type of reform and their impact on employment and productivity. On the other hand, national policy initiatives by a single country may only have a limited impact, especially in the short term and in the case of a large country. Indeed, in monetary union, the strength of endogenous adjustment mechanisms appears to be weaker in larger countries. Finally, the experience of New Zealand and Australia has shown that the longer-term benefits of reforms both in terms of the budget and overall economic performance are significant. Even so, it is not easy to disentangle the various forces at play. Fundamentally, structural reform and the implementation of smart fiscal frameworks tend to go hand in hand – indeed may be two sides of the same coin.

Introduction

1. We take it for granted that fiscal discipline is important because: large deficits and rising debt undermine the long-run sustainability of fiscal policy, excessive deficits will be a burden on future generations, fiscal policy volatility can undermine growth and a pro-cyclical policy can destabilise the economy (Fatás, 2005). Fiscal rules are one way to cope with such fiscal policy biases, even though they need to be

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The views expressed are those of the authors and not necessarily of the OECD.

This is part of a paper, earlier versions of which were presented at the European Commission Workshop on the Budgetary Implications of Structural Reforms held in Brussels on 2 December 2005 and at the Banca d'Italia Workshop on Public Finance in Perugia on 30 March to 1 April 2006. The authors are indebted to Roel Beetsma, Boris Cournède, Marco Buti, Ekkehard Ernst, Vincent Koen, Annabelle Mourougane, Paul van den Noord and Dave Rae for their valuable comments. We are indebted to Sara Crohem and Celia Rutkoski for technical assistance.

underpinned by institutional settings so that they can be enforced at the national, and in the case of the euro area, at the Community level.

2. These concerns were not at the root of the EU fiscal framework. It was designed to address another key concern, namely that once exchange rates within the single currency area ceased to exist, financial markets would no longer discipline fiscal policy. Fiscal profligacy in one country could affect area-wide interest rates and crowd out economic activity in other countries. Even though interest rate differentials across the euro area countries have narrowed despite a divergent fiscal performance, there is little evidence of spill-over effects. The main reason probably is that there is little to crowd out due to persistent economic slack in the large euro area countries.

3. This may be one reason why the arguments in favour of rules-based fiscal co-ordination have shifted towards long-term issues, as they should, especially because ageing-related concerns oblige governments to recognise the implications of current budget decisions for public finances in the future. Also, greater attention has progressively shifted to the incentives built into budgetary institutions that produce fiscal biases (higher deficits, expenditure and taxes). Even though these institutions have improved to some extent, they are still lagging best practice in many euro area countries.

4. At the same time, calls to make the Pact more flexible have mushroomed. Some were motivated by new member countries' need to boost infrastructure outlays, against the backdrop of relatively low public debt levels. Some observers have argued in favour of the "golden rule", along the lines of the one introduced in 1997 in the United Kingdom.

5. Another rationale for a rewrite of the rules is that structural reform is expected to yield long-term economic gains but often entail up-front costs that may dissuade governments from implementing structural reforms. The expected gains of structural reforms are usually uncertain, long-term and spread out across the economy whereas any political and budgetary costs, such as compensation schemes to offset redistributive effects, are more tangible, are felt immediately and are more concentrated. Moreover, some reforms will involve *J*-curve effects; a cut in taxation will reduce budget receipts immediately while effects on incentives to work, save and invest may take some time before they materialise. This asymmetry could discourage reforms, especially in a monetary union, where they cannot be supported via an easing of monetary policy. Similarly, a move towards privately-funded pension schemes typically leads to deficits in the public scheme but initial surpluses in the private schemes as contributors transfer to them.

6. According to the fiscal rules a waiver can be granted under the excessive deficit procedure to countries on the basis of "exceptional circumstances" (EC, 2005a and EC, 2006). While the Treaty had already stipulated that "other relevant factors" should be part of the "exceptional circumstances", these were not specified. The revamped Pact decided by the European Council in March 2005 specifies them and the conditions under which they are taken into account. These include efforts to

pursue the Lisbon agenda, to foster R&D or "a high level of financial contributions" to underpin the "unification of Europe" and "international solidarity" (development aid). Consideration would also be given to pension reforms. Concerning the Lisbon agenda, the new Council Regulation observes: "In order to enhance the growth-oriented nature of the Pact, major structural reforms which have direct long-term cost-saving effects, including through raising potential growth, and therefore a verifiable impact on the long-term sustainability of public finances, should be taken into account when defining the adjustment path to the medium-term budgetary objective for countries that have not yet reached this objective and in allowing a temporary deviation from this objective for countries that have already reached it" (EC, 2005b). All these provisions, however, only apply if "an excess over the reference value is temporary" and if the deficit ratio "remains close to the reference value", as stipulated in the Treaty. In its assessment of the most recent batch of stability programmes the Commission (EC, 2006) noted that no structural reforms were taken into account in setting adjustment path towards the medium-term fiscal objectives because of the lack of information provided in the programmes on the content of reforms and their budgetary implications. Moreover, there were virtually no cases of structural reforms being discussed.

7. Against this backdrop we will address the following three questions:

- Do governments actually know the size of the upfront cost of structural reform or do they at least make any efforts to estimate them? This is an important question, because without such estimates it is hard to see what could eventually underpin a waiver. Unfortunately the answer is a qualified no, as will become clear in the first section of this paper.
- What can the economics profession contribute to estimating the long-run gain of structural reform? The usual instrument is to look at macroeconomic feedback mechanisms and to simulate various scenarios with an economic model to study the fiscal implications of reforms that affect technical progress, the participation rate or the natural rate of unemployment in different settings. This is what we will do in the second section.
- What do historical examples of deep structural reform say about the interplay between structural reform and public finances? The answer from New Zealand and Australia is that their structural reform programmes were followed by a very strong improvement in their fiscal positions.

Costing the impact of reforms on the budget

The UK budget: a role model?

8. Assessing the budgetary implications of structural reforms in the short, medium and long run is shrouded with many difficulties. In many cases, governments do provide a costing of changes in tax and spending plans and often

Table 1

The Costing of Budget Policy Decisions in the UK
(budgetary measures – percent of GDP)[*]

	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007
Budget 2001	–0.2	+0.2	+0.3			
Measures since Budget 2000	–0.3	–0.4	–0.3			
Budget 2002		–0.1	+0.6	+0.7		
Measures since Budget 2001		–0.0	–0.2	–0.2		
Budget 2003			–0.1	–0.0	+0.0	
Measures since Budget 2002			+0.1	+0.0	+0.1	
Budget 2004				–0.1	+0.0	–0.0
Measures since Budget 2003				–0.1	–0.1	–0.1

[*] A plus sign indicates an Exchequer yield.
Source: HM Treasury, Budget 2001, 2002, 2003, 2004.

also beyond the current budget.[1] Obviously, changes in tax and spending plans are pursued for many other purposes than purely fiscal ones. UK Budgets (HMT, 2001, 2002, 2003 and 2004), for instance, provide an assessment of Budget policy decisions over a three-year horizon under the following headings: meeting the fiscal rules and funding public services; meeting the productivity challenge; increasing employment opportunity for all; building a fairer society; a modern and fair tax system; and protecting the environment.

9. Budget 2002, for instance, lists 54 spending and tax measures and estimates their budgetary effect. The budgetary impact of 16 measures implemented since Budget 2001 are estimated as well. The biggest measure was a payroll tax increase and the second biggest an increase in the generosity of the Child Tax Credit and Working Tax Credit for families with children. All other measures were small, ranging from beer duty relief for small brewers to simplifying capital gains tax. While the list of measures is long, only those are included where the impact of the decisions and circumstances can be quantified with reasonable accuracy. Moreover, spending that is fixed by the spending reviews and embedded in Departmental Expenditure Limits is not included in the Budget costing of decisions. In 2002, the net fiscal impact of the identified spending and revenue measures was nearly 1 per cent of GDP, but considerably lower in most other Budgets (Table 1). In comparison, the forecasting error for the deficit was equivalent to 1 per cent of GDP

[1] According to the 2003 Survey on Budget Practices and Procedures (available at http://ocde.dyndns.org/), 55 per cent of the OECD countries provide multi-year cost estimates for all new spending items, and another 20 per cent do it for some mandatory spending items. The survey does not cover revenue changes.

for the year-ahead projection in recent years and nearly 1½ per cent of GDP for the two-year ahead projection. There is no strong hint in the Budget costings that reforms have generated large budgetary costs in the short term. However, this is so mainly, because the spending underpinning the ongoing reforms to health, education and infrastructure are built into (hence respect) the Departmental Spending Limits.

10. What this spending has achieved is open to debate, as the new metrics to measure government outputs, following the Atkinson Review, are not yet fully in place. Assessments of feedbacks of tax and spending changes on economic activity are even rarer. HMT's effects of budget measures, for instance, do not include effects on overall levels of income and spending. This is not surprising, because there is often no consensus on effects. Depending on the underlying model and empirics, a rise in payroll taxes can have a negative short, medium or long-term impact on structural unemployment, or none at all. Effects of R&D tax credits or grants on R&D spending and ultimately growth are notoriously difficult to quantify. Or the effect of savings incentives on substitution between different savings vehicles versus aggregate savings is usually impossible to pin down. And sometimes, long lags imply that any discernible effects of reforms would only show up after many years. Still, in the United States, attempts are underway to include feedback effects in assessing tax and spending proposals (Box 1).

Quantifying the cost of inaction

11. One could argue that, before allowing more leeway under the fiscal rules, unproductive spending should be pruned first, which would probably leave enough room to spend on priority areas, without running up against the deficit limit. Similar issues relate to reforms, or the lack thereof, of budgetary frameworks, which are far from being best practice in many EU countries (Joumard *et al*., 2004). The design of reforms themselves may also be problematic: perhaps the scope for more cost-effective approaches is not being exploited. There are many examples of government spending programmes that tend to undermine growth, come at a high budgetary cost, sometimes grow considerably faster than GDP and are difficult to reform. They crowd out more productive government spending programmes. As such programmes tend to push countries towards the Maastricht deficit limit, the question arises whether policy inaction in such areas should not be taken into account, when granting greater flexibility on spending in priority areas.

12. The potential sources of fiscal stress built into government programmes are multiple. Fiscal pressures may mount because of biased incentives of government programmes, for example in the case of early retirement and disability schemes. The implicit tax on continued work, which gauges incentives to quit work before the retirement age, is very high in many European countries (Figure 1). There have been reforms, but most were minor, though Italy lowered the implicit tax a lot between 1998 and 2003. Early retirement lowers labour utilisation and has fiscal costs that can amount to several per cent of GDP. Similarly, the number of disability benefit recipients varies considerably across countries and only a few countries were

Box 1

Dynamic scoring

In the United States, legislative proposals are scrutinised by the Congressional Budget Office (CBO) and the Joint Committee on Taxation (JCT). They provide a baseline and forecasts of the changes in expenditure and revenues that would result from proposed legislation over the following ten years. * The forecasts provide a cost estimate or "score", for each piece of legislation that is reported by a Congressional committee (Page, 2005). In the past, the scoring was static, not taking into account macroeconomic feedback effects. Dynamic scoring, which is still in its infancy, takes into account induced changes on output, inflation, interest rates or other macroeconomic feedbacks. The scoring is important as it influences how favourably initiatives are viewed in Congress and the Senate. A tax cut, for instance, could raise output significantly, with a large cut in tax rates having little implication for net government revenues. If this feedback is not included, the tax cut will be viewed less favourably by Congress, which is usually constrained to keep the total revenue cost of a tax package within pre-set targets (Altshuler *et al*., 2005).

The outcome of dynamic scoring depends on the models used and on assumptions about macroeconomic policy reactions. In assessing the 2004 budget, forward-looking, life-cycle growth models and more traditional macroeconomic forecasting models were used. For the latter, various monetary policy reactions to the fiscal stimulus were simulated, while the growth models differ in various respects. Given different models and assumptions, the outcomes differed widely. Concerning the JCT's analysis, incorporating dynamic effects reduced the net revenue cost of one proposal by 6 to 28 per cent over the first five years and 3 to 23 per cent over the second five years. Auerbach (2005) concludes from these first attempts, that "… it seems clear that dynamic scoring analysis has value, but also that adjustments to estimates are smaller than some might have expected. The process to date offers some support to those on both sides of the debate. On the one hand, the ability of CBO and JCT to produce dynamic analyses of complex, realistic proposals lends credence to the argument that dynamic analysis and, indeed, dynamic scoring may be feasible. On the other hand, the many models used and the many assumptions needed leave many with doubts about the quality of these estimates and how they would fit into the budget scoring process as currently structured".

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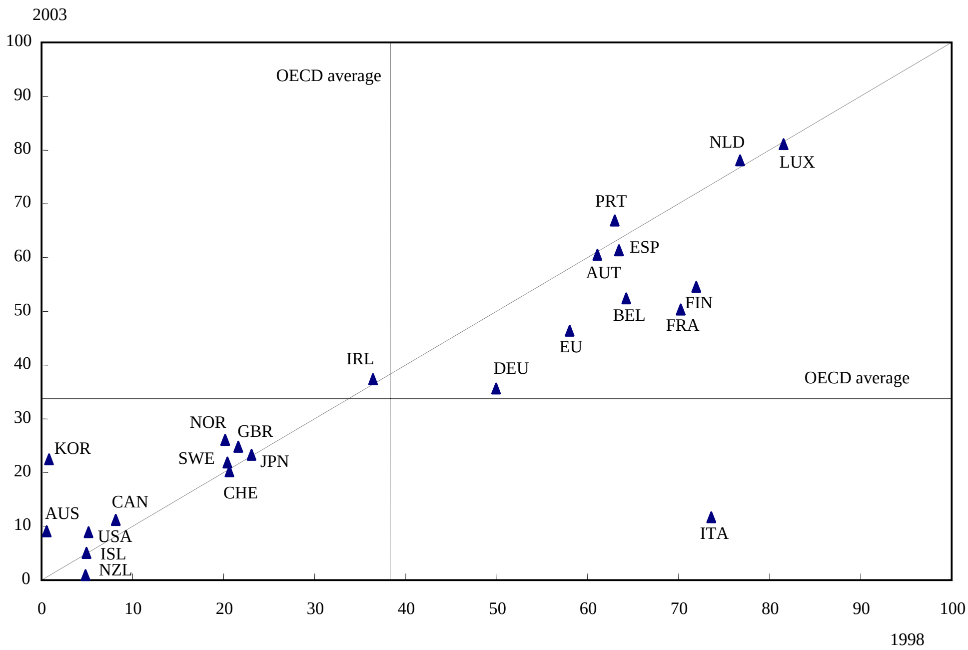
* On the expenditure side, the CBO provides the baseline and the scoring, on the revenue side the CBO provides the baseline and the JCT the scoring.

Figure 1

Implicit Tax on Continued Work: Early Retirement*, **



* Average of implicit tax on continued work in early retirement route, for 55 and 60 year olds.
** EU: 15 European countries excluding Denmark and Greece.
Source: OECD (2005), Going for Growth, OECD, Paris.

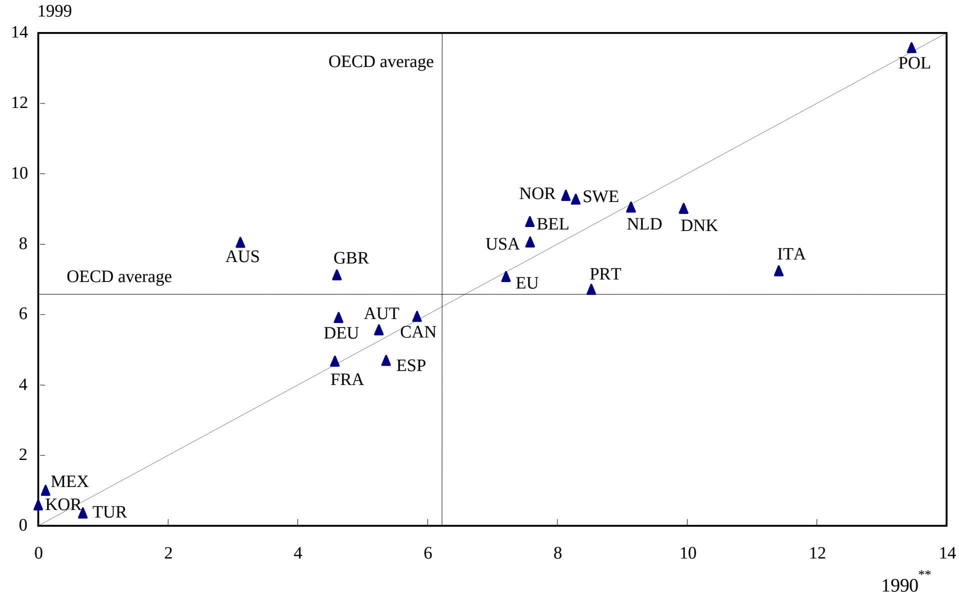
successful in reducing the number of beneficiaries (Figure 2). In fact, in many countries, the number of beneficiaries keeps on rising rapidly.

13. There are also cases, were reform efforts have been considerable, but reform outcomes tend to fall short of expectations. Majnoni d'Intignano (2001), for instance, argues that health reforms in France are recurrent, actually close to one every year between 1975 and 2000, but have barely dented spending growth, or have slowed growth in one year, but with a catch-up towards the underlying spending trend the next. The costing of changes in government programmes is not too difficult for programmes that are relatively simple and where at least some changes in policy parameters influence private decision making in a straightforward way: the implications of pension reforms, for instance, have been well researched by the Commission or the OECD. More complex issues, like the effects of health care reforms are much more difficult to quantify. There are many actors and incentive effects are difficult to model.

14. The cost of inaction can be illustrated by resorting to the now fashionable distinction between the Nordic, Anglo-Saxon, continental and Mediterranean social

Figure 2

Income Support for Disability – Share of Working Age Population Non-employed and Receiving Disability Benefits*
(percent)



* EU15 excluding Finland, Greece, Ireland and Luxembourg.
** 1995 for Austria, Mexico and Poland.

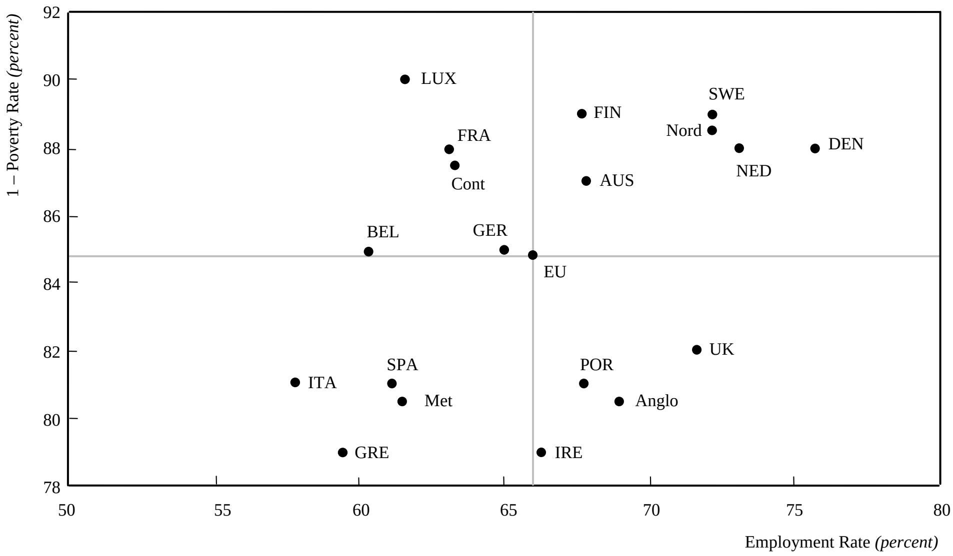
Source: OECD (2005), *Going for Growth*, Paris.

models. Boeri (2002), for instance, compares their performance in terms of meeting three objectives: reductions in income inequality and poverty; protection against uninsurable labour market risk; and the reward to labour market participation. And indeed, geography and economic characteristic tend to coincide, though the match is not perfect. Sapir (2005) uses the same typology, but focuses on efficiency and equity aspects: Efficiency is measured by a high employment rate and equity by a low poverty rate.

15. Figure 3 shows that all Nordic and Anglo-Saxon countries are above average in terms of employment, whereas most continental countries (except Austria and the Netherlands) and Mediterranean countries (except Portugal) rank below average. On the other hand, poverty is relatively high in the Mediterranean and Anglo-Saxon countries and relatively low in the continental and Nordic countries. Sapir (2005) has analysed the reasons for these differences. What is important in the context of this paper is the fiscal sustainability of social models. Net public debt as a per cent of GDP is much lower in the "efficient" countries and much higher in the continental and Mediterranean countries (Table 2). Moreover, debt does not tend to

Figure 3

European Social Systems:
Employment Rates and Probability of Escaping Poverty



Source: Sapir (2005).

come down much in the high-debt countries (except Belgium), while it has stayed low or even come down further in most better-performing countries.

16. A similar pattern emerges when looking at growth performance and fiscal policy (Figure 4). In the period 1999-2005, trend growth was only 1½ per cent per year on average in the three major euro area countries, but 3¼ per cent in the smaller countries. Faster growth coincides with a strong fiscal performance, while the contrary tends to be true for the slower-growing countries. Econometric work provides evidence that fiscal consolidations are more likely to be undertaken and successful if trend economic growth is high (von Hagen *et al.*, 2002). At the same time, the smaller fast growing-economies were able to maintain fairly rapid growth in public spending while keeping their government deficits in check. Greece is of course an important exception with soaring spending and a whopping government deficit despite strong growth.

Quantifying the impact of regulatory reform

17. Things become even trickier when assessing the effects of changes in the regulatory stance on growth and government budgets. The OECD has developed a

Table 2

Gross and Net Debt Development

	Gross debt *(percent of GDP)*	**Net debt** *(percent of GDP)*	**Change in Gross debt**	**Change in Net debt**
	2005	**2005**	**1993-2005**	
Nordic model				
Sweden	61	–6	–18	–16
Finland	48	–41	–4	–24
Denmark	48	2	–11	–23
Netherlands	66	–28	–32	–7
Austria	65	39	3	–2
Anglo-Saxon model				
United Kingdom	46	39	–3	6
Ireland	30	-	–65	-
Portugal	78	46	0*	20*
Continental model				
Germany	72	61	24	33
France	74	45	22	17
Belgium	100	90	–45	–38
Mediterranean model				
Italy	121	98	–5*	–3*
Spain	53	31	–14	–10
Greece	108	-	–2	-

* 1995-2005.

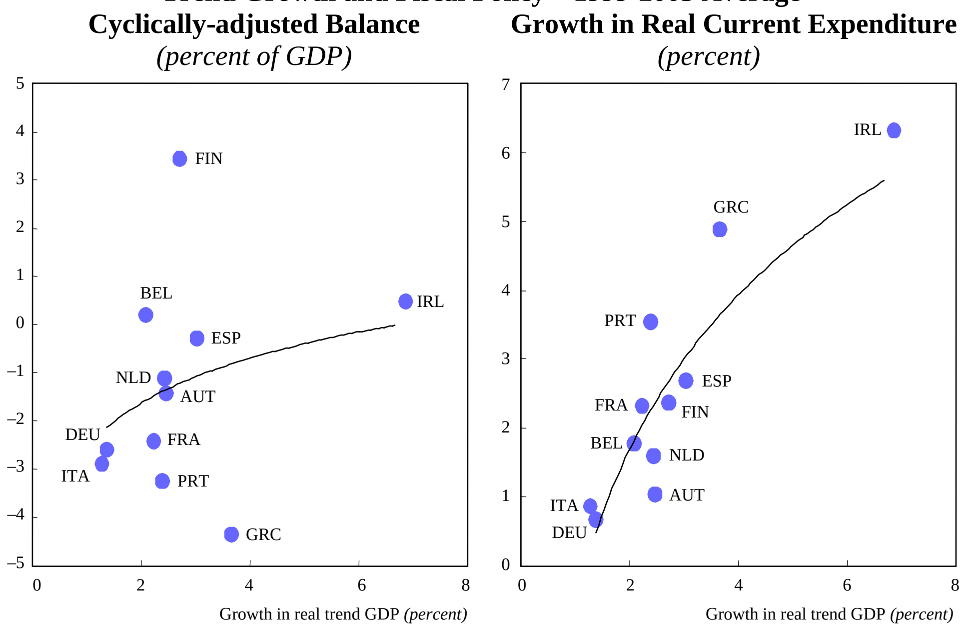
Source: Economic Outlook No. 77 database, OECD, Paris.

broad range of indicators concerning the stringency of labour and product market regulations.[2] The OECD has also produced a lot of empirical work that traces the effects of the regulatory stance on employment and unemployment rates, R&D intensity and ultimately growth. This work has culminated in the OECD's Growth Project (OECD, 2001) and feeds into the ongoing structural surveillance work (OECD, 2005). Substantial methodological progress has been achieved in constructing structural policy indicators with an econometric link to economic performance.

[2] The World Bank has also developed inventories of policy measures. Another example is the indicators developed by the Fondazione Rodolfo Debenedetti.

Figure 4

Trend Growth and Fiscal Policy – 1999-2005 Average



Source: Economic Outlook No. 77 database, OECD, Paris.

18. Such inventories are potentially very useful, but there are also limitations, when assessing the budgetary implications of structural reforms:

- These inventories leave out a wide variety of regulations, such as health and safety or environmental regulations, which could have a budgetary impact.
- There is in general no direct link between these inventories and budgetary effects and it would seem difficult to establish the link between reforms and side-payments to get reforms underway.

19. Moreover, while the body of empirical work on growth is enormous, there are still considerable disagreements about what reforms can achieve in the short and long term. In particular, the short-term adjustment costs associated with reforms are under-researched. Moreover, results are data-quality, model and estimator dependent. While cross-country growth regressions have been an extremely popular means of testing ideas about the sources of growth, many of the variables claimed to be significant have not passed tests of statistical robustness (Ahn and Hemmings, 2000). Another problem is the lack of accepted formal theoretical models that can accommodate the wide range of variables that are often included as explanatory variables, despite advances in the theory of economic growth. A related issue is that causal links between aggregate economic variables and growth are bi-directional, hence most estimates are likely to suffer from endogeneity problems.

Structural reform, feedback mechanisms and fiscal performance: what can a macro-model tell?

20. Even if reforms have measurable direct beneficial effects on primary spending, their overall effect on the fiscal position depends on economic feedback mechanisms and will vary across countries. To quantify the impact of these mechanisms, several simulations were run with the OECD's Interlink model. They show how the macroeconomic effects of structural reform can vary across different situations, and in particular they illustrate the difference between concerted reform efforts versus reforms in a single country.

Effects of coordinated reform in monetary union

21. Simulations have been run to quantify the benefits from co-ordinating structural reform with monetary policy in the case of the euro area. To set a benchmark, we first construct scenarios in which co-ordination with monetary policy is absent. Three scenarios are run: first, total factor productivity is raised; second, labour force participation increases; and third, structural unemployment is reduced. These changes affect the large euro area countries and thus the overall performance of the euro area, for which the level of potential output increases by 1¼ per cent over eight years. The reforms all imply lower inflation and are accompanied by lower interest rates in a way that keeps real interest rates unchanged. Exchange rates are assumed fixed, except in one simulation. Finally, tax rates are kept constant and also government consumption and investment are held fixed in real terms. The results are represented with respect to a baseline scenario which goes to 2012, which is based on the premise that countries converge gradually to their potential production level.[3]

Effects of a rise in trend productivity

22. The first simulation illustrates the effect of a productivity gain on macroeconomic and budgetary performance. As many studies have shown there is considerable potential to raise productivity in the euro area, be it by product and labour market reforms or stronger innovative activity (OECD, 2003 and 2004). The simulation assumes that the level of trend labour productivity goes up by a cumulated increase of 2 per cent over eight years. In the simulation, stronger productivity growth leads to a gradual rise in real wages, which is compatible with

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3 Medium-term scenarios that prolong the short-term projections are regularly up-dated by the OECD. They are based on the premise that the output gap will close over the scenario's horizon (by 2012), while unemployment converges to the structural unemployment rate. Commodity prices and exchange rates are held fixed in real terms, while the oil price declines from $54 at the end of 2007 to $44 per barrel by 2012. Monetary policy aims at price stability, while fiscal policy remains unchanged, with the primary budget balance virtually stable between 2007 and 2012 in most countries. Details can be found in the OECD Economic Outlook 78 (2005).

lower inflation (Figure 5). This raises internal demand and boosts net exports, which benefit from improved competitiveness. Total demand rises somewhat faster than potential output and the output gap closes more quickly than in the baseline. The budget balance improves in actual and structural terms by about 1¼ per cent of GDP at the end of the simulation period. This is mainly due to the lower nominal interest rates and to a lesser extent to improved social accounts. The reduction of the deficit allows only a small decline in the debt/GDP ratio, because lower inflation lowers nominal GDP growth.[4]

Effects of a rise in participation

23. Figure 5 allows a comparison of these first results with a simulation of an increase in labour force participation. Considerable room for increases also exist in this domain, especially by sharpening incentives for young and older workers to work and by removing obstacles to participation by females (Burniaux *et al*., 2003). In this simulation it is assumed that changes in incentives push up trend participation by 1 percentage point gradually over eight years. As in the earlier case, domestic demand and net exports rise. The rise in participation leads, however, to some rise in unemployment, which leads to lower real wages and inflation, which stimulates competitiveness and employment and finally disposable income. Demand is, however, initially not rising as fast as supply, so that the output gap is higher for some years. The budgetary situation also improves in this simulation, while the debt/GDP ratio remains close to the baseline. The improvement of the budgetary situation is likely however to be somewhat underestimated. Especially a rise in the participation of older workers would reduce spending on early retirement, while unemployment should return to the baseline level over the longer term.

Effects of a decline in structural unemployment

24. Also a decline in structural unemployment would raise the employment rate and potential output. This is illustrated by a third simulation which reduces structural unemployment gradually by 1 percentage point over the first three years. The increase in potential output is thus concentrated in these years and initially the output gap widens by more than in the other simulations. This leads to a larger real wage and inflation deceleration than in the other two simulations (Figure 5). This stimulates employment, profitability and competitiveness and leads to stronger internal and external demand. The budgetary improvement is somewhat stronger than in the preceding cases. This is because of lower unemployment. In conjunction

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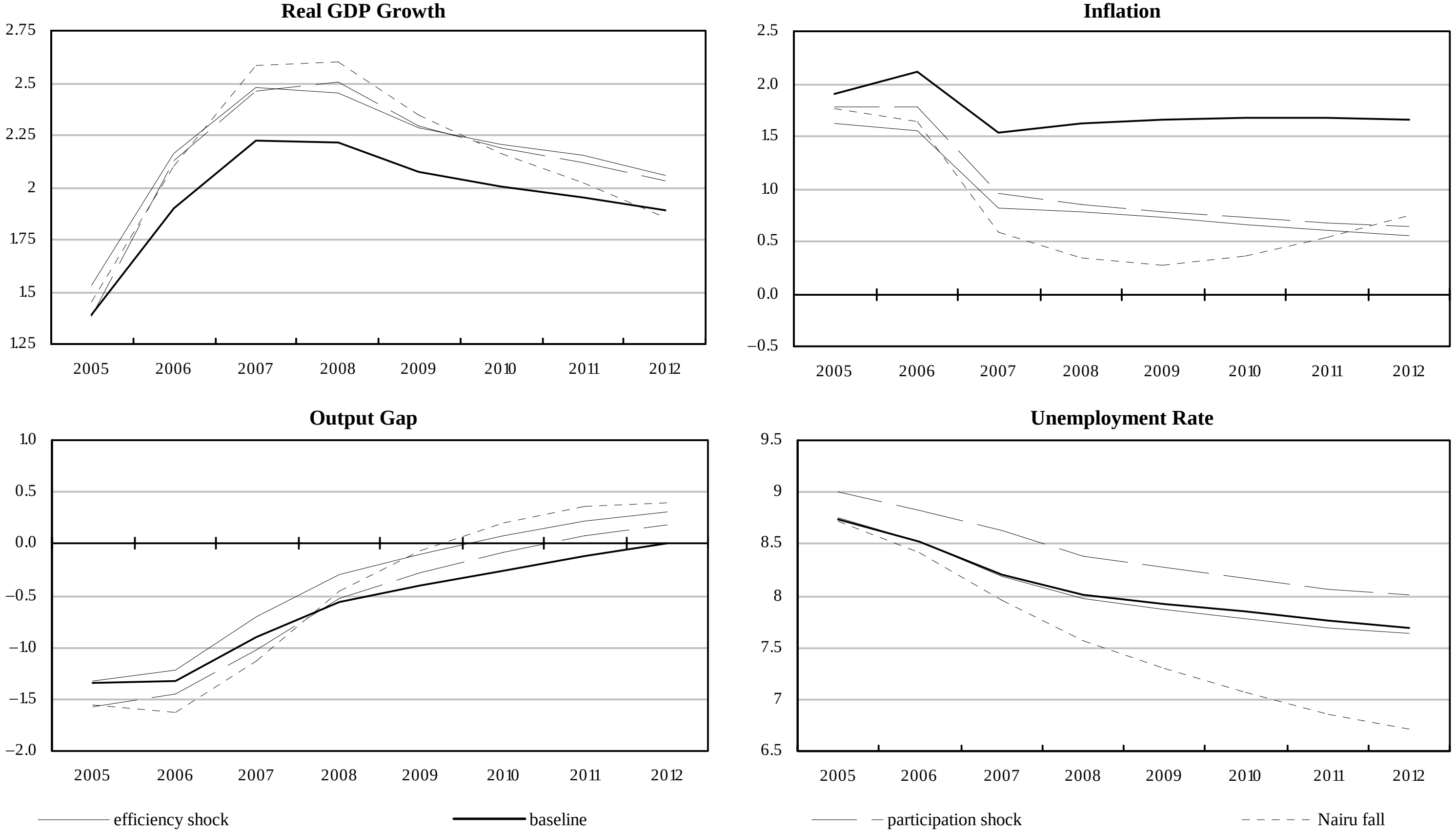
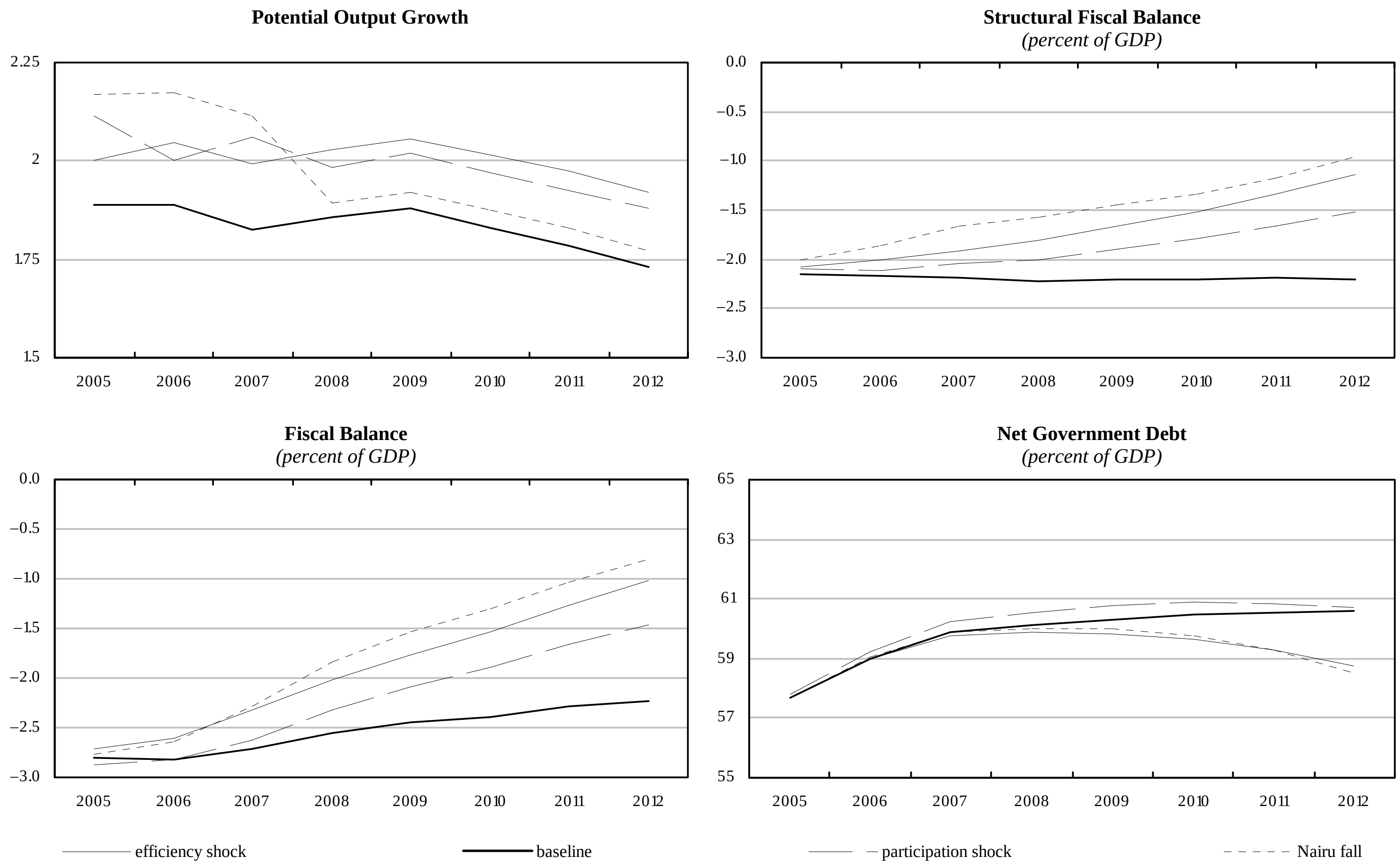
[4] The debt profile is determined by the following equations:

Debt (t) = primary balance (t) + debt (t–1)*(1+ r(t))/(1+g(t)) with r(t) being the nominal interest rate at t and g(t) nominal growth of GDP. With no improvement in the primary budget, lower inflation tends to lower the growth of nominal GDP, which offsets the effect of lower interest rates. In this case public debt will change little with respect to the baseline. If, however, nominal growth declines more than interest rates, a snow-ball effect will raise indebtedness, even if there is no deterioration in the primary budget balance.

Figure 5

Simulated Impact of Various Structural Shocks in the Euro Area





Note: The nature of the shocks is specified in the main text. The nominal exchange rate and real interest rates are kept unchanged relative to baseline. Real government expenditure is also kept at the baseline level.

with the effect of lower interest rates on the budget, also the debt/GDP ratio declines somewhat.

25. The simulations show the positive medium-term effects of the reforms on the government budget, with the gains being larger in the simulations that show a stronger improvement in the primary budget balance. However, the effects on indebtedness are minor, because of the deceleration in inflation induced by the reforms. A more accommodating monetary policy would contribute to improve the budgetary results further. The central role of monetary policy in accompanying the reforms is shown by simulations that again reduce the structural unemployment rate, but now under alternative monetary policy assumptions. The first assumes that real interest rates decline as well as the exchange rate, while the other assumes that nominal interest rates and exchange rates stay at the baseline level.

26. The simulation shown in Figure 6 suggests that an easier monetary policy would stimulate demand considerably. It is assumed that real interest rates are about 100 basis points below the baseline level on average over the simulation period, while the euro is assumed to decline by 5 per cent in real effective terms.[5] The effects on external and internal demand would push the output gap above the baseline level, which would limit the deceleration of inflation. The budgetary improvement would be considerably stronger, in terms of deficits and of debt developments. Concerning the latter, the impact of the improvement in the primary deficit of lower interest rates is not offset by the disinflationary effect and the debt/GDP ratio would decline by 10 percentage points with respect to the baseline at the end of the simulation period.

27. If, on the other hand, nominal interest rates and exchange rates are kept at their baseline values, the higher real interest rates dampen demand considerably and the output gap remains larger than in the baseline scenario throughout the simulation period (Figure 6). With activity weaker and unemployment higher, the improvement in the primary deficit is much slower to come, while nominal GDP rises by less because of lower inflation. The debt/GDP ratio deteriorates considerably as the snow-ball effect is reinforced by lower inflation.

Structural reform in a single country in monetary union

28. In the previous set of simulations it was assumed that all countries embark on structural reforms simultaneously. However, this may not occur in reality, which raises the issue whether the incentives for (or reward of) structural reform is sufficiently strong for individual countries. There may also be a divide between small and big countries in this regard, due to the difference in openness of their respective economies.

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[5] In this simulation the exchange rate is assumed to respond to both inflation and interest rates developments. On the one hand, an exchange rate purchasing power parity rule applies in the long term, implying stable real effective exchanges rates. On the other hand, the lower real interest rates in the euro area induce a real depreciation of the euro exchange rate at least for some time.

Effects of a decline in structural unemployment

29. The importance of monetary policy in facilitating the adjustment of demand to a rise in supply and for improving budget balances leads to questions about the reforms pursued by a single country in the euro area. This divide appears clearly when simulating the impact of a gradual decline in the structural unemployment rate by 1½ percentage points over three years in a small (Belgium) and a large (France) country. They are based on the same assumption as above: the nominal interest rate and the exchange rate are fixed at the baseline level. The results show a marked contrast between the two countries.

30. The small country, because of its much greater openness to trade, benefits much more from the competitiveness gains, which allows a more rapid adjustment of demand and limits the deceleration in inflation (Figure 7). The effect of the reform is positive for the budget balance, though the effect on indebtedness is minor.

31. In contrast, the adjustment path for the large country is much more drawn-out (Figure 8). The impact of higher real interest rates tends to neutralise the competitiveness gains due to lower inflation. Overall, the output gap remains below the baseline level over the whole simulation period. The budget balance hardly improves, while indebtedness is rising. However, significantly lower inflation in a large country will affect area-wide inflation, which could lead to some monetary easing. If the interest rate were to decline in line with overall inflation, the budget balance would improve by more.

32. These simulation results are, of course, model dependent. The weak endogenous adjustment forces in the case of reforms of a single large euro area economy could be exaggerated. It can not be excluded that a better macroeconomic performance, and especially lower unemployment, would lead to substantial confidence effects, which are not included in the model. These could lead to greater dynamism of consumption and investment. The reaction of the US economy to the productivity shock during the 1990s suggests that demand can outstrip supply, following a supply shock.[6] On the other hand, one should not underestimate either the role played by the US monetary authorities, which recognized and accompanied the structural changes. Also the depth and flexibility of the American financial markets were crucial in allowing a rapid transmission of the associated wealth gains onto demand.

Effects of a decline in structural unemployment with a more active fiscal policy

33. A final set of simulations is designed to examine the role of upfront cost, and more generally to look at the possibility that countries use a more activist fiscal

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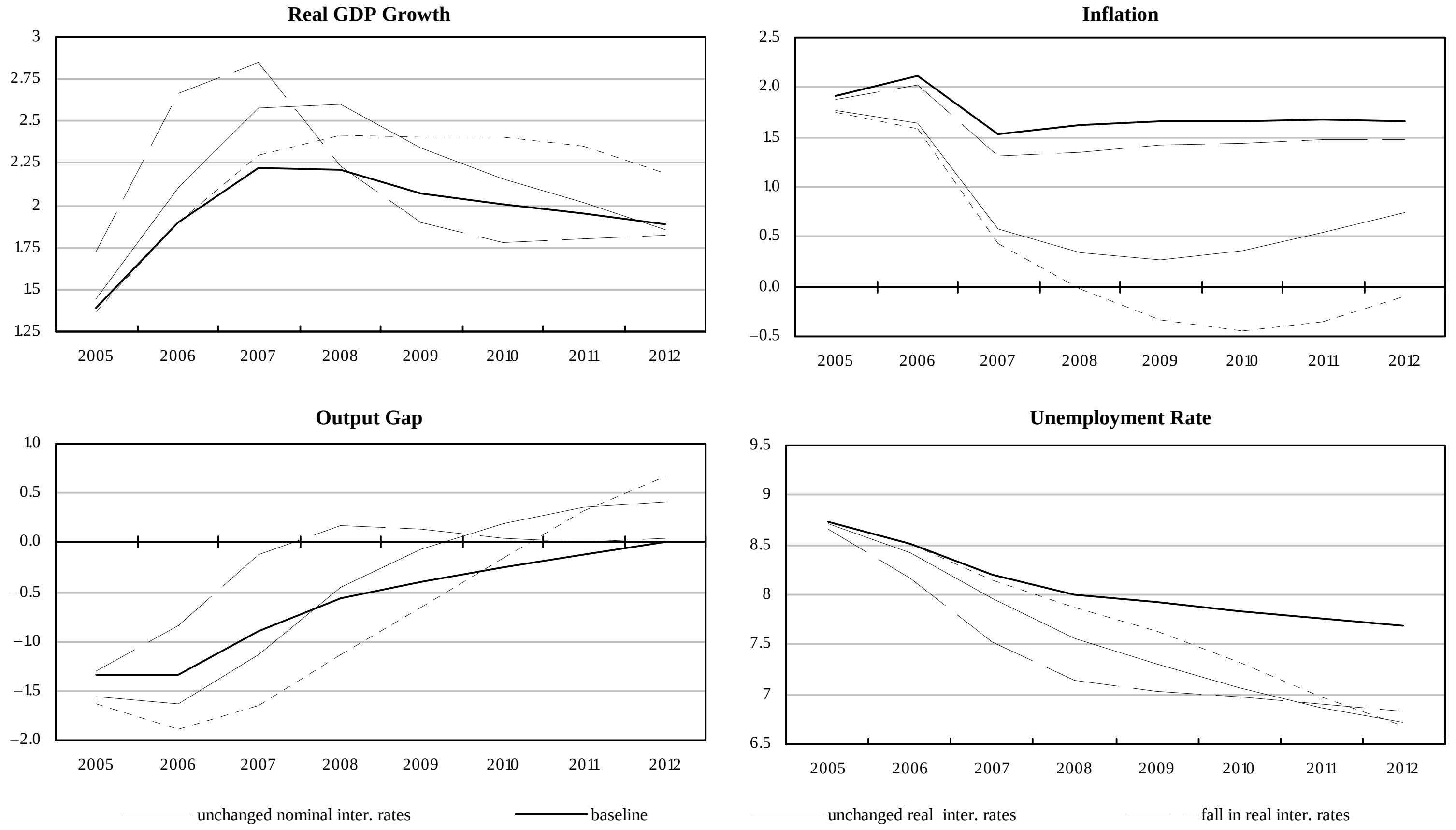
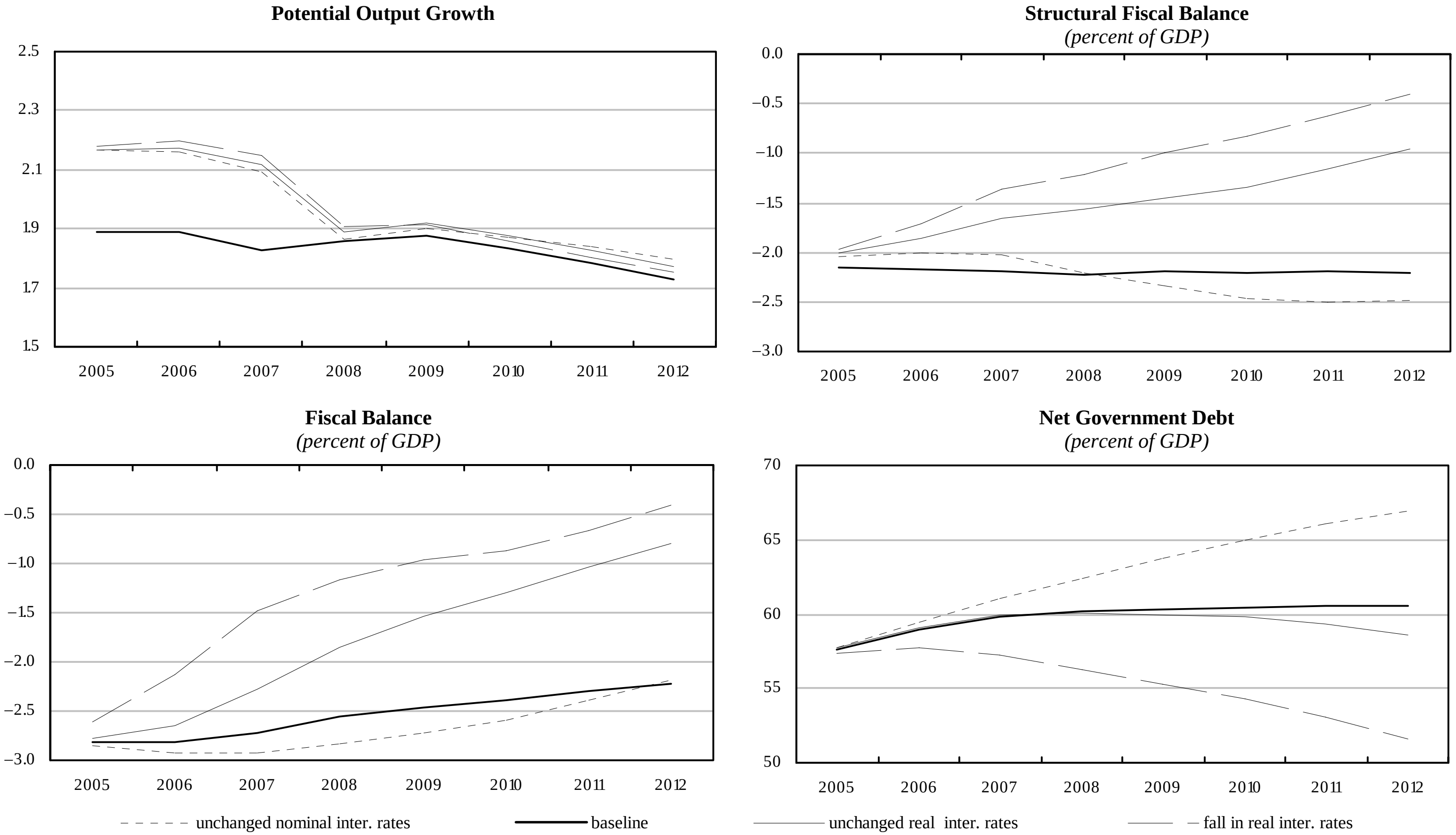
6 This would follow Say's law, which suggests that supply will create its demand. But the American situation even suggests what Val Koromzay dubbed Super-Say's law, whereby a more optimistic outlook on future income can lead to excess demand, when supply conditions improve.

Figure 6

Impact of a Lower NAIRU in the Euro Area under Alternative Monetary Assumptions

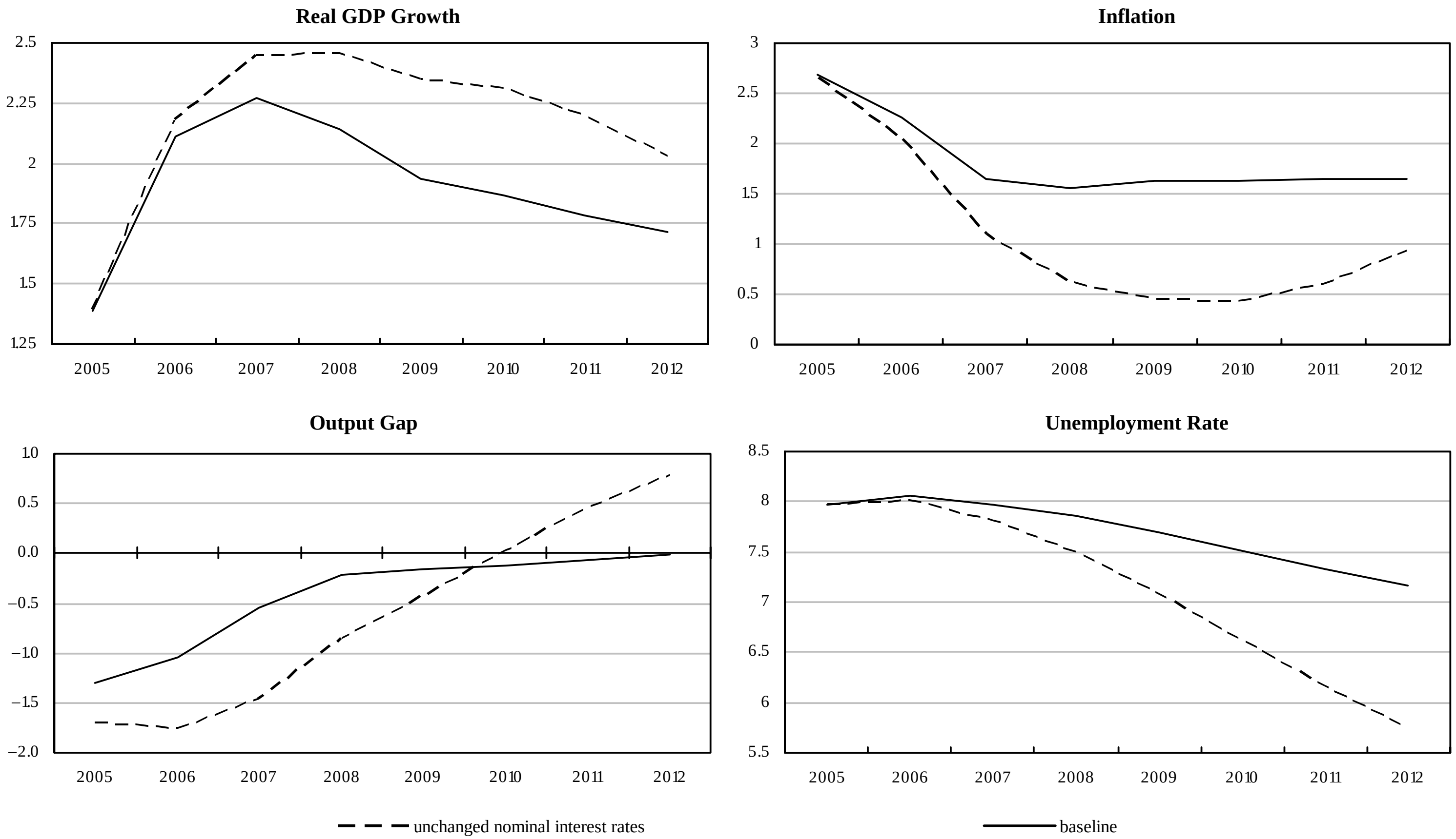


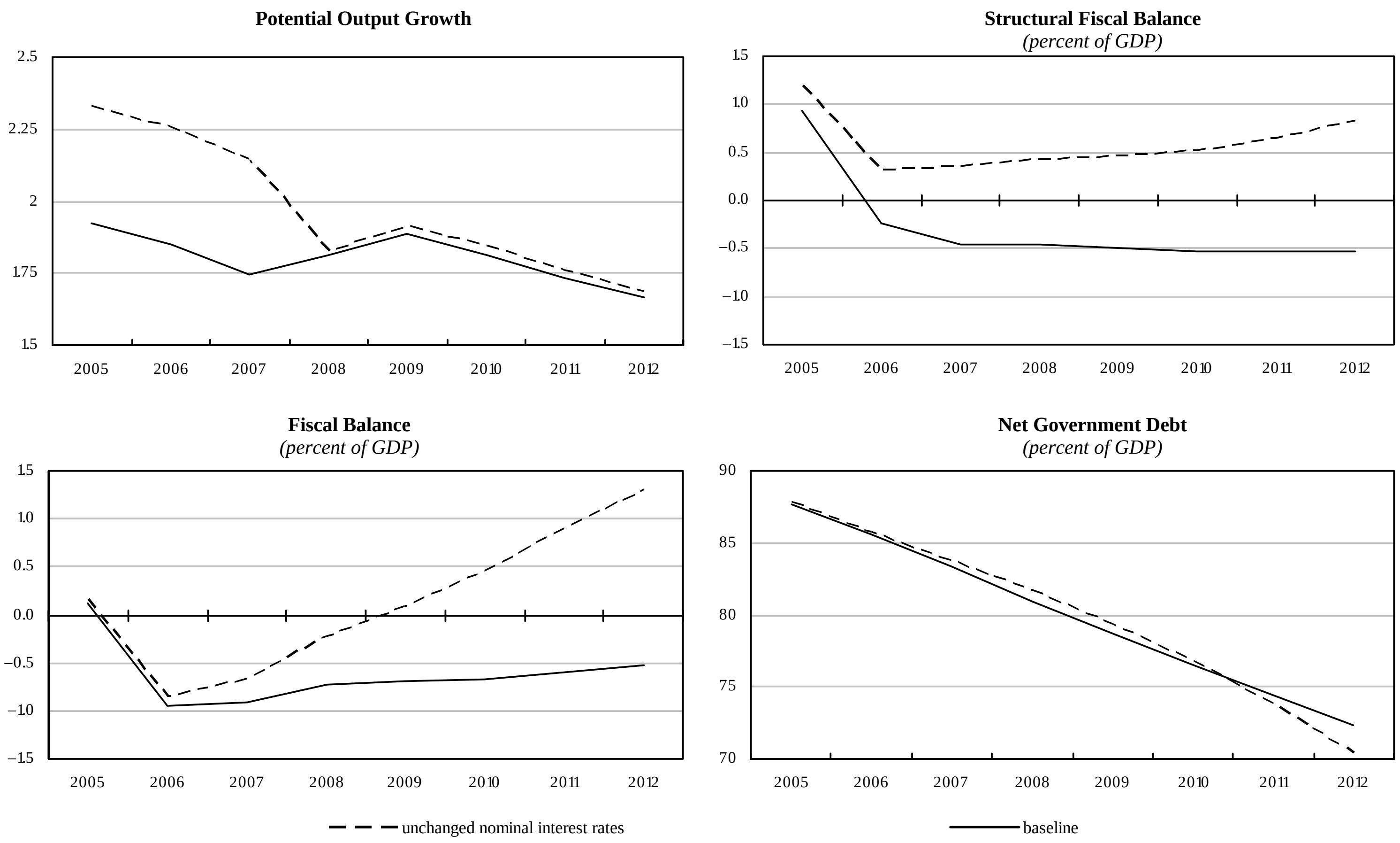


Note: The Nairu is assumed to fall progressively by 1 percentage point in the first three years of the stimulation. The nominal exchange rate is kept unchanged relative to baseline in the case of the simulations with fixed nominal or fixed real interest rates relative to baseline. A flexible exchange rate assumption is retained for the simulation with a fall in the real interest rate. Real government expenditure is kept unchanged at the baseline level.

Figure 7

Impact of a Lower NAIRU in a Small Euro-area Country

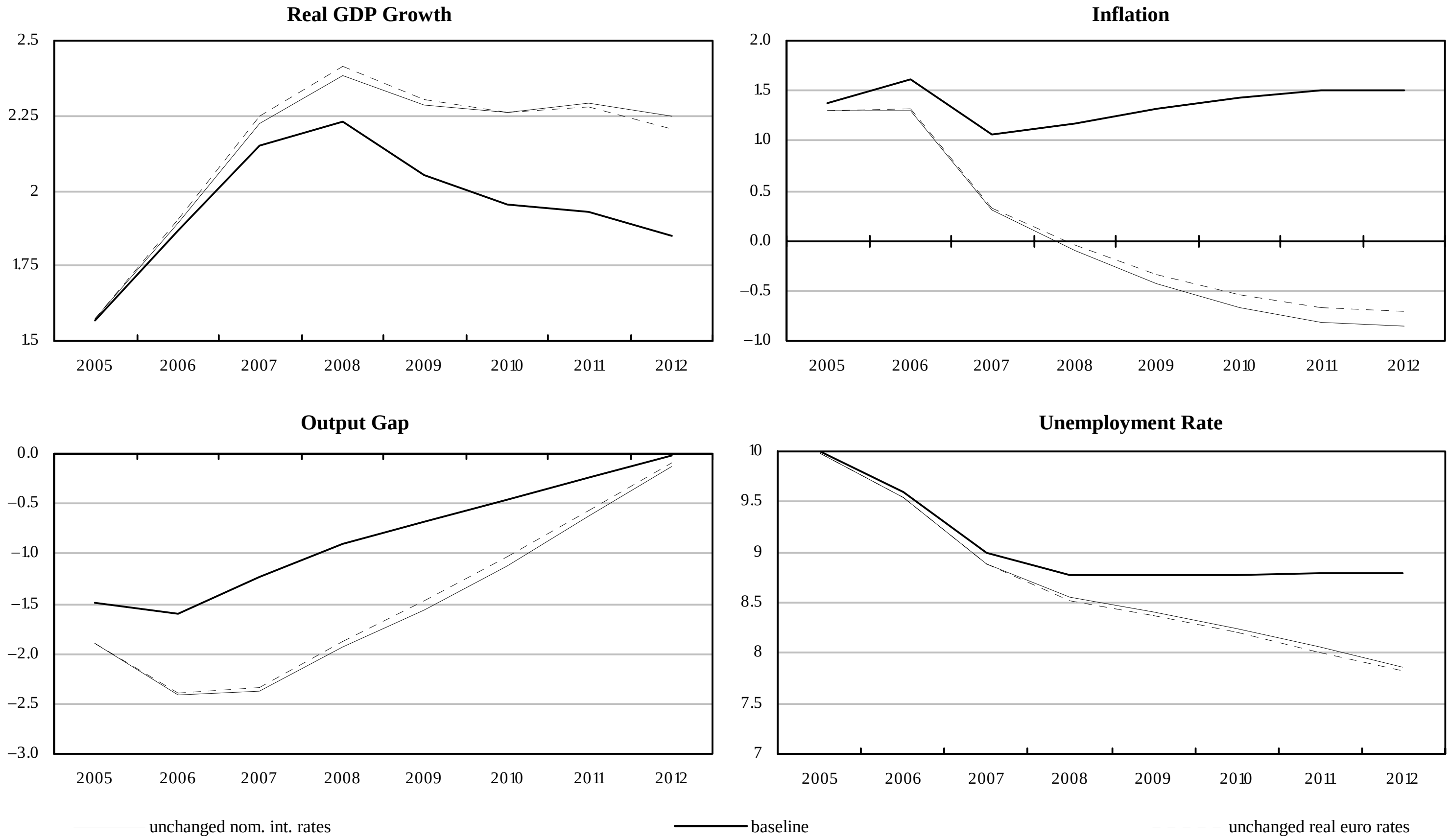


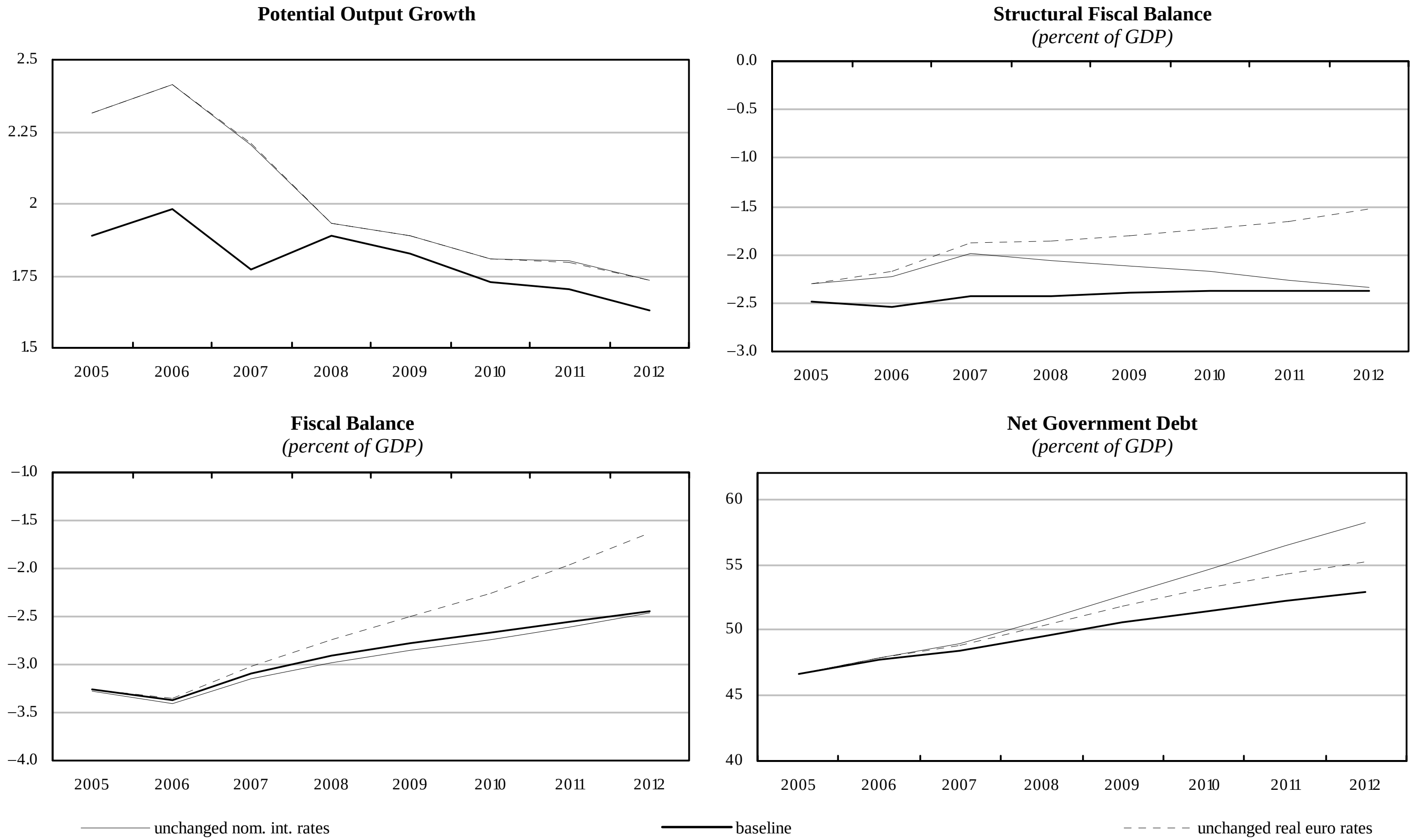


Note: The Nairu is assumed to fall progressively by 1.5 percentage points in the first three years of the simulation. Nominal exchange rate and interest rates are kept unchanged relative to baseline. Real government expenditure is also kept unchanged at baseline level.

Figure 8

Impact of a Lower NAIRU in a Large Euro-area Country





Note: The Nairu is assumed to fall progressively by 1.5 percentage points in the first three years of the simulation. Nominal exchange rate kept unchanged relative to baseline. Real government expenditure is also kept unchanged at baseline level.

Table 3

New Zealand over the Last Three Decades

	1975-1984	**1985-1991**	**1992-2005**
Output growth*	1.0	0.7	3.5
Growth of output per capita*	0.3	0.0	2.4
Consumer price inflation*	13.3	9.2	2.0
Long-term interest rate**	11.0	14.0	6.9
Exports***	28.4	27.4	30.7
Current account balance***	–5.8	–4.1	–5.1
		1987-1991	**1992-2005**
Government receipts***		48.9	42.8
Government spending***		52.6	40.7
General government financial balance***		–3.7	2.1
		1993	2005
Gross government debt***		64.8	26.0
Net government debt***		51.4	–1.1

* Average annual rate, per cent.
** Period average, per cent
*** Ratio to GDP, per cent

Source: OECD Economic Outlook No. 78 database.

policy to accompany their structural reform programme. A rise in potential output due to a decline in structural unemployment improves the structural budget balance. In the absence of monetary policy, euro area member countries may be tempted to use the room for fiscal manoeuvre to accompany reforms to speed up the adjustment of demand to the improved supply conditions. Moreover, the reforms could have a budgetary cost, for instance because they include a cut in social security contributions.

34. To illustrate the joint effect of a decline in structural unemployment and of a more active fiscal policy two scenarios were run for France. The first assumes that the structural budget balance is kept at the baseline level. The second assumes that the decline in unemployment is accompanied by a permanent reduction in employers' social security contributions by ½ per cent of GDP. The results are presented in Figure 9. They clearly show the limits of loosening fiscal policy to accompany structural reforms: the macroeconomic gains are very limited, but the budget deteriorates significantly.

“Big bangs” and gradualism: the experiences of New Zealand and Australia

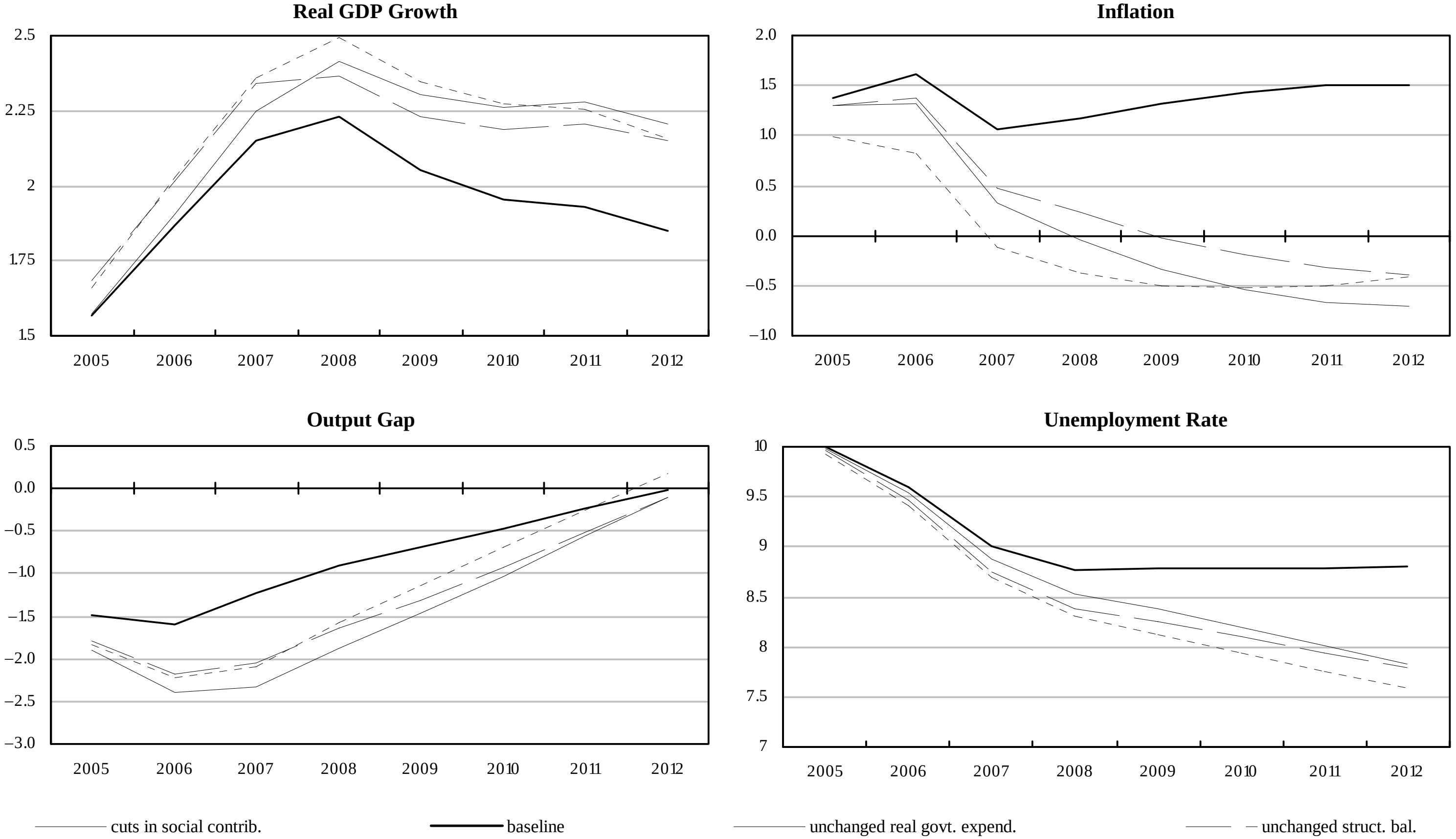
35. Some OECD economies have undergone radical transformations with major fiscal implications and their recent economic histories are consistent with the findings from the above model-based analysis. New Zealand is a prime example. It initiated radical and wide-ranging reforms in the mid-1980s. These reforms encompassed both macroeconomic stabilisation and structural change (Evans *et al*., 1996). The reforms followed a decade of anaemic growth, with even lower rates than those currently observed in the euro area, while inflation was rampant and the current account in deep deficit (Table 3).

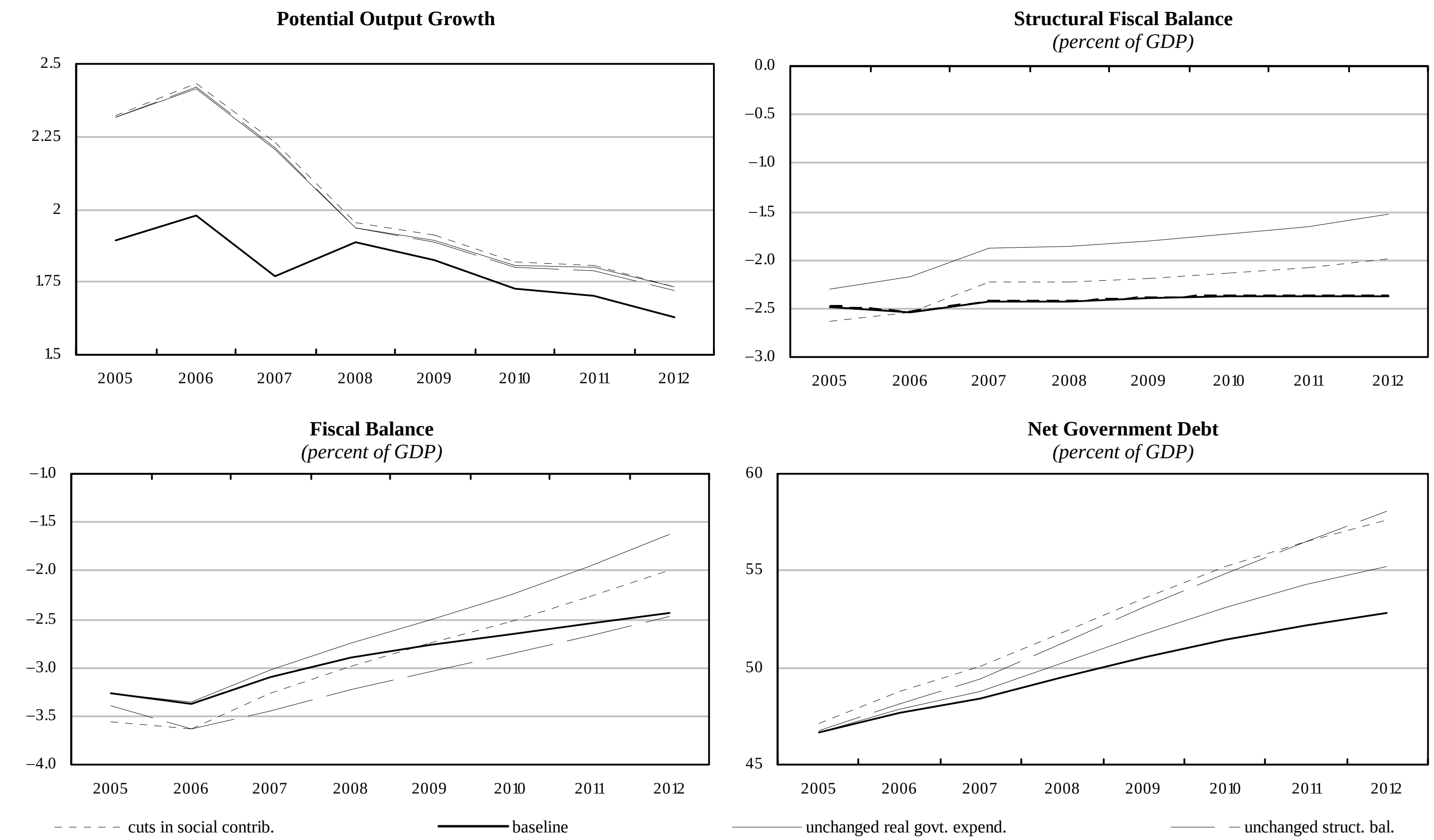
36. Key reforms included financial market deregulation and the granting of operational independence to the Reserve Bank; deep labour market reforms, though they were only enacted from the early 1990s onwards; and telecommunication and electricity reforms. These reforms did not include any side-payments, but there were many reforms affecting the budget directly. Support to manufacturing industries and agriculture was withdrawn, which lowered spending, but also lowered revenues due to hefty tariff cuts on industrial products. Direct government assistance to industry and agriculture declined from 16 per cent of primary government spending to just 4 per cent in 1993/94. At the same time, tax policy put a sharp focus on the neutrality of the tax system: a comprehensive value added tax replaced a myriad of sales taxes, while the corporate and income tax base was broadened and tax rates reduced. Tax incentives concerning exports or retirement savings were abolished. On the spending side, focus was put on organisational and managerial devolution and improved accountability, for instance in health and education. Chief executives became responsible for managing departments, being directly accountable to their Ministers for hitting specific output targets. Moreover, the large number of trading departments was turned into state-owned enterprises, many of which were subsequently sold.

37. Stronger growth did not help fiscal consolidation early in the reform era. Partly reflecting heavy industrial and agricultural restructuring and job losses from rapid efficiency gains, GDP barely increased between 1984 and 1991 (Table 3). Also the exchange rate and real interest rate were high. Early in the reforms, consolidation was largely achieved by revenue increases and while some spending items were pruned severely, spending on health, education and social services increased as a share of GDP. But stronger growth followed and a fiscal surplus was achieved in the 1993/94 financial year. Fiscal performance has been strong since then, the government recording a deficit in only one year since 1994 and a net debt position of more than 50 per cent of GDP has swung into a net asset position. This successful fiscal consolidation partly reflects a decent, though not outstanding, growth performance and partly the principled approach to fiscal management that was put in place in 1994, based on responsibility and transparency. This approach has been taken up in the UK’s code of fiscal conduct and the OECD Best Practices for Budget Transparency. Macroeconomic policy was set to provide a stable and sound framework for fiscal policy rather than stabilise macroeconomic outcomes with short-term adjustments to the fiscal stance.

Figure 9

Impact of a Lower NAIRU in a Large Euro-area Country under Alternative Fiscal Assumptions





Note: The Nairu is assumed to fall progressively by 1.5 percentage points in the first three years of the simulation. Nominal exchange rate kept unchanged relative to baseline. Real interest rates at the euro level are maintained unchanged relative to baseline.

Table 4

Australia since 1973

	1973–1990	**1991-2005**
Output growth*	3.1	3.3
Growth of output per capita*	1.7	2.2
Consumer price inflation*	9.6	2.5
Long-term interest rate**	11.8	7.1
Exports***	15.5	19.5
Current account balance***	–3.7	–4.5
Government receipts***	32.3	35.9
Government spending***	35.5	37.4
Government financial balance***	–3.2	–1.5
	1991	**2005**
Gross government debt***	23.8	15.3
Net government debt***	11.6	0.0

* Average annual rate, per cent.
** Period average, per cent.
*** Ratio to GDP, per cent.

Source: OECD (2005), *Economic Outlook* database, No. 78, issue 2, December.

38. Reforms in New Zealand since the mid-1980s were broad ranging and quick, in the wake of large macroeconomic imbalances. By tackling many areas quickly there was no stable coalition formed to oppose reforms: for instance, farmers who had their subsidies withdrawn,[7] strongly supported tariff cuts; and farmers and other businesses then put pressure on the government to reduce spending to bring down the interest and exchange rate. But moving quickly also led to some backlashes, as the reform process stalled between 1988 and 1991, from when onward it resumed again. The experience highlights that fiscal consolidation and radical change can go hand in hand, even when the results of reforms on economic performance do not come quickly.

39. In contrast with New Zealand, the Australian reform process was gradual, but it was also principled and coherent (Banks, 2005). As in New Zealand, policy prior

[7] The largest farmer association, the Federated Farmers of New Zealand argue that the sudden and unexpected removal of subsidies have made the farming sector stronger and that farmers are determined never again to be dependent upon government handouts (Federated Farmers of New Zealand, 2002). Productivity gains, for instance, moved from 1 per cent pre-reform to nearly 6 per cent post-reform, while the initial impact of the reform, while sizeable, was much milder than officially projected.

to the reforms was characterised by being highly regulated, anti-competitive and redistributive, even though the macroeconomic background, while not brilliant, was more benign (Table 4). Productivity growth of just over 1 per cent between 1973 and 1990 was relatively poor and, also affected by terms of trade losses, the international income-per-capita ranking slipped badly. Though reforms started in 1973 with a 25 per cent across-the-board tariff cut, this precipitated a heavy backlash against reforms. It was not before 1988 that tariff reductions were phased in with virtually all tariffs falling to below 5 per cent by 1996. The early 1980s also saw financial market reforms. Increased competition led to pressure to reform labour markets and sheltered sectors. The reforms ultimately embraced all product markets, factor markets and the public sector, including as in New Zealand the commercialisation, corporatisation and privatisation of many government enterprises.

40. Contrary to New Zealand, Australia adopted a gradual approach to reforms, thus avoiding heavy initial adjustment costs. The programme evolved in a cumulative way to encompass reforms across much of the economy. Moreover, and again contrary to New Zealand, reforms were accompanied by retraining schemes and displaced workers could rely on the relatively generous welfare safety net. Adjustment costs were also eased by sector-specific restructuring and assistance schemes, which amounted to AUD 600 million annually under the Automotive Competitiveness and Investment Scheme. Similarly, when price support for the milk industry was abolished in 2000, farmers were provided with a substantial stream of payments, financed by a levy on milk consumers. Also regional policy schemes eased the adjustment blow in some cases. Policy has thus dealt with the front-loaded timing of the potential losses of reforms as well as the fact that costs of reform are often concentrated on particular groups. The reform process had a fiscal cost, but it was limited and easily outweighed by the overall gains: concomitant with the reforms, there was a sharp rise in the trade to GDP ratio and business R&D surged, boosting productivity growth to among the highest in the OECD and the income-per-capita ranking improved from the 15th place in the mid-1980s to the 8th currently. Not surprisingly, fiscal performance improved a lot as well: the general government balance swung from a deficit peak in the early 1990s of more than 6 per cent of GDP into a surplus by 1998. The fiscal balance has stayed in surplus since then, except in one year, leading to the elimination of government net debt in the course of 2006.

41. Clearly, for both countries the evidence is that major structural reforms brought a major improvement in fiscal performance. Yet, how to apportion the success between a strengthening in budgetary institutions and better growth performance is unclear.

Policy implications

42. The recent reform of the Stability and Growth Pact provides more leeway for EU governments to temporarily breach the 3 per cent deficit limit if this can be

shown to facilitate the implementation of effective, but initially expensive, structural reform. While this principle is underpinned by a clear economic rationale, its implementation is not obvious. Indeed, for it to be properly implemented a number of conditions will have to be met:

- Budgets would need to clearly identify the structural policy measures that are being taken and specify their immediate and multi-annual budgetary cost and benefit profile. So far, this is not happening in a systematic way, with probably the United Kingdom being at the frontier (and even there the picture is not always clear). Indeed, the Commission in its assessment of the most recent batch of stability programmes suggested that the clause related to structural reforms would benefit from a clear specification of the quantitative information necessary for assessing the impact of structural reforms (EC, 2006).
- Budgets would also need to be explicit about the fiscal cost of inaction, *i.e.,* report the budgetary developments in the absence of structural reform. This is a form of transparency that is necessary for the European authorities to call a balanced judgment on countries' trade-offs between the various options available, like reforming health care but not pensions, or any other combination of reform programmes. However, it is rare to find such information in budgets.
- Budgets would, finally, need to give some indication of the broader economic effects of action or inaction, in order to be able to call a judgment on the ex ante effectiveness and efficiency of the proposed measures. However ex ante cost-benefit analysis is rare – not to mention *ex post* cost-benefit analysis. The experience in countries like New Zealand and Australia has shown that the longer-term benefits both in terms of the budget and overall economic performance may be significant. Even so, it is not easy to disentangle the various forces at play. Fundamentally, structural reform and the implementation of smart fiscal frameworks tend to go hand in hand – indeed may be two sides of the same coin.

43. The simulation exercises highlight the positive budgetary effects of coordinated structural reforms in the euro area. But they have to be accompanied by an adequate monetary policy response to make sure that demand adjusts to the improved supply conditions swiftly. The budgetary gains would still depend on the type of reform and their impact on employment and productivity. Efforts to improve supply conditions are surely easier to co-ordinate or coordinated in any case, when it comes to single market initiatives, such as the current drive to liberalise services across the European Union. Co-ordination is more difficult to achieve for labour market reforms. In this domain, national policy initiatives by a single country may only have a limited impact, especially in the short term and in the case of a large country. Indeed, in monetary union, the strength of endogenous adjustment mechanism appears to be weaker in larger countries. Moreover, if reforms were to be accompanied by an easing of fiscal policy, additional macroeconomic gains would also appear very limited.

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SHORT-TERM PAIN FOR LONG-TERM GAIN: THE IMPACT OF STRUCTURAL REFORM ON FISCAL OUTCOMES IN EMU

Paul van den Noord and Boris Cournède[*]

1. Introduction

1. The disappointing compliance with the EU fiscal rules since the inception of the euro has prompted a lively debate, from which new rationales for allowing governments to temporary run deficits in excess of the 3 per cent of GDP rule emerged. Specifically, it has been argued that the long-run benefits from structural reform are often uncertain whereas the immediate budgetary costs – such as compensation schemes to offset redistributive effects – are perceived with greater precision. This asymmetry would discourage structural reform in the face of a tight fiscal rule. Allowing governments to run temporary deficits beyond the 3 per cent mark to finance the up-front cost of structural reform would therefore be welfare enhancing (Beetsma and Debrun, 2005 and Von Hagen, 2003).

2. These arguments have not fallen on deaf ears at the European authorities. In September 2004, the European Commission put forward a proposal that encapsulated most of the ideas that had been around for some time (Van den Noord, 2006). Along with various other "exceptional circumstances", the budgetary upfront cost of countries' structural reform would have to be taken into consideration when assessing the fiscal situation. The interpretation of the "exceptional circumstances" clause enshrined in the Stability and Growth Pact (SGP) and the adjustment path towards compliance with the rules after a breach would both need to be adjusted. The reform that was adopted by the European Council in March 2005 went a long way towards incorporating these views. First, it explicitly included structural reform in the list of "other relevant factors" which the European authorities examine when deciding whether public deficits above 3 per cent of GDP are excessive or not. Second, while the SGP calls EU countries to maintain their public finances close to balance or to move towards that objective by a minimum benchmark adjustment each year, the 2005 reform opens the possibility of deviations from these requirements for countries that introduce structural reforms.

3. Obviously the underlying rationale is debatable. Countries not in breach of the rules (mostly the smaller countries) are not concerned, so with more fiscal leniency their better behaviour would not be rewarded, whereas the "sinners"

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The views expressed in this paper are the authors' and are not necessarily those of the OECD or its member countries. Earlier versions of this paper have been presented to the European Commission Workshop on the Budgetary Implications of Structural Reform held in Brussels on 2 December 2005 and at the Banca d'Italia Workshop on Public Finance in Perugia on 30 March to 1 April 2006. The authors are indebted to Roel Beetsma, Marco Buti, Ekkehard Ernst, Peter Hoeller, Vincent Koen, Dave Rae and Ludger Schuknecht for their valuable comments.

(mostly the largest countries) would be off the hook for a while. The political economy behind this is straightforward (Buti and Pench, 2004). Owing to their greater trade exposure, smaller countries benefit more from international competitiveness gains associated with structural reform – they enjoy a first-mover advantage. This mechanism is much weaker in the large countries that, moreover, face larger multiplier effects on activity when forced to check their fiscal balance. As a result, big countries call for more fiscal "flexibility", whereas small countries do not.[1]

4. Against this backdrop it is useful to dispose of empirical estimates of the effect of structural reform on fiscal outcomes. Two categories of fiscal effects are relevant in this context:

- the short-term cost of compensating the expected losers of structural reform or more generally of "bribing" the electorate. This is seen as a potential deterrent of structural reform to the extent the fiscal rules are biting;
- the longer-term impact of structural reform on expenditure and revenue levels, either directly via tax and expenditure parameters or via the effect of better economic performance on the budget. This long-term benefit could help motivate structural reform, but this is strongly dependent of the degree of myopia of the government.

5. There are different approaches on which estimates of fiscal costs and benefits can draw: case studies, econometric estimates and estimates based on model simulations. The pros and cons of each of these approaches are well known. Case studies may not be fully representative and the validity of an (*ex ante*) model simulation is hard to ascertain – the good old Lucas critique still applies. In this paper basic econometrics is applied, complementing findings from case studies and model simulations reported by Giorno and Hoeller (2006). Econometric estimates suffer from selection bias since only structural reforms that actually have been implemented are included in the observations of whatever sample one uses. These are likely to be the least costly ones in terms of their short-run cost since the more costly ones have probably not been carried out. Hence econometric estimates may put a somewhat too favourable gloss on the short-term fiscal pain and long-term fiscal gain to the taste of policy makers. The results reported in this paper should be considered with this caveat in mind.

2. Methodology and data

6. The econometric technique used here tests for the existence of short-term cost and long-term benefits on the budget and gauges their respective size for a broad sample of OECD countries including euro-area members. We look at general government expenditure and revenues, which are both expected to respond to

[1] By the same token, large countries call for "coordination" of structural policies (in the absence of a first-mover advantage), while small countries care less.

structural reform. Given that we are interested in the short-run and long-run effects of structural reform, it is quite natural to apply an error-correction framework. Specifically, we estimate the following system of equations:

$$\Delta PRI_{it} = -\lambda^{p}(PRI_{it-1} - \alpha^{p} STR_{it} - \sum_{k} \gamma_{k}^{p} CON_{it-1}^{k} - \delta_{i}^{p}) + \beta^{p} \Delta STR_{it-1} + \varepsilon_{it}^{p} \quad (1)$$

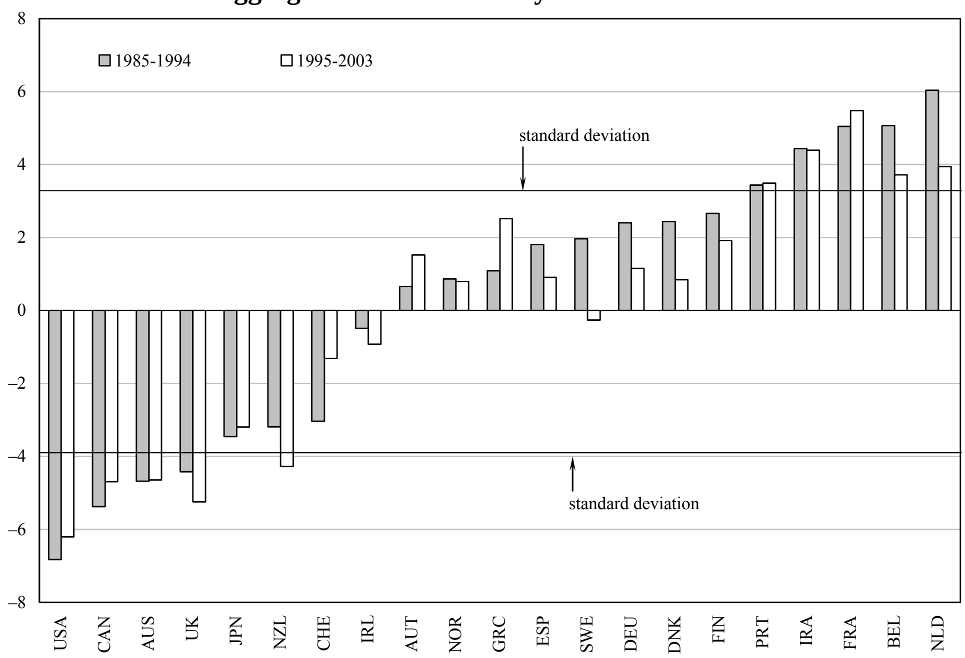
$$\Delta REV_{it} = -\lambda^{R}(REV_{it-1} - \alpha^{R} STR_{it} - \sum_{k} \gamma_{k}^{R} CON_{it-1}^{k} - \delta_{i}^{R}) + \beta^{R} \Delta STR_{it-1} + \varepsilon_{it}^{R} \quad (2)$$

7. In the first relationship PRI_{it} is the level of cyclically-adjusted primary expenditure as a per cent of GDP in country i in year t, and ΔPRI_{it} is its change over the previous period. In the second relationship REV_{it} stands for the level of cyclically-adjusted current receipts of general government as per cent of GDP and ΔREV_{it} is its change. Time series for these variables are readily available in OECD's *Economic Outlook* database. The variable STR_{it} is the overall structural policy stance, with a higher value denoting a tighter stance. The term ΔSTR_{it} is the change in the structural policy stance indicator which serves to capture any upfront budgetary effects of structural reform. δ_i are country fixed effects and ε_{it} is the normally distributed residual. Finally, CON_{it-1} is a vector of control variables. We expect structural reform to generate, *ceteris paribus*, higher expenditure and lower tax revenues in the short run, hence $\beta^P < 0$ and $\beta^R > 0$. We also expect the size of the public sector and therefore both public expenditure and tax revenues to be lower in the long run, so hence $\alpha^P > 0$ and $\alpha^R > 0$. As a result, the fiscal position would deteriorate in the short run but would be broadly unaffected in the long run (this prediction can be further tested by estimating a reduced form equation for the fiscal position – see below).

8. Measuring structural policy has become a blooming new industry, so it is not obvious from the outset what indicator to use. The structural policy indicator capturing structural reform efforts referred to here is the one used by Duval (2006), which provides us with annual observations for the period 1985-2003 for 21 countries. The indicator is calculated as the sum of normalised OECD indicators in five fields (unemployment benefits, tax wedges, employment protection legislation, retirement incentives and product market regulation). They are displayed in Figure 1; a higher value corresponds to a tighter stance (more rigidity) and vice versa, and a decline in the indicator suggests that "appropriate" structural reforms have been implemented. Countries that stand out by relatively "tight" stances (high value of the indicator) all are European countries. Some of these countries have also implemented major structural reforms in the past decade (notably Spain, Sweden, Denmark, Belgium and the Netherlands), suggesting that poor initial conditions are a good "predictor" of future structural reform (as confirmed by Duval, 2006). This is encouraging and suggests some tendency towards global convergence, perhaps helped by the Lisbon agenda.

Figure 1

Aggregate Structural Policy Stance Indicator



Source: Duval (2006).

9. Obviously public expenditure and tax revenues are codetermined by a number of other structural variables (other than structural reform), for which we will need to control. Following Martinez-Mongay (2002), four controls have been considered:[2]

- *Per capita gross national income at 2000 purchasing power parities*. This captures "Wagner's law", which predicts that high-income countries will exhibit higher shares of public spending in GDP than low-income countries owing to a change in preferences in favour of public goods and services such as health care, education and social services. The expected sign is positive.
- *The dependency ratio*. Ageing puts pressure on notably health care and pension expenditure, hence a priori one expects public outlays to be higher in countries that portray a high dependency ratio (measured by the share of people older than 65 in the total population). The expected sign is again positive.

[2] The type of electoral system is another factor that emerges from the literature as relevant for the size of government (majoritarian voting rules yield smaller welfare systems), but it will not be considered here (or rather this will be picked up by the country fixed effects). Baumol's "cost disease", which predicts that as an economy grows the relative price of public services and hence the share of public expenditure in GDP will increase, will be considered as already being captured by the per capita income effect.

Table 1

Primary Expenditure and Its Standard Determinants

Country	Primary Expenditure Ratio *(percent)*		Debt Ratio *(percent)*		Dependency Ratio *(percent)*		Openness *(percent)*		GDP Per Capita *(at 2000 prices and PPP, US$)*	
	1985-1994	**1995-2003**	**1985-1994**	**1995-2003**	**1985-1994**	**1995-2003**	**1985-1994**	**1995-2003**	**1985-1994**	**1995-2003**
Australia	31	33	29	30	17	19	35	42	34388	40831
Austria	47	47	58	69	22	23	70	84	33799	40647
Belgium	43	42	131	122	22	25	134	152	31551	38420
Canada	38	35	79	89	15	17	55	78	33499	38188
Denmark	49	52	74	63	23	23	69	80	34999	41837
Finland	47	48	30	58	12	13	52	69	30869	36492
France	46	48	42	67	21	24	43	50	34517	40164
Germany	41	43	39	60	22	25	50	59	37342	37164
Greece	31	35	74	110	22	27	46	50	16521	19717
Ireland	35	29	99	51	18	17	112	160	24755	42852
Italy	39	39	95	128	21	26	40	51	26902	31696
Japan	24	28	73	122	17	24	19	20	33239	37961
Netherlands	47	42	86	72	18	19	108	121	34166	42149
New Zealand	40	36	64	40	16	17	56	61	28474	32274
Norway	53	55	34	37	15	12	71	72	34502	46292
Portugal	30	37	65	64	20	23	64	66	19418	25232
Spain	33	32	53	67	20	24	37	54	24358	30583
Sweden	56	54	65	72	16	14	61	79	36600	40637
Switzerland	28	31	36	51	21	22	69	77	41653	43892
United Kingdom	38	37	43	48	24	24	51	56	32993	40808
United States	31	30	68	66	18	19	20	24	44591	52872
EU15*	38	39	62	70	19	21	59	72	27473	33304
Average	39	40	64	71	19	21	60	72	31864	38129
Standard deviation	9	8	26	28	3	5	29	35	6670	7219

* Unweighted average.

Source: OECD *Economic Outlook* database.

- *Trade openness (sum of exports and imports of goods and services as a per cent of GDP).* A standard finding in the literature is that more open economies will have bigger governments in order to protect their citizens against cyclical volatility in economic activity. However, in a globalising world small open economies, due to their greater exposure to international competition, will also be under pressure to keep public expenditure and taxes low so as to secure flexibility and resilience, as shown by Buti and van den Noord (2005) for evidence. Hence, the net effect on government size is ambiguous.

- *Public debt ratio to GDP*. There is a large body of literature providing evidence that governments whose debt position threatens to become unsustainable will rein in public expenditure or increase taxes. Hence in countries where public debt is high, expenditure will be negatively and revenues positively affected, and vice versa.

10. Table 1 provides and overview of the controls along with primary expenditure ratios to GDP. European countries which generally portray higher primary expenditure ratios also tend to score higher on debt, dependency, openness and lower on GDP per capita than the United States. This suggests that the control variables are unlikely to be able to explain the bulk of the cross-country variation in primary expenditure. Accordingly, country fixed effects should play an important role, as confirmed by the estimation results.

11. For the error-correction specification to be valid, primary expenditure and current receipts must be integrated time series of order one, hereafter abbreviated as $I(1)$. Overall, the balance of evidence suggests that primary expenditure and current receipts are generated by an integrated process. Breitung's (2000), Im, Pesaran and Shin's (2003), the augmented Dickey-Fuller and Phillips and Perron's (1988) unit root tests fail to reject the null hypothesis of a unit root at standard confidence levels (Table 2). Furthermore, Hadri's (2000) test strongly rejects the null hypothesis of no unit root. Levin, Lin and Chu's (2002) test nuances these findings as it rejects the null hypothesis of a unit root at the 5 per cent level. The same battery of tests indicate that the first-differences of primary expenditure and current receipts are stationary. The upshot is that these two series can be safely modelled as being $I(1)$.

12. The specification of the system (1) and (2) as error-correction equations further requires the presence of cointegration between primary expenditure or government current receipts, respectively, and the control and structural policy stance variables. Johansen's (1995) trace and maximum eigenvalue tests indeed find a cointegrating relationship between these variables. Equations (1) and (2) are best (and have been) estimated with the panel least squares estimator because they do not experience the type of feedback that necessitates a vector error-correction regression.[3]

[3] Such feedback effects (from deviations from the long-term relationship on control variables) could be thought to arise for income per capita because of the link between structural policy settings and long-term growth. To check this, an error-correction equation has been estimated: the change in income per capita has been regressed on its lag and a long-term relationship between the expenditure ratio, the stance indicator, income per head and the other controls (all lagged one period). The coefficient in front of the lagged expenditure ratio is not statistically different from zero. A similar equation has been estimated with the current receipts ratio replacing the expenditure ratio, with the same result. An important implication is that the contemporaneous correlation between structural policy and income does not affect the cointegrating parameters in equations (1) and (2), for which panel least squares are therefore an appropriate estimator. Detailed results are available from the authors.

Table 2

Panel Unit Root Tests on Cyclically-adjusted Primary Expenditure and Current Receipts

(test statistics, p-values between brackets)

	Primary expenditure ratio	**Current receipts ratio**
Null hypothesis: unit root		
Levin, Lin and Chu t statistic	-2.12^{**} (0.02)	-1.93^{**} (0.03)
Breitung t statistic	–0.91 (–0.9)	1.56 $(0.94)^{*}$
Im, Pesaran and Shin W statistic	–0.43 (0.33)	–0.71 (0.24)
Augmented Dickey Fuller chi square	50.9 (0.16)	46.5 (0.29)
Phillips and Perron chi square	26.4 (0.97)	48.2 (0.24)
Null hypothesis: no unit root		
Hadri z statistic	9.0^{***} (0.00)	10.2^{***} (0.00)

Note: *, ** and *** denote rejection of the null hypotheses at 10, 5 and 1 per cent levels. Tests assume the presence of country fixed effects.

3. Estimation results

3.1 Cyclically-adjusted primary expenditure and receipts

13. Estimation results for the primary expenditure and revenue ratios are shown in Table 3. In the expenditure equation the controls are all significant, and broadly in line with those reported by Martinez-Mongay (2002), except for the trade-openness indicator for which he finds the opposite sign. For revenues only trade openness and the debt ratio appear as significant, which may be due to data problems (see below).

Table 3

Estimated Error-correction Equations for Primary Expenditure and Current Receipts

	Change in the share in GDP of	
	Primary expenditure	**Current receipts**
Primary expenditure ratio (–1) (λ^P)	–0.15*** (0.03)	
Current receipts ratio (–1) (λ^R)		–0.21*** (0.03)
Dependency ratio (–1) ($\lambda\gamma_k$)	0.16*** (0.04)	
Per capita income (–1) (log) ($\lambda\gamma_k$)	1.67*** (0.6)	
Trade–openness (–1) ($\lambda\gamma_k$)	–0.017** (0.007)	–0.01** (0.005)
Debt ratio (–1) ($\lambda\gamma_k$)	–0.015*** (0.004)	0.01*** (0.004)
Structural policy stance (–1) ($\lambda\alpha$)	0.19*** (0.07)	0.23** (0.09)
Change in structural policy stance (–1) (β)	–0.22 (0.17)	0.12 (0.2)
Observations	357	357

Note: *, ** and *** denote significance at 10, 5 and 1 per cent levels. Standard errors are reported between brackets.

14. The key result in Table 3 concerns the impact of the structural stance indicator on primary expenditure and current receipts. The sign is as expected *i.e.* a tighter stance leads to higher primary expenditure and revenues. The long-run impact is not negligible: a structural reform equivalent to a cut in the stance indicator by one standard deviation (roughly corresponding to half the difference between *e.g.* France and New Zealand, Figure 1) reduces the primary expenditure and revenue ratios by around 4 percentage points. One health warning is in place though, namely that a country with a good regulatory environment for product and labour markets will typically also have a sound fiscal framework in place, in which case we may be over-estimating the pure impact of structural policy stances on public expenditure. Either way, though, the basic message would be that sound structural policies are associated with less rather than more public expenditure.

15. The change in the stance indicator captures possible upfront budgetary costs of structural reform. The sign in the expenditure equation is indeed negative as expected, and the absolute value of the coefficient is relatively high: a one standard deviation reduction in the stringency of regulation is associated with a temporary budgetary cost of 2/3 per cent of GDP in the following year. Similarly, in the current receipt equation, the sign is positive as expected: making the economy more flexible (which often involves tax cuts) is associated with revenue losses. Despite their economic significance, however, the coefficients do not come out as statistically significant in the regressions. The lack of statistical significance suggests that, while occurring, upfront costs are not very stable over time or across countries.

3.2 A closer look at tax revenues

16. The fact that not all controls work in equation (2) is not satisfactory. It may be due to the fact that government receipts as reported in the National Accounts include receipts other than tax revenue such as transfers from international organisations (*e.g.* regional funds in EU countries) and seignorage payments by central banks, which may behave erratically. We have therefore re-estimated the equation with at the left-hand side receipts from an alternative source, the *OECD Revenue Statistics* database. Tax revenues in the *OECD Revenue Statistics* database do not suffer from the above distortions and also offer a stronger degree of cross-country comparability. One limitation is that they are not available on a cyclically-adjusted basis.

17. Panel unit root tests reported in Table 4 suggest that tax revenues as a share of GDP are an integrated series. Apart from the Levin, Lin and Chu t-statistic, all other tests either fail to reject the null of a unit root at usual confidence levels or strongly reject the null of no unit root. Johansen's (1995) trace and maximum eigenvalue tests find one cointegration relationship between tax revenues, the structural policy stance and the controls. The statistical evidence that the series is non-stationary and cointegrated with its likely determinants strongly suggests specifying the equation of interest in an error-correction form.

18. Estimation results for tax revenues in Table 5 confirm the findings obtained for general government current receipts but with a higher degree of statistical significance. Again less stringent regulation is associated with lower taxes in the long term, presumably reflecting the need to finance less public expenditure. In the short term, the result reported in Table 5 confirms that making markets more flexible comes at the cost of a temporary loss in tax revenues, as expected since the political acceptance of these reforms may require tax breaks. An interesting result is that the coefficient not only has the correct sign and a high absolute value but is now also statistically significant at the 10 per cent level.

Table 4

Panel Unit Root Tests on Tax Revenues

Test statistics, p-values between brackets

	Tax Revenues to GDP Ratio
Null hypothesis: unit root	
Levin, Lin and Chu t statistic	-1.9^{**} (0.03)
Breitung t statistic	0.16 (0.6)
Im, Pesaran and Shin W statistic	–0.7 (0.25)
Augmented Dickey Fuller chi square	45 (0.33)
Phillips and Perron chi square	51.6 (0.15)
Null hypothesis: no unit root	
Hadri z statistic	9.1^{***} (0.00)

Note: *, ** and *** denote rejection of the null hypotheses at 10, 5 and 1 per cent levels. Tests assume the presence of country fixed effects.

Table 5

Estimated Error-correction Equations for Tax Revenues

	Change in the ratio of tax revenues to GDP
Tax revenues ratio (–1)	-0.325^{***} (0.04)
Per capita income (–1) (log)	1.9^{***} (0.6)
Trade–openness (–1)	-0.019^{**} (0.009)
Debt ratio (–1)	0.022^{***} (0.004)
Structural policy stance (–1)	0.19^{**} (0.09)
Change in structural policy stance (–1)	0.37^{*} (0.2)
Observations	357

Note: *, ** and *** denote significance at 10, 5 and 1 per cent levels. Standard errors are reported between brackets.

3.3 A closer look at expenditure

19. When looking at components of social public expenditure, drawn from the OECD's *Social Expenditure Database* (SOCX), the data confirm that inflexible structural policy settings are associated with higher levels of spending on social programmes and vice versa (Table 6). Statistically, the association is strongly significant for overall social expenditure and incapacity benefits. The close statistical relationship between the overall indicator of structural rigidities and spending on incapacity benefits is consistent with the view that disability pensions can be used as a form of income support for people who would otherwise find jobs in more flexible economies. Similarly, the link between spending on old age pensions and structural rigidities can be viewed as an outcome of the usually stronger incentive to retire earlier in more rigid economies (OECD, 2005). Expenditure on unemployment benefits is only weakly related to the structural policy stance with a lower confidence level and a smaller value of the coefficient, probably reflecting the presence of "Danish-model" labour markets that combine job flexibility with generous unemployment benefits.

3.4 Implications for the fiscal balance

20. Our estimates suggest that structural reform raises expenditure and lowers tax revenues in the short run, and therefore we expect to find some deterioration in the fiscal position following structural reform in the short run. Moreover, because in the long run both expenditure and revenues fall in response to structural reform, the long-run impact on the fiscal position should be small or negligible. This prediction can be directly tested by estimating a reduced form equation for the fiscal position. The equation has been specified in a partial-adjustment rather than error-correction form because panel unit roots tests give compelling indications that the cyclically-adjusted fiscal balance is stationary.[4]

$$BAL_{it} = \lambda BAL_{it-1} + \alpha STR_{it} + \beta \Delta STR_{it} + \sum_k \gamma_k CON_{it-1}^k + \delta_i + \varepsilon_{it} \qquad (3)$$

21. The equation, which includes country fixed effects, has been estimated with Bun and Kiviet's (2003) bias-corrected least-squares estimator for dynamic panels. Correcting for bias was necessary because the model includes a lag of the dependent variable and the time dimension is relatively short (18 years). In such conditions, the standard fixed-effect panel OLS estimator suffers from a sizeable downward bias on the coefficient on the lagged endogenous variable, which in turns implies biases on the other coefficients.[5] Schematically, Bun and Kiviet's (2003) estimator is calculated in two steps. The first step is to run a regression without correcting for the Nickell bias. The results of the first-step regression are used to derive an estimate

4 Detailed test results are available from the authors upon request.

5 Originally described by Hurwicz (1950), this bias was rediscovered by Nickell (1981) for dynamic panel regressions.

Table 6

Estimating Error-correction Equations for Different Spending Items

	Change in the Ratio to GDP			
	Unemployment Benefits	**Old Age benefits**	**Incapacity Benefits**	**Overall Social Expenditure**
Lagged ratio (–1)	–0.14*** (0.03)	–0.18*** (0.03)	–0.13*** (0.03)	–0.15 (0.03)***
Dependency ratio (–1)	0.004*** (0.01)	0.056*** (0.02)		0.19 (0.05)***
Per capita income (–1) (log)		0.77*** (0.3)		1.4** (0.6)
Trade–openness (–1)	–0.01*** (0.002)	–0.001*** (0.003)		–0.05*** (0.009)
Debt ratio (–1)	–0.006*** (0.001)		–0.0024*** (0.00078)	–0.02*** (0.005)
Structural policy stance (–1)	0.06*** (0.02)	0.095*** (0.03)	0.063*** (0.002)	0.33*** (0.08)
Change in the structural policy stance (–1)	–0.06 (0.05)	–0.11 (0.07)	0.04 (0.04)	–0.27 (0.18)
Observations	315	315	315	315

Note: *, ** and *** denote significance at 10, 5 and 1 per cent levels. Standard errors are reported between brackets.

the bias (using Kiviet's (1995) formula), which is then subtracted from the first-step estimator to obtain the bias-corrected estimator. The probability distribution of the estimators and the resulting confidence levels have been obtained with a bootstrap procedure.

As expected, a move towards more flexible structural policy settings, as indicated by a decrease in the indicator value, is associated with a temporary deterioration of the fiscal balance (Table 7). The coefficient on the change of the structural policy indicator has the expected sign and is strongly significant. On the other hand, the level of the structural policy stance has no statistically significant impact on the fiscal balance. This is consistent with our view that in the long run the stance of structural policy is closely linked to government size but has little effect on the fiscal balance. These results also broadly concur with findings by Heinemann (2006) and Deroose and Turrini (2006).

Table 7

Estimated Impacts of Structural Reform on the Cyclically-adjusted Budget Balance

	Cyclically–adjusted General Government Net Lending
Cyclically–adjusted government net lending (–1)	0.89 (0.03)***
Dependency ratio (–1) (log)	–3.7 (1.2)***
Debt ratio (–1)	0.036 (0.006)***
Structural policy stance	–0.17 (0.1)
Change in structural policy stance	0.7 (0.2)***
Adjusted R^2	0.91
Observations	378

Note: *, ** and *** denote significance at the 10, 5 and 1 per cent levels. Standard errors are reported between brackets.

4. Conclusions

22. The econometric exercise in this paper offers evidence that the upfront budgetary cost of structural reform is small in comparison with the longer-term benefits for expenditure levels and the tax burden. For the sake of illustration, consider a country that fits the estimated parameter values for primary expenditure in the first column of Table 3 and where the primary expenditure to GDP ratio is 40 per cent initially. Suppose this country embarks on a determined programme of structural reforms and, in five years, reduces the policy stance indicator by one standard deviation. The short-term impact will briefly push up primary expenditure to 40.1 per cent of GDP in the first two years of the programme. But primary expenditure will decline afterwards to a lower long-term ratio of 35 per cent with half the reduction achieved in four years. In present value terms (with a conservative discount rate of 6 per cent), the cumulative expenditure savings amount to 44 per cent of GDP: investment in structural reform is worth making even on conservative assumptions.

23. What policy conclusions can be drawn? As noted upfront, at the margin the EU fiscal rules can occasionally act as a deterrent against structural reform. Even so, together with the analysis by Hoeller and Giorno (2006), the findings reported in this paper highlight the need for great caution when using the new wherewithal provided by the revised SGP to accommodate structural reform. Since the fiscal costs of successful structural reform tend to be small and short-lived in comparison with the long-run benefit, any related waiver from SGP rules should be limited, temporary and conditional on a detailed assessment of the short-term costs and long-term gains of the measures.[6] While this seems to be the intention of the 2005 reform of the SGP, it could usefully be complemented with a strategy to tackle myopia at the source, by committing governments to adopt medium-term fiscal frameworks holding them genuinely accountable.

[6] One possible exception is the introduction of a fully-funded element in mandatory pension regimes, which may justify more substantial and slightly longer-lasting derogations from usual fiscal rules.

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COMMENTS ON SESSION 3: FISCAL SUSTAINABILITY

Hana Genorio[*]

First of all, I would like to thank to Banca d'Italia and especially to Daniele for inviting me to this important conference. This is a very special moment for me, since I am going to do the discussion for the first time in my life.

The three discussants of the third session are Jean-Luc Schneider, Ludger Schuknecht and myself. I will discuss first two papers that were presented this morning. The first paper is called "Debt Sustainability in Emerging Market Countries: A 'Fan-chart' Approach" and the second one is the one projecting OECD health and long-term expenditures. Both papers are an important extension of the fiscal sustainability analysis; the first one by involving fiscal policy actions and combining them with economic variables and the second one by making in-depth analysis of the long-term and health care expenditures with clear division of the main drivers. They are both evaluating and adding various scenarios. The first paper makes a risk analysis of debt dynamics. It incorporates fiscal behavior to the pattern of joint economic shocks, resulting in a more complete, objective and realistic assessment of the risks to fiscal sustainability. The second paper on the other hand extends both health and long-term care expenditures. An extension, which is introduced in the analysis, is a division on demographic and non-demographic drivers of the health care expenditures. With this the authors offer a new, more transparent framework for the projections of long-term and health care expenditures. So, the results in both working papers are more credible and realistic comparing to the approaches used up to now.

First, I will discuss the paper on debt sustainability analysis. The IMF paper makes the analysis in three building blocks: first, they make a joint distribution of shocks of the main economic variables. This means that they do not only include a change of the interest rate but also combine the effect of a change of the interest rate on the GDP growth, for example, or on the exchange rate. In the second block they analyze the fiscal reaction function. Finally, they make a combination of the previous two blocks and apply it for the debt sustainability analysis. The main part is the second block, where they analyze the fiscal reaction function. They estimate it in a panel of emerging countries, but they allow for country specific factors by applying dummy variables. In their framework they also include institutional fundamentals and, as we have seen in the morning presentation, they provide a very sophisticated VAR model, with which they can simulate up to 10,000 different debt paths. Indeed, in their case of 5 emerging countries they have provided up to 1,000 different debt paths. In the first block they do not analyze each economic variable

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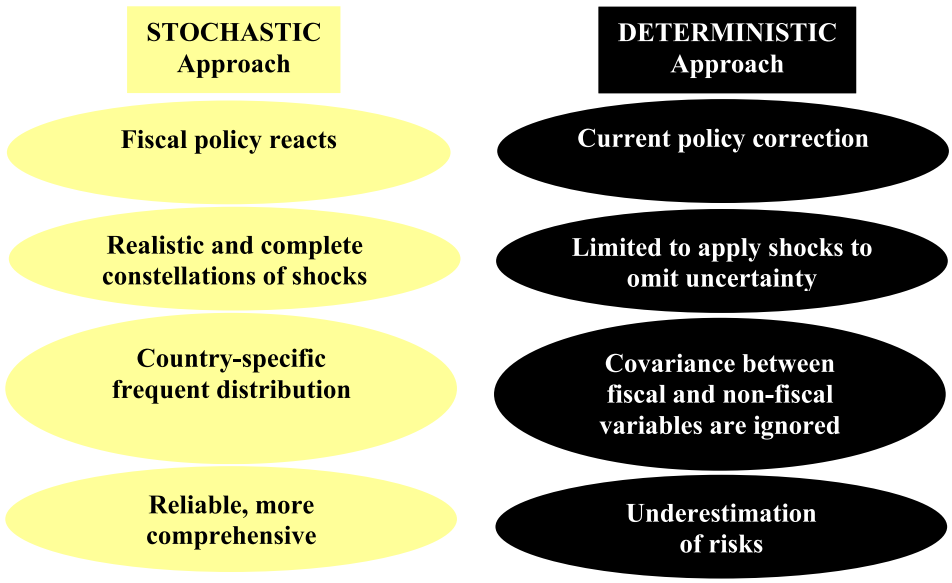
separately, as in the analyses up to now, but they make co-variances of the shocks in their projections. Finally, they end up with devising an algorithm for generating the explicit analysis of debt dynamics where they allow for the fiscal policy to act as a source of risks.

As the estimation of the fiscal reaction function is a very important part of their analysis, I would like to draw some attention on technical shortcomings, which in some part were also recognized by the authors themselves. First, in the estimation of the fiscal reaction function, the occurrence of fiscal crises has a low probability. Hence, in the case of crisis, some other approach of the sustainability analysis would be more appropriate. The second uncertainty is that there is no feedback of the fiscal policy on the economic variables. There exists an impact of the joint economic variables on the fiscal policy ones but not vice versa. Third, there is a lack of the long-term time series data, so the authors use panel data. Finally, this estimation of the fiscal reaction function assumes that the past government behavior will continue. In such analysis, if I was doing the projections as an optimistic person, I would rather avoid some "mistakes" that past governments committed. For example, last year, in Slovenia, the government indexed pensions fully with wages and for the projections of fiscal sustainability I would rather exclude this reaction in my reaction function for projections of the future debt developments.

The main results that the IMF paper present with LIML and GMM model are:

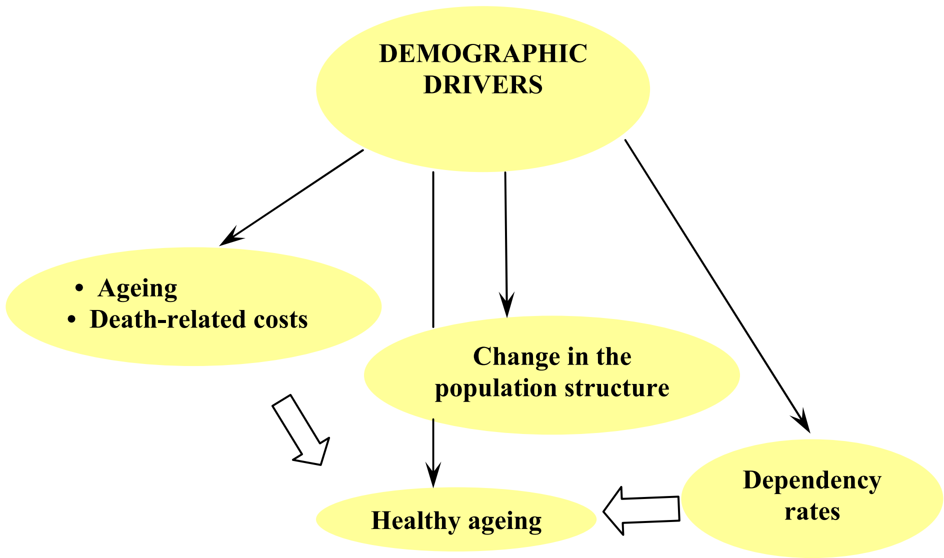
- fiscal response to debt is stronger when debt is lower than 50 per cent of GDP.
- response to booms and recessions is asymmetric.



- worsening of primary balance is larger during contractions than its improvements during booms.

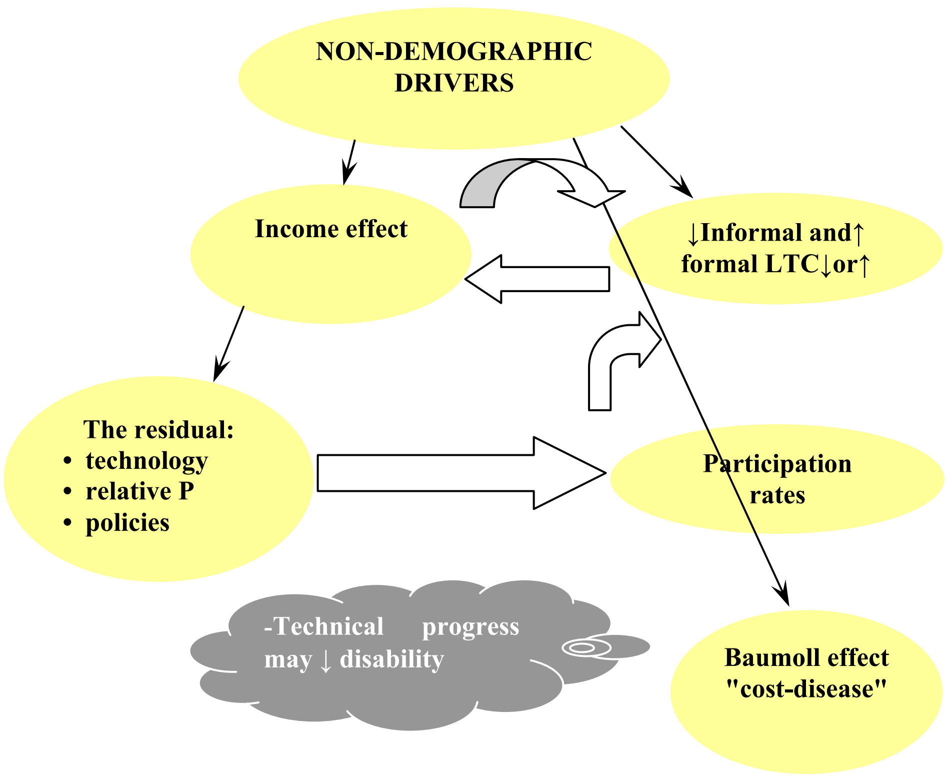
To finish with the first paper, I would like to stress what is the main value added of the paper. Traditionally, deterministic approach was used in the analysis of fiscal sustainability, now this paper introduces a new stochastic approach. First, with the deterministic approach, the analysis includes only current policies and then makes simulations using the current policy corrections. Second, the deterministic approach is limited to applying the shocks to overcome uncertainties. Third, co-variances between fiscal and non-fiscal variables are ignored. Overall, this has resulted in underestimation of risks. Now, with the stochastic approach, we have more realistic and complete constellation of shocks, which allow for country specific fiscal paths. The analysis of fiscal sustainability becomes more reliable and comprehensive. And finally, but most importantly, fiscal policy actually reacts to economic shocks and developments of the debt in the certain macroeconomic environment.

I turn now to the second paper, which is dealing with projections on the health and long-term care expenditures. As the authors already stressed, health expenditures are also very important for the projections of fiscal sustainability. In fact, last year when I made the projections of fiscal sustainability for Slovenia, I also ended up with double health care expenditures by 2050; however I only included the ageing effect. This working paper separates health and long-term care expenditures and then, what is very interesting; it further separates demographic and non-demographic determinants of the long-term and health care expenditures.



First, let's see the demographic drivers of the future health care costs. The main demographic drivers of the health care expenditures are related to ageing and to death related costs. This paper takes into account healthy ageing, which means that if people are going to live longer, they will also be healthier. The authors assume that the biggest health care costs come at the end of the life-time. With this assumption the authors smooth the effect of ageing. In addition, dependency ratio is the most important determinant of the long-term care costs. It rises with ageing but it is again mitigated with the assumption of healthy ageing.

Second, among the most important non-demographic drivers of the health care expenditures authors select the income effect. Basically, what we can expect and what the authors stress is that the development of technology will be accompanied by a big demand shock. Maybe we could compare this with the development of the computer technology, where the same thing happened. The authors provide two scenarios: cost-pressure and cost-containment scenario. What they get is that at the end of 2050, health care expenditures will increase in the first scenario to 13 per cent of GDP and in the second one to 10 per cent of GDP.



Developments in technology also have some positive impact on the long-term care cost, that it is much smaller than on the health care costs and it has rather an increasing effect on the long-term care costs. With the overall development of the economy and economic growth, there will be an increase in employment and participation rates. What the authors expect is that this would decrease informal long-term care and thus foster a need to increase formal long-term care. Therefore, technological development would be a determinant of the increasing long-term care costs. The last one but not least one, actually a very important effect is the so-called "Baumoll effect" or cost disease effect. This effect arises as consequence of the equalization of the wages among sectors, and what the authors expect is that wages in the health sector are going to increase faster than the productivity. From this effect we can expect a big increase in the long-term care expenditures.

In conclusion, what have we learned from this second paper? We discover a new, transparent framework, dealing separately with health and long-term care and with demographic and non-demographic factors. This paper I read after reading the paper with the fancy "fan-charts", so immediately after finishing, I got the idea of having "fan-charts" also for the health expenditure projections. In addition, for the further, more sophisticated analysis, it would be very interesting to actually calculate variances and co-variances between the factors of the health and long-term care and do also some risk analysis as it was done in the first case. Maybe in the future the two authors could make a common working paper, incorporating "fan-charts" into the health care projections.

I would really like to thank both authors for providing some new methods in the analyses of the fiscal sustainability. Actually when I read these two papers, I felt it is a critique of the approach that I used last year, when I was doing the analyses of debt sustainability for Slovenia, where I end up with debt level of 500 per cent of GDP in 2050, which is of course not very likely to happen. With the framework of "fan-charts" I would most probably end up with more realistic results. So, thank you for your attention, hvala lepa za pozornost!

COMMENTS ON SESSION 3: FISCAL SUSTAINABILITY

*Jean-Luc Schneider**

The papers in this session pointed towards two directions. Some of them focus on theoretical issues, such as the economic relevance of different fiscal sustainability concepts, others are more technically oriented, trying to define or refine adequate indicators of long term sustainability. Coming from a non-specialist, my comments will not try to challenge the theses developed in those papers, but rather to offer the view of an outsider about the characteristics that an indicator of fiscal sustainability must feature in order to make it useful for policy advising purposes. Some of these characteristics already exist in several of the indicators that have been presented, but other characteristics are still missing in most.

Fiscal sustainability issues have gathered a renewed interest in the recent period. This in turn provoked a flourishing of papers and indicators aimed at conveying adequate information in a synthetic way. But the adequacy of a given indicator can only be assessed against its intended use. Broadly speaking, fiscal sustainability concerns emerge in two different contexts.

First at national level, budget managers want to be warned well in advance about possible long term problems and the threat of crises. This requires two things from a good indicator: the focus should be put on the rather long term (such as in the indicators discussed in the paper by Gokhale and Smetters); and the focus should be on budgetary relevant accounting perimeters. The second point involves that the design of national institutions affects the definition of good indicators. To be useful, an indicator must be shaped according to the frontiers of the central government or of specific social programs or agencies.

But fiscal sustainability indicators are also used for a second purpose, namely multilateral surveillance, which involves rather different requisites. Here, the rationale is that fiscal position in the long term may exhibit negative externalities for other countries. In its benign form, this is going to happen through trade: necessary fiscal tightening will dampen demand addressed to other countries. But less benign spillovers may also materialize through default and a crisis spreading to financially integrated partners, or through monetization of public debt. Here what is expected from a good indicator is macroeconomic relevance and some comparability across countries. This means that good indicators are to be defined at the consolidated government level, and also that reasonable compromises and simplifications are needed to obtain common definitions and accurate multilateral surveillance.

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The views expressed in the paper are strictly personal and do not reflect those of the French Ministry of Finance.

Because of differences in their purposes, it is not surprising that different kinds of indicators emerge. However, beyond this cause, there are other more methodological reasons for an embarrassment of riches that is well described by the Belgian paper. There are various definitions of sustainability on the market, and many possible choices of indicators for each. The focus may be put on liabilities or on expenditures, on net or gross position, or on the financing gap, at different horizons. Even once the accounting unit has been set, the perimeter to be considered is a matter of appreciation. Should the liabilities be computed on an accrued or forthcoming basis, on open or close ended basis? Should implicit or contingent liabilities be included? How to choose the valuation method? and the discount rate?

All papers insist on how sensitive the results are to such assumptions. The contributions by the Banca d'Italia, the IMF and the ECB also emphasize the importance of the underlying macroeconomic scenarios. Economic growth and demographic changes are key determinants of the denominators in most indicators. But other macro variables, such as developments in relative prices and exchange rates, are probably of likewise importance, although much less discussed in the papers.

The abundance of indicators and their sensitivity to somewhat arbitrary assumptions make everyone well aware of their limitation and of the uncertainty attached to their use. But, because of the leeway in their construction, and in spite of their diversity, some common biases are to be expected from the available indicators. Because the concept of fiscal sustainability is seldom used without any strategic agenda, there may be a tendency to oversimplify and to get down to one single figure supposed to capture the harshness of the fiscal trends. Another bias, which ministries of finance or central banks may not be above of, is to favour dramatic presentations in order to catch the attention of the public or of policy-makers deemed too prone to spending. This is often done by focusing on long term debt ratios, more impressive than financing gaps.

But there is a drawback to using such dramatic indicators to catch a concept as soft as fiscal sustainability. The theoretical question the indicators are trying to answer is not necessarily the most relevant to policy-makers. This question is: can the current set of policies go on forever? And the answer is almost always: no, it cannot. And to prove that, some indicator is exhibited that is going to explode over the long time.

It is rather too easy for a minister to shrug off such presentation. First, policies change anyway, much more often than the horizon of any fiscal sustainability indicator. Second, beyond and sometimes unrelated to policies, crises happen and history teaches that crises are not much alike. Third, what matters in crises is how the markets react, and their reaction is certainly not proportional to any specific indicator or set thereof, as the ECB paper well demonstrates. That makes it too easy to discard indicators as mostly irrelevant to everyday policymaking, although their content in information is usually acknowledged.

How to reconcile this long-term information content with the need to convey some sense of urgency? Let me offer a personal tentative definition of sustainability.

A decision maker would recognize as unsustainable, and take actions to correct a situation that meets both of the following conditions:

(i) its continuation would lead to some exploding imbalances;

(ii) fixing it tomorrow would be significantly more costly than fixing it today.

Condition (i) is the usual one and whether it is met is well assessed by most available indicators. Let us call it the explosion condition. Condition (ii) means that decisions should not be delayed. Let us call it the urgency condition. To assess whether it is met, it is necessary to know what is meant by "significantly more costly". The proper approach is to check whether the cost of fixing the situation, conditional to not having it fixed before, is increasing at a rate that is higher than the decision-maker's discount rate. If so, the situation can rightly be called unsustainable, in the sense that the policy maker should prefer not to delay its resolution.

Most of this session has been devoted to refining assessments of whether the explosion condition is met. However, further works on it may soon enter a zone of decreasing returns. After all, it is difficult to imagine that a certain sustainability problem is worrying, but not captured by relatively basic indicators.

On the other hand, while such approach is mentioned in the CPB paper and in Prof Gokhale's paper, very little has been done so far on the urgency condition, which is yet probably most important to convince that action has to be taken. Let me briefly suggest a possible way forward in two steps.

The first step would be to make the costs of reforms explicit. Adjusting for a situation that threatens to explode in the long term usually involves a mix of increased contributions and reduced expenditures. (Increasing economic growth may also be an option, but there is no need to expand on that, since it should be pursued for its own sake). Increasing taxes or reducing expenditures must not be seen as costly in itself, at least from a macroeconomic point of view. After all, it is equivalent to increasing the price and reducing the quantity of publicly provided services. The economic consequence of such a change is not necessarily more dramatic than, say, those of an increase in housing prices and a corresponding reduction in the size of homes afforded by the households.

The cost of reforming the public finance must be searched elsewhere. In my view, it is twofold. First, some costs are related to the ex-post inefficiency of decisions which were supposed to be optimal at their time, and turn out to be less so after the reform. Those sunk costs materialize at the time of the reform. It is not necessary to do long term projections to calculate them.

A second category of costs is related to the fact that reforming an unsustainable situation may involve a slowdown in the economy. Typically, increasing taxes will increase distortions and reduce potential output (at least if this is not simply viewed as a change in relative prices). This second kind of costs must be assessed over the long term. Macroeconomic models provide reasonably reliable estimates of such costs.

So the first step of an urgency assessment would be to compute both kinds of costs associated with a given reform, and to add them up, that is to compute the total expected present value of the cost of reforming the system today.

The second step would be to do the same for a reform of the system that would be delayed till tomorrow, and to compare it with the cost of today's reform. More precisely, suppose we have agreed on a given relevant long term indicator of sustainability, S, which is going to explode if no reform is implemented, that is which is going to reach some non plausible level S^* at some date T.

Reforming today means to change the parameters of the economy, the tax ratio, the benefits level, etc, so that indicator S is no longer projected at S^*, but rather at a much lower and presumably sustainable level $S°$ at date T. This reform would have a total cost $C0$ (in present expected value computed today). Reforming tomorrow would mean not adjusting any parameter till date 1, and then adjusting the parameters of the economy so that indicator S reaches the same sustainable level $S°$ at the same date T. This reform would have a total cost $C1$ (in present expected value computed today).

It is then easy to compare the cost of reforming tomorrow with the cost of reforming today, both scenarios leading to the same adjusted level $S°$ at the same date T. If $C1$ is higher than $C0$, it means that, in today's present value, it is better to reform now. Note that the reverse may well happen too: for example, if growth is expected to strengthen in the short term, or if the discount rate between today and tomorrow is high, delaying the reform may be optimal.

A question that may be asked is whether the urgency indicator, $U = C1 - C0$, does or does not depend upon the choice of the long term sustainability indicator S. My guess would be that it does not depend much on S. It is not difficult to identify what is likely to play the central part in the urgency indicator. On the short term cost side, this is the interest accrual on the initial net liabilities, plus the new flow of net obligations between today and tomorrow. On the longer term, the spontaneous change in the marginal tax rates provides a proxy for the change in the marginal cost of raising taxes. And the full calculation of the cost indicators is not very difficult, probably no more than computing long term sustainability indicators.

COMMENTS ON SESSION 3: FISCAL SUSTAINABILITY

Ludger Schuknecht[*]

The papers of this session provide excellent insights into the "state of the art" on fiscal sustainability. Most angles of the literature are either covered in survey or original elements in these contributions, as mapped in the survey table below.

Issue	Contributions
1) Measurement issues	Franco, Marino and Zotteri, Gokhale and Smetters
2) Backward-looking assessments	
Empirical studies (stationarity of debt, cointegration of revenue and expenditure, primary balance reaction to public debt)	Survey in Langenus
Fiscal structural reform and growth	Cournede, Giorno, Hoeller and van den Noord
3) Forward looking studies	
Debt, implicit liabilities/spending forecasts in partical equilibrium	Celasun, Debrun and Ostry; Oliveira Martins; Gokhale and Smetters
Sustainability gap and synthetic indicators	Langenus
General equilibrium/supply side effects	Cournede, Giorno, Hoeller and van den Noord
Generational accounting	Surveys in Langenus; Giammarioli, Nickel, Rother and Vidal
Combination generational accounting and general equilibrium	Draper, ter Rele, Westerhout
4) Financability of debt	Giammarioli, Nickel, Rother and Vidal
5) Implications for rules	Franco, Marino and Zotteri

[*] European Central Bank.

What have we learnt in this session?

The paper by *Langenus* surveys the existing literature that analyses sustainability from a backward- and forward-looking perspective. It also provides synthetic indicators of fiscal sustainability which could complement those already compiled by the Commission. Another very useful contribution of his paper is the simulation of adjustment today versus its delay to the intermediate and distant future. He finds that pre-funding of ageing costs would be less economically costly and more intergenerationally fair.

The paper by *Giammarioli, Nickel, Rother and Vidal* also combines a literature survey with an original and highly relevant discussion on the short term financeability of public debt. Analysts of fiscal sustainability typically focus on the non-sustainability (explosiveness) of the supply of government debt and tend to neglect the demand side. However, as the authors point out, if confidence in sustainability is lost, demand for government bonds and willingness to lend (at least at long maturities) may already decline much before debt explodes. Shortening maturities and declining confidence reinforces the short term vulnerability of governments to investors being unwilling to finance further debt.

Franco, Marino and Zotteri point to some important issues with regard to the measurement of expenditure projections and estimates of the amount of pension liabilities. Concerns about comparability of expenditure projections, homogeneity in methods and (in-)completeness of current pension liabilities as compared to total future liabilities suggest to use these indicators only in a complementary manner to the deficit and debt indicators. Measurement problems related to social security projections are also addressed by *Gokhale and Smetters* with particular reference to the US case.

Oliveira Martins, de la Maisonneuve and Bjørnerud provide projections of health expenditure over the coming decades. This study is finds that health spending will rise much more strongly than predicted by the EPC's Working Group on Ageing due to less favourable and likely more realistic assumptions.

Van den Noord and Cournède and *Giorno and Höller* discuss (amongst others) the complementarity of fiscal reform and monetary easing in monetary union. While the authors are falling short of proposing certain policy actions, their argumentation should nevertheless not be misunderstood as a reason for the explicit coordination of fiscal and monetary policies or for up-front interest rate cuts in anticipation of fiscal reform.

The study by *Debrun, Celasun and Ostry* suggests a very interesting approach of measuring risks to fiscal sustainability with the help of fan-charts. The only shortcoming of their approach is perhaps the use of estimated policy reaction functions on the basis of panel analysis. Alternatively, one could perhaps compare fan charts that are based on historical policy responses in the respective countries with alternative reaction functions that reflect different reform paths.

Finally, the paper by *Draper, ter Rele and Westerhout* combines generational accounting with general equilibrium modelling to examine all in one model the sustainability and time path of deficit and debt, the distributional effects on different generations and the supply side effects of different reforms in the Dutch economy.

What do we know and what do we not know?

Judging from the existing literature and what can be learnt from these contributions, we seem to know quite a bit about past government behaviour, about pension systems and their likely costs in coming decades under certain assumptions, about the possible interaction between the fiscal costs of ageing and the real economy and about the distributional effects of current systems and different reform scenarios.

We seem to know much less about health and long term care and how to reform them successfully. We still know with too little precision how economic agents would respond to reforms and how the optimal mix of private and public old age insurance would look like.

Perhaps we know even less about financial vulnerability and risks to the demand side for government bonds in industrialised countries in general and in EMU in particular. The common currency has introduced significant stabilising elements into debt demand, for example, by creating a deep and liquid market for euro area debt, or by making all countries debt eligible for investment portfolios of institutional investors. Pension regulations have resulted in increased and stable demand for government debt to better match the maturity of assets and liabilities of growing pension funds. But on the other hand, domestic debt markets are now less "rigged" as national investors are no longer forced to buy their government's debt and international holders of government bonds can exit markets at very short notice. The conditions under which there may be major deteriorations in the financeability of debt of euro area countries or even "runs" as we currently only know them from the experience of emerging markets may be worth exploring further.

What society in the future?

There is another angle to fiscal sustainability and population aging which we tend to forget when bickering over sustainability gaps, general equilibrium effects or reaction functions. Social security reform is about risk sharing between the private and the public sector and the life we will live as old people. With reform, there will be more risk with individuals. But chances are that higher income, better incentives to save and maintain one's human capital implies that we will be relatively well able to cope with it as members of rich societies.

Without reform, there will be around 100 pensioners for 100 workers in many countries. A Bulgarian colleague of ours told me that this is already the case in his home country. The world has not come to an end there. And it is also not very likely to come to an end in unreformed Western welfare states. But public pensions will be low to maintain government solvency and this will also require that much of the risk of longevity will be shifted to individuals (even though perhaps a bit later than with reforms). Health services will perhaps remain universal but they are likely to be poor to remain affordable. This also implies that much of the risk of having to pay for good quality service in case of serious illness will again be with the individual.

Does it then not matter whether to reform or not? The main difference I see is that unaffordable, degenerate welfare states will not only have to shift part of the risk to the private sector but they will do this in an environment of high taxes, low employment, low growth and, therefore, a generally much poorer ability for private agents to cope with risk. There will also be less private charity to mitigate risk. There may also be more intergenerational fighting and less cohesive and peaceful societies. Fiscal sustainability, social security reform, rebalanced risk sharing will not be about equity versus efficiency, it will be about equity with or without efficiency, cohesion and prosperity. This is ironic because it is today's nanny states that claim that they are better for cohesion and the poor.

In conclusion, we know a lot more about sustainability of public finances than only a few years ago. But we still do not know well when public finances are sustainable, especially as regards the small probability of drastic events on the demand side of public debt. And we have not really thought about what not reforming would mean for our future societies. There is a good side to this. It will keep us fiscal economists in demand for many years to come.