Draft 2.6.2004

Paper to be presented at the 1st Euroframe Conference on Economic Policy Issues in the European Union, Paris, 4 June, 2004

# Population Ageing, Pension Reforms and Public Finance Targets

by

*Heikki Oksanen*[1]

## Abstract

The paper investigates long-term sustainability of public finances under population ageing and presents a method to transform long-term public expenditure projections into medium-term budget balance and debt targets. Firstly, a framework based on the current national accounting concepts is presented, and data on EU-12 (euro area) are used as illustrations. Secondly, it is shown how the proposed rules for actuarial accounting of pension liabilities can be consistently implemented to public pensions. This leads to an extended framework for setting public finance targets. Government deficit and debt shift to new orders of magnitude, which might make implementation problematic. However, extending actuarial accounting to government as an employer already significantly shifts these figures.

**JEL classification:** H1, H5, H6
**Keywords:** Population ageing, pensions, public finances, national accounts

**Acknowledgements**
……. Jeanette Bell (text) and Karel Havik (tables) deserve my warmest thanks for their careful editing work - I am solely responsible for remaining errors and omissions.

**Caveat**
Views expressed are those of the author and do not necessarily reflect those of the European Commission.

1 Adviser, Directorate General for Economic and Financial Affairs, European Commission, BU-1, 5/198, B-1049, Brussels,Belgium
Correspondence: Heikki.Oksanen@cec.eu.int

# 1. Introduction

The paper investigates long-term sustainability of public finances under population ageing and presents a method to transform long-term public expenditure projections into medium-term budget balance and debt targets. Firstly, a framework based on the current national accounting concepts is presented, and data on EU-12 (euro area) are used as illustrations. Secondly, it is shown how the proposed rules for actuarial accounting can be consistently implemented to public pensions. This leads to an extended framework for setting public finance targets.

Previously used measures for sustainability of public finances are first assessed and their implications spelled out. It is recognised that according to the prevailing population projections the share of older people is moving to a permanently higher level, which implies that the time horizon of the sustainability measures need to be correspondingly extended (Section 2).

As there are an infinite number of modes of financing the projected expenditure, additional criteria are necessary and useful to arrive at results which are relevant for policy. Recognising that from a long-term perspective, the most important issue is how to cope with the increase in population ageing related expenditure, notably pensions, the simple principle of actuarial fairness is applied to succeeding generations. This is done by observing that population ageing results from a change in fertility and longevity, and therefore the succeeding generations differ with respect to these characteristics. Taking these differences into account in formulating a benchmark for intergenerational fairness leads to neat results for setting targets for public finances under the current national accounting definitions and simple, conventionally accepted economic assumptions (Section 3).

The benchmark for intergenerational fairness is akin to actuarial fairness in setting the parameters for the public pension system. Therefore the recent proposals to implement actuarial accounting principles in recording pensions in national accounts leads to including the pension liabilities of the government in public debt and to a correspondingly redefined budget balance. The use of these concepts is illustrated with the help of a simple model and stylised data, with new results for public finance target setting (Section 4).

The paper concludes with a discussion on implications for policy design, including data requirements. As the proposed national accounts definitions would lead to a shift of government deficit and debt to new orders of magnitude, it is required that the new concepts are correctly understood and accepted, and consistently implemented to provisions on public finance targets (Section 5).

# 2. Previous indicators of the sustainability of public finances

*A short history of indicators*

In late 1980s, policy advisers shifted their attention from the short term fiscal policy stance to include assessment over medium term, i.e. over the business cycle (Blanchard, 1990, and Chouraqui, Hagemann and Sartor, 1990). From this perspective, one relevant

reference scenario was such that at the end of the period in consideration the same public debt to GDP ratio is reached as prevailed in the beginning (this approach could also be extended by setting the terminal debt ratio on the basis of some additional considerations). Such a reference scenario defined sustainability. It could also be refined, given a projection for public expenditure, to calculate the corresponding constant tax rate over the period. This simple rule can be argued on the basis of minimising the distortion caused by taxes.

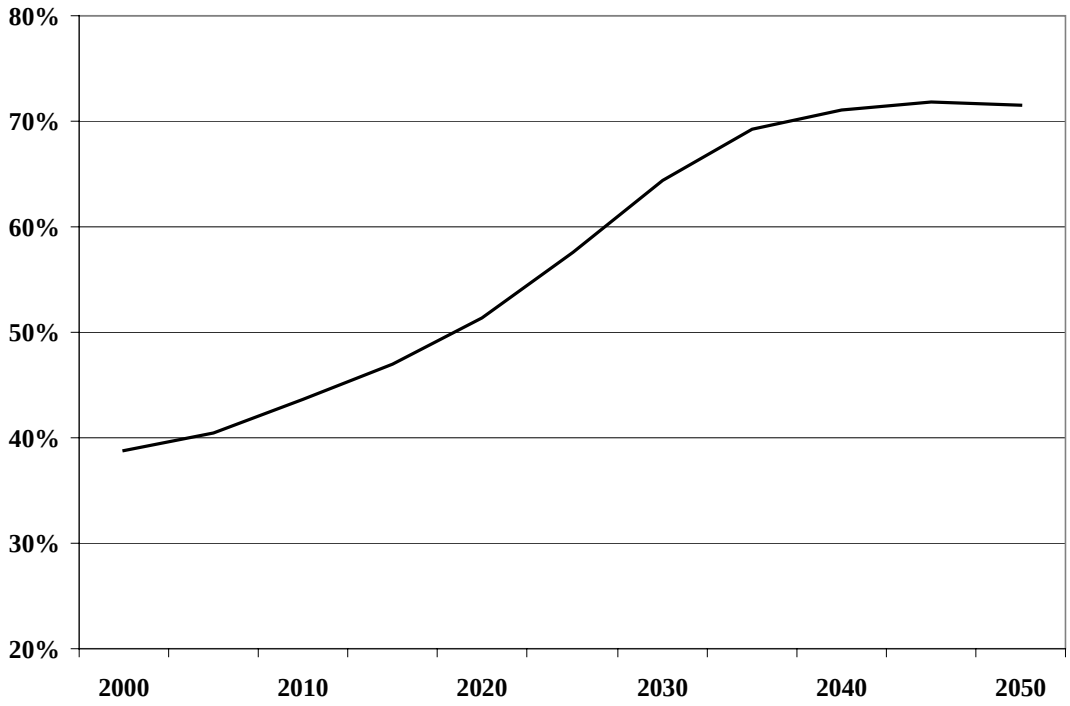
Even if the work along these lines was useful to provide a framework for assessing the fiscal stance, it had its clear limitations. It only gives a meaningful reference scenario if there is no rising trend in public expenditure. This is the simple reason why the framework is not sufficient for any serious consideration of the consequences of a permanent increase in public expenditure caused by population ageing.

*Population ageing is not only a bubble but leads to permanently higher expenditure*

The basic observation which is now commonly accepted is that population ageing in Europe is not only a bubble caused by the post-WWII baby boom age-cohorts – as might have been believed 15-20 years ago – but population age structure is changing and leading to a permanently higher *old age dependency ratio* (OADR), see Figure 1. This stems from persistently declined fertility, shown in Figure 2, and increasing longevity. The Eurostat projection for EU-15 assumes, roughly speaking, that fertility remains constant at the current average of 1.7 children per woman[2], and longevity increases by five years until 2050. It is also assumed that net migration settles at some fixed proportion of population. Figure 1 illustrates that the *change* in the age structure of the population, i.e. *population ageing*, is roughly completed by 2050, not counting for possible further increase in life expectancy. This change is significant and necessarily has such important effects on public finances, that it is only natural that updating the projection is underway, due to be finished later this year.

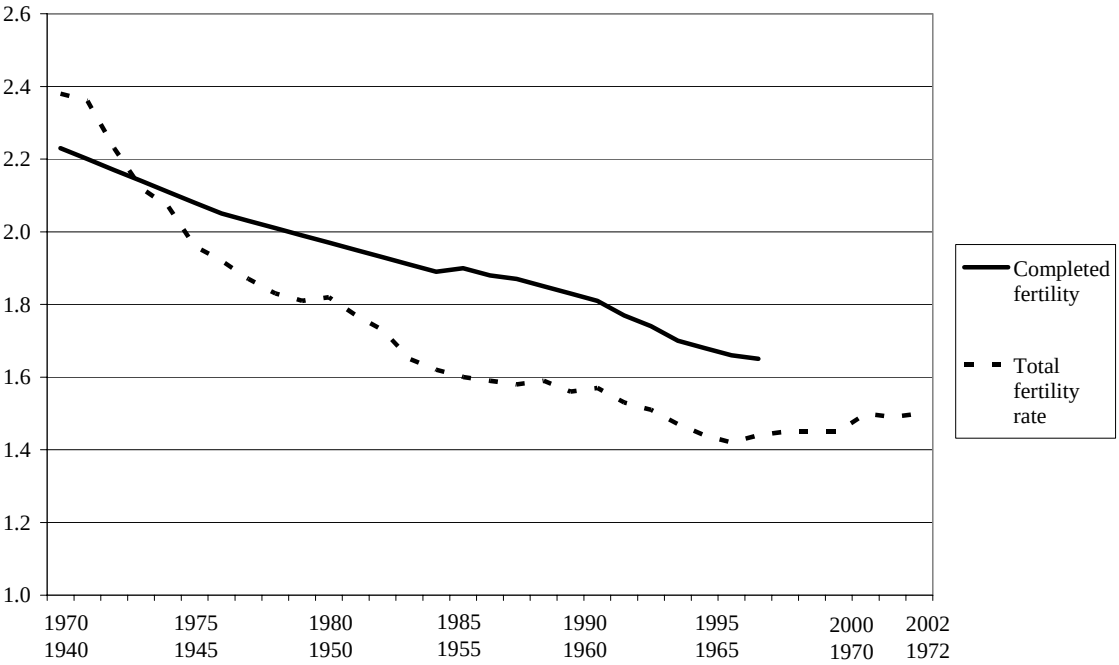
[2] This refers to 'completed fertility', the number of children the average woman gives birth to. 'Total fertility' is a parallel measure, the ratio of births to women of fertile age in a given year. It is affected by 'completed fertility' and the increase in the average age of woman at childbirth – the latter factor explaining why 'total fertility' has been lower than 'completed fertility' since the 1970s. According to Figure 2 'completed fertility' may have declined still further, as the most recent estimate is 1.65.

**Figure 1. Old age dependency ratio* in EU-15, 2000-2050**




* ratio of population aged over 60 years to those aged 20-59 years.
Source: Eurostat projection

**Figure 2. EU-15: Total fertility* and completed fertility****




* number of births in a given year per number of women, weighted by age-specific fertility rates of the respective calendar year, 1970-2001
** number of children by birth year of the mother, 1940-1965
The two times scales overlap by 30 years reflecting the average childbearing age.

The projection for the age structure of the population, combined with the prevailing rules for ageing-related public expenditure, was the basis for the public expenditure projections for all EU Member States for 2000-2050, published in 2001. The simple logic is that the level of expenditure in 2050, as it is based on the apparently steady state permanent level of the OADR under the technical assumption that life expectancy remains constant after 2050, represents public expenditure as a percentage of GDP also beyond 2050, technically speaking to infinity. In the present paper, data on EU-12, composed of the euro area Member States, is used for illustrations.[3]

We should first, now that we are concentrating in defining policy scenarios for financing an up-to-a-point increasing public expenditure, note that there are an infinite number of revenue paths which make the scenario sustainable defined as the requirement that public net debt converges to a constant proportion of GDP be fulfilled. This is a sufficient requirement in this type of a partial analysis where, for example, the question about the sustainability of the required level of the tax rate (at any point in time covered by the scenario) is not posed. Note that such a further question is most relevant, but then it should be also noted that a non-ageing-related expenditure reduction and a tax rate increase are substitutes for finding the required financing for ageing-related expenditure. Here, we leave aside the issue of changing the gross tax level by changing non-ageing-related expenditure and, technically, assume non-ageing-related expenditure to be given.

*First indicator: sustainability gap calculated for period until 2050*

The early studies looking only at a *fixed time horizon*, inspired calculations for finding the tax rate which leads to the debt ratio at the end of the period, i.e. in 2050, equal to the one which would emerge from the path with zero budget balance throughout the period.[4] For EU-12, which has a debt ratio of 57% in 2005, the result for 2050 is 11.5% (57% divided by 4.8, as the projected nominal GDP in 2050 is 4.8 times GDP in 2005). The sustainability gap is then defined as the difference between the resulting tax rate and the one in the policy programme at the beginning of the exercise (2005).

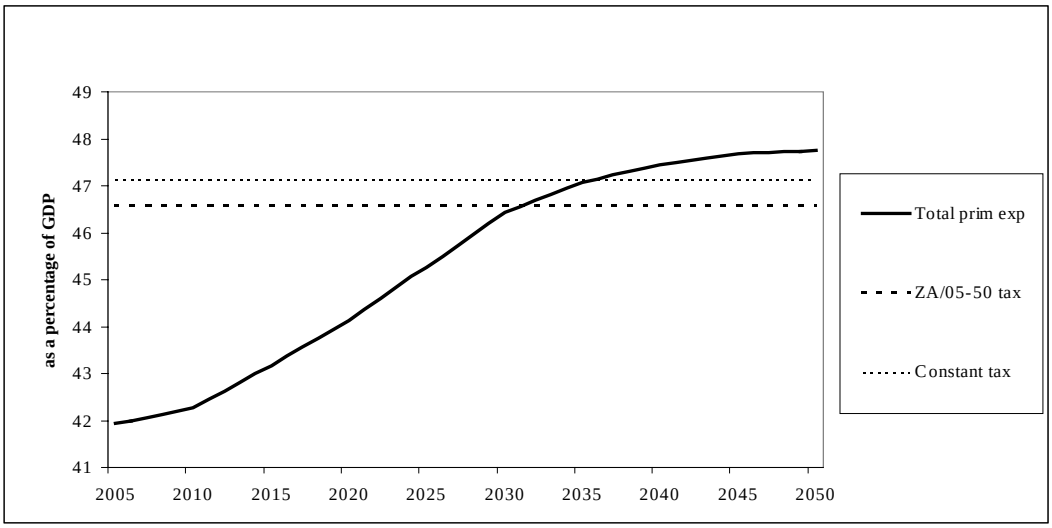
---

3 The data comes from the public expenditure projections in the Economic Policy Committee (2001) report, with some minor adjustments presented in the 2001 Stability and Convergence Programmes of the Member States. The assumptions were: the growth of labour productivity 1.75% p.a., inflation at 2%, and interest rate at 2 percentage points above the rate of growth of nominal GDP. In the data, public debt for 2004 was at 57.4% of GDP. This figure represents *gross* public debt in EU-12 with the minor exception of Finland where net debt enters the calculation due to the considerable assets held by the general government as it includes mandatory occupational pension funds. The conventional practise to use the gross debt figures for the other EU-12 countries is followed here as assets held by the public sector are small in most countries.

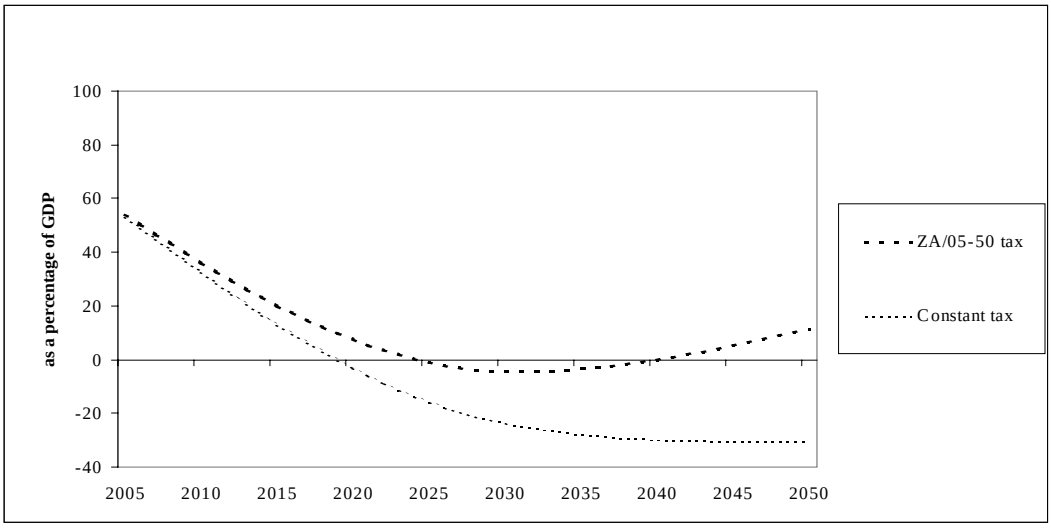
4 An indicator based on this assumption is found in European Commission (2003), Part I, Ch. 3. It is inspired by the 'close-to-balance of surplus' – rule of the Stability and Growth Pact.

**Figure 3. EU-12 public finances under alternative tax rates: ZBB on average 2005-50 (ZA/05-50 tax) and constant tax rate for infinite horizon (Constant tax)**

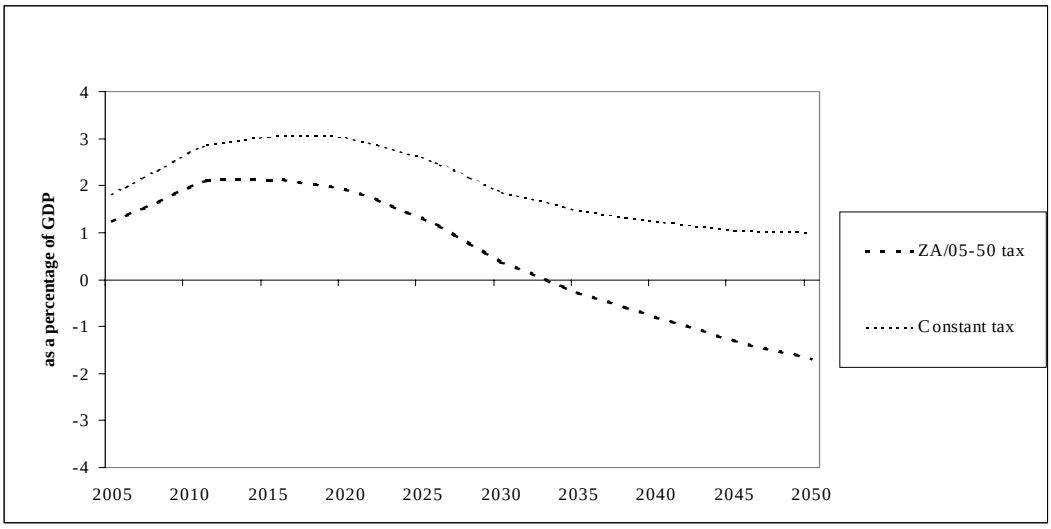
## a. Expenditure and taxes




## b. Debt




## c. Budget balance



The scenario in Figure 3 labelled ZA/05-50 (for zero balance on average in 2005-2050) illustrates this scenario. The U-shape of the debt path indicates that, extending the time horizon beyond 2050, this policy prescription is not financially sustainable as debt first reduces below zero, and then again starts to grow without limit. As this is the outcome for EU-12 average, for many Member States this method produces an even faster debt explosion. The corresponding budget deficit is first positive, and then turns negative. For some Member States it would exceed the 3% of GDP ceiling before 2050.

One way to reconcile sustainability from 2050 onwards would be to increase the tax rate to a new level which would exceed the primary expenditure by an amount required for servicing the debt so as to keep the debt/GDP ratio constant.

*Constant tax rate for infinite future*

The natural alternative solution is to find the constant tax rate which is sufficient to provide financing over an *infinite time period*, assuming that the primary expenditure stays at its 2050 level. As compared to the previous case, the required tax rate is higher. The result is depicted in Figure 3. The debt ratio declines to zero around 2020 and converges to *minus* 31%, i.e. it decreases by 88%. The budget balance jumps to 2% of GDP, increases thereafter and stays above 3% until 2020, and then converges to its new permanent level below 2% (which is required to maintain the constant asset position in the emerging steady state).

This scenario and the resulting alternative indicator for sustainability gap is a straightforward application of the 'permanent balance' approach advocated by Buiter (1985), Buiter and Graffe (2002).[5] This is intuitively appealing, relatively simple and backed by considerations on tax smoothing for minimising the distortion caused by taxes.

The implied significant budget surplus and debt reduction should, however, not be regarded as a recommended policy line, notably in cases where the resulting budget surplus is higher than for the EU-12 on average. The implication could rather be that the rules on the expenditure side should be revised to arrive at a lower expenditure increase, and hence to more reasonable targets for budget surplus and debt reduction.

Another legitimate objection concerns the prescription of the constant tax rate from now onwards. We now turn to an alternative rule for the tax rate.

## 3. Intergenerational fairness as a basis for gradual adjustment

Although prescribing a constant tax rate can be argued for minimising the efficiency loss caused by tax distortion, there are also other economic issues which are relevant. Here, we concentrate on the fundamental question of who should pay for what, and look into

---

[5] For reviews, see Balassone and Franco (2000) and Chalk and Hemming (2000). Frederiksen (2001) presents an application for a large number of countries. The second sustainability gap indicator in European Commission (2003) also belongs to this category.

fairness across generations with respect to financing the population ageing related expenditure, recognising that the successive generations are not identical.

A useful reference for setting a benchmark for intergenerational fairness is the counterfactual assumption that the age structure remains stable. If this were the case, a pure, unfunded fully matured PAYG system can be regarded as fair: all generations are paying the same percentage of their wages as pension contributions, retiring at the same age and receiving pensions at the same replacement rate for all. Similarly, if public debt was accumulated by past generations, rolling it over (in a growing economy as a percentage of GDP) from one generation to the next is a way to share its burden equally across all current and future generations.

But this is not the world we are living in. Instead, the increase in public expenditure is mostly caused by declined fertility and increasing longevity, and the successive age cohorts differ from each other in these respects. Therefore, we should find a new benchmark for intergenerational fairness such that these essential factors are taken into account. This is presented by Oksanen (2004a), as inspired by Sinn (2000), resulting in a framework for calculating a wide range of options for changing the parameters of the pension system, and possibly introducing systemic reforms, including relying more on private sector managed pensions.

In the spirit of illustrating a possible approach which could lead to more refined applications with data on individual countries, we shall construct a simple scenario based on EU-12 data, observing that fertility has steadily declined since 1970 and longevity is assumed to increase gradually up until 2050. The assumption that fertility remains at its current level is an essential ingredient not only for the population projection, but also for intergenerational fairness. The assumption that longevity remains constant after 2050 is only a technical assumption which does not substantially matter for the current exercise (if longevity changes after 2050, this should affect the pension system parameters in force from 2020 onwards as the difference between the average age of retirees and workers is roughly 30 years).

The first argument is that an age cohort with a declined fertility should pay correspondingly more to the pension system, as otherwise, in the case where for example, payments are increased only much later when ageing public ageing-related expenditure increases, future generations would be obliged to bear the consequences.

A parallel argument is valid for the projected increase in longevity up until 2050. If current workers live longer but still retire at the same age as the current pensioners, and therefore enjoy retirement for more years, then fairness dictates that the former should pay more into the system than the sum currently paid out. If not, they leave an increasing burden to future generations.

These arguments are expressed in terms of adjusting the pension system, but as public pension systems are part of the general government finances, they can be extended to apply to the overall tax rate, given the projected ageing-related expenditure. We can, however, only arrive at an approximation as under the prevailing demographic transition, accurate fairness would, at each point in time, require different tax rates for different age cohorts depending on their demographic characteristics. As this is not envisaged, the

result only implements, at each point in time, the principle of fairness for all working-age cohorts on average.

These factors combined imply a rule of thumb that the tax rate should reach its permanent level in 2020. As for the path of adjustment, we do not prescribe any retroactive payments, yet for 2005 - the hypothetical implementation date of the new rule - a jump in the tax rate is introduced, such that it catches up to the level which it would have reached had the rule been followed in the past. This jump in 2005 covers 2/3 of the total increase as compared to the hypothetical case where population ageing would not take place (this is a tax rate which would maintain the debt level of 2004).

In addition, there is an issue about health and long-term care expenditure, which differs slightly from pensions because the projected increase therein is not only benefiting pensioners, but also younger cohorts. Therefore, we introduce a rule of thumb that 2/3 of this increase should be treated in parallel with pension expenditure, applying the principle that while still of working age, each generation should cover the ageing-related increase in this expenditure in advance. Thus, 1/3 of the increase is financed from taxes collected at each point in time, implying a gradually increasing tax component over the whole period 2005-2050. While once again the rule is simple, it serves as a reminder of the underlying issue.

Introducing these two gradually increasing components to the tax rate gives the result depicted in Figure 4, where we reproduce, for comparison, the result of the constant tax rate scenario. The debt level now decreases by 70% of GDP, by 20 percentage points less than in the constant tax scenario. For the budget balance the difference is more notable: in the new scenario it is 0.3% in 2005, instead of 1.8% with the constant tax, and in the range of 1.5-2% of GDP over 2010-2020 instead of around 3%.

This scenario is based on easily available data and rules of thumb on the demographic characteristics of succeeding generations.[6] Acquiring more detailed data on the demography, tax and pension contribution payments of each age-cohort in the past, the pension system and its reform in each individual country would be a demanding, yet most useful task. If made available, it could be easily incorporated into the framework developed here, incorporating it to determinants of the adjustment path of the tax rate.

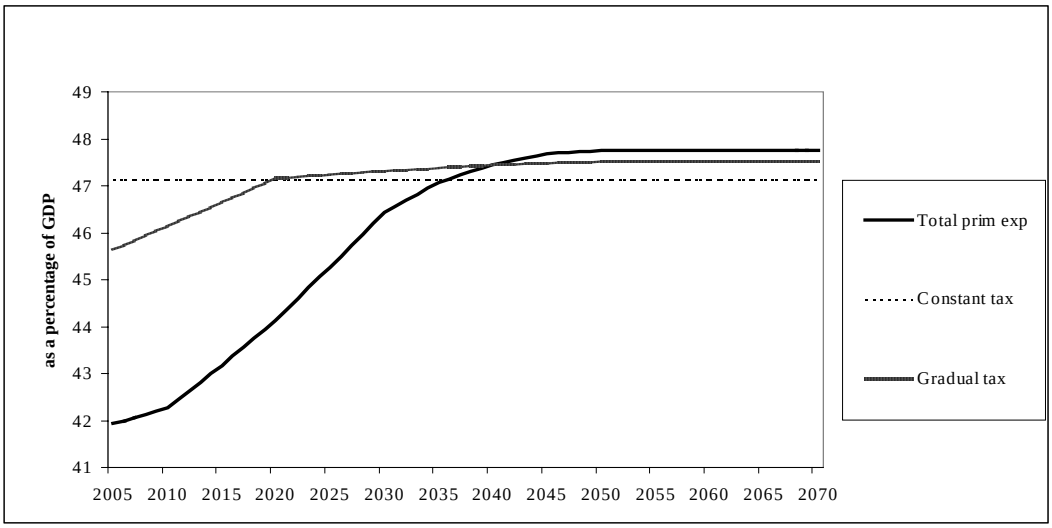
The crucial message is that when the differing demographic characteristics of succeeding generations are taken into account, the principle of fairness leads to a significant reduction of public debt and marked budget surplus is required. However, the time path for the surplus considerably deviates from the one implied by a constant tax rate scenario. Allowing a gradual adjustment, this may make the implied policy prescription more acceptable.

---

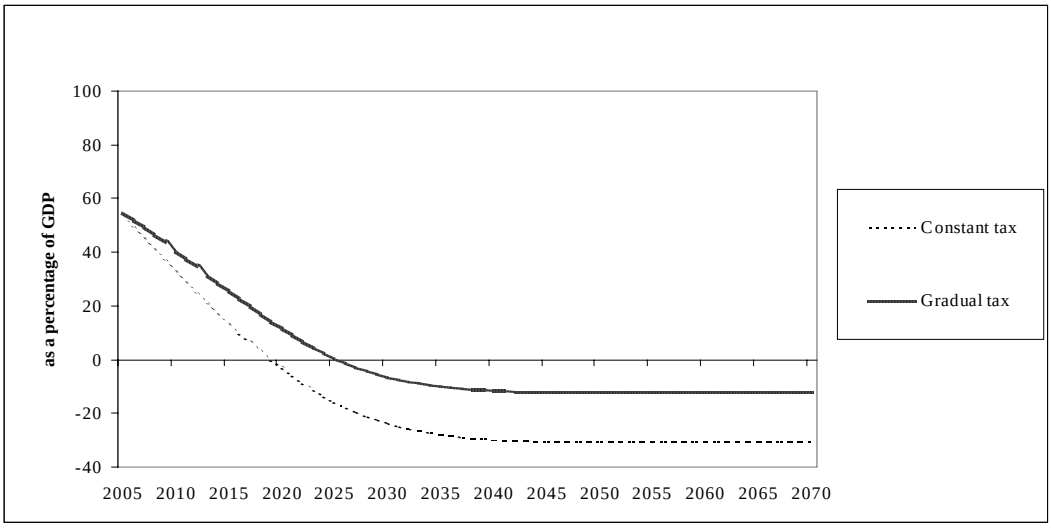
6 Notably, as the average replacement rate is projected to decline in our data, in constructing the scenarios above, we implicitly assume that it goes down smoothly with the rhythm of changing demographic characteristics of successive generations. This might be a good enough approximation for most EU Member States. Italy is, however, a clear exception. Its current rules lead to a projection that pension expenditure as a % of GDP, after having increased up until 2030, will nearly fall back to its current level by 2050. This means that even a constant tax rate scenario above is too favourable up until 2030, if intergenerational fairness is sought after.

**Figure 4. EU-12 public finances under alternative tax rates: constant and gradually changing tax rate for infinite horizon**

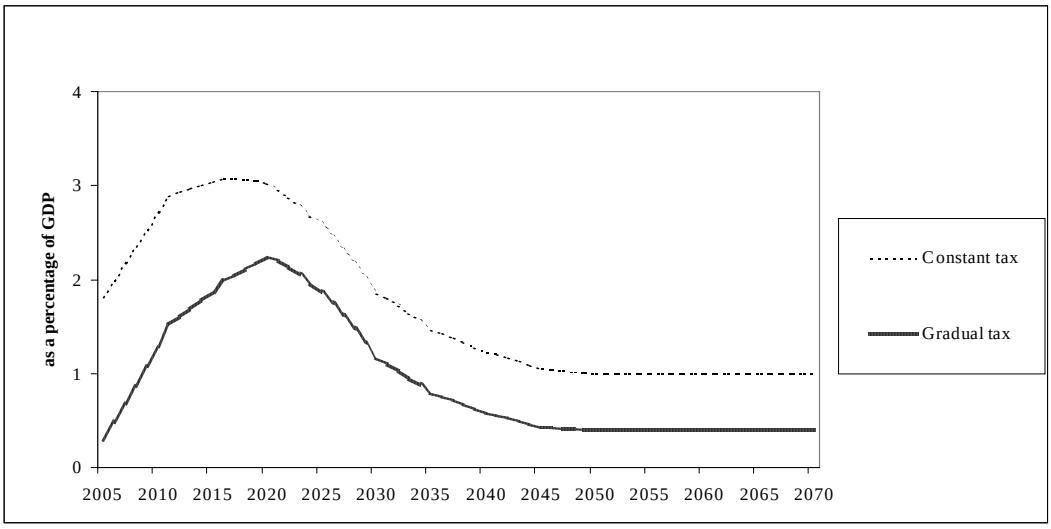
**a. Expenditure and taxes**




**b. Debt**




**c. Budget balance**



*The effects of the level of initial debt*

The framework presented here produces an interesting result with regard to the effect of the initial debt. This is illustrated in Figure 5 which depicts, in addition to the base case of the 57% initial debt ratio, another hypothetical case of initial debt of 20%.[7]

Firstly, the required tax rate (and therefore the primary balance) is naturally lower in the case with lower initial debt, by a factor which depends only on initial debt and the interest rate. Secondly, the *reduction* of debt is the same in both cases. Thirdly, in parallel with the identical reduction of debt, the shape of the path for the budget balance is the same, with only its level depending on initial debt. Fourthly, in the case of lower initial debt the budget balance is higher.

As these implications, except the first one, are not intuitively straightforward and may first look paradoxical indeed, some explanation is required. Recall that we are only looking into sharing the burden of initial public debt and the increase in public expenditure across successive generations, and assuming that the rate of interest adjusts to the rate of growth of the economy, which in turn is determined by the rate of growth of labour force (as the rate of productivity increase is assumed to be given).

Let us start with the last observation concerning the budget balance. With or without further changes in all relevant variables, there is a component in the budget balance stemming from servicing the initial debt. Rolling over the public debt as a percentage of GDP, assuming that nominal GDP grows by 4% p.a. and initial debt is 57% of GDP, the corresponding budget deficit component is constant at 2.2% of GDP. If initial debt is 20%, it is 0.8% (if it is zero, this budget balance component is naturally zero).[8]

The result that the *reduction* of the debt ratio is the same in both cases can be understood as follows: (1) future level of the GDP is lower than in a case without the fall in fertility and the consequent fall in labour force; thus the ratio of the initial public debt to future GDP increases with population ageing; (2) the rate of interest is assumed to be at a fixed margin above the GDP growth rate, i.e. it declines in line with the lower rate of growth; under the assumptions made, these two opposite effects cancel each other out; therefore, the resulting change in debt ratio is determined only by the increase in primary expenditure and the shape of the tax rate path, neither of which depend on the initial debt ratio (an algebraic proof can be found in Oksanen, 2004a; note that if the interest rate is fixed, and therefore leads to an increase in its margin over the rate of growth of the economy, reduction of debt is larger in a country with higher initial debt)

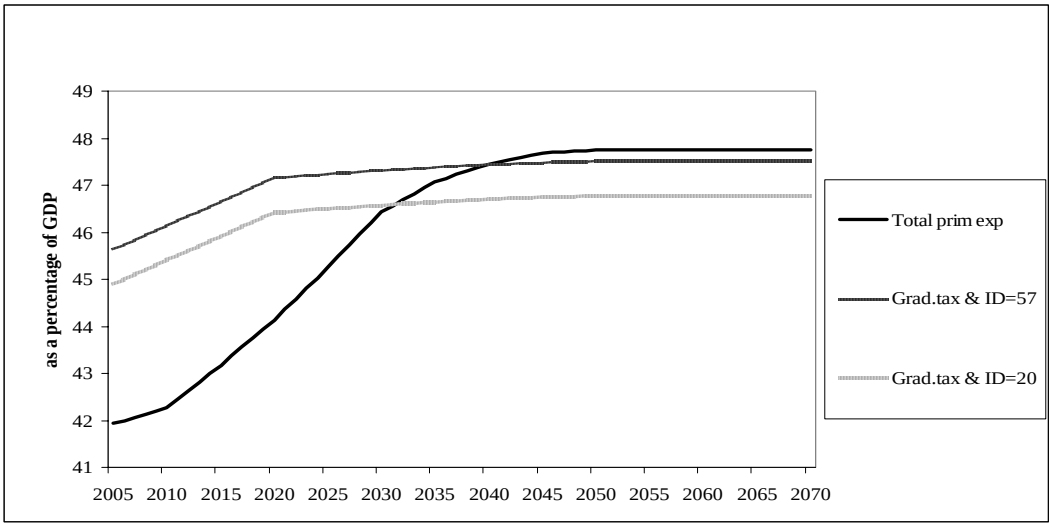
---

7 Note that these results are illustrated for the scenario with the gradual tax rate, but it would also hold for the constant tax rate scenarios with an infinite time horizon.

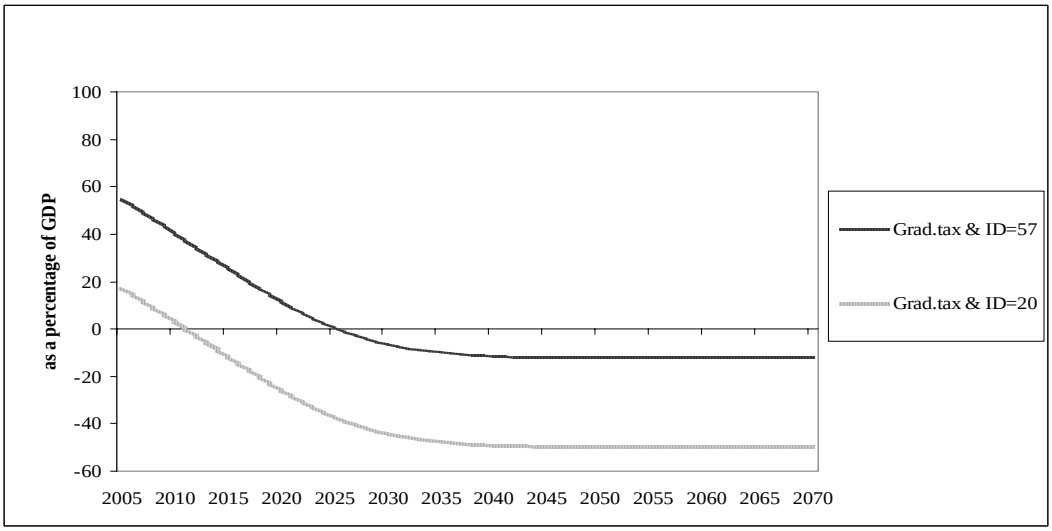
8 To help here: budget deficit is by definition equal to the change in the stock of debt; thus, to maintain the debt to GDP ratio in a growing economy, the deficit must be the larger the more indebted the country. Note also that it is the rate of growth of *nominal* GDP that determines this.

**Figure 5. EU-12 public finances under gradually changing tax rate with initial debt 57% or 20% of GDP**

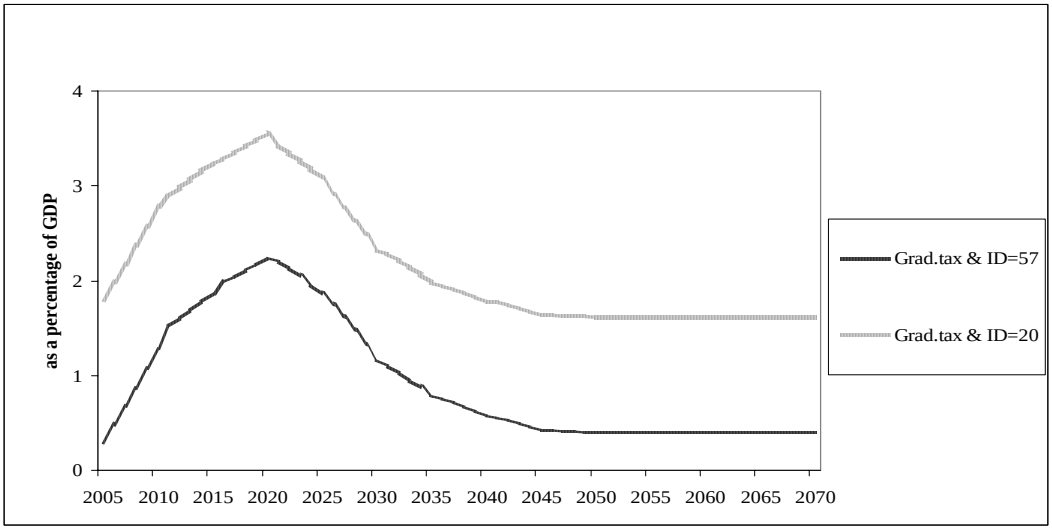
**a. Expenditure and taxes**




**b. Debt**




**c. Budget balance**



*Summary of the implications of scenarios based on the expenditure projections*

The main thrust of the exercise above is, firstly, that the simple rules presented previous studies for setting public finances on a sustainable path under the projected increase in population ageing related expenditure lead, for the EU-12 average, to an elimination of public debt and accumulation of net assets in the general government sector (Section 2 above). The assumptions behind this are simple, transparent and commonly accepted in this type of analysis. Secondly, the introduction of intergenerational fairness as an additional aspect for taking into account the differing demographic characteristics of succeeding generations, leads to a more gradual adjustment and somewhat smaller reduction in public net debt (Section 3; for a more detailed discussion of the assumptions, see Oksanen, 2003)

The main result derived from the EU-12 average figures is that public debt should, under the assumptions made, be eliminated in the next 20 years, and some net assets should be build-up thereafter; the corresponding budget balance surplus gradually increases to a 2% of GDP by 2020 and then declines to a small surplus.

This result might appear surprising to many observers, as well as the second main result that the target for debt reduction does not, under the assumption on the interest rate, depend on the initial net debt, therefore requiring a higher budget surplus in a country with a lower initial debt. However, these are the results which stem from the existing projection for public expenditure, initial debt and a transparently argued benchmark for distribution of burden across generations. They do not mean that there are not other relevant factors in setting the rules for public finances, but it seems fair to say that the results derived above are relevant regardless of other factors, and that they have not been fully incorporated in the previous discussion on setting public finance targets.[9]

Even if the results here might seem unexpected in quantitative terms, they are, in principle, fairly obvious and therefore they, or some aspects of them, have been discussed elsewhere. For example, by Coeure and Pisani-Ferry (2003), making their proposal for a Sustainability Pact, refer to the need to take the projected public expenditure increase (or an estimate of pension liabilities) into account in setting the targets for (net) debt and by implication for government deficit. However, they do not present implications in quantitative terms.

Also, to put the present results into a broader framework, it is useful to emphasise that we are dealing here with the medium term targets for public finances, and not, for example, with the advisable flexibility for budget deficit in any given year over the cycle. For example, there could, under EU rules, be legitimate grounds for allowing more flexibility for a country with low debt. This could be based on an original objective of the fiscal rules for the Economic and Monetary Union of the EU, namely that the Member States which have pursued a lax fiscal policy and have hence accumulated debt, should demonstrate their capability to move to sound public finances. Another argument could be that the generation which let the public debt accumulate should, as long as at least some of them are among the taxpayers, retroactively pay back part of the debt. However,

---

9 This becomes evident, for example, from the recent survey by Buti, Eijfinger and Franco, 2003.

the result above emphasises that the ceiling for budget deficit in any given year should depend not only on the required flexibility but also on the medium term target, and both of these are, in general, country specific.[10]

Furthermore, in interpreting the result for the debt reduction it should be remembered that it is conditional on the projection for the increase in expenditure. This way, the framework establishes a link between pension reforms and fiscal targets: if reforms are successful and lead to a smaller expenditure increase, the implied debt reduction is smaller. However, we should note here that the expenditure projections used in the scenarios already incorporate a decrease in the replacement rate by around one fifth, and an increase in effective retirement age especially for women. Without these factors the increase in expenditure would be much faster, which is obvious as the change in the old age dependency ratio is so much more than the increase in expenditure. One obvious implication is therefore that the ongoing work in the respective EU Committee to verify and update the underlying projections is most important.

It might also be useful to put the decrease in debt ratio derived here into historical perspective by simply observing that changes of nearly the is order of magnitude, albeit in the opposite direction, have recently taken place: from 1980 to 1995 public debt in the EU on average rose by 35% of GDP. Is it then so unrealistic to go now to the opposite direction, especially as there might be good arguments for this?

Subsequent to these comments, to obtain a deeper insight into the prescribed conditional reduction in net public debt, this is discussed in the following section, in a broader framework with the help of what is called *Implicit Pension Debt* in pension economics.

## 4. Recording the pension liabilities in national accounts and setting the public finance targets

*Background*

The current national accounting rules recognise the pension obligations as employer liabilities only if those obligations are funded, i.e. if they are (fully or partially) matched by segregated assets, whereas the main existing company accounting standards require

---

[10] For example, Calmfors and Corsetti (2003) argue in favour of allowing a higher deficit ceiling for a country with lower initial debt without considering the implication of the initial debt for the medium term deficit target; see also European Economic Advisory Group, 2003, Chapter 2. In proposing a Stability Pact for Public Debt, Gros (2003) correctly makes the point that, stemming the iron logic of the respective identity for deficit and net debt in a growing economy, for the countries above the 60% debt ratio, deficit ceiling of 3% of GDP, leads to faster debt reduction in a country with higher initial debt. This follows, of course, the same logic as the equally simple statement above that maintaining any given debt ratio requires a higher deficit in a country with higher initial debt. He does not consider the possible implications of increasing pension expenditure on debt and deficit targets.

their recording, whether funded or not. For example, from 2005 at the latest, all listed companies in the European Union will be required to record all their pension liabilities according to the International Accounting Standards provision IAS19. The purpose is to avoid the type of corporate scandals where pension liabilities have played a big role.[11]

As the nature of obligations does not qualitatively depend on the mode of meeting it, preparations are underway to follow the logic of corporate accounting and implement actuarial accounting for corporations and government as an employer as well as in national accounting.[12]

Here, we consider extending the same principles to all unfunded public pensions. Recent developments in pension economics help to clarify how this can be usefully and consistently done. The basic concept is *Implicit Pension Debt* (IPD) which is defined as the present value of pension rights accrued to date by current workers and pensioners (not to be confused with alternative measures, see Holzmann, Palacios and Zviniene, 2004). Its existence in a pure PAYG pension system with no assets – the most common mode of pension financing in the EU-12 – implies that, sometime earlier, a public pension system had been established and benefits had been given to one or more generation which had not contributed to the system at all or in any case less than the actuarial value of the pensions they received. Diamond and Orszag (2004, pp. 37-38) highlight the parallelism between explicit and implicit public debt by pointing out that explicit public debt reflects the accumulated difference between the spending and revenue from the beginning of the nation to the present, and under the pure PAYG system, implicit pension debt reflects the accumulated difference between pension benefits and revenue for previous and current beneficiaries.

A simple reference scenario is a steady state. Rolling over both explicit and implicit debt as a percentage of GDP is a way to share the burden equally across all current and future generations. Extending the benchmark for intergenerational fairness for a case of population ageing was already done in the previous sections with the result that explicit debt decreased dramatically. Here, the same rule is reconstructed for a stylised case, using the pension economics concepts and applying the proposed actuarial accounting principles. The result is a change in the composition of public debt.

The second key concept is *implicit tax* incorporated in the pension contributions. It is best understood as the excess of the contribution rate in the pure (or partially funded) public pension scheme, higher than that under a hypothetical fully funded system offering the same pension benefits (another expression: the implicit tax stems from the excess of the rate of interest in the financial market over the rate of change of the wage bill, levied on the IPD; see Sinn, 2000, Fenge and Werding, 2003a and 2003b and Oksanen, 2004a, for the origin and applications of this concept). It is instrumental in arriving at a consistent framework under the proposed accounting rules, making sense of

---

11 One of the latest improvements is the requirement that from 2005 at the latest, all listed companies in the European Union record all their pension liabilities according to the International Accounting Standards provision IAS19.

12 See de Rougemont, (2003), which is the Report by the Moderator of the Electronic Discussion Group (EDG) set by international organisations, and the contribution by the OECD Statistics Directorate (2004), both available at http://www.imf.org/external/np/sta/ueps/index.htm.

the newly defined budget balance which is consistent with the sum of explicit and implicit debt.

*Scenarios with stylised data*

The following scenarios are presented to clarify how the rules of pension systems operate under population ageing, and to extend the results for setting public finance targets.

To simplify coverage of the dynamics over generations, the unit period runs from one generation to the next – we can take it to correspond to 30 years, which is currently in EU countries the average childbearing age of women, and also, usefully for some applications, roughly the difference between the average age of a pensioner (70) and that of a worker (40).

The population is composed of children (*E*), workers (*L*) and retirees (*R*). The exercise starts with a stationary population, i.e. fertility at reproduction level, so that the number of people in each category is the same. The fact that in real life, the time in retirement is shorter than at work is taken into account by a correction factor. Until period 0, the ratio of time in retirement to time at work is assumed to be 0.45 (based on 18 and 40 years, respectively).

In period 1, fertility declines from 1 to 0.8. These figures roughly correspond to the 20% decline in the EU on average over a generation: the female generation born in the early 1940s, giving birth on average in the early 1970s, had fertility at the reproduction level of 2.1, while the most recent figure is 1.7. Also, for workers in period 1 and all subsequent generations, longevity is assumed to increase by five years. Assuming a fixed retirement age, the ratio of time in retirement to time at work increases to 0.575 (=23/40).

The unit wage in period 0 is set to 1. The real wage is assumed to increase by 70% in the unit period, corresponding to 1.78% per annum (p.a.) over 30 years. Inflation is assumed to be at 50%, i.e., 1.36% p.a. Neither of these two assumptions matter for certain key results concerning stocks in relation to the wage bill or GDP (which stand for the size of the economy), but in all cases they significantly affect deficit figures. The interest rate, assumed to be uniform, is set at 50% (or 1.36% p.a.) above the rate of growth of the economy (increase in the wage bill and the GDP, assumed for simplicity to be equal). These assumptions mean that the real interest rate in the initial steady state is 3.2% p.a. and then declines to 2.4% when the rate of growth of GDP also declines due to the demographic shock; these numbers broadly comply with the conventional assumptions for long-term scenarios.

The initial public pension system is assumed to be an unfunded, pure Pay-As-You-Go (PAYG) system with the replacement rate proper at 60%. This corresponds to an earnings-related, Defined Benefit (DB) system, under which 1.5 percentage points of the wage are accrued in each year over the assumed 40 working years, and pension rights are indexed to wages. Under such a system public sector liability can be clearly defined and measured. However, for the present analysis, the determination of pensions could be more nuanced as long as actuaries and statisticians can put a number on the liability.

In the initial steady state, the pure DB PAYG system requires a contribution rate of 27% (=60*18/40). The wage bill (net of pension contributions) is assumed to be 40% of GDP.

This simple key is used to transform the results into percentages of annual GDP.[13] All numbers used are but rough stylised facts, but one can note that they correspond to pension expenditure at 10.8% of GDP (=0.4*27), close to current estimates for the EU-15 on average.

In Table 1, periods 0-3 describe the transition from the initial to the new steady state, driven by demographic change and pension system adjustments. The figures for periods -1 and 4 are displayed to show that the system moves from one steady state to another as none of the relative numbers change from period -1 to 0 nor from period 3 to 4. The table presents the results in percentages of the wage or the GDP to illustrate their economic meaning. A more detailed presentation, giving all transactions in monetary units so that they can be inserted into a full accounting framework, can be found in Oksanen (2004b).

*Scenario 1* displays *the pure PAYG system with no adjustment* for period 1. The new contribution rate required from period 2 onwards is 43.1%. Under the current SNA/ESA accounting system, nothing interesting happens to the deficit or funding as the system is always by definition in balance: contributions are adjusted to cover the expenditure. Let us omit the memorandum items for the moment.

What should be noted in Scenario 1 is the increase in the required contribution rate. Apart from issues related to the effects of such an increase, the question of fairness can be invoked, along the lines already discussed in section 3 above: why should the generation of workers in period 1 which initiated the decline in fertility escape the increase in the pension contribution rate required from all future generations? If all generations with the same demographic characteristics are to be treated equally, the pension regime already needs to be changed for period 1 workers.

In *Scenario 2* the contribution rate is increased in period 1 to its permanent level of 37.75%. It is lower than future pension expenditure as a percentage of the wage bill thanks to the proceeds of the fund which reaches 129% of GDP (the algebraic formulas to calculate these numbers are presented in Oksanen, 2004a). Over period 1 - the first period of the demographic shock - the financial surplus of the system is 6.5% of GDP, and in the new steady state, 3.0%.

This is where conventional national accounting stops. However, the memorandum items add useful information about underlying variables. Firstly, the tables display the *Implicit Pension Debt* (IPD) which, for each period, is defined as the pension expenditure in the next period, discounted at the prevailing rate of interest. The IDP with its negative sign plus the assets in the newly created Fund is displayed as a percentage of GDP on row 18. For Scenario 2 the most essential issue is that the latter variable remains at 216% of annual GDP over the transition: this shows that, under the assumptions made, the prescribed policy rule implies neutrality across generations. This contrasts with the

---

13 The stocks of financial variables are transformed to a percentage of annual GDP by multiplying by 30 as the unit period is 30 years. The budget balance figures are adjusted to be compatible with annual accounting by adjusting the denominator to be the average GDP over each 30-year period.

increase in the IPD in Scenario 1 from 216% to 345% of GDP, which is a measure of the future pension burden as no counterbalancing assets are accumulated.

Secondly, the figures for *implicit tax* (row 14) complete the picture. It is constant under a steady state, initially 9% of wages, and may change under population ageing. In Scenario 1 - the pure PAYG with constant benefits and retirement age - workers in period 1 gain considerably: their implicit tax is negative, -1.8%, which also explains why all subsequent generations have to pay a higher implicit tax of 14.4%. In Scenario 2 the unfairness is eliminated and everybody pays the 9% implicit tax.[14]

Scenario 2 still leads to a high contribution rate, and it should not be assumed that the prescribed combination of benefits and contributions is the most desired one. The key to construct other options is to assume that the acquired rights of period 1 retirees are fully respected and the principle of intergenerational fairness is also strictly followed from period 1 onwards, but – in contrast with scenario 2 – the size of the public system for workers in period 1 and after is decided independently of its previous size. *Scenario 3* is one such case: the contribution rate is maintained at 27% and the benefits are adjusted accordingly, starting with those for period 1 workers, so that the accrual rate is adjusted with the effect that the replacement rate reduces from 60% to 37.6%. This scenario preserves the pure PAYG system, and at the same time, respects the benchmark for intergenerational fairness.[15]

The main result from Scenarios 2 and 3 is that the same benchmark for intergenerational fairness which would under a steady state justify maintaining a pure PAYG system, leads under population ageing, to an argument for moving to partial funding, unless the benefits are reduced accordingly. Thus, in any other case which is a variant between Scenarios 2 and 3, the pension system should run a budget surplus, as defined under the current national accounts. This surplus should then be fed to determining the budget balance target for the whole general government, as otherwise the funding in the public pension system would not serve its intended purpose.

---

14 The table also displays the *internal rate of return* for each generation of retirees defined as the rate earned on contributions in terms of pension benefits. As explained in the seminal paper by Samuelson (1958), in pure PAYG systems under a steady state this rate is equal to the increase in the wage bill. The scenarios here tackle the more interesting and relevant issue of what happens under ageing: in Scenario 1, period 1 workers receive, as retirees in period 2, an undue exceptionally high rate of return of 4.0%, after which it falls to 2.4% for all future generations. If this unfairness is eliminated, as in Scenario 2, by already increasing the contributions in period 1, the rate of return declines to its permanent level of 2.9% already for the first transitional generation (which, in the partially funded system, is a weighted average of the rate of change of the wage bill and the interest rate).

15 Interestingly, this scenario can also be interpreted as a transition to a Notional Defined Contribution (NDC) system, where the fixed pension contributions are registered on notional individual accounts earning an administratively fixed rate of interest, and where the capitalised value at retirement is transformed to an annuity paid out as a pension. If the notional rate of interest is set as the rate of growth of the wage bill, pension expenditure and contribution revenue are equal in the long run (for further explanations, see Oksanen, 2004). In the assumed simplified setting, this is sufficient for full financial stability of the system.

# Table 1. Scenarios for population ageing and pensions

**Common assumptions for all scenarios:**
Initially,
- fertility preserves a constant population,
- 40 years at work and 18 in retirement,
- replacement rate proper 60%; pension expenditure 60*18/40=27% of the wage bill,
- pure PAYG system, thus contribution rate is 27%.

In period 1,
- fertility declines by 20% and remains at this level,
- longevity increases so that from period 2 onwards 23 years in retirement.

Economic assumptions:
- real wages increase 70% over the unit period of 30 years (1.78% per annum),
- price level increases 50% over the unit period of 30 years (1.36% per annum),
- unit period interest rate is 50% over the rate of growth of nominal wage bill (1.36% per annum),
- wage bill after pension contributions is 40% of GDP.

For explanation of the proposed revised accounting, see the main text.

**Demographic and economic variables common for all scenarios**

| | **Period** | **-1** | **0** | **1** | **2** | **3** | **4** |
|---|---|---|---|---|---|---|---|
| 1 | E children | 100 | 100 | 80 | 64 | 51.2 | 41.0 |
| 2 | L labour | 100 | 100 | 100 | 80 | 64 | 51.2 |
| 3 | R retired | 100 | 100 | 100 | 100 | 80 | 64 |
| 4 | W wage bill | 39.2 | 100 | 255 | 520 | 1061 | 2165 |
| 4 | Change in wb, % per annum | 3.2 | 3.2 | 3.2 | 2.4 | 2.4 | 2.4 |
| 5 | Interest rate, % per annum | 4.6 | 4.6 | 4.6 | 3.8 | 3.8 | 3.8 |
| 6 | Oadr (60+/20-59), %[1] | 45.0 | 45.0 | 45.0 | 71.9 | 71.9 | 71.9 |

[1] = Old age dependency ratio: ratio of 60+ years old to those aged 20-59 years.

**Scenario 1.** Pure PAYG, replacement rate constant at 60%

| | **Period** | **-1** | **0** | **1** | **2** | **3** | **4** |
|---|---|---|---|---|---|---|---|
| 7 | Pens. expenditure, % of wage bill | 27.0 | 27.0 | 27.0 | 43.1 | 43.1 | 43.1 |
| 8 | Pens. contribution rate, % of wage | 27.0 | 27.0 | 27.0 | 43.1 | 43.1 | 43.1 |
| 9 | Fund assets/annual GDP, %[2] | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | Budget balance/GDP, %[3] | 0 | 0 | 0 | 0 | 0 | 0 |
| **Memorandum items** | | | | | | | |
| 11 | - IPD/annual GDP, %[2] | -216 | -216 | -345 | -345 | -345 | -345 |
| 12 | (- IDP+Fund)/annual GDP, %[2] | -216 | -216 | -345 | -345 | -345 | -345 |
| 13 | Internal rate of return, % per annum | 3.2 | 3.2 | 3.2 | 4.0 | 2.4 | 2.4 |
| 14 | Implicit tax/wage, % | 9.0 | 9.0 | -1.8 | 14.4 | 14.4 | 14.4 |
| **Proposed revised accounting** | | | | | | | |
| 15 | Budget balance/GDP, %[3] | -6.6 | -6.6 | -13.2 | -8.1 | -8.1 | -8.1 |

[2] The ratio is transformed to percentage of annual GDP by multiplying by 30.

[3] Adjusted to be compatible with annual accounting.

**Scenario 2.** Partial funding, replacement rate constant at 60%

| | Period | -1 | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|
| 7 | Pens. expenditure, % of wage bill | 27.0 | 27.0 | 27.0 | 43.1 | 43.1 | 43.1 |
| 8 | Pens. contribution rate, % of wage | 27.0 | 27.0 | 37.8 | 37.8 | 37.8 | 37.8 |
| 9 | Fund assets/annual GDP, %[2] | 0 | 0 | 129 | 129 | 129 | 129 |
| 10 | Budget balance/GDP, %[3] | 0 | 0 | 6.5 | 3.0 | 3.0 | 3.0 |
| **Memorandum items** | | | | | | | |
| 11 | - IPD/GDP, %[2] | -216 | -216 | -345 | -345 | -345 | -345 |
| 12 | (- IDP+Fund)/GDP, %[2] | -216 | -216 | -216 | -216 | -216 | -216 |
| 13 | Internal rate of return, % per annum | 3.2 | 3.2 | 3.2 | 2.9 | 2.9 | 2.9 |
| 14 | Implicit tax/wage, % | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| **Proposed revised accounting** | | | | | | | |
| 15 | **Budget balance/GDP, %[3]** | **-6.6** | **-6.6** | **-6.6** | **-5.1** | **-5.1** | **-5.1** |

[2] The ratio is transformed to percentage of annual GDP by multiplying by 30.

[3] Adjusted to be compatible with annual accounting.

**Scenario 3.** Replacement rate reduces from 60% to 37.6%: pure PAYG, DB or NDC

| | Period | -1 | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|
| 7 | Pens. expenditure, % of wage bill | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 |
| 8 | Pens. contribution rate, % of wage | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 | 27.0 |
| 9 | Fund assets/GDP, %[2] | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | Budget balance/GDP, %[3] | 0 | 0 | 0 | 0 | 0 | 0 |
| **Memorandum items** | | | | | | | |
| 11 | - IPD/GDP, %[2] | -216 | -216 | -216 | -216 | -216 | -216 |
| 12 | (- IDP+Fund)/GDP, %[2] | -216 | -216 | -216 | -216 | -216 | -216 |
| 13 | Internal rate of return, % per annum | 3.2 | 3.2 | 3.2 | 2.4 | 2.4 | 2.4 |
| 14 | Implicit tax/wage, % | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| **Proposed revised accounting** | | | | | | | |
| 15 | Budget balance/GDP, %[3] | -6.6 | -6.6 | -6.6 | -5.1 | -5.1 | -5.1 |

[2] The ratio is transformed to percentage of annual GDP by multiplying by 30.

[3] Adjusted to be compatible with annual accounting.

The newly defined debt ratio, including IPD and assets, and implicit tax (rows 12 and 14) are identical under Scenarios 2 and 3. They therefore serve, under the assumptions made, as indicators of fairness across generations. This would also hold to all combinations of Scenarios 2 and 3, thus allowing for specifying an infinite number of pension reforms with this property.[16]

---

16 The Scenarios assume a fixed retirement age of 60. The dramatic changes in either contributions or benefits caused by population ageing indicate that the retirement age will probably be increased, allowing a more favourable combination of contributions and benefits. These are not explored here as the three-period model is not sufficient to capture the dynamics, and the simplified examples above suffice for the purposes of analysing alternative national accounting rules. It is fairly straightforward to see that the results for the accounting definitions are valid in more complex circumstances, while, for example, estimating the IPD for a changing retirement age under a pension system which is not fully actuarially fair is, in practise, a complex task. Some illustrations with yearly data can be found in Oksanen, 2004.

*The proposed revision of accounting definitions*

While the current SNA/ESA concepts, accompanied by the memorandum items, provide a useful framework for policy design, the next step is to discuss the application of the proposed actuarial accounting definitions to public social insurance pensions.

Let us look first into period 0, the initial pure PAYG system in any of the scenarios 1-3. Pensions paid to retirees are now defined as financial transactions, stemming from contributions paid in the previous period when the recipients were workers. Application of these definitions is not, however, entirely straightforward, because in a pure PAYG system contributions are not invested in interest yielding assets, but used for pensions of the previous generation, so that there is no explicit financial revenue from the contributions.

As some of the key financial variables are not real and observable, they must be replaced by book-keeping entries imputed by actuaries and statisticians, advised by pension economists. The key to consistent accounting is the concept of 'implicit tax'. The last row gives the newly defined budget balance (as a percentage of GDP for a more interesting interpretation). In each period the 'implicit tax' - part of the pension contribution is recorded as government revenue, while the rest is recorded as a financial transaction. Government revenue also includes interest on its assets, and expenditure includes the imputed interest (set to follow the market rate of interest) on the part of contribution, which was in the previous period recorded as a financial transaction. These three flows compose the budget balance.

The portion of pension contributions recorded as a financial transaction is by definition equal to the present value of the pension in next period. In other words, the pension paid out is a financial transaction composed of the principal and the imputed interest. The liability is thus entered into the government balance sheet and in parallel, should be recorded as an asset held by the households. This government liability is the same as Implicit Pension Debt under the memorandum items. Under the proposed system, it should no longer be called 'implicit' as the very idea under the proposed revision is to record it explicitly in the accounts. One possible expression for this liability, estimated by an actuary, is 'Imputed Pension Debt', still IPD for short. In current statistical terminology it is, "Net equity of households on pension funds".

Row 15 for Scenarios 2 and 3 show the result for the deficit ratio under the proposed accounting system. The deficit numbers are the same for both scenarios, declining from 6.6% to 5.1% only because the economic growth rate declines as a result of the shrinking labour force (the deficit ratio which keeps the debt ratio constant is d*g/(1+g), where d is the debt ratio and g is the nominal rate of growth).

For Scenario 1, the memorandum items and the revised system considerably add to the information provided by the by-definition-zero-deficit according to the current SNA/ESA. The implicit debt increases from 216% to 345% of GDP, and the deficit according to the new definition first increases from 6.6% of GDP in the initial steady state to 13.2% in period 1 and then settles to 8.1% of GDP. These high numbers indicate that period 1 workers increase the burden to be left to future generations, though it should be understood that under the revised accounting the correct benchmark for

fairness is not zero deficit, but rather, the 6.6% for period 1 and 5.1% thereafter, derived from Scenarios 2 and 3.

Comparing the results on the public debt and budget balance under the current national accounting rules and under the proposed actuarial accounting imply that the latter can be usefully applied in setting targets for public finances. This can be argued on two grounds, firstly, to clarify further the link between pension reforms and public finance targets, and secondly, to consistently cope with cases where pension liabilities are shifted between corporations and government.

*Setting targets for fiscal variables under population ageing*

The conclusions from the stylised pension system examples in this section can be extended to cover the whole general government sector, notably from the point of view of setting targets for government deficit and debt, i.e. the issues covered in Sections 2 and 3. This can be done by assuming that some explicit public debt existed in the initial steady state. Furthermore, any other ageing-related public expenditure could be added to pension expenditure. Under these additional assumptions, intergenerational fairness would have the additional meaning that not only the burden of implicit pension debt but also that of the initial explicit debt is shared equally across all current and future generations.

This extension leads to a set of modified scenarios with the difference being that the initial debt/GDP –ratio would be added to all (gross and net) debt figures and, correspondingly, the deficit/GDP ratio would have an additional component (which, in all cases, changes due to the change in the GDP growth rate).

Table 2 illustrates one such scenario. Initially, public debt is assumed to be 60% of GDP and the pension system assumptions above are maintained. Under current national accounting, public expenditure includes pensions and interest on debt, and public revenue in composed of pension contributions and a tax for servicing public debt so that its share of GDP is constant. These items are sufficient to cover the transactions which determine burden sharing across generations (i.e. all other public expenditures are assumed to be covered by other tax components; public investment could affect burden sharing across generations and it could be introduced to the framework, if considered relevant).

In period 1 as population ageing starts, the pension system is reformed by reducing the accrual rate so that the replacement rate reduces to 50% of wage for period 1 workers and onwards, and the contribution rate is set according to the rule for intergenerational fairness, i.e. to the level which can be maintained over an infinite period.

Interestingly, these very rough numbers lead to a reduction in public debt by 71.5% of GDP, which is almost exactly the same as in the exercise above with the EU-12 expenditure projection and the gradually increasing tax rate. Government budget balance moves from -1.8% of GDP to surplus of 1.8% over the 30-years long transitional period and then settles down to a 0.3% of GDP surplus in the new steady state. These results indicate that the simple assumptions on the demographic change and the assumption that pension replacement rate reduces from 60% to 50% roughly correspond to the EU-12 projections above, even though many details are left outside the simple framework here,

nor are they spelled out in either one of them (also, the interest rate margins are different).

## Table 2. Scenarios for General government; initial debt 60% of GDP, replacement rate reduced to 50%

For the assumptions on the pension system and the economy, see Table 1.
For explanation of the proposed revised accounting, see the main text.

| | Period | -1 | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|
| 7 | Pens. expenditure, % of wage bill | 27.0 | 27.0 | 27.0 | 35.9 | 35.9 | 35.9 |
| 8a | Pens. contribution rate, % of wage | 27.0 | 27.0 | 33.0 | 33.0 | 33.0 | 33.0 |
| 8b | Tax/wage for serv. initial debt, % | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| 8c | Total tax/wage, % | 29.5 | 29.5 | 29.5 | 35.5 | 35.5 | 35.5 |
| 9b | Assets of gov./GDP, %[2] ( - indic. debt) | -60.0 | -60.0 | 11.5 | 11.5 | 11.5 | 11.5 |
| 10 | Budget balance/GDP, %[3] | -1.8 | -1.8 | 1.8 | 0.3 | 0.3 | 0.3 |
| **Memorandum items** | | | | | | | |
| 11 | - IPD/ GDP, % | -216 | -216 | -288 | -288 | -288 | -288 |
| 12 | (- IDP+assets)/GDP, % | -276 | -276 | -276 | -276 | -276 | -276 |
| 14 | Implicit tax in pension contr./wage, % | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| **Proposed revised accounting** | | | | | | | |
| 15 | Budget balance/GDP, %[3] | -8.5 | -8.5 | -8.5 | -6.5 | -6.5 | -6.5 |

[2] The ratio is transformed to percentage of annual GDP by multiplying by 30.

[3] Adjusted to be compatible with annual accounting.

Thus, the simplified example reiterates the result of Section 3 above that, under the assumptions made, current national accounting concepts provide a basis for setting the targets for the key fiscal variables, i.e. public debt and deficit, and that these targets depend on the initial debt and projected public expenditure under the prescribed pension system rules and other relevant provisions.

The IPD and the budget balance under the proposed actuarial accounting provide further insight. Total public net debt, i.e. explicit and implicit debt minus financial assets held by the government, stays constant as a percentage of GDP over the demographic transition and implementation of the assumed pension reform. Budget balance declines from 8.5% to 6.5% of GDP, solely as a result of the decline in the growth rate of the economy (as these figures correspond to the constant public debt ratio). These figures would be the same for all pension reform scenarios which comply with the benchmark for intergenerational fairness. This follows from the principle that all accrued rights until period 1 are respected, and the burden of previously accumulated explicit and implicit debt is shared equally between all current and future workers. This leaves open the size of the future pension system: whatever size is chosen, the contributions are adjusted accordingly, and all generations are treated equally.

To conclude, this exercise has shown that under the stated assumptions, notably the one on the interest rate, i.e. that it is a fixed margin above the rate of growth of the economy, the requirement of sustainability of public finances, combined with a simple benchmark for intergenerational fairness leads to neat results with regard to setting the fiscal targets: total debt as a percentage of GDP should stay constant. This is an advantage of the

proposed actuarial accounting framework which records the pension liabilities of the government as public debt. Also, the proposed framework makes a clear distinction between pension rights accrued to date and those to be accrued in future. This is useful in designing pension reforms and clarifying as to how different groups are treated under each reform proposal.

The stated assumption on the interest rate is crucial. It means that the factor used to compare the value of transactions at different points in time is indexed to the rate of growth of the economy. This leads to the neat result that intergenerational fairness is associated with a constant debt ratio even if demographic structure and the pension system rules for future benefits are changed.

Naturally, if the interest rate followed another pattern, the results would change. For example, if the interest rate is fixed and therefore its premium on top of the growth rate would increase under shrinking labour force. Then, the policy prescription above would lead to a decrease in the debt ratio over the demographic transition: this would simply result from a higher discount factor used to arrive at the estimate for IPD. However, the debt ratio in the new steady state would again stay constant. Thus, the framework above would suit well for such extensions and generalisations as compared to assumptions made for the illustrations above, and provide guidance for public finance target setting under more general conditions.

*The revision facilitates consistent treatment of employer schemes and public pensions*

As an important further advantage, actuarial accounting is able to cope consistently with specific transactions which shift pension liabilities between sectors, for example, if the government receives a lump sum payment from a corporation and takes over its pension liabilities. Under the proposed accounting rules, such a case is clearly a financial transaction, where the increase in liability and payment received cancel out each other, with no effect on the newly defined net debt and budget deficit. This is an improvement as compared to the problems encountered under the current SNA/ESA.

Under the current rules there is no ideal solution for such cases, which is problematic as the decisions have an impact on implementation of EU public finance rules. Three recent Eurostat decisions confirm this conclusion. For cases where public corporations have made payments to the government in the context of the transfer to government of their pension obligations, the decision under the currently prevailing ESA-95 was that these transactions should be treated as capital transfers rather than financial transactions (Eurostat news releases of 21 October, 2003, and 25 February, 2004). In the decision on the "classification of funded pension schemes in case of government responsibility or guarantee", it was decisive that such schemes be classified outside the government sector (Eurostat news release of 2 March, 2004). This essentially means that, under a pension reform which moves towards (partial) funding and private management, government deficit and net debt increase and the corresponding decrease in future liabilities is not recognised. This follows from the simple fact that under this clarification of the rules, the accumulating surplus in the newly established pillar is not recorded as part of net government revenue.

These decisions by Eurostat were not taken without any problems. According to the majority of experts who gave their opinion during the deliberations, they were the best

compromise solutions under the current framework. In both cases, however, a minority of one third of the experts took another view. In the former case they preferred the payments to be classified as financial transactions, and in the latter, they would have preferred to draw the line between government and financial institutions in such a way as to maintain the mandatory second pillar pension funds within government, thereby avoiding the effect on government deficit due to the pension reform in question.

Essentially, under current SNA/ESA definitions, no good solutions are available in such situations. It is hard to envisage any framework for a clear improvement other than the proposed revised SNA described above. Application of its principles, refined with the concept of implicit tax for public pension systems, solves both situations above.[17] For the latter, privatisation (whether partial or full) would not influence the newly defined government debt and deficit as compared to the corresponding fully public system.[18]

## 5. Summary and conclusions

Most previously used indicators for sustainability of public finances take a constant tax rate required to finance a projected public expenditure as a reference scenario. Although this is appealing for its simplicity, considerations about sharing the burden of increasing population ageing related public expenditure, notably pensions, equitably across generations, leads to a refined framework which prescribes a gradually increasing tax rate. This framework, incorporating a benchmark for intergenerational fairness based on the fertility and longevity of successive generations, can be used for setting targets for government deficit and debt.

An illustration based on the expenditure projections for EU-12, indicates a budget balance surplus, as defined in current national accounts, of around 1.5% of GDP by 2010 and further, of 2%, by 2020. Debt reduction is about 40% in the fist 15 years and 70% until the total adjustment. As the expenditure projection is conditional on the prevailing pension system rules, the framework can be used to discuss pension reforms and other policies to help contain ageing-related expenditure. Any changes in policy then lead to another set of targets for public finances in general.

As the significant budget surplus and debt reduction associated with the projected public expenditure increase look very ambitious indeed, it is useful to put them into a broader analysis of estimating the Implicit Pension Debt of the government, i.e. the commitments made and expectations of future pensions generated by the stated rules. This is done by moving to actuarial accounting also in national accounts (SNA/ESA), following the already implemented provisions for corporate accounts. Preparations are already well underway to do this with regard to pension liabilities of corporations and government as

---

17 Recording the implicit pension liabilities in public debt is advocated also by Coeure and Pisani-Ferry (2003): “ESA 95 should be gradually extended to include a commonly agreed measure of such items”.

18 This does naturally not exclude situations where adjustment to the total contribution and replacement rates are combined with privatisation. However, it should be possible to logically separate such different elements from each other. The proposed revised framework suits this purpose well.

an employer. This paper shows how this principle can be extended to public pensions which are normally unfunded and (largely) financed from compulsory pension contributions or taxes. It is shown that this can be consistently done with the help of the concept of 'implicit tax'. Under the new accounting definitions, the principle of fairness across generations leads to the rule that each generation should pay into the public pension system the actuarial value of their future pensions and the implicit tax for servicing the liability that stems from the fact that some previous generations had contributed to the system less than the actuarial value of the pensions they received.

Illustrations with a simple three-period/three-generations model explain the functioning of the current SNA/ESA and the proposed SNA revision. Combined with the benchmark for intergenerational fairness, each of the alternative national accounting systems provides a framework for setting the targets for government deficit and debt. Most importantly, under the proposed SNA revision, public debt will rise to a new order of magnitude as it will include pension liabilities not currently contained in government balance sheets. Government deficit will consequently also shift to a new level.

While setting the targets for public finances can be dealt with under both the current and proposed national accounting definitions, taking into account all relevant guidance of recent findings in pension economics, the clearest advantages of implementing the proposed actuarial accounting to all sectors appear in situations where pension liabilities are shifted from the corporate sector to government, and where part of the public pension system is privatised. Such situations are encountered, for example, under implementing the current fiscal rules of the European Union.

Apart from the practical difficulties in estimating the pension liabilities of the government and recoding it in national accounts, the most important obstacle to smooth implementation of the proposed actuarial accounting rules might be that everyone should become accustomed to a new order of magnitude for public debt and deficit. In the European welfare states it may rise from the current explicit debt of 60% of GDP to 280%, for example, and an acceptable figure, consistent with the simple benchmark for intergenerational fairness, for the deficit could be 6-8% of GDP, while the deficit could rise well over 10% if pension reforms flounder and an increasing burden is passed to future generations. Extending the proposed national accounting treatment to public pensions is therefore a major issue, and its successful implementation requires that not only experts but also politicians and many others understand and accept the new accounting concepts.

However, it should be noted that even if a comprehensive revision of the SNA for public pension schemes were not implemented, applying the new rules to government as an employer would make an important change to public debt and deficit figures. As the wage bill of government employees in EU-15 is around 10% of GDP, and the stylised figures above assumed that the covered wage bill was 40%, the effects on debt and deficit would be about one quarter of the figures referred to above, i.e. the level of public debt would jump from 60% to 110% in the example above. This alone requires that moving from the current debt and deficit concepts is understood and accepted, and consistently implemented to provisions on public finance targets.

**REFERENCES:**


Balassone, F. and Franco, D. (2000), "Assessing fiscal sustainability: a review of methods with a view to EMU", in *Fiscal sustainability*, Banca d'Italia.

Blanchard, O. J. (1990), "Suggestions for a new set of fiscal indicators", Organisation for Economic Cooperation and Development, Department of Economics and Statistics, Working Paper, No. 79.

Buiter, W. H. (1985), "A guide to public sector debt and deficits", *Economic Policy*, November 1985.

Buiter, W. H. and Grafe, C. (2002), "Patching up the Pact: some suggestions for enhancing fiscal sustainability and macroeconomic stability in an enlarged European Union", *CEPR Discussion Paper* No. 3496, August 2002.

Buti, M., Eijfinger, S. and Franco, D. (2003), "Revisiting the Stability and Growth Pact: grand design or internal adjustment?", No 180, *Economic Papers* –series of the Directorate-General for Economic and Financial Affairs of the European Commission, http://europa.eu.int/comm/economy_finance/document/ecopap/ecpidxen.htm

Calmfors, L. and Corsetti, G. (2003), "How to reform Europe's fiscal policy framework", *World Economics Journal*, 2003:1.

Chalk, N. and Hemming, R. (2000), "Assessing fiscal sustainability in theory and practise", *IMF Working Paper*, 00/81.

Chouraqui, J-C, Hagemann, R.P. and Sartor, N. (1990), "Indicators of fiscal policy: a re-examination, Organisation for Economic Cooperation and Development, Department of Economics and Statistics, Working Paper, No. 78.

Coeuré, B. and Pisani-Ferry, J. (2003), "A Sustainability Pact for the Eurozone", paper dated 10 February, 2003, at http://www.pisani-ferry.net/.

Cros, D. (2003), "A Stability Pact for Public Debt?", *CEPS Policy Brief*, No. 30.

de Rougemont, Ph. (2003), "The Treatment of Employer Retirement Pension Schemes in Macroeconomic Statistics – The EDG on Pensions December 2003 Report", the Report of the Moderator of the Electronic Discussion Group (EDG), reporting to the Intersecretariat Working Group on National Accounts (ISWGNA), available on the EDG website at http://www.imf.org/external/np/sta/ueps/index.htm

Diamond, P.A. and Orszag, P.R. (2004), *Saving Social Security, A Balanced Approach*, Brookings Institution Press, Washington, D.C.

Economic Policy Committee (2001), "*Budgetary challenges posed by ageing populations*", October 2001; EPC is a committee of the European Union; the report is available at http://europa.eu.int/comm/economy_finance/epc/documents/ageing_en.pdf

European Commission (2003), "Public finances in EMU 2003", *European Economy*, No 3/2003.

European Economic Advisory Group at CESifo (2003), "*Report on the European Economy 2003"*, Ifo Institute for Economic Research.

Eurostat news release of 21 October, 2003, "New decision of Eurostat on deficit and debt, Payment to government by public corporations in the context of the transfer to government of their unfunded pension obligations".

Eurostat news release of 25 February, 2004, "New decision of Eurostat on deficit and debt, Payment to government by public corporations in the context of the transfer to government of their pension obligations".

Eurostat news release of 2 March, 2004, "New decision of Eurostat on deficit and debt, Classification of funded pension schemes in case of government responsibility or guarantee".

Fenge, R., and Werding, M. (2003a), "Ageing and the Tax Implied in Public Pension Schemes: Simulations for Selected OECD Counties", *CESifo Working Paper* No. 841.

Fenge, R., and Werding, M. (2003b), "Ageing and Fiscal Balances Across Generations: Concepts of Measurement", *CESifo Working Paper* No. 842.

Frederiksen, N. K. (2001), "Fiscal sustainability in the OECD. A simple method and some preliminary results", Working Paper 3/2001, Finansministeriet, Denmark, at http://www.fm.dk/db/filarkiv/4103/2001-03.pdf.

Holzmann, R., Palacios, R. and Zviniene, A., (2004), "Implicit Pension Debt: Issues, Measurement and Scope in International Perspective", No 0403, Social Protection Discussion Paper Series, the World Bank, at http://www1.worldbank.org/sp/

OECD Statistics Directorate (2004), "Conditions for the proposed change in the treatment of unfunded employer pension schemes in the SNA: illustration for general government accounts", January 23, 2004, on the EDG website at http://www.imf.org/external/np/sta/ueps/index.htm.

Oksanen, H. (2003) "Population ageing and public finance targets", No 196, *European Economy, Economic Papers*, Directorate-General for Economic and Financial Affairs, European Commission, at http://europa.eu.int/comm/economy_finance/publications/economicpapers_en.htm

Oksanen, H. (2004a) "Pension Reforms: an illustrated basic analysis", No 201, *European Economy, Economic Papers*, Directorate-General for Economic and Financial Affairs, European Commission (see the link above), forthcoming also in *CESifo Economic Studies*, 3/2004.

Oksanen, H. (2004b) "Public pensions in the national accounts: an analysis of the proposed revision", manuscript, 10.5.2004.

Samuelson, P.A. (1958), "An exact consumption-loan model of interest with or without the social contrivance of money", *Journal of Political Economy*, LXVI, pp. 467-482.

Sinn, H.-W. (2000), "Why a Funded System is Useful and Why it is Not Useful". *International Tax and Public Finance, 7*, pp. 89-410.