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Population ageing and public finance targets

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Caveat

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Abstract

The paper investigates alternative measures for analysing 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 targets. Data on EU-12 (euro area) are used as illustrations.

Firstly, previously used measures are discussed 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, and that this has consequences on sustainability measures and their interpretation.

Secondly, considerations on intergenerational fairness - based on the fertility and longevity of successive generations - are incorporated, leading to a gradual adjustment of fiscal parameters. The outcome, given the expenditure projections for EU-12, determines public debt reduction and a budget balance surplus of around 1.5% of GDP by 2010 and further, of 2%, by 2020. This budget balance path can be interpreted as a required target implied by the principle of intergenerational fairness, if the underlying expenditure projection is accepted as a commitment, *or* if no policies to deviate from this projection are designed. Correspondingly, the framework can be used to discuss pension reforms and other policies to help contain ageing-related expenditure, with a view to clarifying the effect of these reforms on the corresponding targets for budget balance.

The paper concludes with data requirements for advancing the debate on pension reforms and sustainability of public finances, with the caveat that sufficient data is already available to bolster the conviction that reforms should not be delayed.

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1.   The purpose of this paper and the outline

The purpose of this paper is to analyse long-term sustainability of public finances under population ageing in the light of alternative indicators, and to present a framework to derive paths for medium-term budget balance from the long-term public expenditure projections made available by the Economic Policy Committee (EPC) of the European Union in 2001.

The root of the financial sustainability problem is the increase in the EU old age dependency ratio (OADR), from 40% to over 70%, between 2005-2050.[1] According to EPC data for 2005-2050, pension expenditure will increase in EU-12 by 4.1 percentage points of GDP (from 11.5% to 15.6%). Total ageing-related expenditure will increase by 5.8 percentage points (from 17.6% to 23.4%). Expenditure will increase proportionally far less than the old age dependency ratio because the ratio of average pensions to average wages in EU-12 is projected to decline by roughly one fifth.[2]

The outline of the paper is as follows: in Chapter 2, after some preliminary remarks, we illustrate the previously used measures for sustainability, based on seeking a constant tax rate (tax revenues as a % of GDP) necessary for financing the given expenditure over any period examined. The budget balance and debt reduction paths implied by this tax rate (or *mutatis mutandis*, by a change in some other public finance item) are spelled out.

The new features motivating the present paper are introduced in Chapter 3 where the restriction that the future tax rate should be constant is relaxed. The underlying economic reasoning is that establishing, for each successive age cohort, a link between tax contributions and ageing-related public expenditure benefits can be argued as introducing a sound economic principle. Namely, an undeniable fact in earnings-related pension systems is that, on average, roughly 30 years separate the accrual of pension rights and their use (from the average age of a worker to the average age of a pensioner), and within those 30 years longevity increases. In addition, the number of people in the younger cohorts declines due to declined fertility. Given the expenditure projections, these demographic factors underpin a new rule determining a gradually increasing tax rate so that intergenerational fairness is fulfilled, at least approximately. Again, the results for the budget balance and reduction of public debt are illustrated.

In Chapter 4 the main results in the present paper are compared to those in previous literature.

The emerging budget balance path can be interpreted as a required medium-term target implied by the principle of intergenerational fairness, if the underlying expenditure projection is accepted as a commitment, *or* if no policies to deviate from this projection are

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[1]   Here we use the ratio of people aged 60+ to those between 20 and 59 instead of the commonly used 65+/15-64 –ratio as the age of 60 currently corresponds to the average effective retirement age.

[2]   As the present paper is merely methodological, the results below are confined to EU-12, i.e. average figures for the current euro area countries rather than presenting the results for each Member State. The big differences between them should, however, be kept in mind. - We use EU-12 rather than EU-15 data for our illustrations mainly because we primarily have in mind the EU Member States with relatively generous public pension systems, mostly based on pure Pay-As-You-Go (PAYG) financing, while the three Member States currently outside the euro area differ considerably from most others in some respects.

designed. Consequently, the framework can be used to discuss pension reforms and other policies to help contain ageing-related expenditure, with a view to clarifying the effect of these reforms on the corresponding budget balance targets. These issues are discussed in the concluding Chapter 5, together with a discussion on data requirements for advancing the debate on pension reforms and sustainability of public finances.

The data for EU-12 comes from the public expenditure projections for each euro area member, given in the EPC 2001 report, with some minor adjustments presented in their 2001 Stability Programmes. The assumption for the growth of labour productivity is 1.75% p.a. Inflation is assumed at 2%, and the interest rate at 2 percentage points above the rate of growth of nominal GDP. In 2004, the initial year of the analysis, public debt is at 57.4% of GDP.[3]

The coverage of the present paper is limited, firstly, in that we are not discussing the institutional question as to which level of government could use the method presented below for budget balance and tax rate target setting, and for designing pension reforms. Under the rules for the European Union the competence for securing sound public finances is shared between Member States and the EU Council of finance ministers (ECOFIN), which, in this area, acts on the recommendations of the European Commission. The considerations of long-term sustainability of public finances have recently gained importance, and the method presented below could provide additional input.

Secondly, following the line of research in this area, the analysis only looks into public finances, and therefore excludes any feedback effects from the (alternative) tax rate paths on expenditure figures. One justification for this is that the increase in the tax rate resulting from the scenarios could be substituted by an identical decrease in non-ageing-related expenditure, in which case the potential feedback effects could be different. Some other aspects related to the robustness of the results are further discussed below.

Thirdly, the partial analysis provides a basis for useful first approximations which, appropriately modified, could serve as inputs to a larger macroeconometric model for simulating the effects of alternative fiscal policy rules under ageing populations.

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[3] 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. In further analysis it should be kept in mind that it is rather *net* debt which matters for the issues here. Gross debt and gross asset figures should be looked at separately as necessary.

2.   Previous indicators of the sustainability of public finances

The increase in ageing-related expenditure as such is a measure of the challenge posed by ageing on the sustainability of public finances. This, added to the projected non-ageing-related expenditure which is assumed to be maintained at its initial level, is depicted for EU-12 in Figure 1, uppermost graph.

One financially sustainable option is to increase the tax rate in tandem with the increasing expenditure so that the public debt ratio remains constant throughout the period. Another, more ambitious option is to maintain the budget balance at zero at each point in time. The latter scenario is illustrated in Figure 1.

A simple example of an unsustainable path is based on the assumption of maintaining the 2005 tax rate given in the 2001 Stability Programmes (rendering a close-to-zero budget balance in 2005). Figure 1 shows how public debt declines and the budget balance fulfils, with a small surplus, the 'close to balance' rule until around 2020. After that, as expenditure starts to increase more rapidly, the deficit grows and debt explodes. This is clearly an unsustainable path. One indicator emerging from this scenario is the level of debt in 2050: 91% of GDP.

Constant tax rate for sustainability until 2050

A well-established methodology takes the so-called *Present Value Budget Constraint* (PVBC) as the conceptual basis for defining and testing the long-term sustainability of public finances. It states that the present value of government revenue must be equal to present value of expenditure (without interest payments) plus initial public debt. Alternatively, if the time horizon is finite, the present value of the difference between revenue and expenditure must be equal to the difference between initial debt and the present value of terminal debt.

The first set of conventionally used scenarios looks into a *fixed time period*, i.e. until 2050, given by terminal year of the projections available. In this case, to derive a result for the tax rate which would fulfil the PVBC requires some additional restrictions. It is common that the end of period debt ratio is set by assumption or some rule such as the debt ratio in the beginning of the period (i.e. currently), for example. Alternatively, following previous studies, the terminal value for the debt ratio can be set as 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 scenario in Figure 1 labelled ZA/05-50 (for zero balance on average in 2005-2050) illustrates this option. The constant tax rate for 2005-2050 is about one percentage point higher than the tax rate in the Stability Programmes, rendering faster reduction in debt and a budget surplus of nearly 2% of GDP until 2020. The U-shape of the debt path means, however, that it would not be 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.

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[4]   An indicator based on this assumption is found in European Commission (2002a), Chapter 4. It is inspired by the 'close-to-balance of surplus' –rule of the Stability and Growth Pact.

Figure 1. EU-12 public finances under alternative tax rates: Zero Budget Balance (ZBB tax), Stability Programmes (SP tax) and ZBB on average 2005-50 (ZA/05-50 tax)

a. Expenditure and taxes
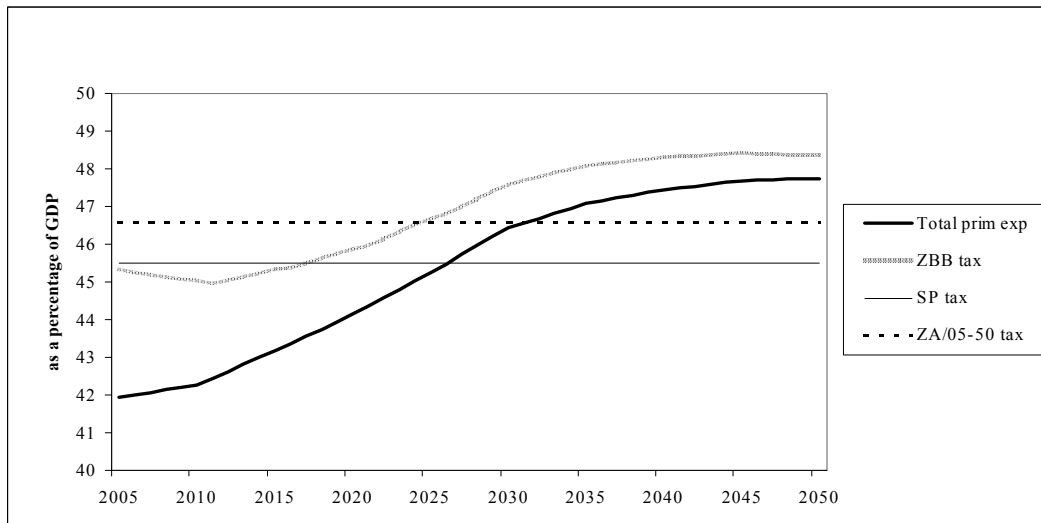
b. Debt

c. Budget balance
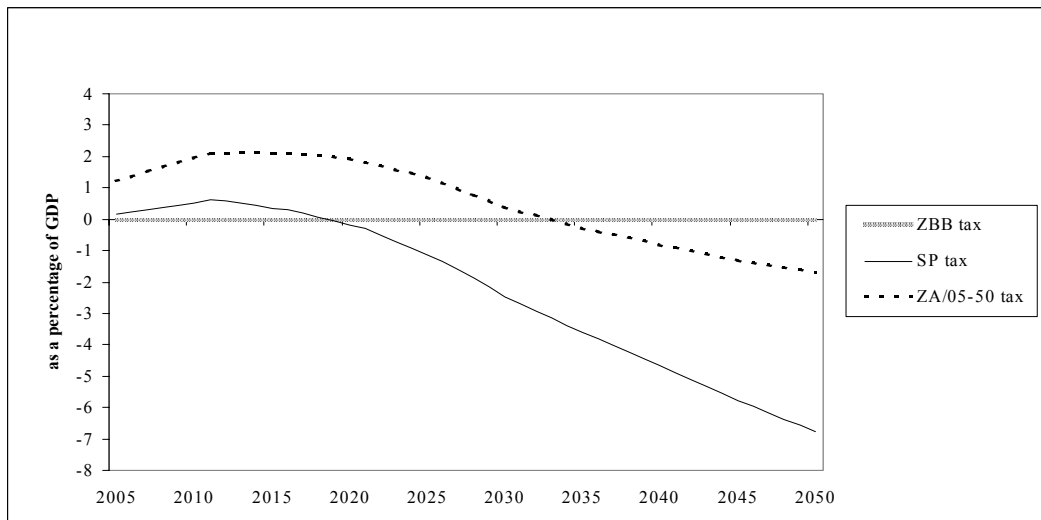
Figure 2. Old age dependency ratio* in EU-15, 2000-2050
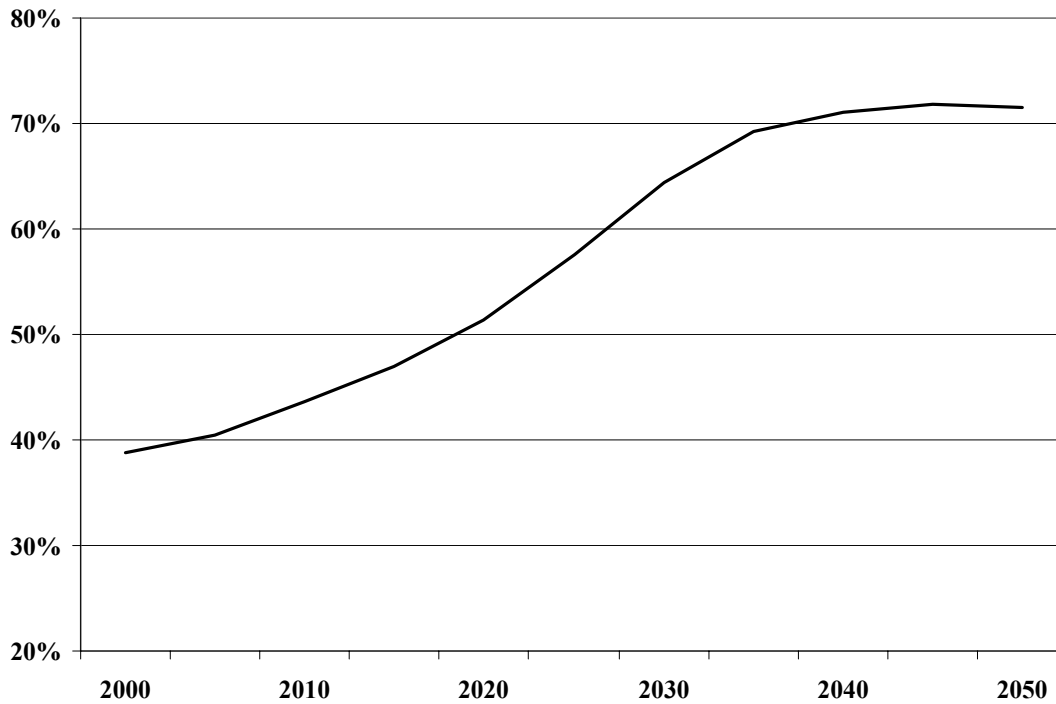
* ratio of population aged over 60 years to those aged 20-59 years.
Source: Eurostat projection

Constant tax rate for infinite future

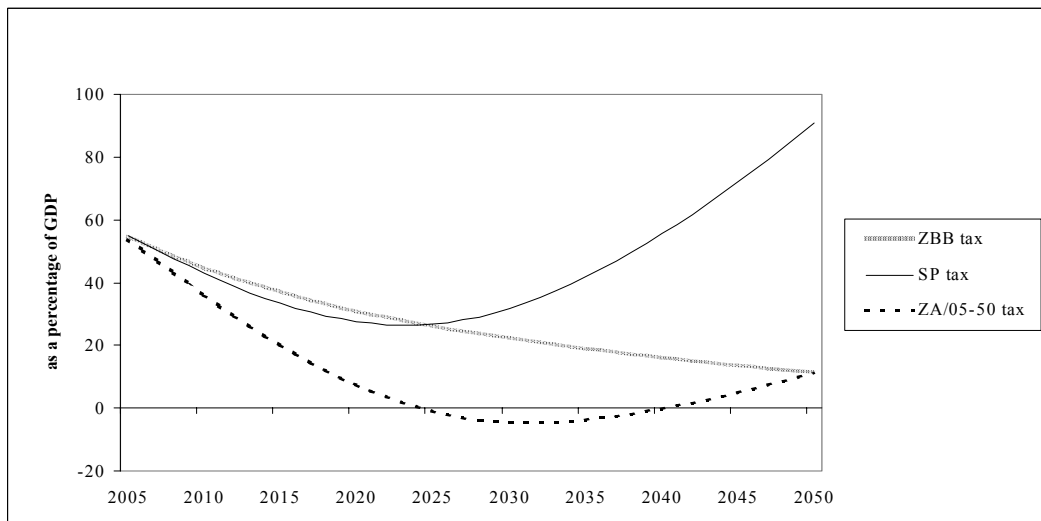The alternative approach of setting an *infinite time period* naturally requires that an assumption be made on the path of public expenditure from 2050 onwards. Fortunately, this can be done on clearly identifiable grounds based to population dynamics. The prevailing demographic projections for the EU are, roughly speaking, based on two key assumptions: fertility remains constant at the current average of 1.7 children per woman, and longevity increases by five years until 2050 and then remains constant. It is also assumed that net migration settles at some fixed proportion of population. Figure 2 depicts the projection for the old age dependency ratio, which illustrates that the *change* in the age structure of the population, i.e. *population ageing*, is roughly completed by 2050. Naturally, if the demographic factors change, another stable age structure emerges, with a different public expenditure projection, which can then be used as a starting point for a similar exercise.

This approach firstly helps to make a distinction between the process of population ageing, i.e. the increase in the OADR, and the characteristics of the (hypothetically) emerging stable age structure. Secondly, the demographic projection lays the basis for a projection on ageing-related public expenditure, driven by the rules of the pension system and any factors determining other ageing-related expenditure. An assumption that all relevant variables have settled to their terminal values by 2050, and that public expenditure as a percentage of GDP therefore remains constant thereafter, provides a methodological anchor for deriving

alternative financing rules which secure sustainability as long as the underlying assumptions on demographic development and ageing-related public expenditure are valid.[5]

Combining the assumptions for public expenditure over the infinite time horizon and the requirement that the PVBC be fulfilled, a constant tax rate from day one of the exercise to infinity can be derived. Here, no *assumption* on the debt at any point in time (or on its path) is required. Instead, the path for the debt is an outcome of the expenditure projection and the assumed fiscal rule.

The result is depicted in Figure 3. The debt ratio declines to zero around 2020 and converges to *minus* 31%, i.e. debt decreases by 88%. The budget balance jumps to 2% of GDP, increases thereafter and stays above 3% until 2020.

The implied budget surplus and debt reduction should not necessarily be regarded as a recommended policy line, notably in cases where the resulting budget surplus is higher than for the EU-12. The conclusion could rather be that the rules on the expenditure side should be revised to arrive at a lower expenditure increase, and hence to lower budget surplus targets and debt reduction. In addition, the rule implying a constant tax rate can be questioned and an alternative rule implying a gradual adjustment of the tax rate can be argued. This is the issue in the next Chapter.

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[5] While using this approach we should keep in mind that the accuracy of extending the demographic projection beyond 2050 by a simple assumption should be verified. Depending on the initial age structure of the population in each country, it might either over- or under-estimate the emerging OADR, but not dramatically. Yet, for the EU as a whole, a simple assumption might be a good first approximation. - It should be noted that although in the Eurostat projections, for some Member States the OADR (old age dependency ratio) decreases somewhat during the 2040s (not shown here), it would not necessarily decline further after 2050. It represents a consequence of the baby-boom generations' passing away, and it is possible that the OADR will increase after 2050, as the full effects of the current low fertility will only materialise with a long lag.

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
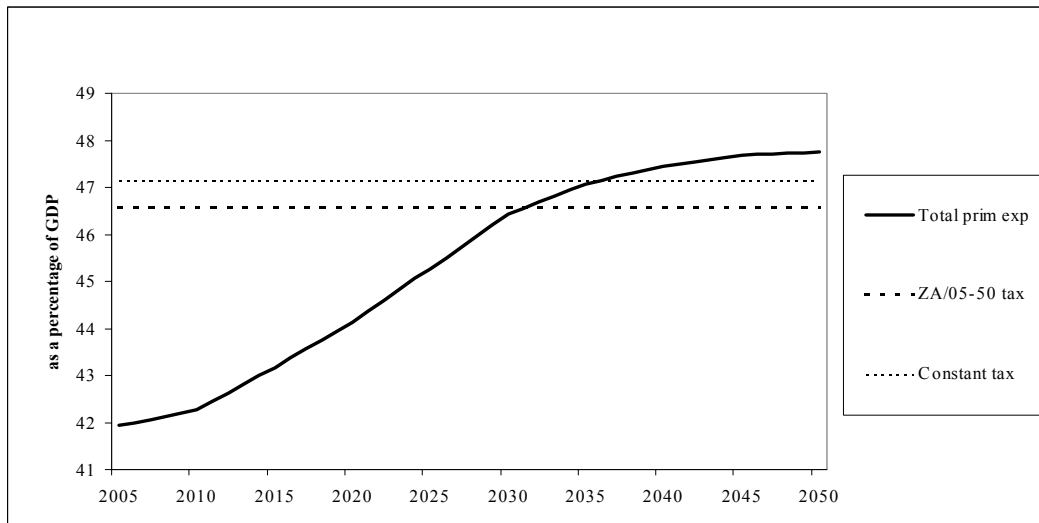
b. Debt
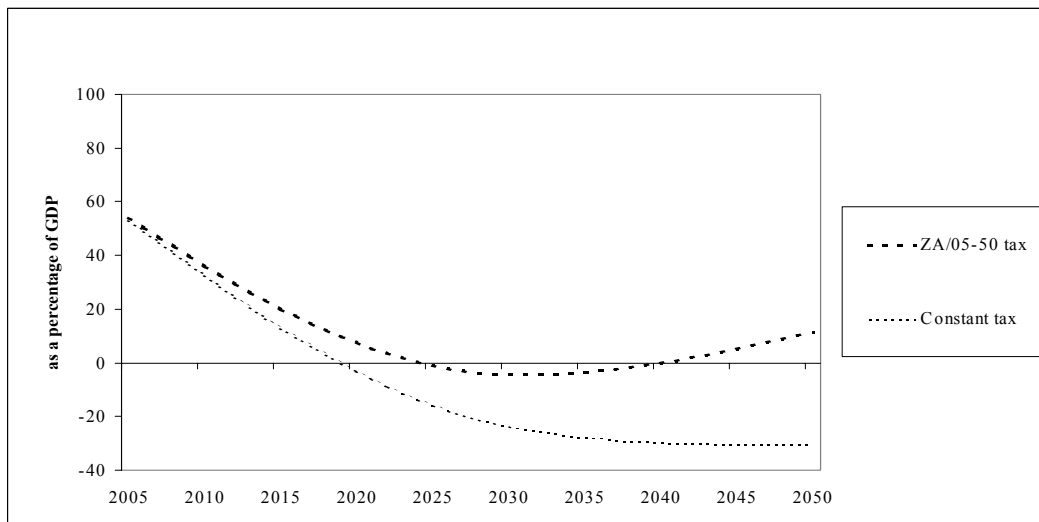
c. Budget balance
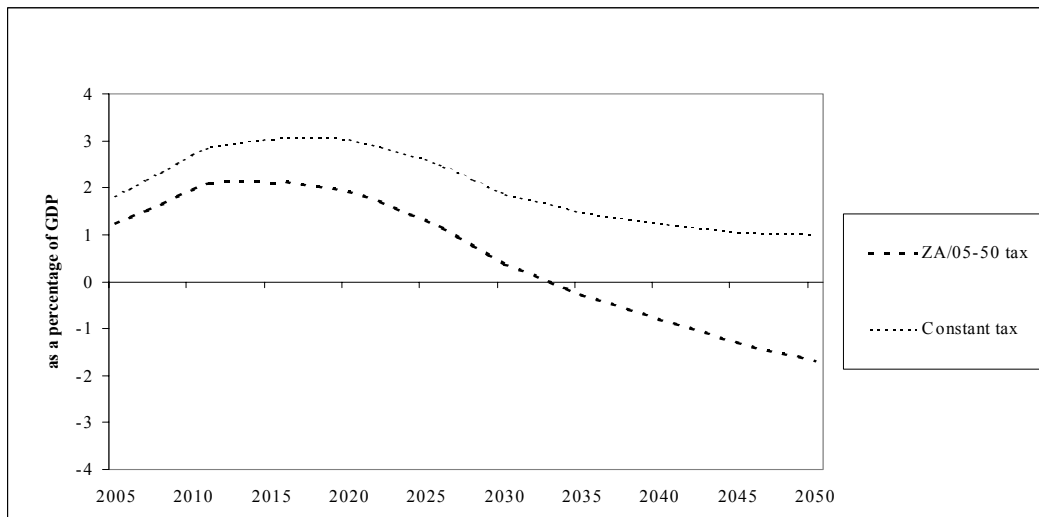
3.   Intergenerational fairness as a basis for gradual adjustment

Assuming a constant tax rate which secures sustainability is often presented as an option which, under the given expenditure increase, minimises the efficiency loss caused by tax distortion. However, accepting it as an overriding norm or policy advice is far from self-evident.

Instead, recognising that the increase in public expenditure is mostly caused by declined fertility and increasing longevity and that the successive age cohorts differ from each other in these respects, it can be argued that these factors should be taken into account in setting the tax rate for each generation. Although the result is only an approximation, this can be done by extending the argument presented by Oksanen (2002), inspired by Sinn (2000), for implementing intergenerational fairness by moving to partial funding in pension systems.

We see from Figure 4 that fertility has steadily declined since 1970. Following the Eurostat projections we assume that fertility stays at its current level of 1.7 children per woman.[6] Longevity is assumed to increase by one year in each 10-year period up until 2050 and remain constant thereafter. These demographic assumptions generate a time path for the old age dependency ratio which converges to a constant, and as seen from Figure 2 above, the Eurostat projection follows this shape.

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 can be developed for the projected increase in longevity up until 2050. If current workers live and enjoy retirement for more years than current pensioners, 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 applied 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.

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[6]   We refer 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 4. EU-15: Total fertility* and completed fertility**
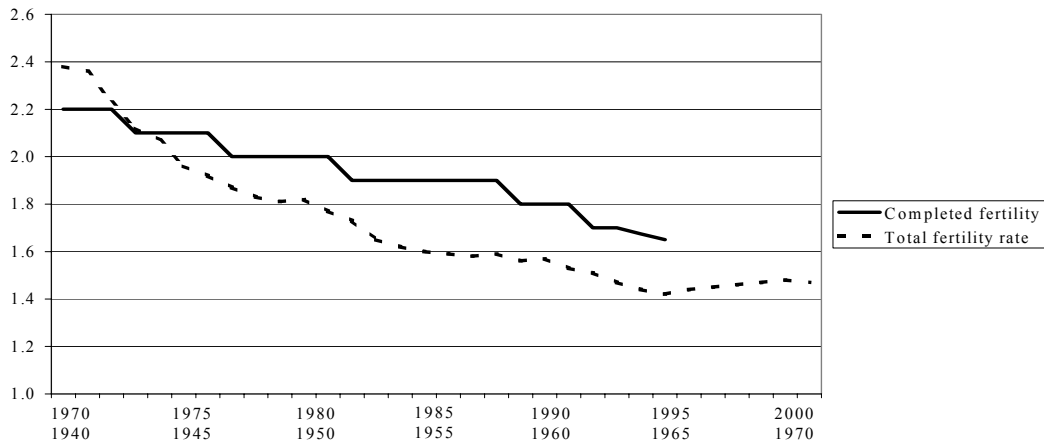
* number of births in a given year per number of women, weighted by age-specific fertility rates of the
   respective calendar year, 1970-2001
** number of children by birth year of the mother, 1940-1965
The two times scales overlap by 30 years reflecting the average childbearing age.

These factors combined imply a rule of thumb that the tax rate should reach the 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 in advance the ageing-related increase in this expenditure. Thus, 1/3 of the increase is financed from current taxes, 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 5, where we reproduce, for comparison, the result of the constant tax rate scenario. The debt level decreases now by 70% of GDP, 20 percentage points less than in the constant tax scenario. For 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%.

Figure 5. 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

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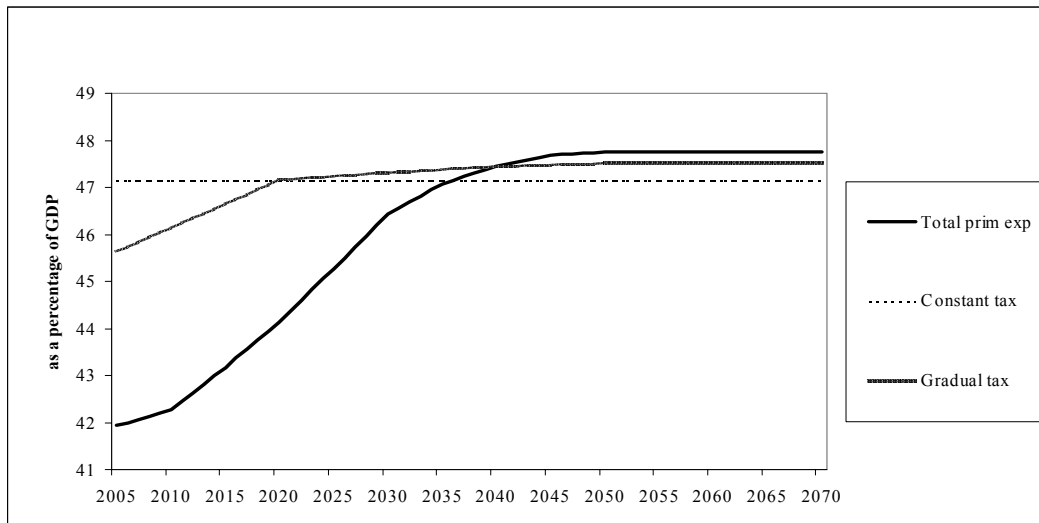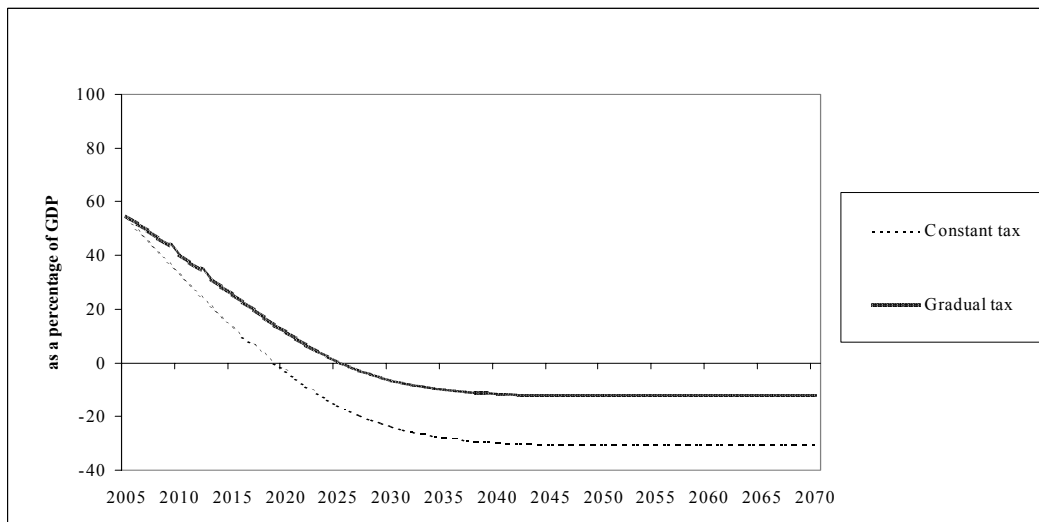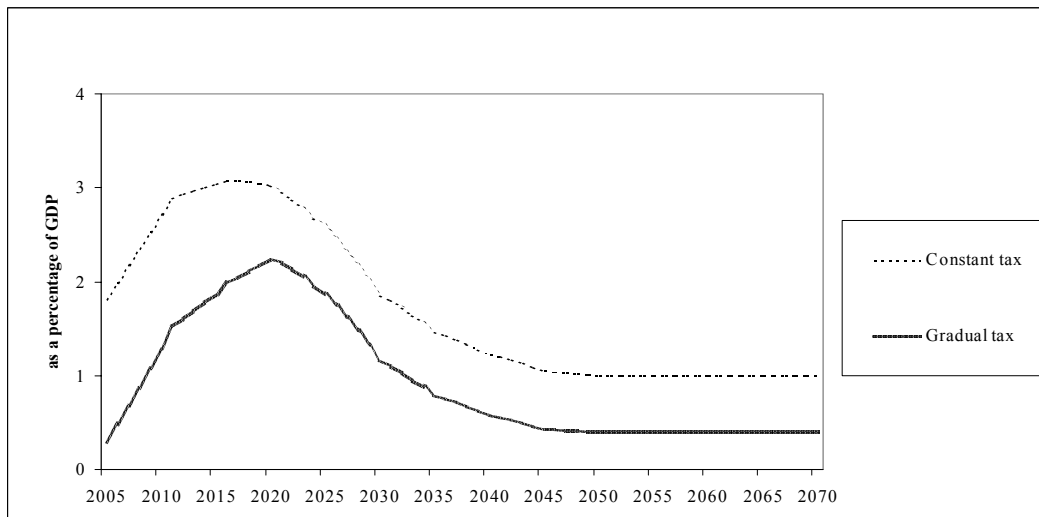
The effects of the level of initial debt

The method followed above produces important results with regard to the effect of the initial debt. These are illustrated in Figure 6, which depicts, in addition to the base case of the 57% initial debt ratio, another hypothetical case of initial debt of 20%.[7]

Firstly and naturally, the required tax rate (and therefore the primary balance) is 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 budget balance is the same, with only its level depending on initial debt.

Figure 6 also illustrates the important result that in the case of lower initial debt the emerging path for the budget balance is higher. So, for instance, in a given country where, in the past, accumulation of pension funds within the public sector has led to a relatively low public net debt, budget balance should also in future be higher than in another which has followed a lax fiscal policy line and accumulated debt. This may first look paradoxical indeed, and requires an explanation.

To gear the mind for understanding the result, it is useful to assume no population ageing and consider a very simple case where public expenditure is a constant proportion of GDP. Rolling over the public debt, whatever it initially happens to be, is a clear case where the current and future generations (of equal size) share the burden of debt equally. Assume, for example that nominal GDP grows by 4% p.a. If initial debt is 57% of GDP, the budget deficit that keeps it constant is 2.2% of GDP, while for a county with initial debt of 20% it is 0.8%.[8]

This result can then be extended for a case where public expenditure increases due to population ageing, and a rule is set for the tax rate. Following the conventional assumptions in this type of analysis, the increase in the productivity of labour is given (converging to 1.75% p.a., according to the assumption by the EPC). Under population ageing therefore, firstly, the future level of the GDP is lower than in a case without ageing. Thus the ratio of the initial public debt to future GDP increases with population ageing, i.e. the burden of the initial debt per worker increases. Secondly, we assume here that the rate of interest is at a fixed margin above the GDP growth rate, i.e. it declines in line with the lower rate of growth. This decline alleviates the debt burden.

Under the simple assumptions above, these two opposite effects cancel each other out. Therefore, the level of the initial debt does not matter for the emerging *reduction* in the debt under the prescribed rule. An algebraic proof for this point is provided in the Annex, under certain simplifying assumptions necessary to manage the mathematics. Note, however, that the scenarios in Figure 6 illustrated here indicate that this result holds more generally.

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[7]   Note that the results in this section are illustrated and explained for the scenarios with the gradual tax rate, but they would also hold for the constant tax rate scenarios with an infinite time horizon describes in the previous Chapter.

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

a. Expenditure and taxes
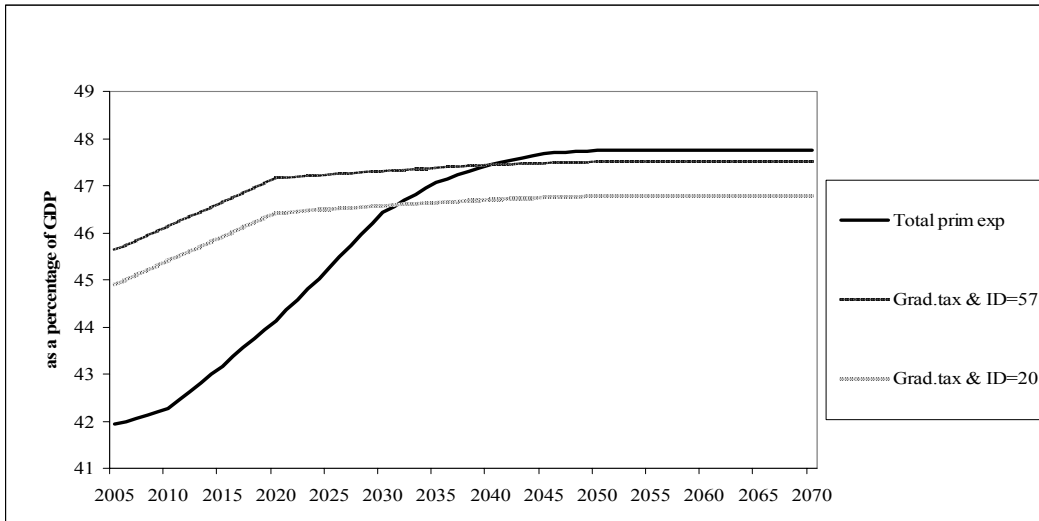
b. Debt
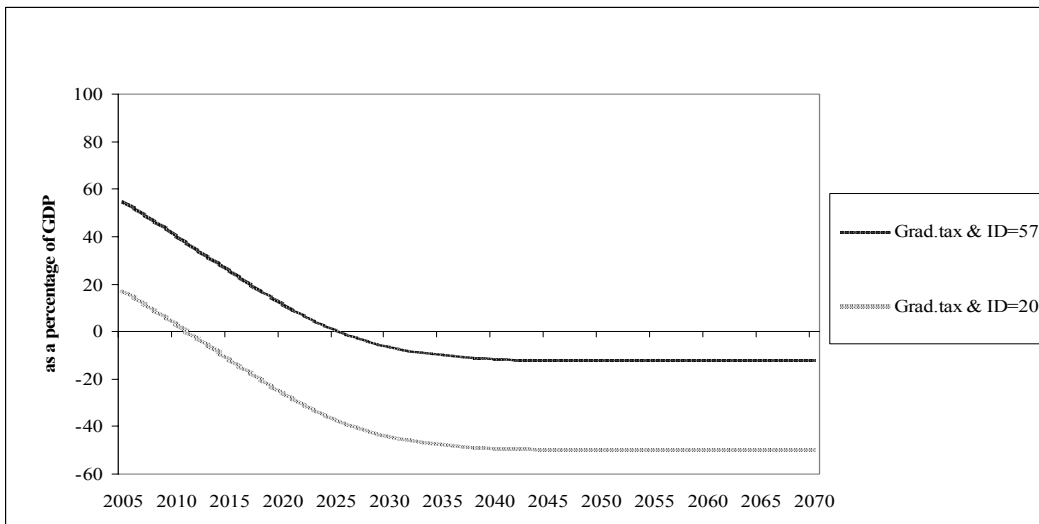
c. Budget balance
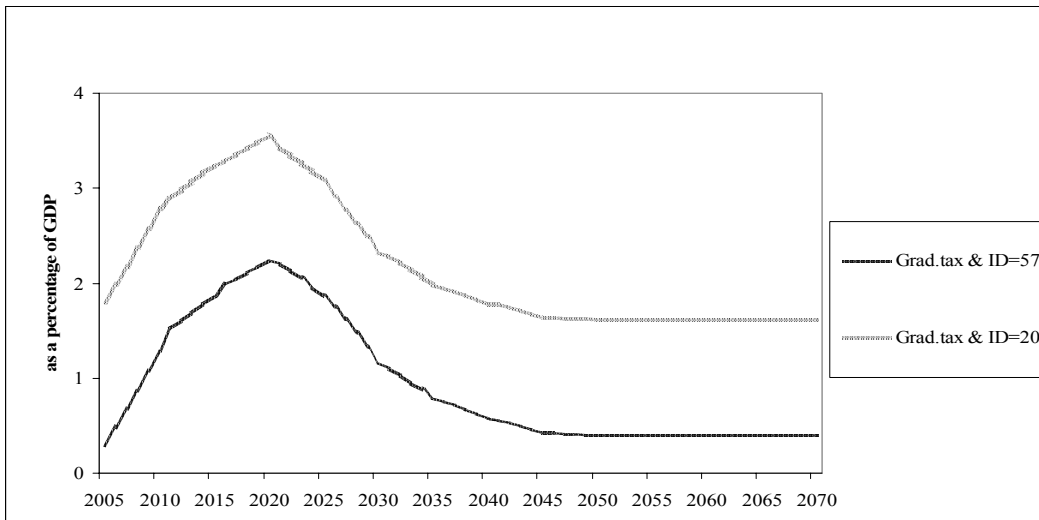
The budget surplus paths which produce the identical debt reduction differ from each other by a constant margin determined by the initial debt positions and the margin between interest rate and GDP growth rate. This difference, 1.4% of GDP, is the same as that in the simple case where we assumed no population ageing.[9]

Sensitivity of the results to various assumptions

As stated in the Introduction, the line of research followed here relies on a partial method in the sense that the public expenditure projections are taken as given, and any possible effects from the alternative tax rates on these figures are excluded. Note, however, that the main results are not affected even if the tax rates affect GDP as long as they do not affect projections for public expenditure as a percentage of GDP: if average pension as a percentage of average wages is not affected by the tax rate (fixed, for example, by an indexation rule) and if the share of the wage bill of the GDP is also given, then the feedback effect from taxes to GDP would not affect the results. Thus, the above assumptions lead to a useful approximation, while further precision could always be acquired by constructing alternative projections for public expenditure as a percentage of GDP under refined sets of assumptions.

Similarly, the results above may to some extent depend on base line projections on real GDP growth and inflation. Again, however, if the projections for public expenditure as a percentage of GDP are not affected by these factors, the same holds for the result for debt reduction. Budget balance is slightly affected as nominal growth of GDP is always one of its determining factors.

The sensitivity of the results to the assumption on the interest rate can easily be tested. There are two possible deviations from the assumption that it is at a constant two percentage points above the rate of growth of nominal GDP: this margin can be another constant, or it may change in the course of ageing. The latter option could be argued on the basis of an open economy: ageing in one country may reduce the GDP growth rate, but as financial markets are integrated with the rest of the world and ageing may proceed at a slower pace elsewhere, the interest rate may decline less than the GDP growth.

A scenario for EU-12, assuming an interest rate margin of one percentage point, gives a result that ultimate debt reduction is 7% of GDP higher (net assets 19% instead of 12%) than with the 2% margin. This effect is so small because the lower interest rate initially makes servicing the public debt cheaper, but later affects public finances negatively as interest earned on net assets is lower. The difference between the corresponding tax rates is negligible: with an interest margin of one the tax rate is 0.05 percentage points higher. The biggest difference the interest rate assumption makes is on budget balance: in the early years the surplus is 0.4 percentage points higher, diminishing thereafter to 0.2.

As these results concern the EU-12 average, the sensitivity of the results is higher for a Member State with either a considerably higher or lower initial debt. A change in the interest rate margin would also have an effect, though relatively small as compared to the main substance here, which is the accuracy of the projections for the increase in ageing-related expenditure.

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[9] Also Buti and Costello (2001, p. 88) illustrate that under a given public finance target a country with higher initial debt will have a lower budget balance and a higher primary balance.

Figure 7.   General government net investment and net saving
           as a percentage of GDP in 11 EU Member States*, 1960-2002

* EU-15 except EL,E,L and S due to unavailability of data
Source: European Commission services

Thus, the results, though derived from a simple analysis, are relatively robust, assuming that the underlying expenditure projections are reliable.

Missing element: public saving and investment?

It is clear throughout the present paper that the analysis is strictly limited to total public expenditure, and hence omits the distinction between public consumption and investment.

Net investment added on to capital stock held by the public sector and public expenditure for the quality of the environment should certainly be taken into consideration alongside public debt or government held financial assets when assessing what one generation leaves to the next. However, a look into the recent history of the EU Member States does not change the broad picture of intergenerational fairness now, nor for the near future. By their tax payments, the generation working from after WWII to the early 1970s supported a level of public sector investment that was large enough to increase the public sector capital stock as a share of GDP. Since then, public sector net investment has been sliding gradually but persistently to a level which hardly maintains the current ratio.[10] Thus, in the span of the generation at work from 1975 to date, no public investment has taken place which could counterbalance the transfer of a higher pension burden to future generations. We see this

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[10]   Very roughly: if public sector capital stock is of the order of GDP per year, and real GDP grows by 2%, then public net investment has to be 2% of GDP to maintain the ratio between public sector capital and GDP. According to Figure 7, it has been below this since two decades.

from Figure 7, which also clearly illustrates that government net saving has been negative for more than 20 years since 1975.

This does not prove what will happen in future, but if it can be assumed that future public investment merely maintains the public capital stock to GDP ratio, then it is sufficient for intergenerational fairness to look into the financial items - notably into public debt reduction. If on the contrary, public investment were to deviate from this benchmark, how it should be taken into account would be straightforward: a change in capital stock in excess of the benchmark should have a one-to-one effect on the targeted debt reduction.[11]

4.   Comparing the main results with previous literature

Ageing is not only a bubble

In many previous studies, as well as in the present paper, sustainability of public finances has been defined as a set of rules for public expenditure and revenue, such that they can be maintained under foreseeable conditions. It was often considered to be sufficient to look into a fixed time period and construct a rule for public revenue such that sustainability is secured. For example, the work on sustainability indicators published by the OECD in 1990 concentrated on smoothing tax rates under expenditure fluctuations. The trend-wise, persistent increase in expenditure caused by population ageing was hinted at, but as estimates were still very vague, the time period considered was restricted and an *ad hoc* assumption of the terminal debt was made to arrive at a benchmark tax rate for sustainability (Blanchard, 1990, and Chouraqui, Hagemann and Sartor, 1990).

Also, it was still believed 15-20 years ago that the post-WWII baby boom age-cohorts merely constituted a temporary population bubble. Under such assumptions, examination of a limited time period would have been adequate. However, the population projections for the EU Member States and most other countries have, for quite some time, indicated that due to persistently declined fertility and increasing longevity, population ageing will lead to a permanently high OADR. Ageing of the post-WWII baby boom generation will affect the speed of population ageing in the next couple of decades, but according to the prevailing projections, the OADR will not decline thereafter, at least not significantly.

As a useful first approximation therefore, the age structure projected for 2050 can be assumed to represent a more distant future, technically speaking the new steady state. This projection stems from the assumptions that the current underlying fertility rate is maintained, that longevity increases by five years until 2050 and then remains constant, and that migration continues at a certain level. These assumptions may turn out to be wrong in either direction, but for the purposes of the method and results presented in this paper this is not decisive: the current demographic factors should determine the tax rate paid by

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[11]   A parallel question is whether private saving and bequests to children should affect judgement on public debt reduction targets? In principle perhaps, as both affect transfers between the generations, but the great uncertainty as to what will happen to private saving in future effectively impedes the setting of any clear rule for taking this link into account. It is therefore prudent to respect intergenerational fairness within public finances taken alone. Based on declared principles followed for collective bequests, people can then choose what to leave privately to their heirs.

current generations over the next 15-20 years, and the principles presented here include the rule for adjusting fiscal policy whenever the demographic factors are observed or projected to deviate from those initially envisaged.

The projection for the age structure of the population, combined with the prevailing rules for ageing-related public expenditure, forms a basis for a public expenditure projection. The key feature of this projection is that ageing-related expenditure converges to a constant proportion of GDP.

This makes it possible to by-pass a methodological problem inherent in applying the PVBC (Present Value Budget Constraint) for sustainability: as in a dynamically efficient economy the interest rate is higher than the GDP growth rate, the PVBC can be fulfilled even in a case where the public debt to GDP ratio increases without limit; the PVBC only requires that the rate of increase in debt is below the rate of interest. As such a case does not make economic sense, an *economically meaningful* condition for sustainability needs to contain some additional restriction, which may vary from one case to another.[12] Here this is taken care of by the requirement that public debt (or rather net assets, as we saw in the scenarios above) as a proportion of GDP must converge to a constant.

This operational definition of sustainability and using an iterative method for each scenario, allows for any shape of time path for the tax rate until the point in time where the new steady state is reached. The scenarios above are based on easily available data and rules of thumb on the demographic characteristics of succeeding generations. Any further details determining the adjustment path, based on the pension system and its reform in each individual country, could be easily incorporated into the scenarios.[13]

From a constant to a gradually increasing tax rate

Long-term public expenditure projections, extended to infinity, have in many previous studies been the objects of exercises to determine, in each case, the constant tax rate required for sustainability. Examples are Buiter (1985), Fredriksen (2001) and more recently Buiter and Graffe (2002)[14]. This is intuitively appealing, relatively simple and backed by considerations on tax smoothing for minimising the distortion caused by taxes.

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[12] See Chalk and Hemming (2000) for a seminal account of using the so-called Present Value Budget Constraint (PVBC) as the theoretical basis for public finance sustainability measures. They discuss deficiencies in various applications, notably the arbitrariness of restricting the time horizon and the terminal debt, though also explaining in a balanced way why, in practice, it is often necessary to make various simplifications.

[13] 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 same rhythm as 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 by 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 for. Also, in calibrating the gradual adjustment scenarios to individual Member States and their potential pension reforms, we should endeavour to use more detailed data on the pension benefits of each age cohort and keep an open mind as to how much the results for the tax rate should differ from the simple gradual adjustment.

[14] For a review, see Balassone and Franco (2000). The novelty in Frederiksen (2001) is a formula for deriving the results from the data on the terminal values for 2050 for ageing-related expenditure in a

The illustrations above make explicit the large budget balance surplus and substantial debt reduction which the principle of a constant tax rate implies for EU-12 on average under the prevailing expenditure projections. To spell out these implications is useful as they make it easier to understand the size of the adjustment effort than if we simply depict the difference between the required and current tax rates (the tax gap).

Describing the *immediate* increase in the tax rate as a required policy change could in policy debate be rightly challenged by pointing out that it is not necessarily fair that the full burden of the increase in public expenditure should be felt immediately. People may rightly question who should pay what and when. This is the motivation for introducing the principle of intergenerational fairness to the framework. The application developed here illustrates the outcome, albeit recognising its approximate nature.

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

Looking into the numbers, debt reduction for EU-12 stemming from the scenario with a gradually increasing tax rate is large - 40% of GDP in the first 15 years and up to 70% thereafter - eliminating the debt fully and creating a (small) net asset position. However, movements of this 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. In any event, the framework does not dictate the policy response: the implied debt reduction is a consequence of the expenditure projection: reforms for cutting expenditure would lead to more modest targets for debt reduction.

Framing of policies

For assessing the implications for public debt reduction it is useful to refer to the parallel question about the so-called *'double burden'* of moving towards funding of pensions. 'Double burden' is often used with a negative connotation to mean that under a move to funding, current workers pay for both their parents' pensions and their own. However, under ageing population, it is fair to modify the rules of the pension system so that the generations which have lower fertility and live longer than their parents, pay into the system more than currently goes out. Thus, a benchmark for a certain degree of 'double burden' can be argued to be fair.

In a recent extensive survey of pension reforms, Lindbeck and Persson (2003) discuss the link between moving to more funding in pension systems and reduction of public debt, indicating that this is not yet fully analysed in the literature. They note that *"redistribution in favour of future generations ... can be accomplished by ordinary fiscal measures* [i.e. measures leading to debt reduction], *quite outside the realm of pension reform"*. They suggest that *"pension reform is a way of <u>framing</u> policies that may otherwise be politically*

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large number of countries. His method is efficient for handling a large data set and provides useful approximations for adjusting the fiscal stance for the long term. However, as compared to the method in the present paper, his method does not allow taking fully into account the projected time path for expenditure from now to 2050, and it is restricted to cases with a constant tax rate.

difficult to achieve" (pp. 105-106). This framing may be interpreted in the following way: (1) assume that it is accepted as an aim that public sector net debt is reduced in order to ease the burden left for future generations; (2) to make it politically acceptable, the rules of the public pension system are revised so that, as compared to a pure PAYG system, current workers pay in more, leading to accumulation of assets in the pension system, and thereby reducing the contributions to be paid in by future generations. Thus, a pension reform serves as a rationale for the reduction of public debt.

The reasoning may also read the other way round: (1) the rules of the public pension system are revised in the prescribed way, based on its own purposes and logic, leading to accumulation of pension assets; (2) in this case it is of paramount importance that this surplus be entered into the budget balance target for the whole general government sector as its purpose would otherwise be eliminated by an opposite change in the other entities of the general government. This leakage to more government expenditure or lower taxes would occur if the public sector budget balance and debt targets were set independently of the pension system reform.

In the present paper we look neither into the rules of public pension systems nor the required changes, but rather take a bird's-eye view of public finances, producing results for budget balance and debt. The framework serves to frame policies while also giving a target for debt reduction, conditional on projected ageing-related expenditure and an approximate implementation of the principles of intergenerational fairness.[15]

The meaning of initial debt

One important result is that under conventional assumptions the target for debt reduction does not depend on the level of initial debt and that budget surplus should be the higher the lower the initial debt. This important yet simple result can be contrasted with the discussion on fiscal target setting, where it is common to refer to the challenge of population ageing but yet take the view that a country with a lower initial debt position can afford higher deficits (this becomes evident from the recent survey by Buti, Eijfinger and Franco, 2003; see also European Economic Advisory Group, 2003, Chapter 2).

This is not to say that the commonly held view that high indebtedness should lead to bigger reduction of debt could have other, well-argued grounds. It 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 and not leave it all to future generations.

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[15] The recent extensive survey by Feldstein and Liebman (2002) reveals that the basic result that under population ageing a pure PAYG system does not produce intergenerational fairness has not received the attention it deserves in the light of the unprecedented population ageing in Europe. The case for partial funding stemming from the simple analysis under unchanged benefits can be seen in parallel to various other, often more refined arguments in favour of more funding and of other pension reforms advocated by Feldstein and Liedman (2002) and many others. In the framework of the present analysis partial funding is equivalent to reducing public debt, and benefit reforms affect public pension expenditure, which drives the results for medium-term budget balance targets.

These considerations could be legitimate, and could be made concrete and operational, and be fed as further adjustment factors into the time path for the tax rate in the gradual tax rate scenarios. The framework presented here is perfectly eligible for that. However, it is not at all certain that these factors would turn around the basic result that with an ageing population, lower initial debt should lead to a higher target for budget balance over the medium to long term. Also, this result is consistent with the easily understandable proposition that the required tax rate, and therefore also the primary balance, are lower for the low debt country.

Parallel approaches to intergenerational fairness

In assessing the outcome for debt reduction it is useful to note the link between these results and the body of literature looking into the so-called *Implicit Pension Debt* (IPD) of the government, defined as the present value of the accumulated pension rights or of projected expenditure, depending on the application. The main thrust of an approach building on the IPD is that both the explicit and the implicit pension debt of the public sector are carried over to future generations, and therefore both should be dealt with in assessing intergenerational fairness and all other economic aspects.

Looking into the IPD opens up the same questions as any carefully made projection of pension expenditure, especially if alternative scenarios are made for pension reform options. As soon as a rule or benchmark is set for the total of explicit and implicit public debt to be carried over to future generations, the same questions arise as above when setting the rule for the gradually increasing tax rate: the time path for the total debt and its composition has to be set. The result for EU-12 is the same as here: a drastic change in the composition of the total debt as the explicit debt completely disappears.

Calculations called 'Generational accounts' also provide assessments on financial sustainability and intergenerational fairness of public policies. Their first purpose is to calculate the transfers which the successive age cohorts pay to and receive from the public sector. In most cases, current policies are shown to lead to exploding public debt, thus the next step of analysis is to change the rules so that sustainability is secured. The adjustment can then be either immediate or gradual, and one can calculate the consequences for each age cohort (e.g. Kotlikoff, 2002, p. 1905). Thus, the same substantive questions as to how the various expenditure items should be attributed to succeeding generations discussed here are also to be tackled under the generational account approach. Gearing the ratio between expenditure and taxes of each generation to its fertility and longevity is an option which could also guide an exercise under generational accounts.

5. Conclusions and outlines for further work

In this paper, having first reviewed the previous work in the field of sustainability of public finance, we present a rule for gradual adjustment of the tax rate to meet the rising public pension and some other ageing-related expenditure in a financially sustainable way, respecting intergenerational fairness. While other options exist which could meet the requirement of financial sustainability, the criterion of intergenerational fairness helps to highlight the key factors which should enter a meaningful discussion on policy options.

The main result is a time path for a budget balance that gradually reaches 2% of GDP for EU-12, and declines thereafter. Debt reduction is about 40% in the fist 15 years and 70% until the total adjustment.

As for policy options stemming from the present framework, an increase in the tax rate could always be replaced by a decline in non-ageing-related expenditure. The advantage of the framework presented here is that it can incorporate either an instantaneous or gradual change in fiscal policy, reflecting any considerations behind them. Preferring a decline of non-ageing-related expenditure rather than an increase in taxes could be motivated by an attempt to avoid the various negative effects of a tax increase. However, as in previous studies in this research line, this policy choice is not treated here, notably because it does not affect the outcome for budget balance and debt reduction.

Furthermore, it is an important result that under the conventional assumptions followed here the result for debt reduction does not depend on the level of initial debt, and that the budget surplus should be the higher the lower the initial debt. This result, which readily follows from the assumptions, could challenge the complacency in countries where initial debt is low (or even negative for the net debt), but ageing-related expenditure is yet projected to increase markedly.

The present paper does not cover the results for individual Member States, but as we know that there are big differences between them with regard to the projected increase in ageing-related public expenditure, it is evident that the results for budget balance and debt reduction would differ markedly too.

The importance of these results for policy-making motivates further work in four main respects.

Firstly, now that a case has been made for the link between the long-term expenditure projections and the medium-term budget targets, one should carefully *verify how well the former capture the effects of the prevailing rules for expenditure under projected population ageing*. This is a major undertaking, and not just a mechanical calculation exercise as the systems are complicated, and even more importantly, as there are many grey areas, lacking clear rules for possible new situations. For example, a view has to be taken on the most likely outcome if pensions are formally set in nominal values or indexed to prices, but discrete decisions are occasionally taken to make them follow real wages. The projections should be specified for a manageable set of carefully chosen assumptions. The projections should change with changes in policy, indicating a reward for an acceptance of reforms. Frequent revisions stemming from reassessments of the effects of other factors could blur the arguments at important stages of the pension reform process.

Secondly, the underlying *demographic projections* should be verified. From the point of view of the present method, this is not a major task as it is not decisive whether or not the

future *fertility* rates underlying the projection are realistic. Here, as the principle of intergenerational fairness drives the results, the relevant question is what the *current* level of fertility implies for the future. If and when fertility changes, the expenditure projection will also change, thereby leading to a revision in the target for budget balance and debt reduction. However, we might need to verify whether the projections to 2050 already contain a good enough approximation of the implications of the current fertility rate.

For *longevity* it is comforting that a projection up to 2050 is sufficient, as life expectancy projected for 2050 determines the target for the tax rate for 2020. Thus, anything that might happen to longevity after 2050 will affect the fiscal variables only after 2020, which gives ample time for adjusting the fiscal parameters as required. Apart from this, any revisions to projections to 2050 should be taken into account as they become available.

Taking these demographic factors together, the proposed method provides a framework for entering their possible revisions into the determination of medium-term fiscal targets. Given the pace of possible change, it would be quite sufficient to make the revisions in 5-10 year intervals.

Thirdly, applying the method, based on intergenerational fairness, should not be limited to only depicting the most likely outcome of the prevailing rules. The nature of the exercise is such that the projections for public debt and budget balance are *conditional*. The outcomes for budget balance and debt reduction should be understood as targets if the underlying (and once again verified) projections are accepted as targets for expenditure or if no policies to deviate from these projections are designed. Correspondingly, the method can be extended to *options for pension reforms* and possibly to changes in other relevant provisions, generating alternative projections for expenditure and corresponding paths for budget balance and debt reduction. Thus, the framework can be used to discuss pension reforms and other policies to contain the increase in ageing-related expenditure, with a view to clarifying the effect of these reforms on public finance targets.

Fourthly, if an important part of the public pension system is privatised by diverting part of pension contributions to a private-sector managed fund, a major change in public sector revenue and expenditure takes place. Typically, the immediate effect is a decrease in revenue, while public pension expenditure declines only much later when public pensions decrease as they will be topped up by pensions paid by the privately managed funds. Under pension reforms, these short-, medium- and long-term effects need to be clearly identified and estimated to arrive at consistent fiscal targets. This is omitted from the present paper as the Member States were not undertaking such major reforms at the time of making the EPC projections.

<center>*   *   *   *   *   *   *</center>

If and when the long-term expenditure projections are used in setting medium-term fiscal targets, their accuracy becomes a much more serious issue than if they are only used to discuss expenditure trends without clear and quantified implications for their medium term effects. The various deficiencies of the data should not, however, be used as an excuse to postpone action. The main message is already known, that under current policies, even if optimistically interpreted, ageing-related expenditures are growing considerably in most countries. The method presented here provides a framework for a policy discussion on setting the medium term budget balance targets to a rising trend, which can then be revised downwards as reforms to contain the increase in these expenditures are implemented.

Annex

Derivation of the result for the effect of the level of initial debt

The result that the level of initial (net) public debt does not affect its reduction, discussed and illustrated in Chapter 3, can be analytically endorsed with a simplified analysis of a public Defined Benefit pension system. Pension expenditure, the fair pension contribution rate and pre-funding derived below can be interpreted as ageing-related expenditure, the fair tax rate, and reduction in public debt, respectively. The concepts could be re-phrased in these terms but this would not affect the results.

The population is composed of children (E), workers (L) and retirees (R). Each of these phases of an individual's life is, for the purpose of managing the mathematics, set to be of equal length, which is set as the unit period:

(1) $\qquad E_t = L_{t+1} = R_{t+2}$.

To make a rough comparison with real life, the unit period is best considered to last 30 years as this is currently the average childbearing age of women.

Parameter f expresses the number of children per worker (on a steady path population then decreases at a rate of 1-f):

(2) $\qquad E_t = f_t L_t$.

The workers pay pension contributions and are paid earning-related pensions, determined as a fraction p_t of the wage rate in the next period as they have retired. This parameter can be interpreted to capture both the replacement rate proper and the time spent on retirement, which is in reality normally shorter than the time at work; given the replacement rate proper, an expected increase in the longevity of workers in each period increases the value of parameter p_t for that period. The wage rate is taken as the unit of account, allowing for any movements of the wage rate, so that the results are solely driven by demographic dynamics, the rules of the pension system and the interest rate. The contribution rate is c_t. To construct a case which is more general than a pure PAYG system, we allow that the system owns financial reserves amounting to q_t as a percentage of the wage bill. The rate of return on all assets, also measured in wage units, is assumed to be uniform and at least equal to the rate of growth of the wage bill the rate. The interest factor is noted as ρ_t, i.e. ρ_t-1 is the rate of interest.

To derive results for population ageing caused by a decline in fertility, fertility is assumed to decline in period 1 to f_n and then stay at this new level. Subscript n stands for the <u>n</u>ew value of the parameter after the change. Period 1 starts a transition, and period 2 is also transitional as the number of retirees is still determined by the previous fertility level. Period 3 is the first period of the new steady state, where the population declines at the new rate of $(1$-$f_n)$.

If we first assume that the pension accrual rate and longevity are constant, we note that pension expenditure is the same as it was before the decline in fertility, not only in period 1 but also in period 2. However, in period 2, when the first generation of adults with the declined fertility have retired, the wage bill is lower as the number of workers is smaller. Therefore, if there has been no adjustment to the pension system, the contribution rate has to be increased to a new level, which will then be required in all subsequent periods.

The question of fairness arises. Why should the generation of workers in period 1 which initiated the decline in fertility, escape the increase in the pension contribution rate to be encountered by all future generations? According to the principle that all generations with the same demographic characteristics should be treated equally, the answer is negative, calling for an increase in the contribution rate already in period 1 for the first generation with lower fertility, so that they should pay the same percentage of wages in pension contributions as any succeeding generation. Thus, in period 1, revenue should exceed expenditure, thereby creating a fund. Thanks to the proceeds from the fund, the contributions paid by all future generations are lower than in a pure PAYG system. This principle, leading to a permanent fund which covers part of the future pensions, was first outlined by Sinn (2000) and further developed by Oksanen (2001 and 2002).

The analysis can also include a permanent increase in longevity, starting with the workers in period 1. Assuming a constant retirement age and replacement rate proper, this leads to a permanently higher value for parameter p_n. For the sake of fairness, this increase needs to be already anticipated in setting the contribution rate in period 1, so that the workers in period 1 pay into the system according to their own future longevity.

The new contribution rate can be derived from the budget balance equations for period 1 and from period 2 onwards, which read as follows:

(3) $\qquad c_n L_1 + (\rho_0 - 1) q_0 L_0 = p_0 R_1 + q_n L_1 - q_0 L_0$, and

(4) $\qquad c_n L_t + (\rho_n - 1) q_n L_{t-1} = p_n R_t + q_n (L_1 - L_0)$.

From these equations we obtain for the new contribution rate

(5) $\qquad c_n{}^* = \dfrac{1}{\rho_n} p_n + \dfrac{\rho_n - f_n}{f_0 \rho_n} p_0 - \dfrac{(\rho_n - f_n)\rho_0}{f_0 \rho_n} q_0$

and for the degree of funding

(6) $\qquad q_n{}^* = \dfrac{1}{\rho_n} p_n - \dfrac{f_n}{f_0 \rho_n} p_0 + \dfrac{f_n \rho_0}{f_0 \rho_n} q_0$.

While these two expressions give the result for the *general case* where nothing particular is assumed about the interest rate, we can insert a conventional assumption, backed by elementary growth theory, and followed in the scenarios in this paper, that the interest rate follows the growth rate of the economy exceeding it by a constant margin. Noting that in the simplified analysis here the level of production is determined by the size of the labour force, which again is determined by fertility in the previous period, we have

(7) $\qquad \rho_n = \dfrac{\rho_0 f_n}{f_0}$.

Note that applying (7) for period 1 as well, means that the decline in the interest rate is already anticipated in period 1, although labour force and production are still determined by the previous fertility level.

The equations for the new contribution rate and the change in the degree of funding in this case give:

(8)
$$c_n^{**} = \frac{f_0}{f_n \rho_0} p_n + \frac{\rho_0 - f_0}{f_0 \rho_0)} p_0 - (\frac{\rho_0}{f_0} - 1)q_0 \text{, and}$$

(9)
$$q_n^{**} - q_0 = \frac{f_0}{\rho_0 f_n} p_n - \frac{1}{\rho_0} p_0 .$$

The latter equation is written in such a way as to show that under this assumption on the interest rate the *change* in the degree of funding does not depend on its initial level. As there is nothing in the formulas above that would prevent the initial degree of funding, q_0, from being negative, the result for the increase in the degree of funding can be interpreted as the reduction of net public debt. Thus, the result that the reduction in public does not depend on its initial level is endorsed.

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