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POPULATION AGING AND FISCAL POLICY IN EUROPE AND THE UNITED STATES

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Abstract

In this paper, we compare the total size of *intertemporal public liabilities* (IPLs) of several European countries and the United States. We utilize the machinery of generational accounting in order to calculate the composition of the countries IPLs, that is the sum of the explicit and implicit liabilities embedded in the respective fiscal policies. The findings suggest that present fiscal policies of all countries with the exception of Ireland have positive intertemporal liabilities and, hence, are unsustainable over the long-term. The study also confirms the claim made by advocates of generational accounting that explicit debt is a poor indicator of long-term fiscal sustainability. Among all EMU participants, those with the highest implicit liabilities report the lowest explicit debt. However, countries with the smallest or negative implicit liabilities have rather high explicit debt levels in the base year of the calculations reported here – 1995.

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1. Introduction

Establishing sound and sustainable public finances is a top priority among policymakers in all Western countries. In Europe, the Maastricht criteria for qualifying as a member of the European Monetary Union (EMU) called for substantial fiscal consolidation with respect to both public sector budget deficits and the stock of outstanding public debt. Except under special circumstances, each prospective member country's budget deficit had to be below 3 percent of GDP and the public debt less than 60 percent by 1997.[1]

Retaining membership in the EMU requires member countries to conform to similarly tight fiscal constraints.[2] However, even on account of non-retirement spending—public capital investments, welfare, and unemployment benefits—staying within the Maastricht fiscal limits constitutes a tough uphill task for many member nations. Germany, for example, whose public debt is already at the limit, will be unable to finance the ongoing process of unifying its Eastern and Western economies via significant additional borrowing from capital markets. Furthermore, pressures to exceed the limits will grow as a ballooning number of retirees demand delivery of the generous retirement benefits promised them under current pension laws. These issues motivate an analysis of the size of the true liabilities, explicit as well as implicit, faced by member nations and of the total fiscal adjustment that may be necessary for establishing long-term fiscal sustainability.

Policymakers in the United States face long-term fiscal problems that are similar, but not as severe as Europe's. High debt accumulated in the 1980s and early 1990s has increased service costs. Although, prospective budget surpluses are expected to help in reducing the size of outstanding debt, political momentum to squander them

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[1] The former criterion was considered to be a "hard"–one that all countries had to achieve—while the latter was considered "soft"–that was not essential if all other fiscal and monetary criteria were met.

[2] Under the Stability and Growth Pact of the Maastricht Treaty, if a country is judged to have violated the deficit criterion in the absence of exceptional circumstances (such as a recession or a natural disaster), a maximum of four months are allowed for corrective action. Sanctions are imposed in several steps. Ultimately, in addition to certain non-pecuniary sanctions, the country may be required to make non-interest bearing deposits with the European Central Bank up to 0.5 percent of its GDP, once for each year that its deficit is considered to have violated the limit. A deposit is forfeited if the country fails to conform to the deficit limit within two years. See http://europa.eu.int/euro/quest/normal/frame.htm?language_nb=5 for more details.

on additional government consumption seems to be growing. Despite improved budget projections, the magnitude of the long-term fiscal challenge remains sizable in the United States. Long-term projections based on 'intermediate' economic and demographic assumptions indicate large revenue shortfalls for Social Security and Medicare. However, these assumptions may be too optimistic from the perspective of these programs' finances. First, future productivity growth is assumed to be higher than warranted by experience during recent decades and, second, future improvements in longevity are assumed to occur more slowly than previous experience would suggest.[3]

In this paper, we implement in a transatlantic comparison of the total size of *intertemporal public liabilities* (IPLs)—the sum of the explicit and implicit liabilities embedded in the fiscal policies of several European countries and the United States. The driving force behind the implicit demands on future public budgets is the demographic transition underway in Europe and the United States. In general, all developed countries have one phenomenon in common: a significant "double aging" of the population. Because of the baby-boom and subsequent baby-bust during the postwar period and because of steady improvements in longevity, future populations in these countries will not only contain a greater proportion of elderly, but also a higher fraction of *older elderly* individuals. That is, general population aging will be accompanied by an aging of the elderly population itself.

Traditional fiscal indicators based on cash-flow accounts fail to address aging phenomena because future liabilities of pay-as-you-go retirement and health care systems are absent from current fiscal flows. Hence, cash-flow deficits and the size of outstanding debt are unreliable as indicators of fiscal sustainability and the debt and deficit criteria for fiscal 'harmonization,' such as those of the Maastricht treaty, may prove insufficient and shortsighted.[4] This paper uses the machinery of generational accounting developed by Auerbach, Gokhale, and Kotlikoff (1991, 1992) in order to

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[3] Although some believe that the high productivity growth witnessed in recent years is likely to be sustained, in our opinion, it does not as yet provide adequate reason to revise upward the long-term productivity growth rate assumed in making Social Security revenue projections.

[4] Note that limits on the debt and on cash flow deficits are sufficient for maintaining a sustainable policy. However, the question of whether such limits, in and of themselves, are sufficient as pre-commitment devices to move to a sustainable policy remains an empirical question—one that only the passage of time will help resolve.

calculate and compare the composition of European and United States' IPLs between explicit and implicit liabilities.

Our analysis is restricted to the U.S., Norway and twelve member states of the EU—Austria, Belgium, Denmark, Finland, France, Germany, Italy, Ireland, the Netherlands, Spain, Sweden, and the United Kingdom.[5] The findings suggest that present fiscal policies of all countries with the exception of Ireland have positive IPLs and, hence, are unsustainable over the long-term. Only Ireland has a small but negative IPL, indicating a small stock of assets and, therefore, the potential to reduce taxes or increase transfers or other public expenditures in the future. Finland and Sweden have the highest IPLs with IPL/GDP ratios of over 200 percent. In Austria, the UK, Spain, Germany, and Italy, this ratio ranges between 100 and 200 percent. Our calculations show somewhat smaller, but nonetheless high, IPLs for the United States, France, the Netherlands, and Denmark, for whom the IPL/GDP ratio lies between 70 percent and 100 percent. Finally, Norway and Belgium have very small IPL/GDP ratios of only 10 and 19 percent respectively.

This study confirms the claim made by advocates of generational accounting that explicit debt is a poor indicator of long-term fiscal sustainability. Among all EMU participants, those with the highest implicit liabilities report the lowest explicit debt. However, countries with the smallest or negative implicit liabilities have rather high explicit debt levels in the base year of the calculations reported here—1995. The explanation for the apparent negative correlation between explicit and implicit liabilities may be that by 1995, EU countries with the highest explicit-debt/GDP ratios had already begun to implement fiscal reforms in order to become eligible for participation in the EMU.

The outline of the remainder of the paper is as follows: Section 2 provides a brief description of the method adopted for estimating IPLs. Section 3, reports and

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[5] The studies were undertaken by a team of experts at the request of the European Commission`s Directorate General XXI (Task Force on Statutory Contributions). Cf Keuschnigg et al (1999) for Austria, Dellis and Lüth (1999) for Belgium, Jensen and Raffelhüschen (1999) for Denmark, Feist et al (1999) for Finland, Crettez et al (1999) for France, Bonin et al (1999) for Germany, McCarthy and Bonin (1999) for Ireland, Franco and Sartor (1999) for Italy, Bovenberg and ter Rele (1999) for the Netherlands, Berenguer et al (1999) for Spain, Lundvik et al (1999) for Sweden, and Cardarelli and Sefton (1999) for the United Kingdom. These studies are available upon request. Results for the United States are based upon Gokhale Page, and Sturrock, (1999). For Norway, see Norwegian Ministry of Finance (1999).

discusses trends in dependency ratios for the elderly and the oldest-old populations in Europe and the United States. Section 4 reports IPLs for 13 European countries and the United States, decomposes them between explicit and implicit liabilities and, for each country, calculates the size of the immediate and permanent hike in all taxes that would reduce IPLs to zero. This section also presents country-specific IPLs calculated under the assumption of a constant population structure in order to examine the degree to which population aging contributes to the size of implicit liabilities. Finally, section 5 summarizes the results and concludes the paper.

2. Intertemporal Public Liabilities and their Measurement

Intertemporal Public Liabilities

The point of departure for our calculations is the government's intertemporal budget constraint. This constraint states that the government's future net taxes must be just sufficient to service or retire its net explicit debt. It can be expressed as:

$$(1) \qquad \sum_{s=t}^{\infty} T_s R^{-(s-t)} - B_t = 0.$$

Here, B_t stands for the public sector's net explicit debt in the base year, t; T_s represents *actual* net taxes collected in future years indexed by s; and R=1+r represents a discount factor where the assumed interest rate is r. The term 'net taxes' is shorthand for 'unified primary budget surpluses:' It refers to aggregate public sector taxes less expenditures on non-interest transfers and purchases of goods and services. Actual future net taxes depend upon future fiscal policy changes. Hence, in general, actual future net taxes will differ from those that would be collected if the current set of fiscal policies were maintained indefinitely. We denote the latter by T^*_s. Equation 1 need not hold when T^*_s is substituted in place of T_s. If it does not, it is standard convention to consider current fiscal policy as being unsustainable: If the present value of net taxes exceeds B_t, fiscal policy would need to be changed to avoid a wasteful accumulation of resources with the government.[6] Alternatively, fiscal policy would have to be altered to avoid government debt default if the present value of net taxes falls short of B_t.

[6] Note that the first term in equation 1 evaluates the present value of the stream of net taxes through the indefinite future.

We report the size of each country's intertemporal public liability (IPL) embedded in its existing fiscal policy.[7] This measure is defined by rewriting equation 1 as

$$(2) \qquad IPL_t = B_t - \sum_{s=t}^{\infty} T_s^* R^{-(s-t)}.$$

As is evident from equation 2, the value of IPL reflects both explicit and implicit government liabilities, the latter caused, for example, by generous pay-as-you-go retirement programs at a time of rapid population aging. The size of IPL also indicates the extent of policy adjustment necessary to restore fiscal sustainability: If positive, the government's total expenditure commitments (including interest payments on its explicit debt) exceed prospective revenues under status quo conditions and net taxes must be increased at some point in the future. If negative, the IPL indicates the extent to which taxes should be reduced.

Measurement

B_t is easily measured as the government's financial indebtedness less its tangible and financial assets.[8] Measuring, the second term on the right-hand-side of equation 2 is more difficult since it requires projections of future government taxes and expenditures under current policy. Reliable projections of taxes, transfers, and government purchases of goods and services are available for only a few of the countries analyzed here. Fortunately, generational accounts have been estimated for most European countries and for the United States. Its machinery offers a relatively straightforward way of projecting future government revenues and expenditures under prevailing fiscal policies. [9]

For those countries where projections of aggregate taxes, transfers, and government spending on goods and services are not available or are not reliable, we

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[7] In the literature, this indicator is also called "generational balance gap" or "true debt." See Raffelhüschen (1999a) for a broader discussion.

[8] Intra-agency debt—that is liabilities of the government held in other government accounts—are not included in the calculation.

[9] For a brief description of generational accounting see Auerbach, Gokhale and Kotlikoff (1991, 1992, 1994). The method employed in this paper follows the standards developed in the European Commission's project *Generational Accounting in Europe* [cf Raffelhüschen (1999b,c)].

project these aggregates using a standard procedure. For each country, relative profiles of taxes and transfers by age and sex are available for the base year (1995). These profiles are obtained from micro-data surveys, one for each tax and transfer category in each country.[10] The available tax profiles cover all forms of statutory payments to the government and transfer profiles reflect both in-cash and in-kind benefits.[11] The relative-profile values for government purchases of goods and services are assumed to equal 1 for each age and sex because of the 'public good" nature of these outlays.[12] Because they reflect the age- and sex-specific distribution of taxes, transfers, and purchases of goods and services across the population, the set of profiles for a given country constitute a detailed representation of the fiscal policy prevailing in that country during the base year.

Next, for each country, aggregate taxes, transfers, and government purchases in the base year (at all levels of government—federal, state, and local) are distributed among individuals alive in that year according to the corresponding age-sex relative profiles. This procedure yields per capita taxes, transfers, and government purchases for the base year. For future years, profiles of per capita taxes, transfers, and government purchases are obtained by applying an assumed long-run growth factor of 1.5 percent per year to the base year's per capita profiles. Thus, let $h^{x}_{a,i,t}$ represent the i^{th} type of tax per capita for a person of sex x aged a in year t. Then, the i^{th} per capita tax in year s>t is calculated as:

$$h^{*x}_{a,i,s} = h^{*x}_{a,i,t}(1+g)^{s-t}. \qquad (3)$$

The same growth factor is used for every country included in this study. Appropriate modifications are made to future per capita values in those cases where recent fiscal policy changes imply future changes in the distribution of taxes or transfers by age and sex. Next, for each country, two profiles of per capita net taxes—taxes net

[10] See the references mentioned in footnote 2.

[11] All available information was used to derive age-sex profiles for the various types of taxes and transfers. Whenever there was insufficient information to distinguish payments by age or sex, we distribute the base-year aggregate amount equally by age or sex.

[12] For some countries, such as the United States, government purchases on goods and services are distributed according to a few age-sex categories. However, the part of government spending that represents purchases of pure public goods—such as defense—is distributed uniformly across the living population.

of transfers and net of government purchases of goods and services—are computed (one for each sex) for each future year s:

$$(4) \qquad \eta^{*x}_{a,s} = \sum_i h^{*x}_{a,i,s} .$$

Finally, aggregate taxes net of transfers and net of purchases of goods and services for future years are computed as

$$(5) \qquad T^{*}_{s} = \sum_x \sum_{a=0}^{D} \eta^{*x}_{a,s} P^{x}_{a,s} .$$

In equation (5), $P^{x}_{a,s}$ stands for the number of individuals of sex x aged a in year s. Country specific population projections based on assumptions on mortality, fertility, and immigration consistent with those of official medium-term estimates of future demographic trends were employed in the calculations.[13]

For countries where reliable long-term projections are not available, we use the method described above to obtain future aggregate taxes, transfers and government spending. For others, such as United States, where reliable medium and long-term projections are available from official government agencies, we use the method described above to extend the projections beyond the last year available. The projections are extended sufficiently far out into the future so that adding more years makes no appreciable difference to present value calculations—that is, until the second term on the right-hand-side of equation 2 has converged.

3. A Cross-country Comparison of Demographic Trends

Figure 1 shows the elderly dependency ratio for the European countries considered here and for the United States. The figure shows the ratio of the population over age 60 to that aged between 20 and 59.[14] The ratio for the year 1995 is based on actual population data whereas ratios for 2015, 2035 and 2055 are based on the above-mentioned population projections for the various countries. Among European countries, Sweden, Italy, and Belgium have the highest elderly dependency ratios in 1995. All

[13] For the country-specific data sources, see the references listed in footnote 1.

[14] The cut-off age was chosen at 60 because this is the effective retirement age in public pension systems in most of the countries considered here.

countries are projected to experience a significant increase in their elderly dependency rates over the next 15 years. The gain in the ratio is largest for Finland, but Sweden and Italy are, again, prominent as countries that will experience the steepest increase in the size of the elderly relative to the working-aged population. By 2015, more than half of the populations of these three countries will be aged 60 or older. By contrast, the elderly dependency ratio will be at a modest 37 percent in the United States.

Population aging will continue in Europe well beyond the first two decades of the next century. In Italy, nearly four out of every five persons will be aged 60 or older by 2035! In Sweden, Austria, and Germany, two of every three persons will be elderly according to the criterion used here. Again, the population in the United States will be relatively much younger with only one of every two persons in the elderly category. Except in Ireland and Spain, where elderly dependency ratios continue to rise beyond 2035, the process of population aging will cease after about five decades.

Population aging has two dimensions: Not only will there be more elderly individuals in the future, healthier lifestyles and medical advances will lead to an expanding population of the older old. Figure 2 shows dependency ratios for the oldest-old—the ratio of those aged 75 or more to those aged 20-59—for the years 1995, 2015, 2035 and 2055. This ratio is at or just over 10 percent for most of the countries considered here (the UK, at 15, is an exception). By 2035, this ratio is expected to roughly double for 10 of the 13 countries considered here. It more than triples for Italy: by 2055, roughly two out of every five Italians will be aged 75 or older. In the United States, this ratio is expected to increase through 2035, but then fall back slightly by 2055. Overall, the elderly dependency ratio will almost double in another 3 decades and the oldest-old dependency ratio will close to triple by the middle of the next century.

4. Findings

Explicit, Implicit, and Total Intertemporal Public Liabilities

Figure 3 shows country-specific IPLs. The countries in this and earlier figures are sorted in ascending order according to their total IPLs as of 1995. The figure also shows the magnitudes of explicit liabilities (public sector net outstanding debt in 1995) and implicit liabilities calculated according to the method described earlier. Only Ireland has a negative IPL: Despite its relatively significant population aging and high

level of explicit debt, Ireland's 1995 fiscal policies generate a surplus of future net taxes relative to non-interest expenditures. The projected surpluses are more than sufficient to repay its explicit debt, indicating the potential for somewhat lower taxes, higher transfers, or greater government purchases in the future.[15] Norway's rich petroleum reserves amount to almost twice its GDP. An overwhelming fraction of this wealth is (directly or indirectly through taxation) controlled by the government. Norway's implicit liabilities slightly exceed its explicit assets, producing a small positive IPL.

Belgium also has a low positive value of IPL, but for the opposite reason: Its high explicit debt slightly exceeds its negative implicit liabilities. Knowing that the Maastricht treaty's debt/GDP criterion of 60 percent by 1997 was out of reach, the Belgian government sought to reduce the annual deficit to well below the 3 percent threshold by mainly increasing tax revenues. Denmark, the Netherlands, France and the United States have moderate levels of IPLs—less than 100 percent of GDP. The correlation coefficient between the explicit and implicit liabilities of the 14 countries shown in Figure 3 is –0.63. Had all countries' policies been fully sustainable, each country would have had implicit assets exactly offsetting its explicit debt, and the cross-country correlation coefficient would have been –1.0. The explanation for the partial negative correlation between the implicit and explicit components may be that the Maastricht treaty induces immediate fiscal adjustment on countries with high explicit debt or deficit levels but not on those whose policies imply high implicit liabilities.

This suggests that criteria such as those of the Maastricht treaty may allow countries with primarily implicit liabilities to postpone policy adjustments, that is, to maintain an unsustainable policy stance for some period of time. Generational accounting studies have shown that postponing adjustments to achieve fiscal sustainability generally result in making the required adjustments (tax increases or transfer cuts) larger.[16] Hence, although the Maastricht criteria would ultimately force corrective action on countries with primarily implicit liabilities, the postponement of such action might escalate its cost to prohibitively high levels. The corollary to this, of course, is that policy choices would become more transparent and the process of

[15] A part of the explanation for Ireland's implicit surpluses is that its population aging occurs much later.

[16] For example, see Gokhale, Page, and Sturrock (1999).

adopting timely fiscal reforms would be improved were such criteria based on total IPLs, rather than just their explicit components. Figure 3 supports this hypothesis: It shows that high IPL economies, such as Sweden and Finland, have low explicit debt levels in 1995. Perhaps, as a result of assessing the stance of fiscal policy only on the basis of outstanding explicit liabilities, the Maastricht treaty may be failing to convey the appropriate degree of urgency with regard to the need for fiscal reforms in these countries.

Italy is another instance of a country with relatively high explicit liabilities. Italy adopted a major pension reform in 1995, which resulted in a sizable reduction in its implicit liabilities—by more than 70 percent of GDP. As a result, Italy's overall IPL is entirely accounted for by its outstanding debt. In terms of total IPL, the United States ranks roughly in the middle of the group of countries in figure 3. Despite a low explicit debt/GDP ratio, its IPL/GDP ratio is almost 100 percent because of relatively high implicit liabilities. For Germany, Spain, the UK and Austria, we find a value of total IPLs well over 100 percent of GDP. Again among these countries those with the highest implicit liabilities show the lowest explicit ones.

A noteworthy feature of figures 1 through 3 is their implication that both types of population aging mentioned earlier seem to contribute to raising the size of implicit liabilities. For example, Figure 1 shows that the elderly dependency ratios in the UK, Austria, Sweden, and Finland will not increase as much as Spain's. Figure 2 shows that these countries will experience much greater increases in their oldest-old dependency ratios than will Spain. According to figure 3, however, implicit liabilities are larger in the four aforementioned countries than in Spain, suggesting that life-span extension may be a significant contributor to long-term fiscal shortfalls.

Tax Adjustment Necessary for Achieving Fiscal Sustainability

Figure 4 reports the additional tax revenue per year (as a percent of GDP) that would be required to eliminate each country's sustainability gap. In this calculation, all taxes are increased by a scale factor θ beginning in the base year and kept in place indefinitely. Thus, both living and future generations' tax liability is affected during the rest of their lifetimes. All countries except Ireland need to implement tax hikes in order to restore fiscal sustainability. The required hikes in tax revenues range from 0.3

percent of GDP in Norway to almost 9 percent in Finland. The ranking of countries with respect to the size of required revenue hikes corresponds to that with respect to their sustainability gaps. Note that sustainability could also be achieved via transfer cuts of similar magnitude as a percent of GDP (not shown).[17]

To isolate the impact of explicit liabilities, Figure 4 also reports the increase in all taxes as a percent of GDP that would be necessary to eliminate a country's implicit liabilities alone—that is, under the assumption of zero explicit debt. The difference between the tax hike necessary under this assumption and the hike required to eliminate the total IPL indicates the role of explicit liabilities. For all countries with positive outstanding debt, assuming zero debt reduces the required revenue increase. For Finland and Norway—countries with explicit assets rather than debt—eliminating the assets implies greater required revenue increases. For Belgium, whose IPL is positive only because its explicit debt is larger than its implicit asset, the required change in taxes (when explicit debt is assumed to be zero) is negative. In the case of Italy, where almost the entire IPL is accounted for by explicit debt, eliminating the debt implies a (near) zero required increase in tax revenue. For both Denmark and the Netherlands, explicit debt accounts for a significant part of total IPL. Hence, eliminating it generates a sizable reduction in the required tax hike. For France, Germany and the United States, and Spain, explicit debt accounts for between one-third and one-half of the total IPL. Hence, the required tax hikes (ignoring explicit debt) are about one-half to two-thirds as large as those required for eliminating the entire sustainability gap. Assuming zero explicit debt, the required tax hikes are almost as large as those needed for eliminating the entire IPLs for the UK, Austria, Sweden—countries for whom explicit debt accounts for a small fraction of the total IPL. To reiterate the previous discussion, a low explicit debt/GDP ratio by itself does not convey any information about the size of the overall sustainability gap.

The Role of Population Aging

In most of the countries considered here, population aging and the generosity of promised public pension benefits are the main factors underlying large implicit

[17] Of course, transfer cuts would affect the current retirees much more than tax hikes. The burden of the latter would fall primarily on current and future workers.

liabilities. To evaluate the impact of demographic change, we re-calculate the increases in all taxes that would be necessary if the population were allowed to grow as projected, but its age structure were maintained as in 1995. Maintaining the 1995 age structure throughout the future implies that the tax-paying population remains sizable whereas the relative size of the benefit-recipient population does not expand over time. Hence, compared to baseline projections, tax revenues would be larger, and benefit outlays smaller, under a constant population structure.

For those countries for whom population aging is projected to be rapid and persistent, maintaining the 1995 structure will reduce the size of the implicit liability and the associated hike in all taxes required to eliminate the total IPL. However, the impact of fixing the population structure at its 1995 level also depends on other factors such as the age-sex composition of per capita taxes, benefits and government purchases of goods and services (tax-benefit structure, for short). If the 1995 tax-benefit structure generates a large implicit liability, it may be transformed into an asset when the population structure is held fixed, even if the projected population aging is not very pronounced. Of course, if the age and sex specific taxes, benefits, and purchases imply a small or negative implicit liability under baseline population projections, fixing the population structure may transform it into an asset and the required tax hike may become a tax cut.

Figure 4 shows that tax hikes are negative as a percent of GDP for Ireland, Norway, Belgium, the Netherlands, Italy and Germany. Of these, the difference from the baseline is greatest for Italy because population aging is projected to occur immediately, be pronounced, and quite persistent. Given the relatively modest projections of population aging in Norway, its large negative required tax change under this experiment must result from a very generous initial tax-benefit structure. Belgium's tax-benefit structure generates an implicit asset even under baseline population aging. Hence, fixing the age-structure makes the implicit asset even larger, indeed, higher than Belgium's explicit debt. This accounts for the negative tax change under the current experiment. Like Italy, Germany's population aging also occurs in the immediate future and is quite significant. Hence, eliminating it transforms the implicit liability into an asset that is even larger than its explicit debt.

Denmark and the Netherlands provide an interesting contrast. Population aging is much less severe in Denmark than in the Netherlands. Hence, despite their nearly identical size of implicit liabilities, eliminating population aging generates a negative required tax change for the Netherlands whereas the Danish figure remains positive.

Austria and Finland are projected to experience rapid population aging. Finland's elderly dependency ratio will grow significantly in the immediate future whereas Austria is will experience pronounced reduction in mortality for the oldest-old over the next few decades (see figures 1 and 2). For both countries, maintaining the 1995 population structure delivers a significant reduction in the tax hike required to restore fiscal sustainability.

The United States is close to the median European countries with respect to its overall sustainability gap. However, its population aging is not as rapid or persistent as in most European countries. Hence, eliminating aging results in only a modest reduction in the required tax hike—similar in magnitude to the reductions in Ireland and France.

Conclusion

This paper offers a comparison of population aging and fiscal policy among several European countries and the United States. Competition for budgetary resources will intensify in these countries as the baby-boom generation grows older, lives longer, and exerts political pressure to maintain the generosity of extant public retirement and welfare systems but younger workers are unwilling to bear ever heavier tax burdens. This paper reports the total intertemporal public liability of each country as the sum of its explicit outstanding debt and the present value of its implicit liabilities—the excess of projected transfers and government purchases over tax revenues.

The results suggest several conclusions: First, population aging is rapid and persistent in almost every European country. The aging process has two dimensions: The sizes of both the elderly as well as the oldest-old populations will rise significantly compared to working-aged populations. Compared to European countries, the aging phenomenon is much less pronounced in the United States.

Second, explicit outstanding debt across countries can be a severely misleading indicator of how badly overall fiscal policy is "out of whack" in any given country.

Countries with high outstanding debt are precisely those with low overall intertemporal public liabilities, and vice versa. This negative correlation between country-specific explicit and implicit liabilities may have emerged because countries that perceived a fiscal problem due to their high explicit debts were more prompt in implementing fiscal reforms that reduced their implicit liabilities.

Our calculations show that, for those European countries with the highest implicit liabilities (Germany, Spain, the UK, Austria, Sweden, and Finland), eliminating total intertemporal liabilities requires increases in all tax revenues exceeding 4 percent of GDP. Some European countries such as Italy and Belgium have already implemented far-reaching fiscal reforms, but these countries are those with the highest explicit debt levels. The motivation for implementing such reforms resulted from the criteria for participating in the EMU as stated in the Maastricht treaty. However, these criteria may prove inadequate because, by ignoring implicit liabilities, they allow for a postponement of needed fiscal reforms in those countries with the highest implicit liabilities. This may make the cost of conforming to the Maastricht criteria prohibitive and pose a threat to EMU's effectiveness or ultimately even its survival. Relative to population aging and fiscal problems in Europe, future fiscal challenges for the United States seem to be considerably milder.

References

Auerbach, A., J. Gokhale, and L Kotlikoff (1991), Generational Accounting: A Meaningful Alternative to Deficit Accounting, in: D. Bradford (ed.), Tax Policy and the Economy, Vol. 5, Cambridge: MIT Press, 55-110.

Auerbach, A., J. Gokhale, and L. Kotlikoff (1992), Generational Accounting: A New Approach to Understand the Effects of Fiscal Policy on Saving, *Scandinavian Journal of Economics*, *94*, 303-318.

Auerbach, A., J. Gokhale, and L. Kotlikoff (1994), Generational Accounting: A Meaningful Way to Evaluate Fiscal Policy, Journal of Economic Perspectives, 8, 73-94.

Auerbach, A., and P. Oreopulus (1999), *American Economic Review,* Vol. 89 No.2, 176-185.

Auerbach, A., W. Leibfritz, and L. Kotlikoff (eds.) (1999), *Generational Accounting Around the World*, Cambridge: Cambridge University Press.

Berenguer, E., H. Bonin and B. Raffelhüschen (1999), The Spanish Need for a Broader Tax Base, in: European Commission (ed.), *Generational Accounting in Europe*, Brussels, forth.

Bonin, H., Raffelhüschen, B. and J. Walliser (1999), The German Squeeze: Unification and Aging, in: European Commission (ed.), *Generational Accounting in Europe*, Brussels, forth.

Bovenberg A. and H. ter Rele (1999), Government Finances and Aging in the Netherlands, in: European Commission (ed.), *Generational Accounting in Europe*, Brussels, forth.

Cardarelli, R. and J. Sefton (1999), Rolling Back the UK Welfare State?, in: European Commission (ed.), *Generational Accounting in Europe*, Brussels, forth.

Crettez, B., Feist, K. and B. Raffelhüschen (1999), Generational Imbalance and Social Insurance Reform in France, in: European Commission (ed.), *Generational Accounting in Europe*, Brussels, forth.

Dellis, A. and E. Lüth (1999), Does Belgian Fiscal Policy Cope with Debt and Aging? in: European Commission (ed.), *Generational Accounting in Europe*, Brussels, forth.

European Commission (1999), Generational Accounting in Europe, Brussels, forth.

Feist, K., Raffelhüschen, B., Sullström, R. and R. Vanne (1999), Macroeconomic Turnabout and Intergenerational Redistribution in Finland, in: European Commission (ed.), *Generational Accounting in Europe*, Brussels, forth.

Franco, D. and N. Sartor (1999), Italy: High Public Debt and Population Aging, in: European Commission (ed.), *Generational Accounting in Europe*, Brussels, forth.

Gokhale, J., B. Page, and J. Sturrock, "Generational Accounts for the United States: An Update" in Auerbach, A., W. Leibfritz, and L. Kotlikoff (eds.) (1999), *Generational Accounting Around the World*, Cambridge: Cambridge University Press, pp. 489-517.

Jensen, S. and B. Raffelhüschen (1999), Reconsidering the Danish Welfare State, in: European Commission (ed.), *Generational Accounting in Europe*, Brussels, forth.

Keuschnigg, C., M. Keuschnigg, R. Koman, E. Lüth and B. Raffelhüschen (1999), Restoring Generational Balance in Austria, in: European Commission (ed.), *Generational Accounting in Europe*, Brussels, forth.

Lundvik, P., E. Lüth and B. Raffelhüschen (1999), The Swedish Welfare State on Trial, in: European Commission (ed.), *Generational Accounting in Europe*, Brussels, forth.

McCarthy, T. and H. Bonin (1999), EU Transfers and Demographic Dividends in Ireland, in: European Commission (ed.), *Generational Accounting in Europe*, Brussels, forth.

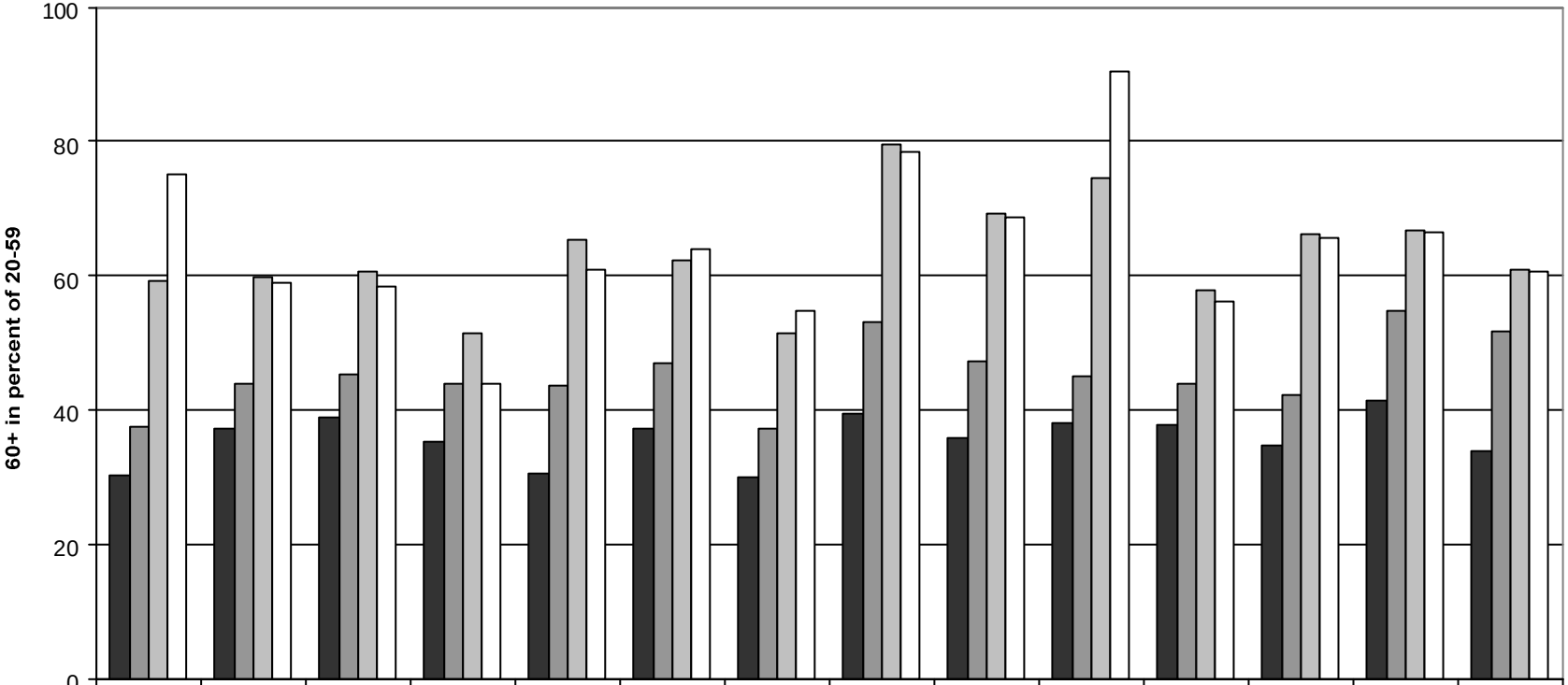
Norwegian Ministry of Finance (1999), The National Budget 2000, The Norwegian Economy, Oslo.

Raffelhüschen, B. (1999a), Generational Accounting: Method, Data and Limitations, in: European Commission (ed.), *Generational Accounting in Europe*, Brussels, forth.

Raffelhüschen, B. (1999b), Generational Accounting in Europe, *American Economic Review,* Vol. 89 No.2, 167-170.

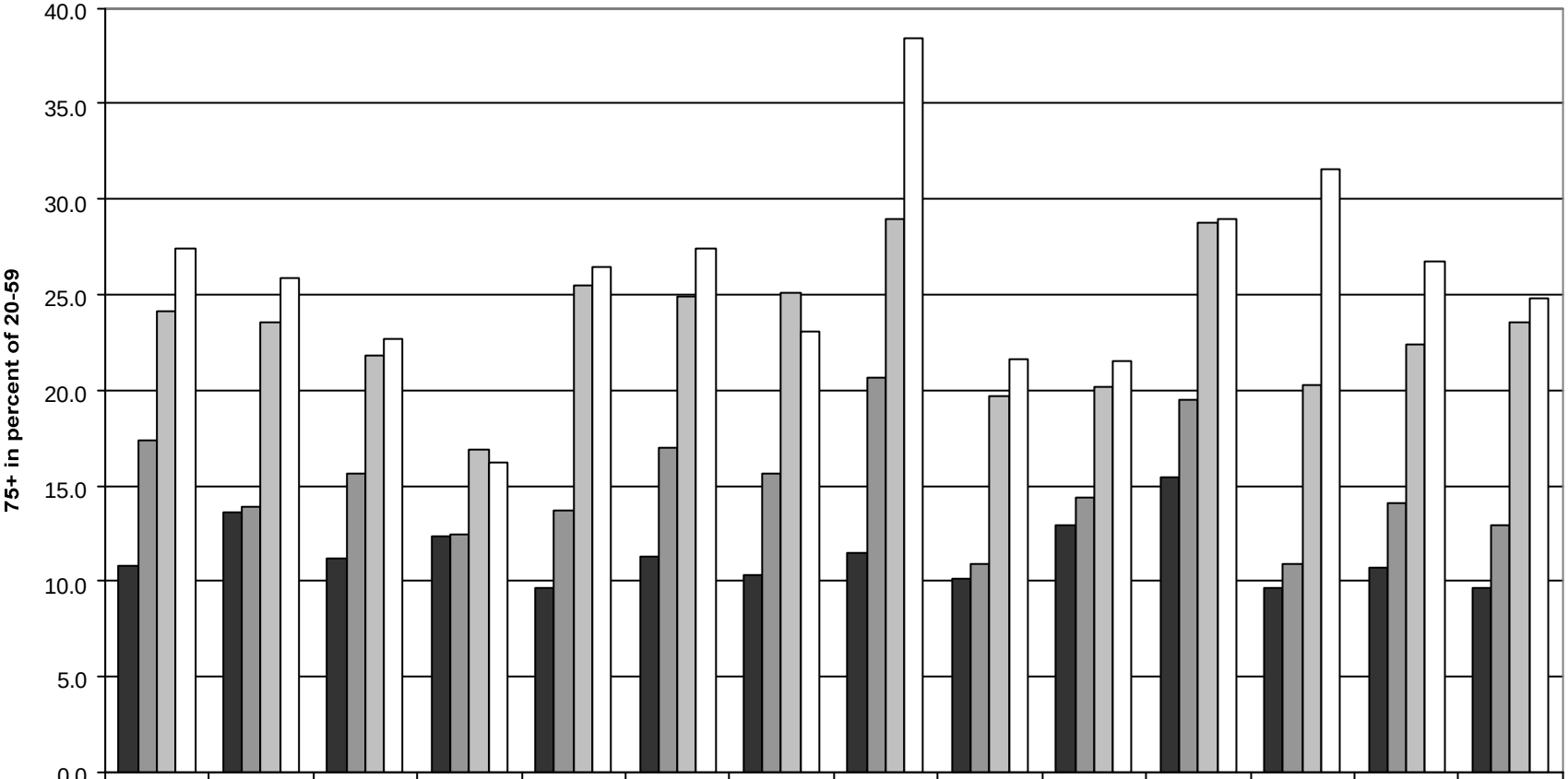
Raffelhüschen, B. (1999c), Aging, Fiscal Policy and Social Insurance: A European Perspective, in: A. Auerbach and R. Lee (ed.), *Demographic Change and Fiscal Policy*, Cambridge: Cambridge University Press, forth.

Figure 1: Elderly Dependency Ratio in Europe and the US (1995)



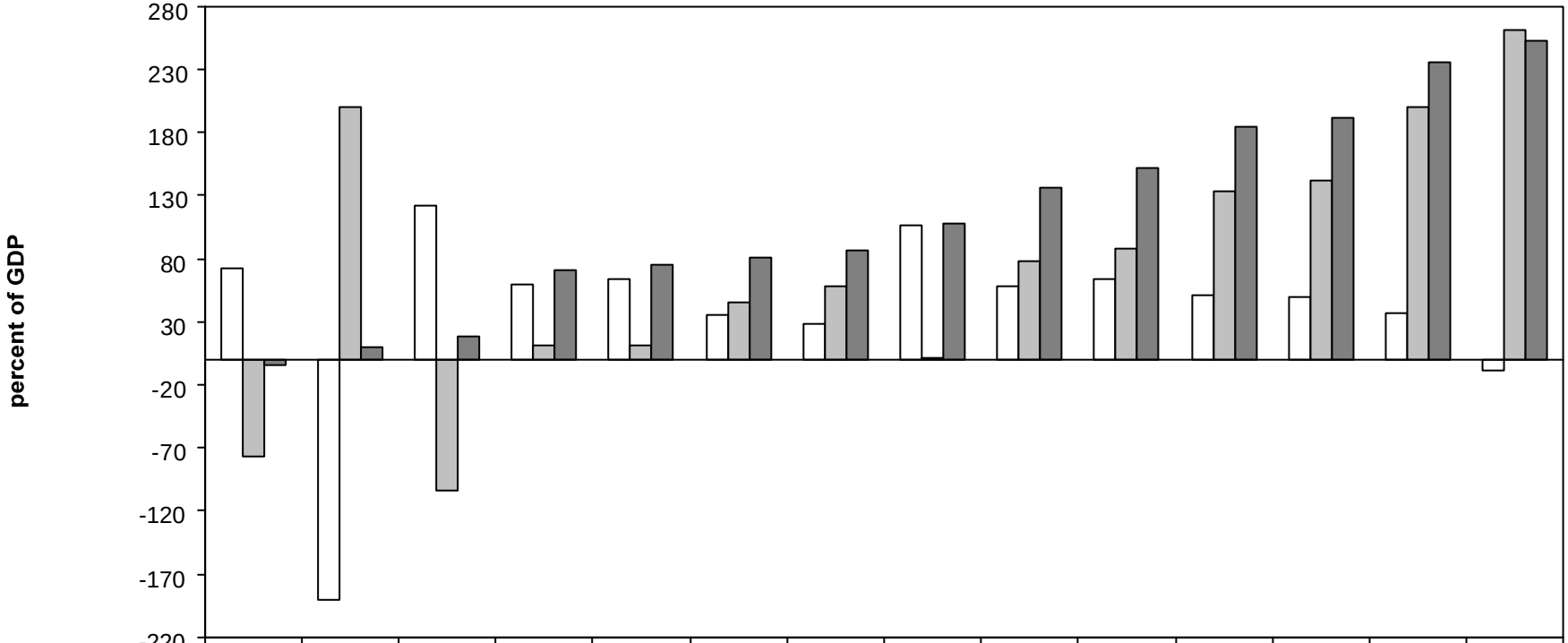
	IR	NO	BE	DK	NL	FR	US	IT	GE	SP	UK	AU	SW	FI
1995	30.2	37.1	39.0	35.2	30.5	37.1	29.9	39.5	35.7	38.1	37.7	34.7	41.4	34.0
2015	37.5	43.8	45.3	44.0	43.6	46.9	37.1	53.0	47.3	45.1	43.8	42.3	54.9	51.7
2035	59.2	59.7	60.5	51.5	65.3	62.2	51.3	79.7	69.2	74.5	57.8	66.2	66.8	60.9
2055	75.1	59.0	58.5	43.9	61.0	64.1	54.8	78.4	68.8	90.4	56.2	65.5	66.5	60.6

Figure 2: Oldest-Old Dependency Ratio in Europe and the US (1995)



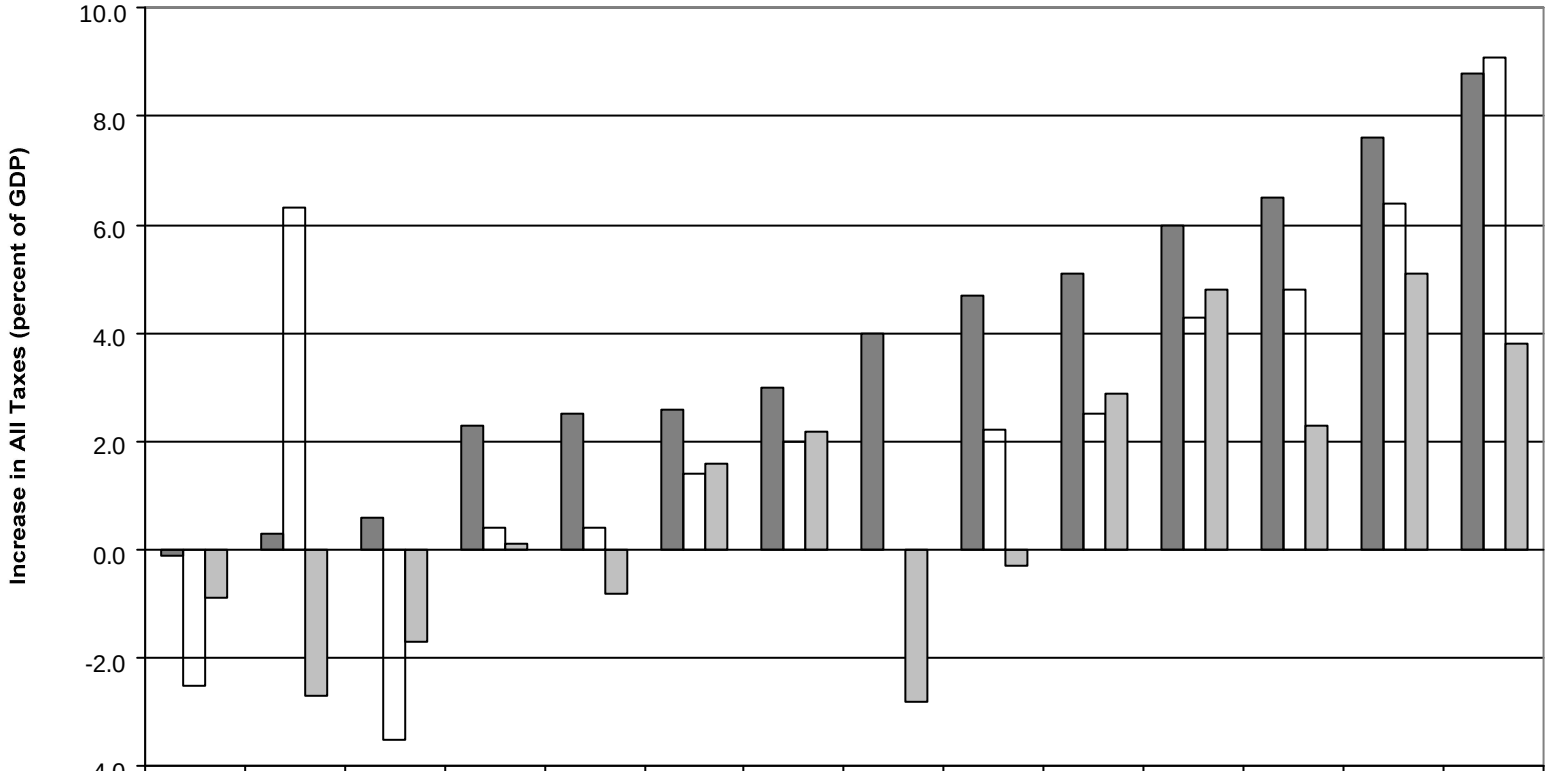
	IR	NO	BE	DK	NL	FR	US	IT	GE	SP	UK	AU	SW	FI
1995	10.8	13.6	11.2	12.3	9.6	11.3	10.3	11.5	10.1	12.9	15.4	9.6	10.7	9.6
2015	17.4	13.9	15.6	12.4	13.7	17.0	15.6	20.6	10.9	14.4	19.5	10.9	14.1	12.9
2035	24.1	23.6	21.8	16.9	25.5	24.9	25.1	29.0	19.7	20.2	28.8	20.3	22.4	23.6
2055	27.4	25.9	22.7	16.2	26.4	27.4	23.1	38.4	21.6	21.5	29.0	31.6	26.7	24.8

Figure 3: The Composition of Intertemporal Public Liabilities



	IR	NO	BE	DK	NL	FR	US	IT	GE	SP	UK	AU	SW	FI
explicit debt	72	-191	122	60	65	36	29	106	58	63	51	50	37	-8
implicit debt	-76	200	-103	12	11	46	59	1	78	89	134	143	200	262
sum	-4	10	19	71	76	81	87	107	136	152	185	193	237	253

Figure 4: Impact of Explicit Debt and Population Aging in Intertemporal Public Liabilities



	IR	NO	BE	DK	NL	FR	US	IT	GE	SP	UK	AU	SW	FI
Baseline	-0.1	0.3	0.6	2.3	2.5	2.6	3.0	4.0	4.7	5.1	6.0	6.5	7.6	8.8
No Explicit Debt	-2.5	6.3	-3.5	0.4	0.4	1.4	2.0	0.0	2.2	2.5	4.3	4.8	6.4	9.1
No Pop. Aging	-0.9	-2.7	-1.7	0.1	-0.8	1.6	2.2	-2.8	-0.3	2.9	4.8	2.3	5.1	3.8