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**Article**

## Public Debt and Demography - An International Comparison Using Generational Accounting

CESifo DICE Report

**Provided in Cooperation with:**

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*Suggested Citation:* Hagist, Christian; Moog, Stefan; Raffelhüschen, Bernd; Vatter, Johannes (2009) : Public Debt and Demography - An International Comparison Using Generational Accounting, CESifo DICE Report, ISSN 1613-6373, ifo Institut für Wirtschaftsforschung an der Universität München, München, Vol. 07, Iss. 4, pp. 29-36

This Version is available at:

<https://hdl.handle.net/10419/166982>

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## PUBLIC DEBT AND DEMOGRAPHY – AN INTERNATIONAL COMPARISON USING GENERATIONAL ACCOUNTING

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### Introduction

“Bailing out” has recently become a standard expression in newspapers’ business sections all over the world. First, there was the financial sector, followed by the automotive industry until finally many large and middle-sized companies longed for public help. The survival of huge corporations or crucial financial institutions is of great interest in a crisis that has come close to a collapse of both the capital and labour markets but over the long run another question arises: Who’s going to bail out the governments?

Imagine the US not just borrowing some USD 730 billion for the fiscal stimulus package to fight a deep recession but borrowing this sum every year from now on until forever. This is the amount the US would have to pay as an annuity for its pre-crisis explicit and implicit debt if no reform of social security and other entitlement programs like Medicare were instituted. Other developed countries are better off but still far from fiscal sustainability.

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We would like to thank Tobias Benz for helpful comments.  
Furthermore we gratefully acknowledge financial support from  
Stiftung Marktwirtschaft. All errors remain our own.

<sup>1</sup> A detailed description of the method of Generational Accounting including a literature review and a discussion of the concept’s limitations can be found in Hagist (2008). See also Raffelhüschen (1999) and Bonin (2001).

This study provides the outcome of a Generational Accounting analysis for eight OECD countries, namely Austria, France, Germany, Norway, Spain, Switzerland, the UK and the US. Generational Accounting is a well-recognized concept that answers questions about a country’s fiscal sustainability and its intergenerational balance or misbalance. The methodological root goes back to Auerbach, Gokhale and Kotlikoff (1991, 1992 and 1994), who sought to illustrate the effects of intergenerational policy. After all, probably nearly every piece of legislation affects not only living but future generations as well. Therefore, in the last 15 years several Generational Accounting studies for 29 different countries have been added to today’s literature. Some countries like Norway even include Generational Accounts in their government reports. However, due to different sets of necessary assumptions and different statistical measures and methodologies, these studies are often not comparable. This is why we set-up a comprehensive framework for our sample so that the outcomes are comparable and can also be interpreted in absolute and relative terms.

### Methodology, data and general assumptions

#### Methodology

Generational Accounting is based on the intertemporal budget constraint, capturing all present and future payment and transfer flows between an individual and the public sector, thus allowing a calculation of net tax payments of every living and future generation over their remaining life cycle. A Generational Account is therefore the average net tax payment over the remaining life cycle of a member of one cohort.

Contrary to classic budget indicators like the explicit debt or budget deficits, Generational Accounting makes it feasible to derive the implicit debt of a country’s fiscal policy through entitlement programs like social security or social health insurance schemes. Therefore, statements on long-term implications or, even simpler, the sustainability of a current policy can be confirmed quantitatively.<sup>1</sup>



Using this concept, a fiscal policy can be called sustainable if the intertemporal budget constraint holds, i.e., if all net tax payments of all living and future generations plus the official public (explicit) debt sum up to zero. If this is not the case, the fiscal situation of a country is unbalanced or in other words, unsustainable. The public is then confronted with a so-called fiscal gap, the sum of the explicit and implicit debt. It reveals the unfunded claims of a country's population against its public coffers.

In addition to the fiscal gap, it is possible to derive numerous indicators to compare the fiscal situation among countries or between different scenarios.<sup>2</sup> The revenue gap, for example, states how much a country would have to raise taxes and social security contributions to close its fiscal gap. Thus, adding the revenue gap to the current tax quota results in the so-called sustainable tax quota.

So far, only two other studies (at least to our knowledge) work with comparable frameworks, i.e., the Directorate-General for Economic and Financial Affairs of the European Commission (1999) and Hagist (2008).<sup>3</sup> Other comparable governmental reports from the EU or the OECD often use a slightly different concept – the OECD fiscal sustainability concept – which draws on Blanchard et al. (1990) (see also Benz and Fetzer (2006)).

#### *Data and general assumptions*

To compute the stated indicators for our cross-country-analysis, we require a projection of each population, the expenditures and revenues of the public sector as stated in their national accounts in a base year, age and sex-specific microprofiles for the different expenditure and revenue types, and a growth rate as well as a discount rate. Due to the delay of internationally comparable statistics, we have chosen the year 2004 as our base year. Therefore all numbers and values are in present value terms for the year 2004, if not stated otherwise. Population projections are calculated with a demographic program developed by Bonin (2001).

For all European countries, basic demographic data, such as the base year's population, age-specific fertility rates and mortality tables as well as information about migration, are taken from Eurostat or for the

US from the Census Bureau. Budget data stem from OECD (2008a) and are divided into several subcategories like pension payments, social health insurance, etc., via several other statistics (OECD 2008b; OECD 2007a; OECD 2007b; OECD 2007d; OECD 2007e and OECD 2007f).<sup>4</sup> Age and sex-specific microprofiles are from various sources described in Hagist (2008) for Austria, France, Germany, Switzerland, the UK and the US; in Fichtner and Hagist (2008) for Norway; and in Gronert-Alvarez (2008) for Spain.

All Generational Accounting results are sensitive to growth and discount rate assumptions. For an infinite time horizon, any future projection of these parameters remains arbitrary. This is especially true in an international comparison because in such an analysis one not only accounts for the fluctuation over time but for the variation of these parameters between the countries. However, as Fetzer (2006) has shown, in such an analysis as ours the quantitative level of the results is only affected by the difference between the real growth and the real interest rate and not by their absolute levels. So we employ a growth rate of 1.5 percent p. a. and a discount rate of 3 percent p.a. (i.e., a difference of 1.5 percentage points). This seems to be a reasonable compromise considering the comparability of our results between the countries and the observations of these parameters in the past. The real growth rates of the countries analyzed have been between 0.9 (Switzerland) and 2 percent (US) p.a. within the last three decades. A reasonable range of interest rate assumptions is determined by the fact that public receipts and expenditures are significantly more uncertain than non-risky long-term government bonds on the one hand, but not as volatile as the return on risky assets on the other hand. Accordingly, the discount rate chosen should range between the average rates of return on these types of assets. In light of this argument, we have opted for a standard discount rate of 3 percent p.a.

### **The fiscal and demographic status quo**

#### *Fiscal situation in the short run*

Table 1 reports the fiscal status quo of our cross-country sample. As is evident every country, with the notable exception of Norway, had a budget deficit in our

<sup>2</sup> Benz and Fetzer (2006) discuss the pros and cons of several indicators.

<sup>3</sup> There are, however, numerous studies by different international bodies using other methodologies.

<sup>4</sup> For a more detailed description of the data sets used, see Hagist, Moog and Raffelhüschen (2009). Norway's oil wealth and its Government Pension Fund were modelled after petroleum projections by OECD (2007c).

**Table 1**  
**Budget and primary deficit and public debt in 2004, in % of GDP**

	ESP	CH	AUT	NOR	GER	FR	US	UK
Budget deficit	0.4	1.1	1.3	-11.1	3.8	3.6	4.2	3.4
Primary deficit	-1.6	-0.5	-1.7	-12.5	1.0	0.8	1.7	1.4
Public debt	45.4	55.3	62.8	40.6	62.5	60.4	57.1	37.2

Sources: OECD (2008a,b); Eurostat; own calculations.

base year 2004 ranging from 0.4 percent of GDP (Spain) to 4.2 percent (the US). Due to its oil wealth and the assigned revenues, Norway had a budget surplus of 11.1 percent of GDP. In terms of the Maastricht criteria our sample can be divided into two groups. One group (Austria, Norway, Spain and Switzerland) easily fulfilled the Maastricht criterion of a budget deficit below three percent of GDP, the other four (France, Germany, the UK and the US) – which are also the biggest economies in our sample – did not clear this hurdle. The same conclusion basically holds regarding the primary deficits, with the big four having significant structural deficits. With respect to the public debt in 2004, the picture is slightly different, with the UK at the lowest level and Austria and Germany at the highest.

The structure of the revenues and expenditures of every country in 2004 can be found in Table 2.

**Table 2**  
**Public expenses and revenues in 2004, in % of GDP**

	ESP	CH	AUT	NOR	GER	FR	US	UK
<b>Expenses</b>	<b>38.9</b>	<b>35.9</b>	<b>51.0</b>	<b>45.4</b>	<b>47.1</b>	<b>53.2</b>	<b>36.2</b>	<b>43.3</b>
Social security	13.0	12.7	21.3	17.7	22.1	22.1	7.0	15.8
Health	5.5	4.1	7.1	7.7	6.1	7.3	7.4	6.8
Education	4.4	5.8	6.0	6.2	4.2	6.2	6.3	5.7
General public services	4.8	4.4	7.1	4.3	6.1	7.3	4.6	4.5
Interest payments	2.0	1.6	3.0	1.4	2.8	2.8	2.6	2.0
Miscellaneous	2.7	2.8	4.2	2.9	3.2	4.5	2.1	2.6
Other expenses	11.1	9.0	9.5	9.5	8.6	10.3	10.9	10.5
<b>Revenues</b>	<b>38.5</b>	<b>34.8</b>	<b>49.6</b>	<b>56.6</b>	<b>43.3</b>	<b>49.6</b>	<b>32.0</b>	<b>40.0</b>
Taxes	22.1	21.6	28.3	33.8	21.8	26.4	18.9	28.4
Direct taxes	10.2	14.4	13.6	21.0	10.0	11.1	11.5	15.4
Indirect taxes	11.9	7.2	14.7	12.8	11.8	15.3	7.4	13.0
Social security contributions	13.0	7.0	16.3	9.4	18.0	18.0	7.1	8.2
Other revenues	3.5	6.3	5.0	13.3	3.6	5.1	5.9	3.3

Sources: OECD (2007a, 2008); Eidgenössische Finanzverwaltung (2008); own calculations.

France had the largest government share of economic activity with 53 percent of GDP followed by Austria and Germany. The US and Switzerland had the lowest values with 36 percent. Social security programs, such as pensions and means-tested benefits, are the main reasons for these differences in expenditures. While Austria, France and Germany contribute

40 percent of their public budgets to these categories (around 20 percent of GDP), for the US this ratio amounts only to 20 percent (or seven percent of GDP). Also, health expenditures vary between the countries. It should be noted, however, that measuring health expenditures is difficult in a COFOG (classification of the functions of the government) scheme, which is why our numbers are slightly different to the ones reported in OECD (2007e) or Hagist (2008). One reason, for example, is that while for the latter two studies long-term care expenditures in Germany are a health-related expenditure category, they are included in the social security expenditures in our COFOG budget. This also holds for Switzerland where the biggest share of health expenditures is paid by private insurance companies operating in a state-controlled market, which is why Hagist (2008) includes them in his analysis.

Interestingly total education expenditures differ considerably between the analyzed countries. However, this is not correlated with the total fertility rate and must be seen as a political decision. Although Germany and Spain have the lowest shares of expenditures on education and also very low fertility rates (about 1.4 children per fertile woman), Switzerland and Austria have comparable levels of fertility but spend more on education.

On the revenue side, it is possible to distinguish between the different priorities of the countries' fiscal policy. While social security contributions play a minor role in countries like the US, the UK, Norway and Switzerland, they have nearly the same level of revenue as direct and indirect taxes in Austria, France and Germany. Direct taxes are relatively the lowest in Germany, while Switzerland and the

US place the lowest indirect tax burdens on their citizens. The UK has the highest share of direct taxes, however the overall burden on tax (and contribution) payers is relatively lower. Norway is again an exception when it comes to tax revenues due to its natural resources. The returns on licensing and the public-owned petroleum companies are responsible for the large share of miscellaneous revenues in our Table.

*Demography in the status quo*

The determinants of the demographic development of a country are basically the mortality rate, the fertility rate and the net migration. Table 3 shows the development and the expectations of the total fertility rate in our eight countries. The fertility rate is probably the most debated of the three determinants, especially in Continental Europe. In the sample under evaluation, all countries had fertility rates greater than or equal to 2.0 at the beginning of the 1970s. The replacement fertility rate for the entire population is approximately 2.1. In all analyzed countries the fertility rate decreased progressively until stabilization occurred in the mid-1980s. However, this stabilization took place at very different levels. While the US, France and the UK recovered on a relatively high level of over 1.8 children per fertile woman the German-speaking community of Austria, Germany and Switzerland stabilized at approximately “only” 1.4 children per fertile woman.

Regarding mortality, there is a clear trend across all analyzed countries that longevity for both sexes is rising. However, the pace of this trend is quite different for each country. While female Americans ranked third in our sample in 1970, they have the lowest life expect-

tancy in 2003 and also the lowest expectation for 2060 by more than two years. Furthermore the differences between the sexes and their development vary among the countries. For example, while the relatively large difference of 7.5 years in France in 1970 between men and women dropped to only 7.0 over 33 years, it fell from 6.2 years in 1970 to 5.1 years in Switzerland even while French longevity as a whole grew faster. In our sample Switzerland and France have, however, the highest life expectancy for 2060 – 90 years for females and over 85 years for males, respectively.

The third parameter which is crucial for population development – net migration – can be influenced by political decisions. While all countries in our sample are net “importers” of people, there are differences not only due to factors like labour markets or income but also policy-induced ones. Citizens of all EU member countries can settle in the UK, for example. In contrast Austria, France and Germany have restricted the movement of citizens from the new Eastern European member states (which they are allowed to do until 2011). As indicated in Table 3, Spain followed by Switzerland and Norway are the most open economies with respect to migration in the base year, followed by Austria and the US. However, Spain’s high net migration is expected to decline quite significantly over the next five decades.

**Demographic development and fiscal sustainability**

Given the current demographic situation and the expectations of Eurostat and the Census Bureau about the development of the crucial demographic parameters, we project each population for the eight coun-

**Table 3**

**Demographic assumptions**

	Year	ESP	CH	AUT	NOR	GER	FR	US	UK
Fertility rate	2004	1.4	1.4	1.4	1.9	1.3	2.0	2.0	1.8
	2060	1.6	1.6	1.6	1.9	1.5	1.9	2.0	1.8
Net migration (% of total population)	2004	1.5	0.5	0.4	0.5	0.2	0.2	0.4	0.3
	2060	0.3	0.3	0.3	0.2	0.2	0.1	0.4	0.2
Life expectancy men	2004	77.1	78.7	77.5	78.4	76.1	77.0	75.3	77.0
	2060	84.5	85.8	84.9	85.2	84.9	85.1	81.5	85.0
women	2004	83.8	83.9	83.1	82.2	81.7	84.0	80.5	81.4
	2060	89.6	89.9	89.2	89.2	89.1	90.1	85.5	88.9

Sources: Eurostat; Census Bureau; National Statistical Offices.

Figure 1

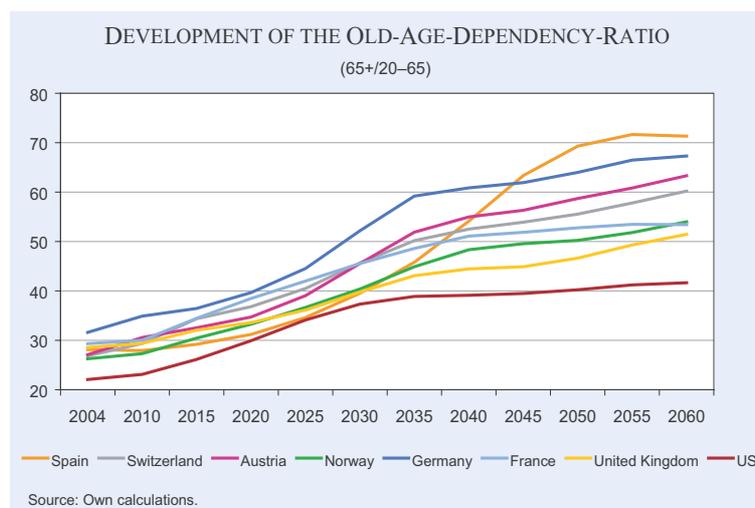
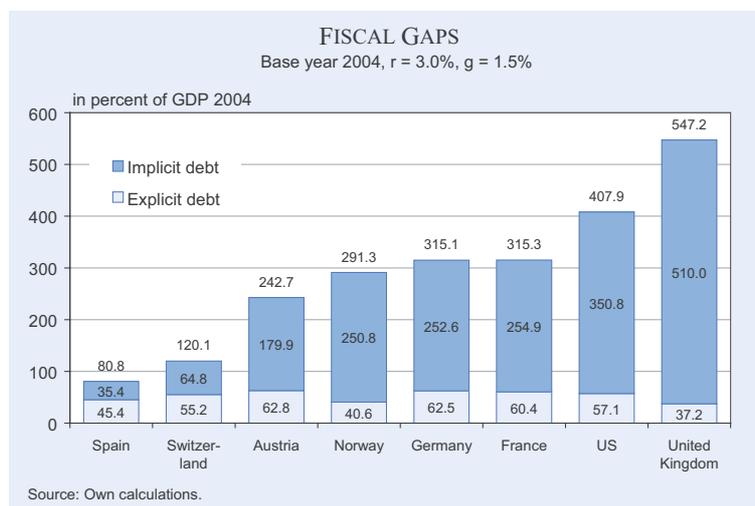


Figure 2



tries. While for the fiscal analysis the ageing of societies is the most important point, we present our projections in the form of the old-age-dependency-ratio, the relation between probable pensioners to the potential work force. Figure 1 illustrates our results.

As the Figure indicates, in 2004 Germany was the oldest economy of our sample. There were nearly 32 people over 65 years of age per 100 people aged 20 to 65 years. This ratio will rise until 2060 to around 67. The only “older” country in this regard will be Spain with a ratio of 71 “old-timers” to 100 in the working generations. The Figure shows that the countries with the current and expected low fertility levels will also be the old ones in the future, while the US with the highest birth rate and also a very high net migration will be the youngest. However, for fiscal purposes not the absolute levels of the old-age-dependency ratio but rather the relative development is of most in-

terest. Here all countries are quite similar with a doubling of its old-age-dependency ratio.

Another factor that is often overlooked is the youth-dependency-ratio. As we have seen above, not only fertility rates but also education expenditures, the biggest block of public expenditure for adolescents, are quite different over our sample. While some countries are only faced with “expensive” pensioners, others also face the challenge of financing the very young at the same time. For example, in a fiscal sense, Germany is in a comfortable situation given its very low level of fertility and its low level of education expenditure per head while the US is facing the exact opposite with a high level of education expenditure and a fertility near the replacement rate.

Given the demographic projections and the aligned data sets, it is possible to derive the two sustainability indicators, the fiscal and revenue gap. Figure 2 shows the fiscal gaps for the analyzed countries.

Here the ranking for the fiscal gap, i.e., the sum of explicit and implicit debt, is quite different from the one based on the official public debt quotas. While in the first ranking the differences between the countries are quite small, we have major differences given the ranking based on the fiscal gap. In total, Spain heads the ranking with a rather small fiscal gap of 0.8 times its 2004 GDP. Despite Spain’s quite low share of expenditures devoted to social security and health this result seems surprising given the projected rise in Spain’s old-age dependency ratio. One explanation for this could be the current low levels of pension benefits for Spanish women. As we have based our projection on today’s structure of pension benefits, our results could be misleading considering that the labour participation of Spanish women has changed dramatically since the end of the Franco regime. Switzerland ranks in second place. Due to its ma-

**Table 4**  
**Revenue gaps and sustainable tax quotas, in %**

	ESP	CH	AUT	NOR	GER	FR	US	UK
Necessary enhancement/revenue gap	3.0	5.3	7.0	10.2	14.6	9.0	13.2	19.2
Sustainable tax quota	42.2	30.3	56.3	64.0	55.7	57.3	41.9	55.2

Source: Own calculations.

for public pension reform and a special accounting of its health care system,<sup>5</sup> Switzerland faces intertemporal liabilities of “only” 65 percent its GDP. Adding the official public debt, the fiscal gap amounts to 120 percent.<sup>6</sup>

The UK is at the very bottom of our sustainability ranking with a total gap of nearly 550 percent of its GDP. This is at a first glance surprising considering that the British deficit is smaller than those of France and Germany. The British primary deficit, however, was quite large compared to the latter two countries. Maybe even more astonishing might be the implicit gap of the US. Despite the growing population and comparably low social expenditures, the future liabilities of the US public add up to 3.5 GDPs.<sup>7</sup> However, as already said before, education expenditure is quite high and there is one major difference when it comes to social expenditures – the public health care sector. While all of the seven other countries have a more or less universal health coverage, the US covers publicly only the poor and the elderly (and public employees). So relatively spoken its public health system is very expensive given expenditure per insured individual compared with other countries. A third reason is that the US has not carried out – again in comparison to most of Continental Europe – a major overhaul of its social security programs.

With a significant difference of close to one GDP, France, Germany, Norway and Austria follow the US. Given the budget data and the demographic projec-

tions, it is another unexpected outcome. It seems that the market-friendly Anglo-Saxon countries are clearly living their current public lives on credit while Continental Europe has at least achieved some fiscal responsibility with the latest reforms of its welfare states.

Norway cannot be seen as part of Continental Europe, not only geographically but also in terms of this analysis. If Norway had no oil, it would look like the US or the UK in fiscal terms, given that the Government Pension Fund and future oil revenues are worth over 275 percent of GDP. But to be fair, Norway has taken action this year against this development with a major overhaul of its pension system, which has not been taken into account in this study.<sup>8</sup>

There are some caveats in this analysis, however, especially if you compare the countries, which is our stated goal. For an international comparison the fiscal gap might not be appropriate for several reasons. The biggest flaw may be that the eight countries have a quite different demographic outlook, which will determine their future economic power and as a result their ability to pay their debts. With a growing population, the economic power of the US will increase and so will its GDP (and thus its tax base) while the German population will not only shrink in size also its workforce will decline, which co-determines GDP. An appropriate indicator for an international comparison should take these facts into account.

This is why we also report the so-called revenue gap and the resulting sustainable tax quota in Table 4.<sup>9</sup> As is evident, the ranking itself stays almost the same, with only France and Norway changing ranks. However, it is clear that the demographic development cannot only be reduced to ageing but must also include the growth and dynamics of a population. France has the same fiscal gap as Germany but must adjust its total tax revenues by “only” nine percent while in Germany the required rise in revenues amounts to 14.6 percent. The UK still requires the biggest increase but relatively the revenue gaps are much closer among the countries than the fiscal gaps.

<sup>5</sup> The difference of this number to Hagist (2008) could be explained by the accounting of the Swiss health insurance system. While Hagist (2008) considers the mandatory system as part of the Swiss fiscal policy, this study – directed by the budget data of the OECD – only reflects public health via investments in public hospitals and subsidies of health insurance premiums.

<sup>6</sup> The difference between the Swiss fiscal gaps reported here and in Hagist et al. (2009) are due to different assumptions on the indexation of pension entitlements.

<sup>7</sup> Hagist et al. (2009) even report an implicit debt for the US that is significantly higher. However, this study does not reflect the increase in the official retirement age and price (not wage) indexation of social security benefits.

<sup>8</sup> For a detailed description and intertemporal analysis of the Norwegian pension reform, see Grasdahl et al. (2009).

<sup>9</sup> The revenue gap can also be interpreted as the necessary enhancement of taxes to close the fiscal gap.

In addition, countries like Switzerland, the UK and the US have more room to manoeuvre with current tax quotas below 40 percent while Germany, Austria and France are already near or above the 50 percent benchmark. Caution is thus necessary in interpreting our results.

## Conclusion and outlook

During the next few decades the populations of most developed countries will grow older as a result of the low level of birth rates since the 1970s and/or the continuously increasing life expectancy. Generational Accounting which was introduced in the early nineties, can illustrate the effects of this ageing process on a country's fiscal situation.

We quantify for Austria, France, Germany, Norway, Spain, Switzerland, the UK and the US how unsustainable their public finances are due to the demographic development. A ranking is hard to define as we know that our analysis is far from perfect given the rather static framework. However, if the authors had to choose to live in a country based solely on our findings, the choice would be sunny Spain. However, this choice is not completely compelling. Facing a dynamic ageing process, it is far from clear if Spain could repeat the growth of the last decades without an enlargement of benefits in its social systems. In addition, we only have rather minimal information as to whether the current public pension structure will prevail, i.e., if in the future Spanish women will only receive pension benefits near the socially accepted minimum. Perhaps a more persuasive choice would be Switzerland – even if it only ranks second with regard to the fiscal gap. Overall the Swiss are better off than all other countries (except Spain) in our sample by quite a margin. Furthermore, the transfer and tax quotas are quite low, especially as seen from a European perspective, so there is still some room for manoeuvre. Additionally, the Swiss have proven that they are also able to fix long-term problems in the area of social security with their public pension reform. The third “best” country in our ranking, Austria, is not as impressive as Switzerland. With its high tax and transfer quotas, Austrians face lower intertemporal liabilities as, say, their German counterparts but their room to act without cutting transfers in a significant way is already very slim. For the rest of the sample a ranking is even more difficult. One could choose nations that already have high government involvement (and ergo high tax and transfer

quotas) like Germany and France. These will be strongly affected by the demographic development though not as strongly as the UK and the US, which still have low tax and transfer quotas but a higher pressure on them.

The next research steps are two-fold: On the one hand more countries should be included in our analysis and the reform measures should be considered in a more detailed way (i.e., we had, for example, insufficient information on the French pension reforms). On the other hand better sustainability indicators could be derived from Generational Accounts using a macro-modelling approach rather than from a partial equilibrium analysis.

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