

Romp, Ward; Beetsma, Roel; Busse, Matthias; Larch, Martin

**Working Paper**

## Some Intergenerational Arithmetic to Control Public Debt in the EU

CESifo Working Paper, No. 11669

**Provided in Cooperation with:**

Ifo Institute – Leibniz Institute for Economic Research at the University of Munich

*Suggested Citation:* Romp, Ward; Beetsma, Roel; Busse, Matthias; Larch, Martin (2025) : Some Intergenerational Arithmetic to Control Public Debt in the EU, CESifo Working Paper, No. 11669, CESifo GmbH, Munich

This Version is available at:

<https://hdl.handle.net/10419/314708>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# Some Intergenerational Arithmetic to Control Public Debt in the EU

*Ward Romp, Roel Beetsma, Matthias Busse, Martin Larch*

## **Impressum:**

CESifo Working Papers

ISSN 2364-1428 (electronic version)

Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH

The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute

Poschingerstr. 5, 81679 Munich, Germany

Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email [office@cesifo.de](mailto:office@cesifo.de)

Editor: Clemens Fuest

<https://www.cesifo.org/en/wp>

An electronic version of the paper may be downloaded

- from the SSRN website: [www.SSRN.com](http://www.SSRN.com)
- from the RePEc website: [www.RePEc.org](http://www.RePEc.org)
- from the CESifo website: <https://www.cesifo.org/en/wp>

# Some Intergenerational Arithmetic to Control Public Debt in the EU

## Abstract

Long-term projections are the bedrock of any analysis looking at the sustainability of public finances. This paper computes the changes in economic growth in individual European Union (EU) countries needed for government debt-to-GDP ratios to stay on their baseline trajectories (taken from the European Commission's Debt Sustainability Monitor 2023) under low-fertility, high-fertility, low-migration and high-migration scenarios. These scenarios are provided in the Commission's Ageing Report (2024). We find that deviations of migration from the baseline entail the largest effect on the required rate of economic growth. The effects of the low-fertility scenario kick in only in the very long run and even exceed those of low migration. Our findings inform policymakers on the urgency to apply measures to raise productivity growth. The urgency is heightened by the fact that in some countries demographic projections tend to be optimistic. Whether the necessary measures are taken is eventually a matter of political will more than anything else.

JEL-Codes: H500, H600, J110, J130.

Keywords: demography, migration, fertility, debt, GDP.

*Ward Romp*

*University of Amsterdam / The Netherlands*  
*w.e.romp@uva.nl*

*Roel Beetsma*

*University of Amsterdam / The Netherlands*  
*r.m.w.j.beetsma@uva.nl*

*Matthias Busse*

*Former European Commission*  
*Brussels / Belgium*  
*matthiasbusse@gmx.net*

*Martin Larch*

*European Commission, Brussels / Belgium*  
*martin.larch@ec.europa.eu*

We thank public finances and country experts of the European Commission's Directorate-General for Economic and Financial Affairs (ECFIN) for providing us with the relevant data and helpful explanations about the different scenarios we consider. The views expressed in this paper are those of the authors and do not necessarily represent those of the European Commission, the European Fiscal Board.

# 1. Introduction

Governments of advanced economies, and especially those in the EU, will be confronted with mounting pressure on the public purse, in particular linked to the green and digital transitions, defence, and the costs of ageing. The rising spending pressures cumulate against a background of shrinking working-age populations. According to the latest demographic projections, the number of people in the EU between 15 and 64 years of age will on average decline by more than 1.2 million every year. Against this backdrop, Draghi (2024) sketches *additional* investment needs of about 5% of GDP annually. Public debt ratios,<sup>6</sup> by historical standards already high in a number of countries during peacetime, are projected to rise further. If historical investment patterns are followed, then around 20% of the additional investments - around 1% of GDP - needs to be publicly financed. The burden on taxpayers, now or in the future, will have to increase substantially, unless spending reductions elsewhere can be found or GDP growth can be raised substantially and durably.

Demographic shocks are important factors influencing GDP and a government's fiscal situation. For some countries past vintages of population projections turned out to be on the optimistic side, with migration being the most difficult driver to predict (Larch and Busse, 2024). In this paper we *combine* the information from the European Commission's (2024c) Debt Sustainability Monitor 2023 and the European Commission's (2024a) Ageing Report to compute the changes in economic growth in individual EU countries needed for government debt-to-GDP ratios to stay on the baseline trajectories in the Debt Sustainability Monitor under alternative demographic scenarios from the Ageing Report: low-fertility, high-life-expectancy, low-migration and high-migration scenarios. Within total public expenditure only the cost of ageing is assumed to be sensitive to the demographic scenario. More importantly, the additional investment needs mentioned above are not factored in. They will come on top of the ageing-related costs. If the required extra economic growth depicts a gloomy picture, these additional investment needs will make the picture even gloomier.

We find that over a 15-year horizon a deviation of migration from the baseline generally exerts the largest effect on the required change in economic growth. The effects of the low-fertility scenario kick in only in the longer run but then generally exceed those of lower migration. In the short run, low fertility gives a bit of a push to growth as labour supply benefits from a higher participation rate as less children need to be raised.

---

<sup>6</sup> Here, and in the sequel, by public debt ratios we mean debt-to-GDP ratios.

To calculate additional growth needs under different assumptions we combine information from the Debt Sustainability Monitor and the Ageing Report, because the former contains various sensitivity scenarios, but demographic shocks are missing, while precisely these are central in the latter report, which in turn lacks the effect of the costs of ageing on debt ratios. Hence, we bring together insights from both reports by providing estimates of required extra real growth in the four demographic scenarios of the Ageing Report in order to keep debt-to-GDP ratios on the baseline scenario in the Debt Sustainability Monitor. Note that we look at deviations from the demographic baseline scenario, which may entail an increasing debt ratio over the long term, i.e. we do not impose any concept of long-term sustainability.

The remainder of this paper is structured as follows. Section 2 lays out the framework of the analysis, while Section 3 presents the results. Section 4 presents a sensitivity analysis. Section 5 concludes the paper and discusses potential policy implications.

## 2. Framework for the analysis

The European Commission regularly publishes two important reports with long-term projections for all EU countries: (i) the Debt Sustainability Monitor and (ii) the Ageing Report. The former looks at public finances more broadly, while the latter focuses on the age-related expenditures, i.e. public spending on pensions, health care, long-term care, education and unemployment benefits, under a baseline and alternative scenarios. We *combine* information from the two reports to determine how much extra (or less) GDP growth EU economies need under alternative demographic scenarios to keep debt ratios on the trajectory of the baseline scenario set out in the Debt Sustainability Monitor. These trajectories themselves may not lead to stabilisation of debt ratios. However, assuming that in unstable cases governments take consolidation measures to raise budget balances to levels that stabilise debt ratios will leave our analysis unchanged under the assumption that such measures do not lead to feedback effects on GDP growth itself. This might be a rather strong assumption for the shorter run, but in the longer run, if anything, a stabilisation of the debt ratio will impact the economy positively and, hence, the consolidation burden is likely to be smaller than needed to stabilise the debt ratio at a given projected GDP level. Inflation and nominal interest rates are considered to be exogenous in the 2024 Ageing Report, hence it is the same under the different scenarios, which implies that additional real growth is the

only “instrument” to push the debt path under an alternative scenario towards that of the baseline.<sup>7</sup>

Our calculations are based on the following framework. In each period going forward, we calculate the extra GDP growth needed to keep the debt ratio at its baseline level, assuming that debt ratios up to now have equalled their baseline value. Hence, we implicitly assume that the extra GDP growth has fully materialised up to now.<sup>8</sup> To show how this is concretely implemented, start with the standard debt accumulation identity for a scenario indicated with superscript  $s$ , in a country denoted by subscript  $i$ . Time is indicated by subscript  $t$ :

$$p_{i,t}^s b_{i,t}^s = p_{i,t}^s p d_{i,t}^s + (1 + i_{i,t}) p_{i,t-1}^s b_{i,t-1}^s,$$

where  $b_{i,t}^s$  is debt in real terms,  $p_{i,t}^s$  the price level,  $p d_{i,t}^s$  the primary deficit and  $i_{i,t}$  the nominal interest rate. Nominal interest rates are exogenous and country-year specific, which reflects differences in perceived default risk and market liquidity. Most importantly, nominal interest rates do not vary between demographic scenarios. Primary deficits are scenario specific, which also makes nominal debt levels scenario specific. The baseline is a scenario just like any other scenario, but to highlight its relevance, we will denote the baseline with superscript “0”. Dividing by the scenario-specific real GDP level  $y_{i,t}^s$  and prices, we obtain the usual first-order approximation for the scenario-specific debt ratio  $d_{i,t}^s$ :

$$d_{i,t}^s = p d_{i,t}^s + \frac{1 + i_{i,t}}{(1 + \pi_{i,t})(1 + \gamma_{i,t}^s)} d_{i,t-1}^s,$$

where  $\gamma_{i,t}^s \equiv (y_{i,t}^s / y_{i,t-1}^s) - 1$  denotes the rate of real GDP growth and  $\pi_{i,t}$  denotes inflation. Differences between nominal growth rates in the baseline and the alternative scenarios may in principle come from both inflation and real growth. In the Ageing Report, inflation only differs from the baseline in the so-called “higher inflation” scenario, which we do not consider here.

---

<sup>7</sup> Exogeneity of inflation is an important assumption. Debt ratios, especially when they are high, are very sensitive to inflation shocks. The Medium-term fiscal-structural plans under the EU’s revised Stability and Growth Pact set nominal paths of net primary expenditure in advance for the entire duration of the plan. Deviations of inflation rates from their projections, which may lead to cumulating price differences from their projection, could over time cause substantial deviations of public spending ratios from their projections, which in turn could lead to pressures to revise the plans – see Beetsma (2024).

<sup>8</sup> By definition, we start the projection period with a debt ratio equal to its baseline value, hence consistently inserting the required extra growth into the dynamics will keep the debt ratio at its baseline value in each new period when we go forward.

Because we focus only on the alternative demographic scenarios, differences in nominal growth must come entirely from different in real growth rates.

To determine the extra required growth, we first calculate the required level of real GDP  $\tilde{y}_{i,t}^s$  to attain the same debt ratio  $d_{i,t}^0$  as in the baseline:

$$\tilde{y}_{i,t}^s = b_{i,t}^s / d_{i,t}^0.$$

To focus on the required *extra* growth, we must take growth in the specific scenario into account. Let  $\hat{y}_{i,t}^s$  indicate the level of real GDP that the economy would have if all required extra growth in the past, leading to the required level  $\tilde{y}_{i,t-1}^s$  in  $t - 1$ , and the latest scenario-specific exogenous growth ( $\gamma_{i,t}^s$ ) would have materialised

$$\hat{y}_{i,t}^s = \tilde{y}_{i,t-1}^s (1 + \gamma_{i,t}^s).$$

From this we can calculate the required extra growth  $\delta_{i,t}^s$  to reach  $\tilde{y}_{i,t}^s$ , assuming real GDP reached  $\tilde{y}_{i,t-1}^s$  in the previous period:

$$\delta_{i,t}^s = \frac{\tilde{y}_{i,t}^s}{\hat{y}_{i,t}^s} - 1 = \frac{b_{i,t}^s / d_{i,t}^0}{\tilde{y}_{i,t-1}^s (1 + \gamma_{i,t}^s)} - 1 = \frac{b_{i,t}^s / d_{i,t}^0}{b_{i,t-1}^s / d_{i,t-1}^0} \frac{y_{i,t-1}^s}{y_{i,t}^s} - 1 = \frac{d_{i,t-1}^0}{d_{i,t}^0} \frac{d_{i,t}^s}{d_{i,t-1}^s} - 1.$$

With the required extra growth of GDP realised in the past, the debt ratio in each scenario in the previous period equals that in the baseline, i.e.  $d_{i,t-1}^s = d_{i,t-1}^0$ , and the required extra growth in period  $t$  reduces to:

$$\delta_{i,t}^s = \frac{d_{i,t}^s}{d_{i,t}^0} - 1.$$

The Debt Sustainability Report and the Ageing Report, unfortunately, do not contain information on scenario-specific debt ratios. However, we can use the debt accumulation identity to obtain:

$$\delta_{i,t}^s = \frac{1}{d_{i,t}^0} \left( p d_{i,t}^s + \frac{1 + i_{i,t}}{(1 + \pi_{i,t})(1 + \gamma_{i,t}^s)} d_{i,t-1}^s - p d_{i,t}^0 - \frac{1 + i_{i,t}}{(1 + \pi_{i,t})(1 + \gamma_{i,t}^0)} d_{i,t-1}^0 \right).$$



Assuming once more that policymakers managed to keep the debt ratio at the baseline level in the previous period, i.e.  $d_{i,t-1}^s = d_{i,t-1}^0$ , we have

$$\delta_{i,t}^s = \frac{1}{d_{i,t}^0} \left( pd_{i,t}^s - pd_{i,t}^0 + \frac{1+i_{i,t}}{1+\pi_{i,t}} \left( \frac{1}{1+\gamma_{i,t}^s} - \frac{1}{1+\gamma_{i,t}^0} \right) d_{i,t-1}^0 \right).$$

Finally, the Ageing Reports assume that the difference between the primary deficits in different scenarios is driven entirely by differences in the costs of ageing ( $CoA_{i,t}^s$ ), hence  $pd_{i,t}^s - pd_{i,t}^0 = CoA_{i,t}^s - CoA_{i,t}^0$ , and we have:

$$\delta_{i,t}^s = \frac{1}{d_{i,t}^0} \left( CoA_{i,t}^s - CoA_{i,t}^0 + \frac{1+i_{i,t}}{1+\pi_{i,t}} \left( \frac{1}{1+\gamma_{i,t}^s} - \frac{1}{1+\gamma_{i,t}^0} \right) d_{i,t-1}^0 \right).$$

Applying the appropriate first-order approximations, this becomes:

$$\delta_{i,t}^s = \frac{1}{d_{i,t}^0} (CoA_{i,t}^s - CoA_{i,t}^0 - (1+i_{i,t}-\pi_{i,t})(\gamma_{i,t}^s - \gamma_{i,t}^0)d_{i,t-1}^0)$$

The required extra growth should compensate for the difference from the baseline scenario in the cost of ageing and the real growth rates in period  $t$ .

### 3. Results

The statistical appendices to the Debt Sustainability Monitor 2023 contain the debt ratio  $d_{i,t}^0$ , the (implicit) nominal interest rate  $i_{i,t}$ , and the inflation rate  $\pi_{i,t}$  in the baseline (see “Annex 8 Country fiches tables and graphs”). Eurostat generously shared with us the real GDP levels in the baseline and alternative scenarios ( $\gamma_{i,t}^0$  and  $\gamma_{i,t}^s$ ) used in the 2024 Ageing Report. From these levels we calculate the growth rates of GDP. The statistical annex to the 2024 Ageing Report, series 135 – 143, contains the cost of ageing in percent of GDP ( $CoA_{i,t}^0$  and  $CoA_{i,t}^s$ ) in the baseline and the alternative scenarios.

The total cost of ageing (henceforth referred to as “cost of ageing”) is the sum of age-related public spending on pensions, healthcare, long term care and education. The baseline projections are based on a general no-policy-change assumption, i.e. reflecting only legislated or credibly announced measures, and assume that policies remain unchanged over the projection period.

A number of macroeconomic assumptions are made for each country. These comprise economic growth and its driving factors, changes in labour productivity (total factor productivity and capital deepening), the labour force (participation, employment and unemployment rates) and interest rates. Total factor productivity (TFP) growth is assumed to steadily rise reversing the trend decline observed in many countries over the past few decades. Nominal interest rates of all euro area countries are assumed to converge to 4 percent in the long run (Ageing Report 2024, p.184). With an average inflation rate of 2 percent aimed at by the European Central Bank, this would imply a real interest rate of 2 percent.

Figure 1 depicts economic growth in percentage points for different scenarios *relative* to the baseline, Figure 2 shows the cost of ageing in percentage points of GDP *relative* to the baseline, and Figure 3 depicts the extra GDP growth in percentage points needed to keep the debt ratio at its path under the baseline. The different scenarios are:

- high life expectancy, captured by a two years higher life expectancy than in the baseline;
- low fertility, captured by a fertility rate 20% lower than in the baseline;
- high migration, which assumes 33% higher non-EU immigration than in baseline; and
- low migration, where non-EU immigration is 33% lower than in the baseline.

In all scenarios, the emigration rate is assumed constant as a fraction of total population.

Figure 1 shows that for most countries the high-life-expectancy scenario has only a moderate effect on economic growth relative to the baseline. This is because economic growth is measured as growth of the economy as a whole, not as per-capita growth. Broadly speaking, if an increase in life expectancy does not lead to an increase in retirement age, growth will remain unaffected, because the number of workers stays unchanged, although growth per capita will fall, as more people have to share the same unchanged level of economic output. To the extent that the retirement age rises with life expectancy, we expect to see an increase in growth compared to the baseline when life expectancy increases. This is indeed confirmed for some countries notably Greece, Italy and the Netherlands<sup>9</sup>. In all three countries, this is explained by the fact that the retirement age is indexed to the development of life expectancy. For Greece, as of 2021, the minimum and statutory retirement ages are adjusted in line with changes in life expectancy every

---

<sup>9</sup> The country fiches accompanying the Ageing Report contain the most relevant features of the country specific retirement systems. For the exact details, we refer to the Economic Policy Committee – Ageing Working Group (2025) PENSREF database.

three years, while for Italy eligibility requirements for old-age, early retirement, and social assistance pensions are indexed to changes in life expectancy.

The low-fertility scenario starts to weigh on economic growth only in the longer run, because children born now will enter the labour market only about 18 to 25 years later. In fact, for some countries there is even a small uptick in growth in the shorter run, because a lower number of children to take care of positively impacts labour supply. In the long run, growth falls in all countries relative to the baseline. Lower growth is in the range of 0.3 – 0.5 percentage points, which is substantial relative to the low rates of GDP growth EU countries have become accustomed to over the recent past. Because emigration is assumed constant as a fraction of the population and because emigrants tend to be relatively concentrated in the younger cohorts (the age group 15-44 years), countries with relatively large emigration rates, such as Cyprus, Luxemburg or Malta, will be hurt less in terms of GDP growth under the low fertility scenario.

A shift in net migration from the baseline to the high-migration scenario has in most cases an almost immediate positive effect on economic growth, as more migrants enter the labour market. Overall, the effects range from about zero to 0.5%-points growth increase relative to the baseline. A few countries stand out. First, Malta strongly depends on migration for its economic growth. In the high-migration scenario, economic growth immediately jumps to 4.3% compared to 3.9% in the baseline, a 0.4 percentage point difference. After some further increase, this difference gradually declines. Economic growth in Cyprus, Ireland, and Slovenia and Spain also depends strongly on migration, but not as much as in Malta. Opposite effects occur under the low migration scenario.

Turning to age-related spending in percent of GDP (Figure 2), we observe that relative to the baseline it generally rises over time under the high-life-expectancy scenario, driven by higher costs of retirement benefits, health- and long-term care. Long-run differences relative to the baseline can go up by a full percentage point for a number of countries. In the low fertility scenario age-related costs fall after a couple of years relative to the baseline in all countries. Fewer children have a positive effect on the labour supply and raise GDP as highlighted above. However, by far the biggest effect is that after a few years savings on education spending start to matter. In the long run, the costs of ageing relative to the baseline rise because fewer people enter the labour market, hence fewer people are available to shoulder the rising costs of population ageing. High migration in almost all countries has a substantial suppressing effect on the cost of ageing relative to the baseline, in a number of instances reaching one percentage point of GDP in the longer run. Migrants are on average of working age, the group for which age-related public spending is lowest.

The opposite is the case in the low-migration scenario. The total cost of ageing responds strongly to migration in some countries that depend a lot on migration for their economic growth, especially Malta, Cyprus and Slovenia, all economies with a small population.

We now turn to the extra economic growth required to keep the debt-to-GDP ratio at the baseline (Figure 3). The patterns of required extra growth are rather similar in most cases. We discuss the “regular” patterns first. The high life-expectancy scenario for most countries requires extra economic growth increases over time relative to baseline growth, because the cost of ageing is increasing over time relative to the baseline. The required extra growth can become quite substantial in the long run. For example, for Austria it exceeds 0.5%-points relative to the baseline. The high-life-expectancy scenario incorporates the effect of legislated responses to changes in life expectancy. While many countries have not yet made solid arrangements in this regard, some countries have taken measures in anticipation of a trend increase in life expectancy. For example, the Netherlands features an automatic update (with some delay) of the retirement age for a public pension when life expectancy rises. Indeed, we observe that for that country only little extra growth is needed to keep debt ratios on their baseline path.

Low fertility in most cases initially leads to a drop in the required extra growth, because age-related expenditures fall, but in the longer run the required extra growth starts to increase and continues to rise over time. In the low-migration scenario the required extra growth starts to rise immediately while the opposite is true under the high-migration scenario. Overall, deviations in migration have a particularly substantial effect on the required extra growth to keep the debt ratio on its baseline path. In most instances, the longer-run effects lie between 0.5 and 1%-points of lower (in the high-migration scenario) and higher (in the low-migration scenario) required extra growth. Realising that these are annual differences in required extra growth, compounded over the years the effect on required extra GDP in level will be large, see Table 1. We observe that in most cases the effect of lower or higher migration on required extra growth starts shrinking again after a couple of decades, presumably the result of ageing among the new entrants of the country.

Some countries exhibit paths that are not immediately intuitive. The required extra growth in Cyprus, Denmark, Ireland and Sweden seems to explode or fluctuate in cycles. First, consider Denmark. Its debt ratio even becomes negative in 2038. Required extra growth ( $\delta_{i,t}^s$ ) can be split into two parts, namely (i) different costs of ageing between the alternative and the baseline scenario, and (ii) different growth rates between these two scenarios:

$$\delta_{i,t}^s = \frac{CoA_{i,t}^s - CoA_{i,t}^0}{d_{i,t}^0} - (1 + i_{i,t} - \pi_{i,t})(\gamma_{i,t}^s - \gamma_{i,t}^0) \frac{d_{i,t-1}^0}{d_{i,t}^0}$$

This expression shows that a low initial debt ratio blows up differences in the cost of ageing due to the denominator effect in the first term on the right-hand side. Moreover, a rapidly declining debt ratio magnifies the effect of growth rate differences between the scenarios through the ratio  $d_{i,t-1}^0/d_{i,t}^0$  in the second term. Denmark starts with a low debt ratio which is moreover rapidly declining, resulting in large absolute values of required extra growth.

Swedish growth relative to the baseline is driven by the so-called “indicative age” (see Sweden Country Fiche, 2023). In the Ageing Report, from 2026 and onwards exit ages into retirement will be indexed to a new “indicative age”, which is set to rise in line with the remaining lifetime at the age of 65. The indicative age is calculated every year based on the unisex life expectancy at 65. When it reaches a threshold, then a change is triggered. The Eurostat population projection foresees a further increase in the indicative and all related eligibility ages again in 2035, 2051 and 2069, raising the earliest age for an old-age pension to 67 in 2035 and the earliest age for the pension to 70 in 2069. Under the high life expectancy scenario these discrete changes to the indicative age – and hence the effective retirement age – happen in different years compared to the baseline scenario. Combined with relatively high participation rates (20.3 in 2022, increasing to 29.7 in 2070) for the relevant age group (65-74), changing the effective retirement age at different dates generates large effects in the required extra growth. A similar effect can be observed – to a lesser extent because of smaller adjustment steps – for the Netherlands. The large figure for Sweden in the low-migration scenario in Table 1 for 2070 results from the fact that the projected debt ratio falls to a 2% debt-ratio in the later years and, hence, the required TFP increase to keep the debt ratio at its baseline blows up to a large amount.

While for Greece the difference in growth rates with the baseline does not exhibit an irregular pattern, the difference in the cost of ageing does. This is due to a sustainability clause (Greece Country Fiche, p.6), which stipulates that if long-term projections show a rise in public pension expenditure of over 2.5 percentage points of GDP relative to 2009 expenditure, then relevant parameters of the pension system are changed to bring the increase in expenditure to below its targeted threshold. In addition, the retirement age in Greece is linked to life expectancy at 65 (Greece Country Fiche, p.16). Legislation stipulates a mechanism to adjust the retirement age in line with life expectancy every three years as of 2021. This change of the retirement age does not translate in big changes of economic growth compared to the baseline. This is mostly because the

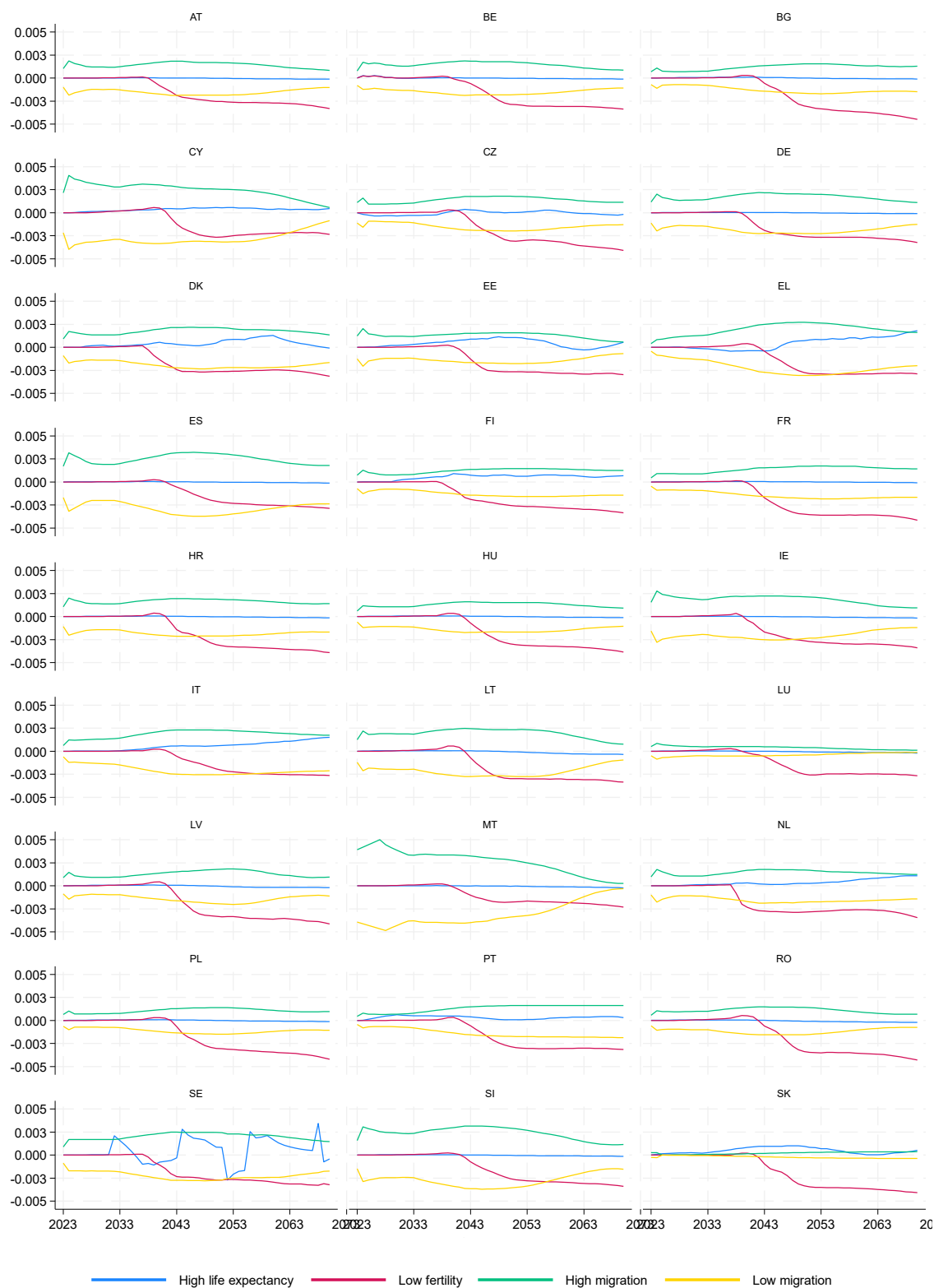
labour force participation rate of the relevant group (65-74) is relatively low – it is projected to increase from merely 9.3% in 2022 to 24.3 in 2070 (Table 3, p.22, of the Greece Country Fiche).

**Table 1: Scenario-specific cumulative required extra economic growth to keep debt-to-GDP ratios at the baseline, 2070**

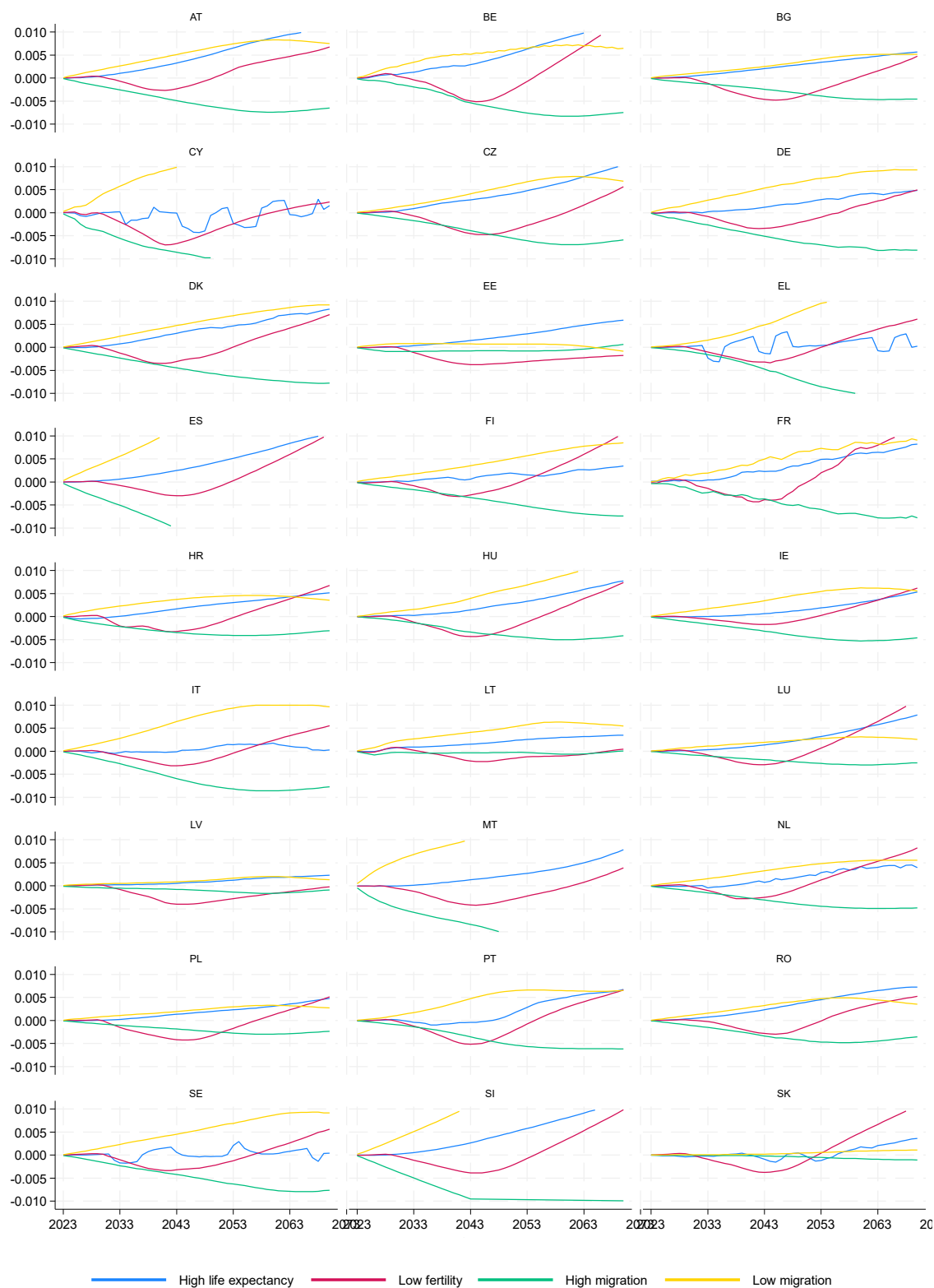
	HIGH LIFE EXPECTANCY	LOW FERTILITY	HIGH MIGRATION	LOW MIGRATION
AT	0.18	0.11	-0.22	0.31
BE	0.13	0.09	-0.19	0.24
BG	0.18	-0.03	-0.23	0.32
CY	-0.11	-0.24	-0.92	19.19
CZ	0.21	-0.01	-0.26	0.38
DE	0.12	0.04	-0.33	0.54
DK	0.09	-2.70	-3.79	0.46
EE	0.46	-0.27	-0.16	0.18
EL	0.00	0.09	-0.31	0.50
ES	0.10	0.07	-0.33	0.59
FI	0.03	0.13	-0.21	0.30
FR	0.08	0.13	-0.17	0.22
HR	0.10	0.08	-0.21	0.30
HU	0.09	0.05	-0.17	0.30
IE	0.72	0.19	-0.76	3.66
IT	-0.02	0.06	-0.20	0.28
LT	0.09	0.04	-0.12	0.39
LU	0.20	0.05	-0.18	0.22
LV	0.06	-0.03	-0.12	0.15
MT	0.10	-0.04	-0.47	1.05
NL	0.05	0.11	-0.21	0.28
PL	0.05	0.04	-0.11	0.13
PT	0.08	0.05	-0.23	0.34
RO	0.07	0.09	-0.12	0.14
SE	0.31	2.09	-1.00	174.04
SI	0.14	0.05	-0.37	0.68
SK	-0.02	0.10	-0.02	0.02

Note: numbers are in fractions of annual GDP. For example, the first number, 0.18, corresponds to 18% of annual GDP or approximately 0.3% per year over the sample period.

**Figure 1: Economic growth in various demographic scenarios compared to the baseline scenario ( $\gamma_{i,t}^s - \gamma_{i,t}^0$ ), 2022 - 2070**



**Figure 2: Cost of Ageing (as a fraction of GDP) in various demographic scenarios compared to the baseline scenario ( $CoA_{i,t}^s - CoA_{i,t}^0$ ), 2022 - 2070**





**Figure 3: Scenario-specific required extra economic growth to keep debt-to-GDP ratios at the baseline, 2022 - 2070**



## 4. Sensitivity analysis: lower labour market participation of immigrants

This section explores the consequences of the high-migration scenario when labour participation and/or productivity of first-generation migrants is lower than of the incumbent population. This is a plausible situation since immigrants are less familiar with the labour market of their new country of residence and at least part of the immigrant group originates from non-Western countries where the skill level does not entirely match the needs of a Western knowledge-intensive economy. To calculate the resulting levels of GDP and cost of ageing is beyond the scope of this paper. But we can determine the scenario-specific required extra economic growth to keep debt-to-GDP ratios at the baseline provided we assume the costs of ageing do not depend on the labour force participation rates. We can calculate this because we only need the growth rate of real GDP compared to the baseline scenario,  $\gamma_{i,t}^s - \gamma_{i,t}^0$ .

If we assume that technology and capital growth are comparable in each scenario to the baseline, then a simple growth decomposition exercise shows that  $\gamma_{i,t}^s - \gamma_{i,t}^0$  is completely determined by the growth of labour input in the specific scenario compared to the baseline (multiplied by the output elasticity of labour  $\alpha$ ):

$$\gamma_{i,t}^s - \gamma_{i,t}^0 = \alpha \left( \frac{L_t^s - L_{t-1}^s}{L_{t-1}^s} - \frac{L_t^0 - L_{t-1}^0}{L_{t-1}^0} \right) \approx \alpha \left( \frac{(L_t^s - L_{t-1}^s) - (L_t^0 - L_{t-1}^0)}{L_t^0} \right),$$

where  $L$  measures labour input. In principle, we do not know what drives growth of labour input in the baseline or any other scenario, but we can assume that the difference in the migration scenarios compared to the baseline is mostly due to migration. That implies that if labour participation measured in efficiency units of first-generation migrants is a fraction  $0 < \lambda < 1$  of that of the incumbent population,<sup>10</sup> then the difference in growth rates is the same fraction. If we assume that the cost of ageing in a low-participation-high-migration scenario is comparable to that in the “pure” high-migration scenario discussed in Section 3, but the growth rate difference is a fraction  $\lambda$ , then the required extra growth in the low-participation-high-migration scenario is:

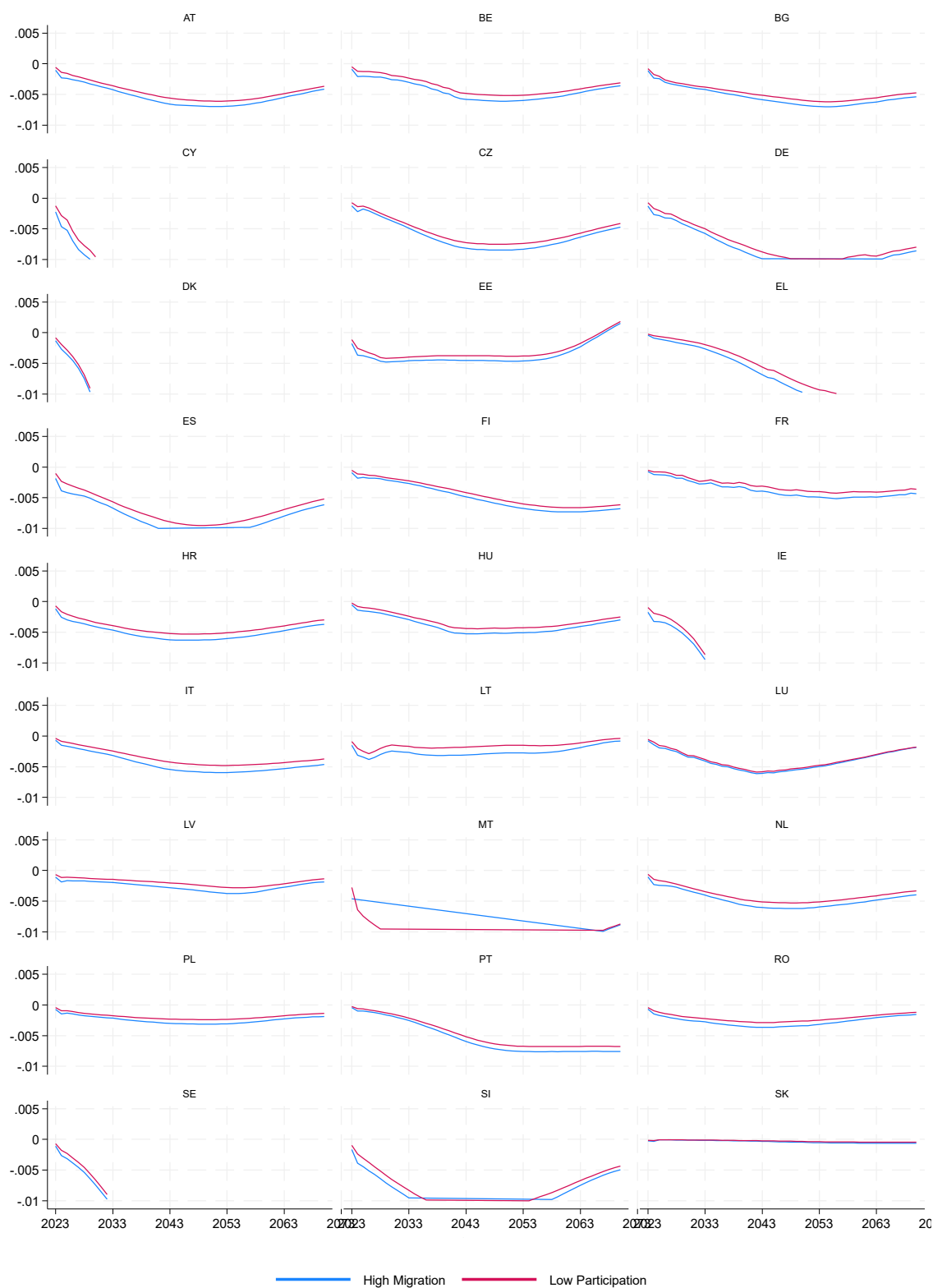
---

<sup>10</sup> Because labour participation is expressed in efficiency units,  $\lambda < 1$  captures a lower number of hours worked and/or lower average productivity per immigrating person. For convenience we use “lower participation rate” to refer to both possibilities.

$$\delta_{i,t}^{LPHM} = \frac{1}{d_{i,t}^0} (CoA_{i,t}^{HM} - CoA_{i,t}^0 - (1 + i_{i,t} - \pi_{i,t})\lambda(\gamma_{i,t}^{HM} - \gamma_{i,t}^0)d_{i,t-1}^0),$$

where superscript “HM” denotes the high-migration scenario (for any participation rate of the immigrants) and the superscript “LPHM” the low-participation-high-migration scenario. Figure 4 depicts this for  $\lambda = 50\%$ . We observe that the difference in required extra growth resulting from the lower participation rate relative to the normal participation rate is small. The reason is that the cost of ageing is the main driver of the effect on required growth and we have made the assumption that lower participation does not affect the cost of ageing in the future. In practice, most pension systems are at least partly of the defined-contribution type, hence lower participation would lead to lower contribution now and lower expenditures in the future. This would shrink the first term  $CoA_{i,t}^{HM} - CoA_{i,t}^0$  in the formula for  $\delta_{i,t}^{LPHM}$ , and the red line would be pushed even further toward the blue line in Figure 4. Hence, the required extra growth can fall even further.

**Figure 4: Comparison of required extra GDP growth to keep debt-to-GDP ratios at the baseline, 2022 - 2070, for high migration with normal (blue) versus 50% lower participation (red)**



## 5. Concluding remarks

This paper has combined information from the European Commission's most recent Debt Sustainability Monitor and most recent Ageing Report to compute the changes in economic growth in EU countries needed for government debt ratios to stay on their baseline trajectories as set out in the Debt Sustainability Monitor under different scenarios. We considered a high life-expectancy, low-fertility, low-migration and high-migration scenario. Of the public expenditures only the cost of ageing is assumed to be sensitive to the demographic scenarios.

We observe that the different scenarios can lead to significant amounts of required extra growth compared to the baseline. Compounded over the years the effect of different scenarios on GDP will be substantial and, hence, the demand in terms of required extra productivity of the labour force will be substantial. The different migration scenarios have a particularly large effect. Increased immigration, especially of high-skilled workers can substantially alleviate the required extra growth under faster-than-anticipated increases in life expectancy and the associated extra ageing costs. Over the very long run these benefits from higher immigration shrink due to the ageing of the new entrants in the work force.

The analysis has been conducted under a number of assumptions underlying the Debt Sustainability Monitor and Ageing Report. One of these is that the productivity of immigrants equals that of the original population. To the extent that immigrants end up in less well-paid jobs, which is more likely for immigrants from non-Western countries, the high-migration scenario will be less favourable and the low-migration scenario will be less unfavourable in terms of growth. From a historical perspective the projected long-term real interest rate of 2% seems to be on the high side. With a lower real interest rate, a given increase in immigration is likely to have a larger positive effect on growth (or required extra growth will be smaller to keep debt on its baseline path), because it is easier for firms to make the investment to put new labour inflow to work. The high-life expectancy scenario and the low-fertility scenario will also be milder in that investment will be easier to complement those who work longer, respectively to replace those who disappear from the labour force. The required additional growth would be easier to attain.

## References

- Beetsma, R. (2024), The new economic governance framework: Implications for monetary policy, *In-depth Analysis* at request of ECON committee of the European Parliament, [https://www.europarl.europa.eu/RegData/etudes/IDAN/2024/760265/IPOL\\_IDA\(2024\)760265\\_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/IDAN/2024/760265/IPOL_IDA(2024)760265_EN.pdf)
- Draghi, M. (2024), *The future of European competitiveness*, part A, September, European Commission.
- European Commission (2024a), 2024 Ageing Report. Economic and Budgetary Projections for the EU Member States (2022-2070), Institutional Paper 279, April 2024, doi:10.2765/022983 (online).
- European Commission (2024b), 2024 Ageing report - Statistical annexes all horizontal tables.
- European Commission (2024c), Debt Sustainability Monitor 2023, Institutional Paper 271, March 2024, doi:10.2765/860483 (online).
- European Commission (2024d), Debt Sustainability Monitor 2023, Annex 8 Country fiches tables and graphs.
- Economic Policy Committee – Ageing Working Group (2023), 2024 Ageing Report, Cyprus – Country Fiche.
- Economic Policy Committee – Ageing Working Group (2023), 2024 Ageing Report, Greece – Country Fiche.
- Economic Policy Committee – Ageing Working Group (2023), 2024 Ageing Report, Sweden – Country Fiche.
- Economic Policy Committee – Ageing Working Group (2025), PENSREF database, [https://economy-finance.ec.europa.eu/economic-research-and-databases/economic-databases/pensref-pension-reform-database\\_en](https://economy-finance.ec.europa.eu/economic-research-and-databases/economic-databases/pensref-pension-reform-database_en)
- Larch, M. and M. Busse (2024), Europe’s demographic winter and the new EU fiscal rules, <https://cepr.org/voxeu/columns/europes-demographic-winter-and-new-eu-fiscal-rules>.