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Fiscal Studies (1996) vol. 16, no. 2, p1-20

Population Ageing, Public Debt and Sustainable Fiscal Policy

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I. INTRODUCTION

Due to rising life expectancy and declining fertility, the world's population is ageing rapidly. Not only does the number of elderly relative to the number of working-age people increase, so does the proportion of the *very* old in the general population of the aged. In consequence, government spending on pensions, health care and other services provided for the aged is increasing and has been projected to rise on an even larger scale after the turn of the century. How can the old-age social expenditures be accommodated into a sustainable path for the general government budget?[2]

In most European countries, public outlays allocated to the elderly are financed on a pay-as-you-go (PAYG) basis, i.e. benefits paid to retired people are directly financed by contemporaneous taxes levied on workers. In periods with dramatic swings in the age structure, the tax rate is likely to swing as well. For example, when the population is ageing, the ratio of the number of persons of drawing age to that of those of contributing age increases, and PAYG financing implies an increase in the transfers from young to old. Does that cause generational conflicts, and will the PAYG scheme eventually be undermined?

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Financial support from the Danish National Research Foundation is gratefully acknowledged. Henrik Jacobsen provided excellent research assistance.
[2] The implications of ageing populations for social expenditures have been studied in detail by OECD (1988). For more general treatments of the economics of ageing, see, for example, Hurd (1990), Börsch-Supan (1991), Bös (1992) and World Bank (1994).

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The ageing phenomenon is not the only source of budgetary strain, however. Many governments also feel a pressure from high levels of real interest rates (and public debt) and large structural budget deficits. At the same time, a higher weight has been attached to debt reduction. In Europe, for example, countries aiming at EMU are required to bring their public-debt-to-GDP ratio below 60 per cent, and public deficits should be below 3 per cent of GDP. Since nearly all EU members (and potential entrants) currently fail to comply with these convergence criteria, tighter fiscal policies are to be expected. What is the magnitude of the fiscal adjustments to be undertaken as a result of the perceived need for debt reduction?

In this paper, we consider alternative financing strategies in response to changing demographics. Our study is relevant for a country with substantial public debt and thus for most European countries. If a pressure on old-age public expenditures cannot be financed through further debt issues, either a higher tax rate or cuts in expenditures outside the old-age budget must be implemented. The focus in the paper is very much on the *timing* of this contractionary fiscal process.[3] In particular, instead of phasing in the increasing social expenditures gradually, as implied by PAYG financing, one could ask whether governments should begin to save in anticipation of future demographic burdens.

If such a forward-looking fiscal policy is embarked upon, an indebted government would begin to bring down its debt-to-GDP ratio, hence easing the tax burden on future generations. A far-sighted strategy would further enable the government to maintain tax rates rather constant over the years. Indeed, since the dead-weight loss imposed by a distortionary tax is known to increase by more than in proportion to the tax rate, tax smoothing can be motivated on efficiency grounds, cf. Barro (1979). Moreover, such a policy can be defended on intergenerational distribution grounds. Overall, the prospects of population ageing seem to provide a case for designing fiscal policy within a medium- to long-term financial strategy.

We address this theme with Denmark as a case-study. However, as indicated by Table 1, the magnitude and to some extent also the timing of the demographic transition are similar across most OECD countries. Furthermore, public sector involvement in securing pensions and services for the old is pronounced in all industrialised countries. Hence, the methodology and results should be of more general relevance (see also Johnson (1993)). In Section II, we try to identify the nature of the demographic transition and its implications for old-age expenditures. Section III sets out an intertemporal framework for designing fiscal policy, and Section IV investigates the fiscal adjustments needed if the future tax

[3] The view that population ageing calls for fiscal consolidation is not undisputed, however. Cutler, Poterba, Sheiner and Summers (1990), for example, argue that population ageing does not require an increase in the optimal level of the *national* saving rate. Since several studies — for example, Jensen and Nielsen (1993a) — seem to suggest that the *private* net saving rate increases following a lower fertility rate, the argument put forth by Cutler et al. must imply that the *public* net saving rate falls.

TABLE 1

Percentage of Population over 60 Years Old

	1990	*2000*	*2010*	*2020*	*2030*
Denmark	20.2	20.4	24.8	28.4	32.1
Germany	20.3	23.7	26.5	30.3	35.3
Japan	17.3	22.7	29.0	31.4	33.0
UK	20.8	20.7	23.0	25.5	29.6
US	16.6	16.5	19.2	24.5	28.2
OECD weighted average	18.2	19.9	23.1	27.0	30.7

Source: World Bank, 1994.

burden were to be smoothed. In Section V, we discuss how to evaluate the desirability of alternative strategies. Finally, Section VI brings out some conclusions.

II. PAY-AS-YOU-GO TAX PROFILES

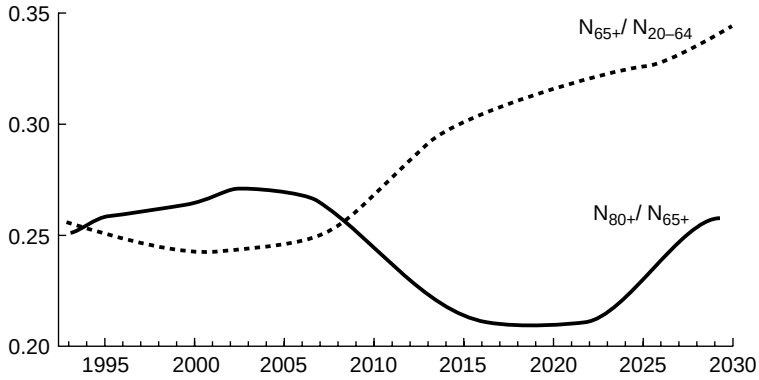
In this section, we treat government outlays to the elderly as if they constitute a separate government budget. Under a pay-as-you-go financing scheme, the per-period budget constraint is $N_e(g_e+h_e) = N_l y_l \tau_l$, where the left-hand side comprises current government spending on the elderly and the right-hand side contains the associated taxes levied on workers. N_e, g_e and h_e denote, respectively, the number of elderly, real per capita spending on services and real per capita income transfers (pensions etc.) to the elderly. N_l is the number of working-age people, y_l is their real average before-tax income and τ_l is the old-age social security tax rate (defined by the equation). The last is assumed to adjust endogenously in response to changing demographics. In order to make assessments of τ_l in the future, we need population projections and assumptions about the future course of g_e, h_e and y_l.

As to the demographics, following standard age demarcations we define the working-age population as those between the ages of 20 and 64, the elderly population as those aged 65 and above,[4] and the *very* old, N_v, as those aged 80 and above. The projection period is 1994–2030. It is most interesting to look at the ratio of elderly to working-age people, N_e/N_l, and the ratio of very old to the general population of elderly, N_v/N_e; see Figure 1. While the former curve provides information about the general ageing process, the latter tells which of either the young or the old group of elderly is growing most rapidly. If both

[4] Although difficult to calculate, the average effective retirement age in Denmark seems to be slightly less than 63 years; see Jensen and Nielsen (1993b).

FIGURE 1

Demographic Projections



Source: Danmarks Statistik, 1993.

ratios are rising at the same time, we have the phenomenon often referred to as 'double ageing'.

The first remarkable observation is that N_e/N_l displays a 'j-curve': over the next 10 years or so, N_e/N_l is falling, whereupon it increases rather dramatically. By international comparison, the prospect of a demographic 'breathing-space' is rather unique (although a similar phenomenon appears to characterise the UK). Second, there seems to be a tendency for N_e/N_l and N_v/N_e to move in different directions, at least over the next 25 years: during the 'breathing-space', the share of very old is rising, and when general ageing sets in, the share of very old is falling. From about 2020, however, there will be some double ageing in Denmark.

From an economic perspective, the apparent absence of double ageing until 2020 may be quite important. As indicated by Table 2 (which lists the base-year levels of h_e and g_e for different ages),[5] there is a strong positive relationship between age of the elderly and public outlays on old-age services.[6] The point is, of course, that very old people's need for medical care, home care etc. is substantially higher than young elderly's need for those services. For that reason, changes in the age structure within the group of elderly should be taken into account when assessing the budgetary implications of ageing. For example,

[5] The Danish public pension system is a flat-rate system; every citizen above age 67 is secured a decent minimum living standard via this flat-rate pension. In addition, about one-sixth of today's pensioners are covered by occupational pensions, and about one out of eight receive payments from individual pension schemes. For at least half of today's pensioners, and for at least a third of pensioners 30 years from now, the public pension benefit will represent the only or the most important means of old-age security.

[6] Although we find that public expenditures allocated to income transfers fall a bit above a certain age (because elderly people having left their private homes are no longer eligible for full public pension benefits), the effect of rising outlays to services is by far the dominant one.

TABLE 2

Per Capita Old-Age Expenditures

Age	h_e	g_e	h_e+g_e
65	74.3	14.7	89.0
70	78.9	27.0	105.9
75	80.2	40.3	120.5
80	79.6	67.7	147.3
85	78.1	108.5	186.6
90	76.3	157.0	233.3
95	60.0	222.1	282.1
99+	66.6	222.1	288.7

Source: Socialkommissionen, 1993.

while the 'breathing-space' (as identified by the simple ratios of elderly to working-age people) points to a fall in social expenditures, the increasing share of very old (and expensive) people tends to moderate this effect. Similarly, when general ageing takes off from about 2005, the share of very old falls, hence moderating the costs of ageing.

As to the average income of working-age people, we simply take GDP divided by the number of working-age persons, i.e. y_l = GDP/N_l.[7] The future path of y_l thus depends on both demographic factors and the growth rate of labour productivity (q). For simplicity, we regard q as constant, and the average labour income in the future is therefore given by $y_{l,t} = y_{l,0}(1+q)^t$.

The future paths of h_e and g_e are determined by the underlying indexation rules. We first consider a pure *price* indexation scheme (denoted by p), implying that all future levels of per capita services and transfers are maintained at their base-year level. This scheme implicitly assumes that gains from productivity growth entirely accrue to members of the work-force. For example, if productivity grows by 2 per cent a year, the growth rate of total benefits to the elderly will be 2 percentage points less than that of the before-tax income of wage-earners.

It would probably be more realistic to assume that productivity gains are shared between workers and pensioners. For that reason, we examine an alternative scheme, where both cash transfers and other costs go up in line with

[7] When comparing h_e and y_l, one should take into account that GDP includes capital income as well as labour income. Since evidence suggests that a significant part of the former accrues to the elderly, adjustments could be made for this, in particular if the ratio h_e/y_l is used as a measure of the relative living standard. Similarly, public pensions are taxed, albeit on easier terms than labour income. In this paper, however, we focus upon how h_e and y_l change over time rather than their absolute levels.

earnings (henceforth referred to as *wage* indexation, *w*).[8] Although this may be a realistic scheme in the light of past experience, it may be more difficult to employ in the future given the demographic projections as outlined above.[9] Indeed, since changes in the future PAYG tax rate are totally determined by changes in the ratio of elderly to working-age people, wage indexation most likely involves a considerable increase in the tax burden of working-age people.

While price indexation is unlikely to be acceptable to the old, wage indexation is probably unacceptable to the young. Also, wage indexation could distort labour markets to an extent which should not be neglected. With the aim of reconciling the potential conflict between generational equity and economic efficiency, we examine a 'compromise' scheme characterised by wage indexation of transfers, while other costs are indexed at a rate one percentage point lower than the growth rate of wages. Under this combined scheme (denoted by *c*), productivity growth does to some extent mitigate the financial problems arising from population ageing.

Furthermore, there is an important caveat regarding price indexation of old-age services. In fact, given that the main costs of looking after the elderly are wage costs (and medical costs), it seems rather unlikely that these costs could be kept in line with prices. At the very least, rising wage costs would have to be compensated by productivity increases in the provision of services. Alternatively, the quality of services — and hence the living standard of the elderly — would fall.

Let us now see how sensitive the future tax burden is to alternative productivity growth rates and alternative indexation schemes; see Table 3. The base-year level of τ_l is 11.0 per cent. We find that no matter the indexation scheme and productivity growth rate, the tax burden will fall up to 2005. Again, this reflects the remarkable feature regarding the timing of the ageing process in Denmark known as the 'breathing-space'. Fortunately, there is still time to think about how to 'avert the old age crisis' — to paraphrase World Bank (1994).

The first column, reporting the tax profile under wage indexation, could well serve as the 'status quo' bench-mark. Indeed, as argued in footnote 9, per capita public transfers and services allocated to the elderly have largely been provided on a wage indexation basis in the past. The numbers can therefore be seen as an illustration of the consequences of proceeding on that basis. An increase in the tax rate of 4 percentage points over the period from 2005 to 2030 would, other

[8] Again, y_l does not only include wages. However, having a Cobb–Douglas technology in mind, the wage share can be taken as constant over time.

[9] According to evidence provided by Socialkommissionen ('Committee on Social Policy', 1993), the purchasing power of public pensions increased by more than real wages of blue-collar workers over the period 1970–92. While per capita services allocated to the elderly did not increase by quite as much as real wages over the same period, they did increase in real terms. As an approximation, we therefore conclude that wage indexation on average describes a realistic indexation scheme for government expenditures to the elderly over the last 25 years or so in Denmark.

TABLE 3

PAYG Tax Rates, 1993-2030

	τ^w	τ^p q = *1%*	τ^p q = *2%*	τ^c q = *1%*
1993	11.0	11.0	11.0	11.0
2000	10.7	10.0	9.3	10.4
2005	10.7	9.5	8.5	10.3
2010	11.4	9.7	8.2	10.8
2015	12.6	10.1	8.2	11.8
2020	13.3	10.1	7.8	12.2
2025	13.9	10.1	7.4	12.6
2030	14.8	10.3	7.1	13.2

Source: Authors' calculations

things being equal, cause a rather serious fall in the average after-tax income received by wage-earners.

As shown by the numbers reported in the second and third columns, productivity growth combined with price indexation seems to 'solve' this problem. It is interesting to note that in a scenario with price indexation and a modest productivity growth assumption of 1 per cent a year, the tax rate is hardly rising.[10] However, by adopting the same policy in combination with a more optimistic growth scenario (q = 2 per cent a year), the tax burden on working-age people will fall steadily throughout the projection period and hence bias the generational distribution of income in a way hardly acceptable to the elderly.

As pure price indexation might 'decouple' the living-standard profiles of the two age-groups, the 'compromise scenario' previously outlined, in which transfers are indexed to wages whereas services lag behind by one percentage point a year, may be more realistic. The results reported in the last column of Table 3 confirm the presumption that this scheme would moderate the increase in the tax burden. However, since transfers constitute the major part of total per capita public outlays to the elderly, we see that higher tax rates are unavoidable.

To sum up, if we treat public outlays to the elderly within a separate, balanced budget setting, and if realistic productivity growth rates and indexation schemes are assumed, the underlying demographic structure tends to delineate a j-shaped tax profile: falling over the first 10–15 years (the 'breathing-space') and rising over the subsequent 20–25 years (when the 'baby boomers' reach pension age). This finding is important for the issue taken up in the next section.

[10] Obviously, identical results are obtained in the more general case where the increase in per capita expenditures is lagging behind wages by 1 percentage point.

III. FISCAL POLICY IN AN INTERTEMPORAL SETTING

1. Why Be Far-Sighted?

While the assumption of a separate old-age budget employed in the previous section is an attractive analytical abstraction, in many countries (Denmark included) outlays to the elderly are an integrated part of the general government budget. The previous section also assumed a balanced budget for each period. This may, however, be seen as a too 'myopic' way of dealing with the budgetary consequences of population ageing. For those reasons, we now look at more general fiscal policies that are based on longer planning horizons.

There are at least three reasons for acting in a more forward-looking fashion. First, as we have argued above, a PAYG financing scheme is likely to produce a j- shaped trajectory of the future tax burden. Since the 'baby-boomer' effect tends to dominate the 'breathing-space' effect, the *average* tax burden over the relevant time horizon is likely to exceed the current one. It follows from Barro's (1979) so-called tax-smoothing proposition that from the viewpoint of economic efficiency, the tax rate should be kept as constant as possible over the years. The point is that the dead- weight loss imposed by a distortionary tax increases by more than in proportion to the tax rate. Thus if, for example, population ageing causes a fall in the tax rate needed to finance the old-age social security budget from 11.0 per cent in 1993 to 10.7 per cent in 2005, and then an increase again to 14.8 per cent in 2030, it would be less costly to have a financing scheme with tax rates always at about 12½ per cent year after year rather than a tax system where rates vary between 10.7 and 14.8 per cent.

Second, a longer planning horizon could also be motivated by concerns over the sustainability of fiscal policy. Data on debts and deficits seem to indicate that a number of countries would have to modify their policies in a contractionary direction in order to avoid excessive debt accumulation. For example, OECD (1994) has estimated the average debt-to-GDP ratio in the small OECD countries to be 74.0 per cent in 1994, a figure expected to increase to 77.5 per cent already in 1996. With or without formal debt requirements, such as those implied by the Maastricht Treaty, many countries fear that it will become increasingly difficult to service these high debts. Not only high real interest rates, low economic growth rates and large structural deficits, but certainly also the pressures stemming from population ageing tend to aggravate these problems.

While the tax-smoothing proposition leads to a recommendation of tax rates being not only as constant but also as low as possible, sustainability considerations seem to rule out a cut in tax rates. Needless to say, higher tax rates could be avoided if instead expenditures could be cut. In any case, since a sustainable fiscal policy over a given period has been operationalised as one which implies that the ultimate debt-to-GDP ratio at most attains its initial level (cf. Blanchard, Chouraqui, Hagemann and Sartor, 1990), the demographic

pressure on public expenditures requires a fiscal contraction of some kind. Most likely, a fiscal contraction would make fiscal policy more credible: it would signal that the authorities are well prepared to meet the future pressure on the social security budget. A gain in credibility could be reflected in, for example, lower interest rates. However, since a fiscal tightening could compromise attempts to fight current high levels of unemployment, governments might well be reluctant to implement one. Indeed, the balance between short-term stabilisation and long-term sustainability is very subtle.

The third argument in favour of a far-sighted strategy is somewhat related to the sustainability argument. It has to do with the distribution of the tax burden across different generations. If fiscal adjustments are postponed, future taxpayers would not only have to cover the costs of providing for the elderly, they would also have to service the public debt which meanwhile might have grown large. For that reason, it seems advisable to start bringing down public debt now. This would clearly impose extra costs on currently living generations, either in the form of higher taxes or in the form of a fall in public services provided for them.

We shall return to the efficiency and intergenerational distribution arguments for far-sighted fiscal policy in Section IV.

2. The Analytical Framework

Within the confines of the government's intertemporal budget constraint, alternative fiscal strategies can be considered.[11] The timing and magnitude of a fiscal contraction are the guts of our argument. We stress the importance of the government's planning horizon, debt targets and future expenditure programme. Also, even if it is beyond the control of a small economy operating in an integrated world economy, the importance of the growth-adjusted real interest rate is examined.

When fiscal policy is set in a forward-looking fashion, we assume that governments smooth the tax burden associated with a given expenditure programme. For a given time horizon, n, we calculate a *permanent* tax rate, $\overline{\tau}_{1,n}$, which has three properties: first, it is constant; second, it is effective from the beginning of the year after the base year (i.e. $\tau_s = \overline{\tau}_{1,n}$ for $s = 1,...,n$); and third, it ensures that fiscal policy is sustainable. The last assumption rules out that the debt- to-GDP ratio at the end of the planning horizon, b_n, can be higher than in the base year (i.e. $b_n \leq b_0$). The permanent tax rate thus comprises current and future primary expenditures (including the costs of population ageing), interest payments associated with existing public debt, and the revenues needed to either stabilise or bring down public debt. Two alternative debt targets are considered: a 'soft' one, where the ultimate debt-to-GDP ratio is the same as in the base year,

[11] This section is kept non-technical. A more formal treatment is available upon request. See also Jacobsen, Jensen and Nielsen (1994) and Jacobsen, Jensen and Lentz (1995).

and a 'tough' one, where all outstanding debt has been settled at the end of the planning horizon.

While $\bar{\tau}_{1,n}$ identifies the conduct of fiscal policy in the case of a very resolute and far-sighted government, the timing of the introduction of sustainable fiscal policy could be different. As indicated by our demographic investigation, the projection period (1994–2030) can be divided into one sub-period (1994–2005) with a declining demographic pressure and another sub-period (2006–30) with strong population ageing. Even if the government's time horizon is long, it might be tempted to enjoy the short-term benefits from the reduced pressure on public expenditures during the 'breathing-space' period. Formally, suppose the government chooses to postpone the fiscal adjustment by, say, m years (where $1 < m < n$). Suppose further that a pay-as-you-go strategy with a balanced budget (i.e. leading to no change in the ratio of public debt to GDP) is pursued in each of the m years, whereupon the government switches towards a forward-looking policy. The permanent tax rate, $\bar{\tau}_{m+1,n}$, thus has to cover the average primary expenditures after time m, accrued interest payments on the initial debt and the desired debt reduction. The primary surpluses accumulated up to period m clearly have to be subtracted. If m is around a dozen years, the expenditure programmes after period m are likely to be more expensive than those before period m, and we would expect that $\bar{\tau}_{m+1,n} > \bar{\tau}_{1,n}$. $\bar{\tau}_{m+1,n} - \bar{\tau}_{1,n}$ can therefore be seen as a measure of the costs of postponing the tax adjustments that are required in any case.

We now turn to the magnitude of the fiscal adjustment. The difference between the current tax rate, τ_0, and a permanent tax rate, say $\bar{\tau}_{1,n}$, may convey some useful information about the magnitude of the required fiscal adjustment. In fact, following Blanchard, Chouraqui, Hagemann and Sartor (1990), it has become standard practice to interpret $\tau_0 - \bar{\tau}_{1,n}$ as an indicator of fiscal sustainability: if $\tau_0 - \bar{\tau}_{1,n} > 0$, fiscal policy *could* be relaxed, and if $\tau_0 - \bar{\tau}_{1,n} < 0$, fiscal policy *should* be tighter. While that interpretation seems valid if the time horizon is short (e.g. $n = 1$), care should be exercised if the time horizon is longer (as in the present study where $n = 37$). The point is that if the output gap is non-zero in the base year (i.e. if GDP does not correspond to 'normal' capacity utilisation), the base-year levels of taxes, τ_0, cash transfers, h_0, and, perhaps to a lesser degree, government spending, g_0, will be inadequate bench-marks. To illustrate, suppose there is a recession in the base year. Due to the operation of built-in stabilisers, τ_0 would be lower and both g_0 and h_0 would tend to be higher than in a 'normal' year. If the 'average' of the 37 years from 1994 to 2030 is a 'normal' year, it would not make sense to make calculations on the basis of the unadjusted budget in the base year. Put differently, if $\tau_0 - \bar{\tau}_{1,n}$ is to serve as an appropriate indicator of fiscal sustainability, the base-year deficit should be cyclically adjusted.

The year of 1993, the base year in this study, marked the end of a fairly long slump in Denmark. As estimated by OECD (1994), the output gap was –5 per

cent, indicating that GDP was 5 per cent below what it would be in a 'normal' year. We have suggested elsewhere (Jensen and Motzfeldt, 1994) that under certain realistic assumptions, the output gap is likely to be closed by 1998. As our cyclically- adjusted 1993 deficit we thus take the one projected for 1998. Let cyclically- adjusted variables be denoted by a tilde. We have estimated $\tilde{\tau}_0$ to equal 53.2 per cent and $\tilde{g}_0 + \tilde{h}_0$ to equal 54.6 per cent; hence our estimated structural budget deficit is 1.4 per cent for 1993. The corresponding debt ratio, b_0, equals 61.2 per cent. All variables are measured in real terms and as a ratio to GDP. The non-adjusted budget balance and public debt are linked in a stock-flow consistent manner.

As to the future expenditure programme, we distinguish between expenditures allocated to the elderly and other expenditures. Regarding the latter, we assume that they constitute a constant share of GDP. While this may not be quite realistic, it allows us to keep the influence of changing spending priorities separate from the influence of changing demographics. In relation to old-age expenditures, we distinguish between cash transfers and other costs. Both categories of expenditures are assumed to go up in line with earnings. As argued above, this assumption is fairly consistent with the actual way these expenditures have evolved in the past.

Finally, the magnitude of the fiscal adjustment clearly depends on the real interest rate, or rather, as the economy is growing, on the growth-adjusted real interest rate. The direct effect of a higher interest rate is a rise in the costs of servicing the initial public debt. There is also an indirect effect through the discount factor. Clearly, a higher interest rate means that a smaller weight is attached to expenditures concentrated at the end of the planning horizon. Since 'double ageing' is likely to take place over the last decade of the planning horizon, its costs will be smaller, the higher is the interest rate. In the calculations below, we assume a growth-adjusted real interest rate of 3 per cent a year.

IV. RESULTS AND IMPLICATIONS

1. Baseline Assumptions

Given the baseline assumptions stated above, we now show the tax and debt profiles under alternative fiscal strategies; see Figure 2. In each case, the tax rates are depicted in the diagram to the left and the corresponding debt developments in the diagram to the right. Except for the pay-as-you-go scenario, two different debt targets are considered: debt *stabilisation* ($b_n = b_0$), with solid curves, and debt *settling* ($b_n = 0$), with dashed curves.

As a bench-mark, consider the pay-as-you-go scenario, Figure 2(a). The overall budget is balanced each year, i.e. the debt-to-GDP ratio is smoothed

throughout. The message is clear: the tax rate is likely to rise quite dramatically in the next century. By 2030, for example, the tax rate is projected to be almost 5 percentage points above its current level. Changing demographics are not the only reason, however; the structural deficit in the base year and the positive growth-adjusted real interest rate also contribute to the required tax increase.

Instead of smoothing the debt ratio, a polar alternative would be to smooth the tax rate from 1994 to 2030, as in Figure 2(b). The difference between the permanent tax rate and the current (cyclically-adjusted) tax rate in 1993 is 1.6 percentage points. This indicates a need for *some* tightening in order for fiscal policy to become long-term sustainable. If the tax rate is raised to its sustainable level, the public sector will start saving: the debt-to-GDP ratio will be brought down from 61.2 per cent in 1993 to 39.3 per cent in 2013. Thereafter, as the 'baby-boomer' effect sets in, a long period of government debt issuing takes place until the initial debt-to-GDP ratio is recaptured in 2030. If the debt is to be eventually settled by 2030, there is a need for an additional tax increase of 1 percentage point.

Debt reduction seems to have become an area of high priority across a broad political landscape. As we have seen, if the process of settling public debt is stretched over many years, the *extra* burden on taxpayers is fairly modest. However, an ambitious debt target could also mean that the government wishes to settle the debt in a medium-term perspective. Both the following demographic wind (1994–2005) and the economic boom currently experienced by many European countries would facilitate such a strategy.

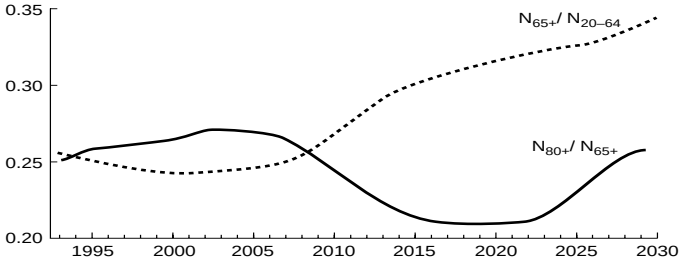
Figure 2(c) shows the case where the tax burden is smoothed from 1994 to 2005, then followed by a pay-as-you-go strategy. If the government wishes to settle its outstanding debt over an adjustment period of 12 years, the overall tax rate must increase by 5 percentage points above the current level. This is hardly realistic. Suppose the additional tax burden is levied solely on labour income. With a share of wages in GDP at about 60 per cent, the labour tax rate should then be raised by about 8 percentage points! A fiscal contraction of that size would clearly depress the macroeconomy.

We have also portrayed the case where the government does not aim at a lower debt-to-GDP ratio. If fiscal policy is no more ambitious than that, the current tax rate is almost sustainable. Since the major part of the expenditures is concentrated in the beginning of the adjustment period, the debt-to-GDP ratio is allowed to rise a little bit before returning to its initial level in 2005.

Finally, consider the scenario where the government behaves first in a short-sighted fashion (during the demographic 'breathing-space') and then in a far-sighted way. Specifically, we assume that the debt-to-GDP ratio is smoothed up to 2005 and the tax burden is smoothed thereafter. This scenario could be relevant if a government feels tempted to derive short-term benefits from the reduced pressure on public expenditures during the 'breathing-space'. It could be a worrying policy to pursue, since subsequent adjustments could be rather tough

FIGURE 2

Taxes and Public Debt (Ratio to GDP), 1993-2030



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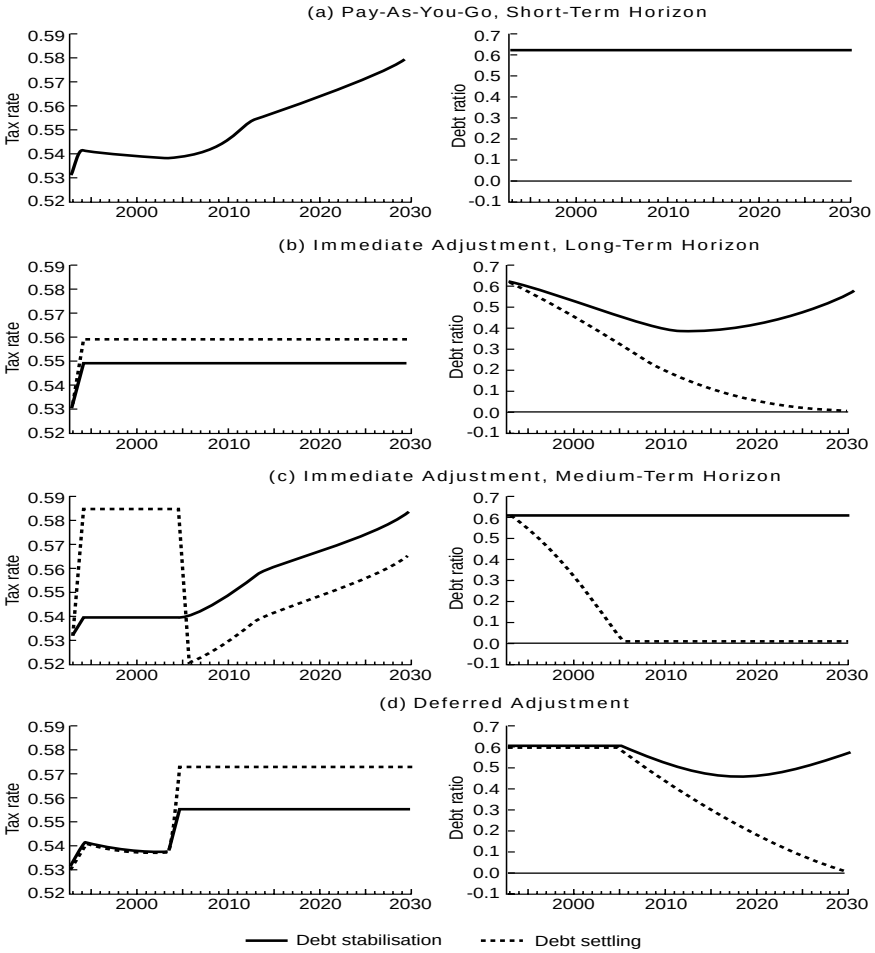

to implement. We therefore try to evaluate the 'costs' of postponing the required adjustment; see Figure 2(d). The permanent tax rate from 2006 onwards is found to be 2.4 percentage points above the current level and 0.8 percentage points above the permanent tax rate if it were implemented from the very beginning. A policy of tax smoothing thus involves a rather significant 'jump' in the tax rate at the time when the policy change is enacted.

In sum, in order to prevent government debt from increasing in the long run, fiscal policy should be tightened. Even in the medium term with a following demographic wind, current fiscal policy is hardly sustainable.

2. Robustness

In general, if there is a need for fiscal contraction, the reason is 'high' primary expenditures, 'large' interest payments, 'ambitious' plans for debt reduction or a structural deficit in the base year. In this section, we attempt to examine how sensitive the magnitude of the required fiscal adjustments is to the timing of the fiscal strategy, the debt target, the growth-adjusted real interest rate and the indexation of per capita outlays to the elderly. Furthermore, given the emphasis of the paper, we would also like to isolate that part of the adjustment that is attributable to changing demographics.

If we want to isolate the effect of changing demographics, the combined effects of debt service, debt reduction and the structural deficit should be eliminated, and the path of primary expenditures should be governed entirely by demographic factors. Let $\tilde{\tau}_0^*$ be the base-year tax rate in the hypothetical case where public debt and hence interest payments are zero, and where the structural deficit is zero. Further, let $\tilde{\tau}_{1,n}^*$ be the permanent tax rate that covers the current and (discounted sum of) future primary expenditures. $\tilde{\tau}1,n^* - \tilde{\tau}_0^*$ then provides a measure of the fiscal adjustments needed in order to cover the costs of changing demographics.

Consider Table 4. The first row restates the results under baseline assumptions. Note that the required increase in the tax rate as a result of changing demographics is less than 1 percentage point. How are these results affected if the growth-adjusted real interest rate, r^v, is only 1 per cent?[12] On the one hand, the burden associated with servicing the public debt falls. If the ratio of debt-to-GDP eventually converges back to its initial level, the lower interest rate means that the required increase in the tax rate is more than halved. On the other hand, a lower interest rate raises the discount factor, hence the 'baby boomers' become more costly in present-value terms. Indeed, the isolated effect of ageing is higher than the combined effect. However, even if the real interest rate were to fall to such a low level, there is still a need for a fiscal tightening.

[12] Although this is a low value compared with levels in the 1990s, in the longer run one might expect some narrowing of the gap between the real interest rate and the economic growth rate.

TABLE 4

Robustness of Results

		$\tilde{\tau}_{1,37} - \tau_0$		$\tilde{\tau}_{1,37}^{*} - \tilde{\tau}_0^{*}$
		$b_n = b_0$	$b_n = 0$	*(ageing effect)*
Wage indexation	$r^v = 3.0$	1.6	2.6	0.8
	$r^v = 1.0$	0.7	2.1	1.0
Differentiated indexation	$r^v = 3.0$	1.0	2.0	0.1
	$r^v = 1.0$	0.0	1.4	0.3

To what extent does the adherence to the compromise scenario with differentiated indexation defined in Section II represent a solution to this sustainability problem? Clearly, if old-age services are indexed at a lower rate (1 percentage point less) than cash transfers, the ageing effect is reduced. With r^v at 3 per cent a year, there still is a sustainability problem. However, if r^v drops to 1 per cent a year, the problem disappears. But still, unless something similar to the compromise scenario is implemented, and the growth-corrected interest rate is extraordinarily low, fiscal tightening is hardly avoidable in the long run.

V. DOES TAX SMOOTHING PAY?

It has so far implicitly been taken for granted that tax smoothing is optimal, but we have said nothing about the quantitative significance of this proposition. In this section, we try to evaluate whether tax smoothing really is worthwhile as a means to reduce average labour market distortions.

An alternative criterion for assessing the desirability of tax smoothing versus debt smoothing may be based on intergenerational redistribution effects. We here partly draw on an earlier treatment of the relationship between ageing and intergenerational welfare; see Jensen and Nielsen (1993a).

1. The Efficiency Argument for Smoothing

Following standard practice, we consider the dead-weight (or efficiency) loss associated with taxation as the assessment criterion for the distortionary effect imposed by a labour income tax, τ. We shall not go into details here but just briefly indicate how to proceed.[13]

The point of departure for the measurement of dead-weight loss associated with taxation is a simple image of the labour market with curves representing elastic labour demand and supply. The computation involves a subtraction of the total welfare after the introduction of the labour income tax (the sum of

[13] For more information on the calculation, see Jacobsen, Jensen and Nielsen (1994).

consumers' surplus, producers' surplus and the government revenue) from the total welfare in the hypothetical case where the revenue could be collected on a lump-sum basis. Assuming that capital income taxation is approximately revenue neutral (not an unrealistic assumption in the Danish case),[14] and taking the production structure to be Cobb–Douglas, the dead-weight loss may be written as $E = \varepsilon\tau^2 Y/2$. Here, τ is the labour income tax rate and Y is GDP. ε is defined by $\varepsilon \equiv (1/\alpha)\eta^d \eta^s/(\eta^d + \eta^s)$, where α is the wage share in production, η^d is the numerical elasticity of labour demand and η^s is the numerical elasticity of compensated labour supply.

Given this expression for the dead-weight loss, we are now equipped to examine the quantitative importance of following either of the above scenarios for tax rates and public debt in the period 1993–2030. First, we use the following values for the key parameters: $\alpha = 0.538$, $\eta^d = 2.16$ and $\eta^s = 0.103$. (The last estimate relies on Smith (1990), while the former two draw on Danish National Accounts.) These parameter values result in a value for ε of 0.183.

Using this value of ε in the formula for the dead-weight loss, we discover that the differences in the dead-weight losses associated with the three strategies — (a) balanced budget in the entire period, (b) far-sighted tax policy and (c) balanced budgets until 2010 and far-sighted tax policy thereafter — are very slight. Indeed, the difference in the present value of the dead-weight losses between strategies (a) and (b) accounts for only about 0.03 per cent of GDP in 1993.

Using a much higher estimate of the elasticity of compensated labour supply, probably the most uncertain parameter in the computation, does not really change the picture. A three-times-as-high elasticity only produces a difference in dead- weight losses of 0.1 per cent of GDP.

So while for efficiency reasons it is preferable to adjust to the upcoming period of population ageing by keeping the overall tax rate constant, it does not make much difference, quantitatively, whether this strategy or one of balanced budgets is pursued.

2. Concerns over Intergenerational Equity

A more potentially forceful argument for keeping tax rates constant over a period of major swings in the composition of the population relates to intergenerational distribution.

We demonstrated above that when the number of old people increases drastically relative to the number of workers, then the contribution the latter pay in order to sustain transfers and services to the former that keep pace with (before-tax) wages will increase markedly. If, until the process of population

[14] Interestingly, the capital income tax in Denmark — aside from the corporate income tax — actually yields a negative net revenue, because much of private sector capital income benefits from special tax concessions whereas all interest expenses are fully deductible from taxable income.

ageing sets in, fiscal policy has implied a constant debt-to-GDP ratio and balanced budgets, then those generations that become old during the ageing period will hardly feel the ageing process at all. In contrast to this, the general tax burden of those who are working when the process runs its course will experience taxes that rise in line with increased old-age-related expenditures and will thus be quite substantially affected.

In the opposite scenario with far-sighted fiscal policy from now on, taxes would be raised to a constant level well before the ageing process really sets in, so that the economy would end up with the same debt-to-GDP ratio at the end of the horizon. Compared with the former scenario, those generations that become old during the process of population ageing are now taking part in society's preparation for the period by making it possible to reduce public debt in the mean time. Furthermore, since when ageing sets in there will be smaller interest payments (on a smaller public debt), those generations that are of working age during the ageing period will not have to pay quite such high taxes as in the first scenario. It is therefore fair to say that this scenario has the property of sharing the burden of the ageing process in a better way between generations, in particular between the old and the young when the population ages.

In an earlier paper (Jensen and Nielsen, 1993a), we have investigated the relation between population ageing, the public pension system and intergenerational redistribution. Different strategies for the evolution of benefit and tax rates within a PAYG public pension system in the face of demographic changes were considered, and the implications of these strategies for intergenerational redistribution were mapped. It clearly emerged that a strategy of keeping pension benefit rates unchanged, while having contributions adjust (upwards) under population ageing gave rise to the most uneven generational impact, essentially because those generations that become old during the ageing process are not made to carry any burden. A strategy of keeping the ratio of the benefit rate to the after-tax wage fixed (so that both benefits and contributions carry part of the burden of ageing) fared better, as did a strategy of keeping contribution rather than benefits unchanged. In a similar vein, we would expect in the present context that a strategy of debt reduction before the ageing process really sets in will represent a more intergenerationally equitable response than simply having the entire burden of ageing being borne in the form of taxes paid by contemporaneous workers.

A more careful investigation of the intergenerational equity argument for sustainable policy under population ageing, using, for example, the technique in Jensen and Nielsen (1993a), lies outside the scope of this paper and must be relegated to future work.

VI. CONCLUSIONS

As a consequence of ageing populations, there is a pressure on public outlays allocated to the elderly. This paper has discussed two alternative approaches to overcome the future demographic burden, namely pay-as-you-go financing (to indicate short-sighted fiscal policy) and funding in advance (to indicate far-sighted fiscal policy). Both strategies are organised by the public sector and assumed to be integrated into a sustainable fiscal programme. Although we have taken Denmark as a case-study, our results easily generalise to other OECD countries.

Under a pay-as-you-go scheme, we find that the future tax rate is likely to delineate a j-shaped profile: slightly falling over the first 10–15 years (the demographic 'breathing-space') and rising over the next 20–25 years (when the 'baby boomers' reach pension age). The results are, however, rather sensitive to the assumptions about, notably, productivity growth, the indexation rule adjusting per capita outlays and the real interest rate.

While pay-as-you-go financing thus tends to imply varying tax rates, tax smoothing is characterised by varying debt-to-GDP ratios. Against the benchmark of the cyclically-adjusted tax-to-GDP ratio in 1993, we have shown that the permanent tax rate is about 1.6 percentage points higher than the 1993 ratio. However, changing demographics seem to account for only about a half of that increase. Hence, if fiscal policy in Denmark is unsustainable at present, this is also due to excessive spending in the past combined with high current growth-adjusted real interest rates. Whereas considerations of economic efficiency point to tax rates being as constant and as low as possible, concerns over the sustainability of fiscal policy thus seem to rule out a cut in tax rates, at least if current spending priorities remain unchanged.

Although the case for far-sighted behaviour can be made rather easily, it may be controversial to translate this wisdom into the daily practice of tax policy. In particular, the risk of fiscal 'overkill' might well rule out such a policy. Also, since recent research on the 'politics' of budgetary policy has identified a short-term deficit bias of political decision-making, the temptation to cut taxes during the initial period with lower demographic burdens might be hard to resist.

Overall, the message of the paper is that in spite of all obstacles to a long-term orientation in the conduct of fiscal policy, there are several good reasons for such a policy. In the interest of equity between generations, we suggest that those who become old during the population ageing period should be more heavily involved in reducing public debt over the next decade or so, thus lowering the burden that will have to be borne by working-age people during the ageing period. Furthermore, explicitly making fiscal policy sustainable from now on is likely to bring credibility-related secondary gains in the form of lower national interest rates and lower inflation.

REFERENCES

Barro, R. J. (1979), 'On the determination of public debt', *Journal of Political Economy*, vol. 87, pp. 940–71.

Blanchard, O., Chouraqui, J., Hagemann, R. and Sartor, N. (1990), 'The sustainability of fiscal policy: new answers to an old question', *OECD Economic Studies*, vol. 15, pp. 7–36.

Börsch-Supan, A. (1991), 'Aging populations', *Economic Policy*, vol. 12, pp. 103–40.

Bös, D. (1992), 'Economics of aging', University of Bonn, Department of Economics, Discussion Paper no. A-370.

Cutler, D., Poterba, J., Sheiner, L. and Summers, L. (1990), 'An ageing society: opportunity or challenge', *Brookings Papers on Economic Activity*, no. 1, pp. 1–72.

Danmarks Statistik (1993), *Statistiske Efterretninger, Befolkning og Valg*, Copenhagen.

Hurd, M. (1990), 'Research on the elderly: economic status, retirement, and consumption and saving', *Journal of Economic Literature*, vol. 28, pp. 565–637.

Jacobsen, H., Jensen, S. H. and Lentz, R. (1995), 'Befolkningsaldring, offentlige udgifter og finanspolitikkens holdbarhed', *Ekonomisk Debatt*, vol. 23, pp. 23–35.

—, — and Nielsen, S. B. (1994), 'Population ageing, public expenditures and sustainable tax policy', mimeo, Economic Policy Research Unit, Copenhagen Business School, February.

Jensen, S. H. and Motzfeldt, C. (1994), 'Offentlig gæld og budgetunderskud i Danmark — er finanspolitikken holdbar?', *Nationaløkonomisk Tidsskrift*, vol. 132, pp. 1–17.

— and Nielsen, S. B. (1993a), 'Aging, intergenerational distribution and public pension systems', *Public Finance*, vol. 48, pp. 29–42.

— and — (1993b), *Økonomi, Demografi og Ældrepolitik*, Copenhagen: DJØF Publishers.

Johnson, P. (1993), 'Ageing and European economic demography', in P. Johnson and K. F. Zimmermann (eds), *Labour Market Implications of European Ageing*, Cambridge: Cambridge University Press.

OECD (1988), *Aging Populations — The Social Policy Implications*, Paris: OECD.

— (1994), *Economic Outlook*, June, Paris: OECD.

Smith, N. (1990), 'Household labour supply and taxes in Denmark', mimeo, Centre for Labour Economics, University of Aarhus.

Socialkommissionen (1993), *De Ældre — En Belysning Af Ældregenerationens Forsørgelse*, Copenhagen: DBK bogdistribution.

World Bank (1994), *Averting the Old Age Crisis*, Washington DC: World Bank.