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Sommario

Le implicazioni del cambiamento demografico sul sistema economico e finanziario italiano

INTERVENTI

RUBRICHE

Ageing and the sustainability of public finance

Lilia Cavallari[*◊]
Flavio Padrini[*]
Nicola Carmine Salerno[*]
Lorenzo Toffoli[*]

Abstract

This paper analyzes the impact of the demographic transition on welfare expenditures and the sustainability of public finances. A comparison among different projections reveals that welfare expenditure is expected to grow substantially in the coming decades, both in absolute and as a percentage of GDP. It is expected to return to values comparable to current levels only in the very long run, albeit with a much older population. Based on indicators of sustainability incorporating these projections, we argue that a remarkable consolidation effort would be required to reach a plausible debt target, especially under the latest projections. A less demanding yet still significant effort is required to ensure solvency in the long run.

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Sintesi - Invecchiamento della popolazione e sostenibilità delle finanze pubbliche

Il presente lavoro analizza l'impatto della evoluzione demografica sulla spesa per il welfare e sulla sostenibilità delle finanze pubbliche. Dal confronto tra le diverse proiezioni emerge che la spesa per il welfare è destinata a crescere in modo sostanziale nei prossimi decenni, sia in termini assoluti che in percentuale del PIL. Si prevede che tornerà a valori paragonabili ai livelli attuali solo nel lunghissimo periodo, anche se con una popolazione molto più anziana. Sulla base degli indicatori di sostenibilità che incorporano queste proiezioni, argomentiamo che sarebbe necessario un notevole sforzo di consolidamento per raggiungere un obiettivo di debito plausibile, soprattutto secondo le ultime proiezioni. Per garantire la solvibilità nel lungo periodo è necessario uno sforzo meno impegnativo ma comunque significativo.

JEL Classification: H55; H68; J11.

Parole chiave: *Welfare; Invecchiamento; Spesa pubblica; Debito pubblico; Sostenibilità del debito.*

Keywords: Welfare; Ageing; Public expenditure; Public debt; Debt sustainability.

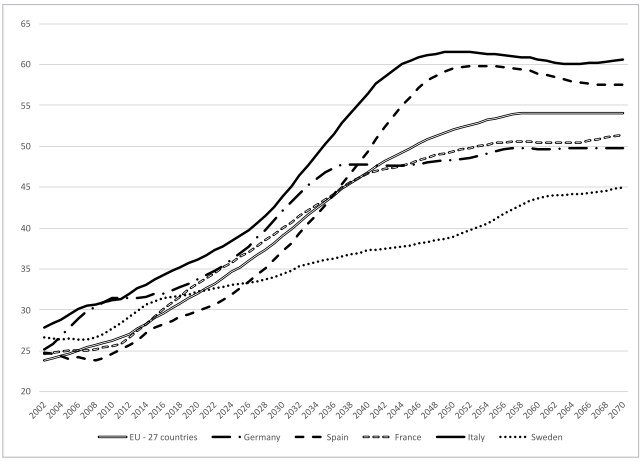
1. Introduction

A fast process of population ageing characterizes both developed and developing countries, shaping what is considered one of the most pervasive transformations in our society. The main drivers of ageing are fertility and life expectancy. In most developed countries, fertility rates started to decline in the sixties while life expectancy has been growing since the second half of the nineteenth century, with the exception of the period of the two world wars. In the last decades, developed countries have experimented a significant increase in the share of elderly.

Figure 1.1a shows the evolution of the old-age dependency ratio, i.e. the ratio between elderly and active population, for representative European countries. Historical data from 2002 to 2019 are chained with Eurostat projections for the period 2020-2070. In all countries, the dependency ratio grows for most of the horizon. For Italy, it has risen from 28 per cent in 2002 to 36 per cent in 2019 and is projected to reach 62 per cent in 2050 and stabilize thereafter. In Europe, the ratio rises on average from 25 per cent in 2002 to 53 per cent at the end of the next fifties, a value almost ten percentages point below the one for Italy. There is large heterogeneity across countries. Spain is projected to age at a similar pace, almost reaching Italy's dependency ratio by the beginning of the 2050s. For Germany and France, on the contrary, the dynamics is similar only until the beginning of the 2030s. Thereafter, ageing will substantially slow down, leading the old-age dependency ratio approximately 10 percentage points below the value for Italy at the end of the projection horizon. The population dynamics appears especially favourable in Scandinavian countries. In Sweden, for example, the dependency ratio will be about 45 per cent in 2070, more than 15 percentage points below the value for Italy.

Figure 1.1 – Old-age dependency ratios in some representative EU countries and in the Italian macro-areas (1)(2)

(a)



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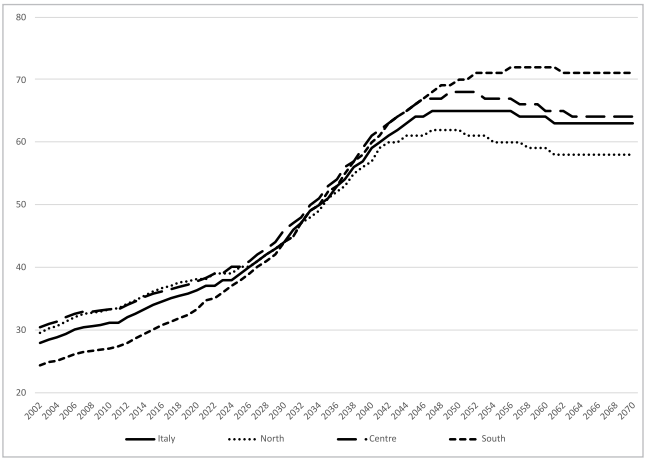


Source: authors' elaboration on Eurostat and Istat databases.

(1) The old-age dependency ratio is the ratio between people aged 65+ and people aged 15-64. In the rest of the paper, the denominator refers to the population aged 20-64. – (2) Projections in panel (a) and panel (b) are, respectively, from Eurostat and Istat baseline scenarios.

Looking across Italian regions, the ageing process appears far from homogeneous. Figure 1.1b reports the old-age dependency ratio for Italy as a whole and for the three macro-areas of North, Centre and South. The South presents the less favourable prospective: in 2002, the ratio was about 24 per cent against a national level of 28 per cent, reflecting the primacy of the youngest population, but the gap is expected to be bridged by the 2030s (around a ratio of 44 per cent) and reversed thereafter. Ageing will proceed at a far more rapid pace in the South than in the rest of the country, and the dependency ratio will reach 71 per cent as opposed to 58 in the North, 64 in the Centre, and 63 per cent on average by the end of the forecasting horizon. Notice that the gap between the South and the national average (about 8 percentage points) will be even larger than the gap between Italy and the EU-27 average (about 7 percentage points).

Demography is bound to play an important role for convergence both within and across countries.[1] The economic literature has long recognized that population ageing can affect economic growth through different channels. In labour markets, major drivers are the reduction in the share of active population and the decline in labour productivity along with ageing of the working population. It is argued that ageing can reduce not only the productivity of older workers, but spread negative effects on the productivity of the whole workforce and the propensity to innovate. Recent evidence documents that ageing indeed reduces Total Factor Productivity (TFP) and discourages firm dynamics, essentially because old people are less innovative[2]. In contrast to these views, efficiency reasons suggest that population ageing may turn beneficial for growth. Specifically, the scarcity of labour input

1 Daniele et al. (2019).
2 Lee and Shin (2021).

could favour innovation and automation processes and increase total factor productivity.[3] Indeed, these processes can contribute to improve the economy's growth potential, though evidence on their relevance is scant. In particular, the productivity boost that would be required to offset the consequences of ageing population documented so far appears high in light of what is observed in the data.

Ageing is also an important determinant of saving behaviour. An ageing society has typically a relatively high propensity to save, because people face longer periods of inactivity[4]. This could contribute to foster the accumulation of capital and stimulate growth, but only provided that savings are effectively conveyed towards productive investments, which is not obvious. Moreover, nothing ensures that savings will continue to grow at the actual pace. Indeed, relatively low growth rates coupled with uncertainties about the sustainability of welfare systems could endanger the capacity of future generations to save at historical rates[5].

Economic and demographic perspectives are intertwined in a complex and dynamic way, and these interactions play a relevant role for public finances. This paper focuses on the role of the demographic transition for welfare expenditures and the sustainability of public finances. It is structured as follows. Section 2 compares alternative projections of ageing-related expenditure, accounting for differences in the underlying demographic scenarios and macroeconomic assumptions, and discusses their policy implications. Section 3 provides medium and long-term indicators of fiscal sustainability incorporating the latest projections by AWG. Section 4 contains brief conclusive remarks.

3 Acemoglu and Restrepo (2017).

4 Del Negro et al. (2019) and Bernanke (2005).

5 OECD and Eurostat historical data on households' savings rates show decreasing trends for many Western countries, including Italy (where the phenomenon is particularly accentuated).

2. Ageing-related spending projections and the demographic transition

This Section compares different projections for ageing-related expenditures against a baseline given by the latest projections for Italy (RGS, 2022). The sensitivity analysis accounts for alternative scenarios on the demographic evolution (Section 2.1) and for the latest issue of the European Commission's projections (Section 2.2). Section 2.3 discusses the main policy implications.

As most developed countries, Italy faces a demographic transition that will lead to a significant increase in the weight of old-age population in the next decades. An ageing population affects both the dimension and composition of welfare expenditure. Welfare provisions concentrated in old-age population brackets – like pensions, acute health care and long-term care – will gain importance and their expenditure is likely to increase both in absolute levels and as a percentage of GDP. The opposite is true for provisions spread across population brackets or that are explicitly targeted to youngsters, like education. Population ageing affects public finances also indirectly through its impact on the whole economy, and particularly on labour force, productivity and savings. [6] In any regime – pay-as-you-go or fully funded – ageing has significant effects on the production of resources needed to finance the welfare state.

The projections of ageing-related expenditure play an important role for assessing the medium- and long-term sustainability of public finances. In the current configuration of the Stability and Growth Pact, these projections are included in the computation of minimum Medium-Term Budgetary Objectives (MTOs), i.e. the budget deficit targets consistent with sustainable debt levels. In addition, they are considered by the European Commission in

6 Maestas et al. (2016).

the context of the annual country-specific recommendations of the European semester for evaluating pensions, acute health care, long-term care and education provisions.

Ageing-related spending projections for Italy are released on a bi-annual basis by the State General Accounting Department (*Ragioneria generale dello Stato*, RGS) of the Ministry of Economy and Finance. The RGS report provides own projections for pensions, acute health care and long-term care (the so-called "National scenario"), while projections for education are mainly based on analyses of the Working Group on Ageing Populations and Sustainability (AWG) of the European Commission.[7] The AWG was constituted by the Economic Policy Committee (EPC) of the Council for Economic and Financial Affairs (ECOFIN) to help assess the long-term sustainability of public finances and the economic consequences of ageing populations in Member States. It provides projections of expenditures (pensions, acute health care, long-term care and education) for all the EU countries every three years.[8] The RGS and AWG projections share a common methodological approach, while being based on a (slightly) different set of demographic and macroeconomic assumptions.[9]

The comparison across projections allows to identify "fundamental trends" in the evolution of ageing-related expenditures that are robust to changes in the underlying assumptions and are not related to the specific contingences of a given vintage, like the COVID-19 pandemic.

The key message from these comparisons is that ageing-related expenditure

7 RGS projections are used in official budgetary documents (Economic and Finance Document and its Update) in compliance with the Stability and Growth Pact (SGP).

8 Until 2018 AWG released also projections for unemployment benefit spending.

9 Occasionally, the International Monetary Fund (IMF) disseminates its own projections for medium and long-term pension expenditures within more extensive analyses of Italy's public finances. These projections consist in sensitivity exercises based on the RGS scenarios. See, for example, Ufficio parlamentare di bilancio (2018).

is expected to rise significantly in percentage of GDP over the next two decades. The expenditures ratios for pensions, acute health care and long-term care share a common hump-shaped profile, whereby expenditure increases up to a peak in the forties and then slowly converges to the pre COVID-19 level (2019) at the end of the projection horizon (2070). In more recent projections, the difference between the peak and the pre COVID-19 level ranges from 2.5 percentage points in RGS to 4.5 percentage points in AWG.

As it will be discussed soon, these dynamics raise major challenges for policy. Public resources devoted to financing ageing-related expenditures are already high and overall fiscal space is limited, making it difficult to ensure the full coverage of rising expenditures in the coming decades. In the very long run, when expenditures would stabilize around current values, there would be little room for addressing structural issues of underfunding.

2.1. The RGS-2022 projections

The projections RGS-2022[10] are based on the latest demographic projections of ISTAT[11] (ISTAT, 2021), updated with residents as of January 1st 2022. They consider demographic changes occurred after 2019, including the consequences of the COVID-19 pandemic.[12]

The demographic transition is characterized by a slow increase in total fertility rates (TFR), a decline in net migration inflows and an increase in

10 Ragioneria generale dello stato – RGS (2022).

11 Istituto nazionale di statistica – ISTAT (2021).

12 Istat corrects the projections with a now-casting method, implying that estimates for the very first years of the projection horizon are (strongly) affected by the trend emerging in the latest survey period. RGS-2022 accounts for the most recent release of the population resident in Italy as of January 1st 2022, while maintaining the same demographic parameters in the ISTAT projections. The previous round of Istat demographic projections had been released in 2019 and did not account for COVID-19 (ISTAT-2019).

life expectancy. Total population amounts to 59.6 million in 2020, 54.1 million in 2050 and 47.6 million in 2070 in ISTAT-2021, against values of, respectively, 60.4 million, 57.8 million and 52.6 million in the previous release (ISTAT-2019).

In what follows, we will focus on the baseline RGS scenario together with two variants accounting for alternative demographic developments, labelled "high-variant" ("low-variant") for the case of high (low) population growth.[13] These scenarios are meant to illustrate the sensitivity of expenditure projections to demographic assumptions (while leaving the assumptions on labour market and productivity unaltered). Notice that the GDP dynamics may vary across scenarios because of the interplay of demography with macro assumptions.

In the high-variant scenario, the TFR exceeds its baseline level by 0.26 percentage points at the end of the projection horizon, while life expectancy exceeds the baseline by 2 years for men and 2.1 years for women. Moreover, net migration flows are on average higher than in the baseline by 42.000 units per year. Symmetrically, in the low-variant scenario these differences have the same magnitude but assume negative signs. At the end of the forecasting horizon, in 2070, the Italian population would be 41.0, 47.6 or 54.5 million for, respectively, the low-variant, the baseline and the high-variant scenario (in any case well below the population in 2020).

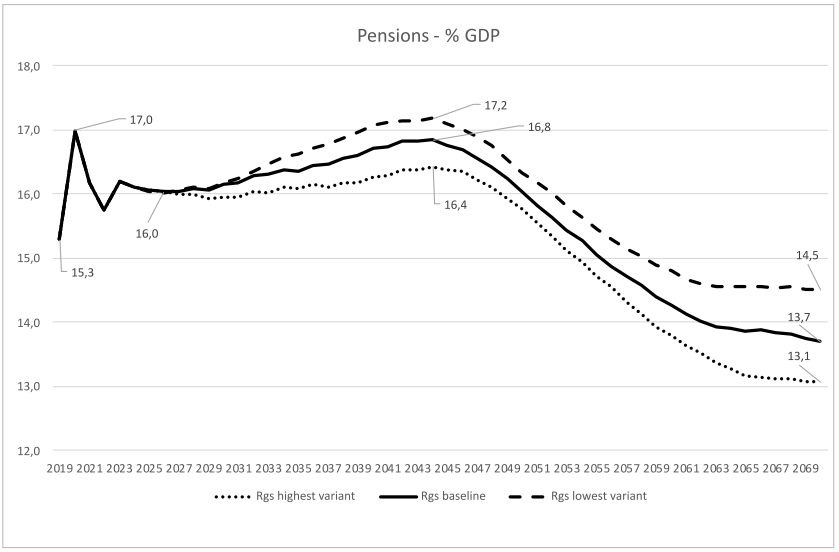
13 For brevity, the label "high-variant" is used to denote the scenario incorporating the highest population growth among the various hypotheses adopted by RGS, and similarly the "low-variant" label denotes the scenario with the lowest population growth.

2.1.1. Pensions

Projections for pension expenditure are reported in figure 2.1a. The dynamics is similar for the baseline projections and the two variants. Expenditure ratios tend to increase substantially until the middle of the forties, reaching a peak in 2044 equal to 16.8 per cent of GDP in the baseline, 17.2 in the high-variant and 16.4 in the low-variant scenario. Indeed, this period corresponds to the retirement of "baby boomers" (i.e, people born during the demographic expansion following the Second World War, now aged between 65 and 70). These (large) cohorts are entitled to pensions that reflect for a non-negligible part a very generous wage-based criterion. In fact, the notional defined contribution (NDC) pension scheme introduced in 1995 will be fully effective only around 2040. In a second phase dating between the middle of the forties and the middle of the sixties, the trend will be reversed and expenditure will decrease, as a consequence of the gradual disappearance of baby-boomers and closer connection of pensions to career contributions. In the remaining part of the projection horizon, the expenditure ratio will stabilize around relatively low levels, reflecting the end of the demographic transition as well as full effectiveness of the NDC accumulation scheme. In 2070, the expenditure ratio falls to 13.7 per cent in the baseline scenario, 13.1 per cent in the high variant and 14.5 per cent in the low variant.

Figure 2.1 Ageing-related expenditure to GDP ratio in RGS-2022 projections

(a)



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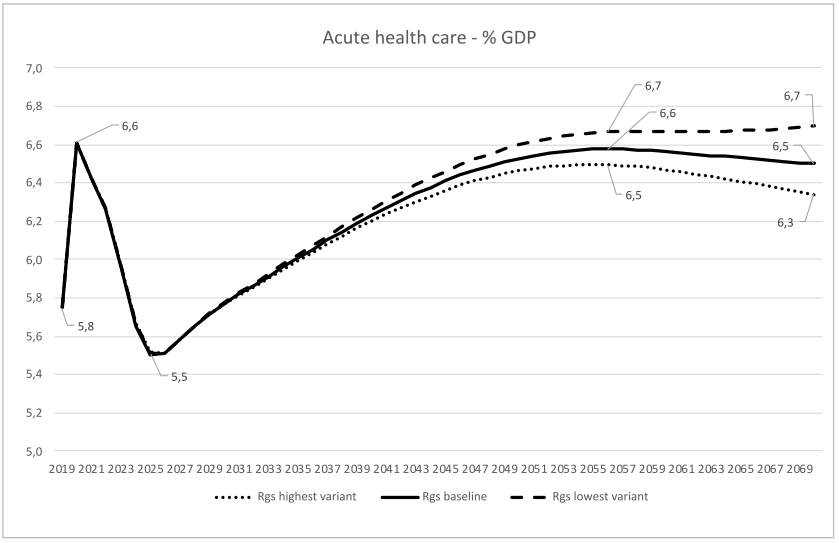
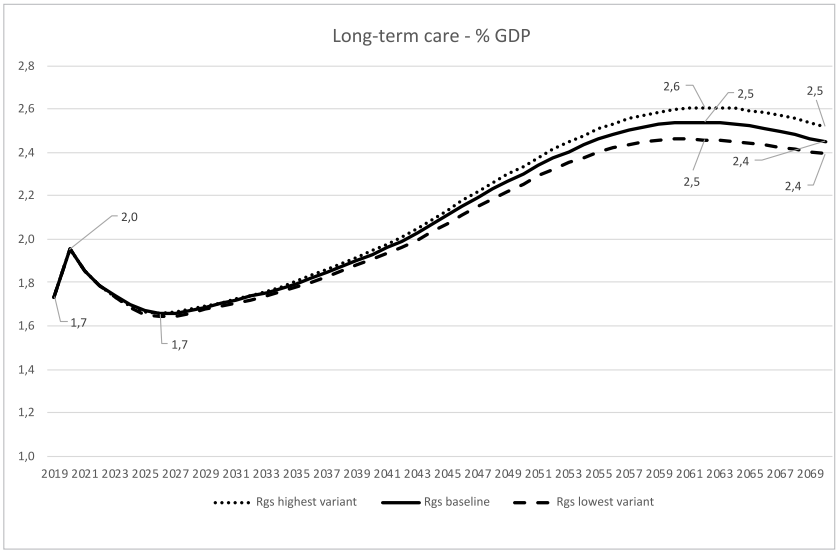
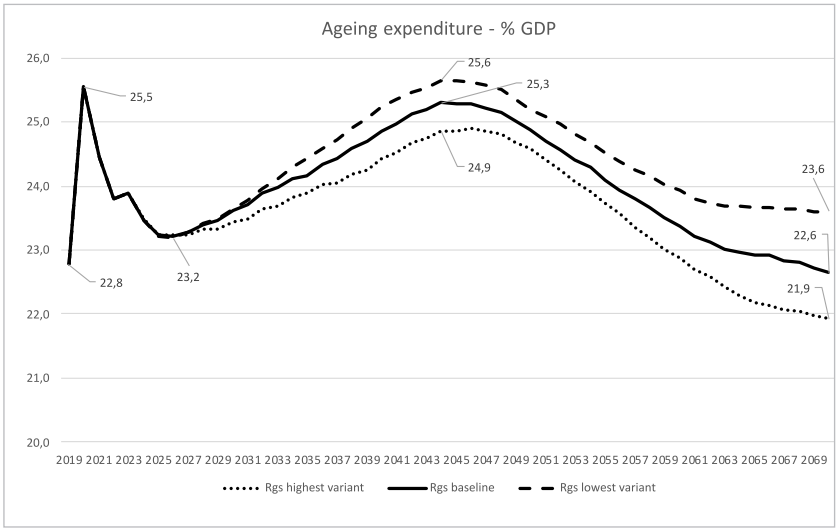


(c)



(d)



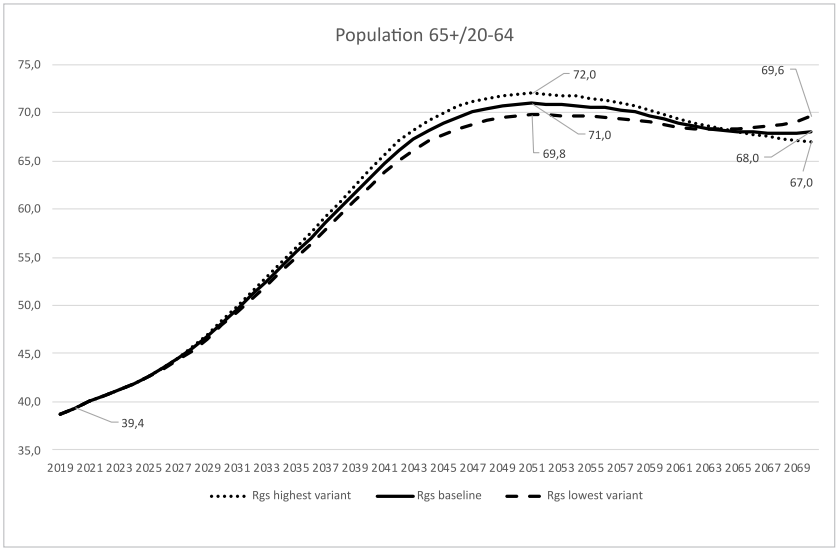
Source: authors' elaboration on RGS (2022) data.

In all scenarios, the share of active population is expected to shrink while inactive population increases, and the demographic transition takes place in the space of about thirty years (figure 2.2a). The old-age dependency ratio, i.e. the ratio between people aged 65+ and people aged between 20 and 64, deteriorates substantially over the projection horizon. It goes from about 39 per cent in 2020 (in all scenarios), to 70, 71 and 72 per cent in 2051 for, respectively, the low variant, the baseline and the high variant; thereafter the ratio gradually reaches a value of 68 per cent in 2064 in all scenarios before diverging again. Notice that by the end of the forecasting horizon the ranking is completely reversed: the old-age dependency ratio is highest (80 percent) in the low-variant scenario, followed by the baseline (68 percent) and the high-variant scenario (67 per cent).

The demographic developments expected in the various scenarios have both direct and indirect effects on the pension expenditure ratio. Changes in population size and composition by age affect the numerator of the expenditure ratio, while changes in active population affect the denominator through their impact on GDP. The high-variant scenario, for example, foresees a more intense ageing for most part of the projection horizon compared to the other scenarios, but also a relatively high population growth. The former tends to deteriorate the pension expenditure ratio by increasing the numerator, while the latter does the opposite through the effect on GDP (the denominator). Recalling that the hypotheses on employment rates and labour productivity are identical in all scenarios, one may argue that the evolution of pension expenditure reflects differences in GDP growth originating from the dynamics of active population. Until the mid-sixties, in fact, high growth in the high-variant scenario (figure 2.2b) more than offsets unfavourable demographic effects (figure 2.2a).

Figure 2.2 Population and GDP assumption underlying RGS-2022 projections (1)

(a)



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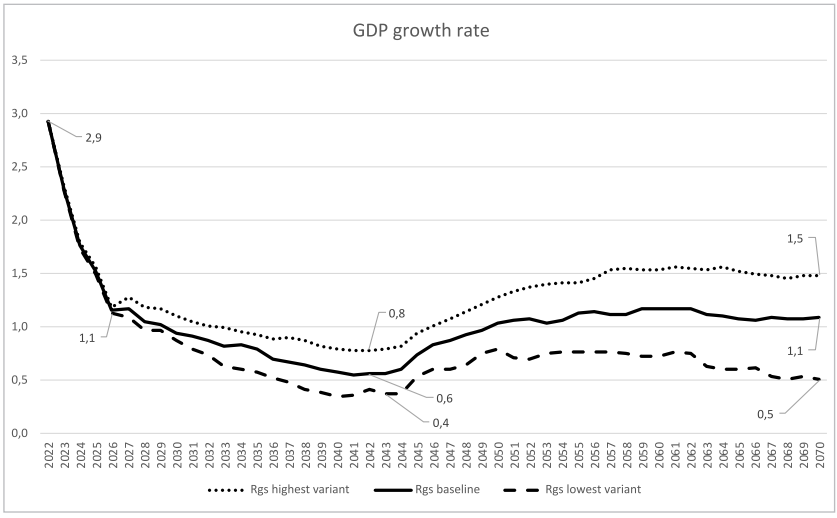


Source: authors' elaboration on RGS (2022) data.

(1) The horizontal axis in panel b starts from 2022 to account for outliers in 2020 and 2021 that would make differences across releases barely recognizable.

2.1.2. Acute health care and long-term care

Acute health care (AHC) consists of treatments of short-to-medium duration for the cure of urgent episodes of illness or disease after which the patient can gradually recover his normal daily capabilities. Long-term care (LTC) consists of treatments continued over time for patients who have lost, definitively or for long periods, normal daily capabilities and need regular assistance. Acute health care expenditure is generally financed under the national health system, and this is indeed the case for Italy. The funding of LTC expenditure, instead, typically depends on the nature of the service and the provider. Expenses for LTC with a high health content are normally provided by the national health system and are included in its budget, and this is the case for Italy. Non-medical expenses or LTC with low health content, instead, are often included in the budgets of other Institutions. In Italy, for example, a significant part of these expenses is borne by INPS in the form of attendance allowances and by Municipalities addressing specific needs of their residents.

Projections for AHC and LTC expenditure are based on the "Reference scenario" of RGS-2022, i.e. the variant considered for the calculation of the sustainability indicators. The scenario draws on three main assumptions: 1) per-capita expenditure profiles by age and gender shift rightwards with increases in age-specific life expectancy (gains in life expectancy transfer partially into better health); 2) AHC per-capita expenditure grows with per-capita GDP; 3) for most of LTC expenditure items, per-capita expenditure grows with GDP per employed (i.e. productivity); 4) the elasticity of per-capita expenditure to per-capita GDP or to GDP per employed is equal to 1.1 at the beginning of the projection period and gradually converges to unity in 2070; 5) the probabilities of requiring LTC are held constant at 2019 levels. Notice

that the Reference scenario focuses on ageing, while overlooking potentially relevant factors, like innovation and technological progress[14]. Furthermore, it does not consider the possibility of shifts from informal assistance within families to assistance provided by specialised institutions, which may be important especially for LTC.

Figure 2.1b depicts the evolution of the expenditure to GDP ratio for acute health care. The ratio has reached a peak of 6.6 per cent at the height of the COVID-19 pandemic in 2020, 0.8 percentage points above the pre-COVID-19 level. Then, after a five-year decline, the ratio increases in both the baseline and the variants until the beginning of the forties, and starts to diverge thereafter. In the low-variant scenario, the expenditure ratio is stable between 2050 and 2060, before growing again. In 2070, the ratio reaches 6.5 per cent in the baseline (0.7 percentage points above its 2019 value), against 6.3 per cent in the high-variant and 6.7 per cent in the low-variant scenario. At its maximum value, in 2070, the range of sensitivity amounts to broadly 0.4 percentage points.

These dynamics are mainly determined by the ageing process, with the expenditure ratio that grows during the demographic transition and roughly stabilizes at its completion. Per-capita acute health care spending is indeed concentrated in old age brackets (after 70), so that aggregate spending grows as long as the share of elderly in the population is increasing, and stabilizes in the new demographic steady state.

Concerning LTC (figure 2.1c), the expenditure ratio has reached 2.0 per cent in 2020, 0.3 percentage points above its 2019 value. After a six years decline following the COVID-19 peak, the baseline and the variants are aligned until 2040. A new peak is reached at the beginning of the sixties

14 Innovation and technical progress would keep the elasticity above unity for all the projection horizon.

(2.5 per cent for the baseline and the low-variant scenario, 2.6 for the high-variant scenario), before converging to slightly lower values at the end of the forecasting period. Even at its maximum value, the range of sensitivity remains quite narrow, around one tenth of a percentage point. Also for LTC, the dynamics reflects ageing and the demographic transition and for reasons similar to those discussed earlier for acute health care.

It is worth noticing that LTC is the only expenditure for which the high-variant projection surpasses the baseline in the final part of the transition and, conversely, for the low variant. This is due to the fact that a longer expected life poses less challenges in terms of providing acute care for central age brackets and more challenges in providing long-term care and assistance in the old-age brackets (over 80). Underlying, there is the hypothesis that people who reach very old ages generally benefit from a better health status during youth and adulthood, but will need more assistance in the final part of their lives.

2.1.3 Total ageing-related welfare expenditure

After six years of decline following the COVID-19 peak, total ageing-related expenditure – obtained as the sum of pensions, acute health care and LTC (figure 2.1d) – displays a positive trend until the middle of the forties, reaching 25.6 per cent in the low-variant scenario, 25.3 per cent in the baseline and 24.9 per cent in the high-variant scenario (these values are more than 2 percentage points above their corresponding values in 2019). Subsequently, the ratio declines in all scenarios, reaching 23.6, 22.6 and 21.9 in, respectively, the low-variant, the baseline, and the high-variant scenario by the end of the forecasting horizon. In 2070, the range of sensitivity is as large

as 1.7 percentage points.

2.2. The AWG projections

We now turn to the latest projections of the Ageing Working Group (AWG-2021[15]), based on economic and demographic hypotheses as of 2017[16]. AWG-2021 considers the short-term effects of the COVID-19 crisis, by incorporating the Spring Forecasts of the European Commission as of May 2020 and assuming a quick return to the pre-crisis patterns.

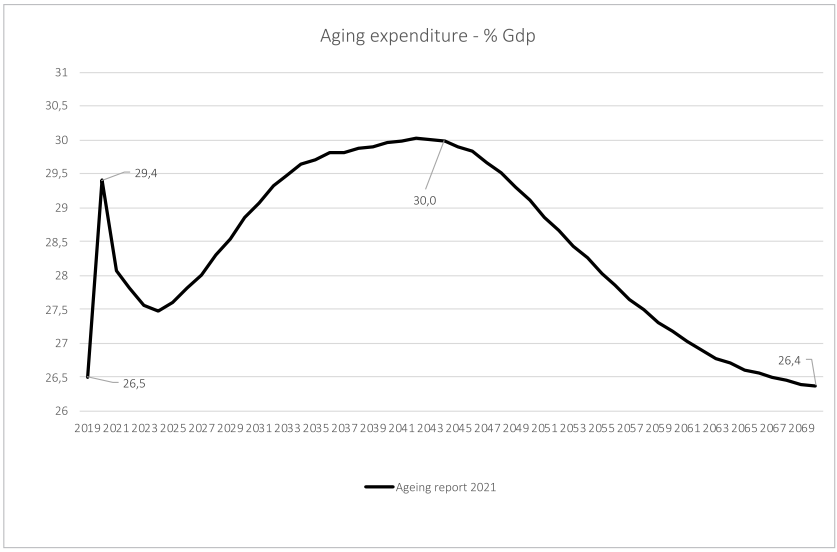
Total ageing-related welfare expenditure (figure 2.3a) peaks to 29.4 per cent in 2020 after the COVID-19 crisis and turns back to its original trend reaching the value of 27.5 per cent in 2024. Thereafter, expenditure increases in line with the demographic transition. A new peak of 30.0 per cent is reached in 2042, and then the ratio declines up to 26.4 in 2070.

Total ageing-related welfare expenditure mimics the pattern of pension expenditure, by far its largest component. As it has been observed before for the RGS projections, the initial upward trend is mainly driven by the retirement of "baby boomers". Similarly, the reversal thereafter is explained by the progressive disappearance of "baby boomers" and the gradual transition to a fully-fledged notional accumulation system.

15 European Commission (2021).
16 Details on the hypotheses underlying AWG projections are provided by European Commission (2020a).

Figure 2.3 Projections of the ageing-related expenditure to GDP ratio and its composition in AWG projections

(a)



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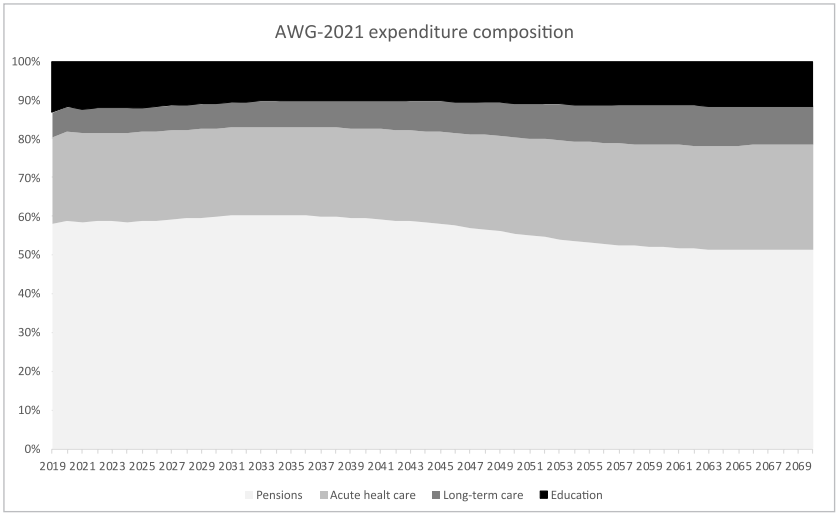

Source: authors' elaboration on AWG (2021) data.

In analogy with what has been observed before, the ageing process is the main responsible for the evolution of acute health-care and LTC expenditures: they grow in line with the old-age dependency ratio and roughly stabilize at the completion of the demographic transition.

Education expenditure covers costs borne by public budgets from primary school until second-level graduation (the "Laurea specialistica"). The expenditure ratio declines along with the demographic transition, with the share of young population that decreases until the middle of the thirties and has a moderate rebound over the rest of the projection horizon.

With a few exceptions at the beginning and at the end of the projection horizon, expenditure ratios for pensions, AHC and LTC are higher in AWG-2021 than in RGS-2022 (baseline scenarios). The reason is a more favourable GDP growth expected in RGS-2022 for the first part of the projection horizon, more than compensating the less favourable development of the old-age dependency ratio.[17]

Figure 2.3b shows the composition of ageing-related welfare expenditure over the projection horizon. The weight of pension expenditure rises from 58.1 per cent in 2019 to 60.5 per cent in 2034, then slowly declines and stabilizes to 51.5 per cent around 2063, reducing by approximately 8 percentage points in fifty years. Acute health care and LTC move in the opposite direction, both increasing their weight by around 4 percentage points (from 22.3 to 26.9 per cent the former and from 6.4 to 10 per cent the latter). The share of education expenditure remains substantially stable.

17 AWG-2021 is based on the Eurostat-2020 baseline demographic scenario with base year 2019.

2.3. Policy implications

The evolution of ageing-related expenditure emerging from RGS and AWG projections poses major challenges for public finances. One issue regards the resources required to finance increasing expenditures in the next two decades. The projections point to a rise in welfare expenditure (and hence the need for additional resources) that, in the mid-forties, will range between 2.2 and 3.3 percentage point of GDP. It is debatable to what extent these needs can be borne by the public budget, especially in countries, like Italy, that have limited fiscal space.

In the long term, when the demographic transition will be over, all projections foresee that welfare expenditure will stabilize at levels close to the current ones, albeit with a much older population. This, in turn, raises questions of sustainability of the level and quality of welfare allowances. Pensions treatments, for example, will be far less generous than today. In addition, welfare provisions, like health care, that are currently underfunded compared to major economies, will become even more needed (and require additional financing). The quest for resources is bound to be harsh.

The literature has long recognized that ageing population exacerbates the tension between the quantitative and qualitative adequacy of welfare provisions on the one side and the sustainability of the welfare system on the other side. A variety of policy options have been suggested, entailing the amount of private and public resources to be mobilized as well as the type of coverage mechanisms and financial instruments to be used.[18] There is not a general consensus on how to strike a balance among these elements neither on the effectiveness of single proposals. After all, there is no easy or

18 Diamond (2000), Guerzoni (2008), OECD (2019), Fornero (2020), OECD (2021a), OECD (2021b).

mechanical solution to the trade-off, and the pros and cons of each option must be evaluated considering the specific socio-economic features of the entire welfare system.[19]

The literature has considered three broad categories of intervention, distinguishing policies that mainly seek to control age-related items in the public budget, to diversify financing sources, or to expand available resources via demographic or economic incentives. The measures in the first group include, among others, the adoption of less generous criteria for pension accumulation, stringent requirements for retirement, gradual retirement in combination with part-time work, reduction in the provisions covered by the national health system, and the introduction of forms of co-payment to complement public resources and stimulate responsibility in the access.

The second group refers to a wide range of proposals aimed at flanking the public pillar of welfare financing with one or more private pillars (pension funds, health care funds, private accumulation accounts, eventually supported by fiscal incentives). The rationale for diversification is that public and private pillars have properties that could complement each other[20]. Moreover, a properly designed multi-pillar system could free public resources that might be devoted to provisions hard to finance on a private basis, like purely redistributive measures or insurance coverages for the poor (for example LTC). [21]

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19 Barr (2002).

20 Salerno (2015), Koetsier (2017), Franco and Tommasino (2020). As argued in the latter, "The NDC scheme and the pension funds are subject to different risks and returns. PAYG schemes insure against inflation and financial market risks. However, they are vulnerable to declines in employment, as well as to political risks (governments may 'default' on their promises). Funded schemes are vulnerable to investment risk, but their returns (while more volatile) tend to exceed those of PAYG systems in the long term. These different features make it advisable to opt for a mixed system, exploiting the portfolio-diversification logic".

21 An important element of the multi-pillar design concerns tax credits for lower incomes. Today in Italy incentives are designed as tax deductions. See for example OECD (2021).

The third group comprises a large variety of measures aimed at securing the overall sustainability of the welfare system by acting on underlying demographic and economic perspectives. Examples include measures for increasing the birth rate, fostering labour market participation and employment (typically of youngsters and women), sustaining labour productivity and facilitating the integration of migrant workers.

All these policies imply non-negligible costs. The measures in the first group, which are relatively easy to design (at least in principle), can result hardly feasible from a political or social perspective. Any reduction in the amount, access or quality of welfare provisions has immediate costs for actual beneficiaries, not to say about the long-term consequences for society.

On the other hand, even policies that might have a broad consensus (or face less political and social opposition) are not exempt from problems of financing capacity, and may turn difficult to implement. For given resources, the costs borne for implementing policies in the second or third group require changes in the composition of welfare expenditure that reduce the resources available for other targets or beneficiaries. Even shifting toward a multi-pillar scheme of welfare financing can be costly, at least in the transition period, for beneficiaries fully entitled to public provisions. In alternative, the additional financial requirements implied by these policies could be borne by the public budget. For Italy, however, the option is limited because of the outstanding level of public debt and an already high fiscal pressure.

3. Medium- and long-term fiscal sustainability indicators in light of the demographic transition

This section analyses the impact of the cost of ageing on the sustainability of public finances, drawing on the spending projections analysed in Section 2.2 together with the long-run macroeconomic and interest rate projections of the European Commission (European Commission, 2022; European Commission, 2020b).[22] Two separate indicators for medium and long-term sustainability will be considered, and both of them will be estimated under pre- and post-pandemic projections. The methodology draws on European Commission (2022), extended to provide a full description of analytical derivations (in appendix).

The analysis is meant to provide a quantitative assessment of the consolidation effort that is required to secure fiscal sustainability in a scenario in which ageing costs materialize. The effort, measured by the additional improvement in the structural primary balance, is concentrated in the first year of the projection period. Afterwards, the primary balance would remain unchanged, except for the cost of ageing.

To assess medium-term sustainability, we construct a "debt-rule gap" indicator ($\overline{drg}$) representing the initial budgetary effort that would be required to comply with a given debt rule over the projection horizon. We consider the current configuration of the debt rule in the Stability and Growth Pact as well as alternative configurations allowing for a prolonged period of consolidation

22 For the estimation of the sustainability indicators, European Commission (2022) and (2020b) use AWG projections of pension spending net of taxes while the AWG projections described in Section 2.2 use pension spending gross of taxes. Despite differences in levels, these projections are very similar in terms of dynamics, which is what matters for the sustainability indicators. Moreover, European Commission (2020b) includes unemployment benefits in the overall ageing costs that are disregarded in European Commission (2022). Given that the projections for unemployment benefits are almost flat, this has negligible consequences for the sustainability indicators.

or for a higher debt target.

To assess long-term sustainability, a "solvency gap" indicator ($\overline{sg}$) will be used that measures the initial additional budgetary effort needed to stabilize the ratio between debt and GDP (henceforth debt ratio) by the end of the projection period (2070).

3.1 Medium-term fiscal sustainability indicators

The assessment of medium-term sustainability relies on indicators of the consolidation effort that would be required to comply with various configurations of the debt rule. We first illustrate the methodology for the construction of these indicators. Then, we provide estimates based on both the latest macroeconomic and ageing cost projections and on projections from the pre-pandemic period.

3.1.1 The debt-rule gap indicator

The debt-rule gap ($\overline{drg}$) indicator measures the change in the structural primary balance that is required in the first year of the projection period to ensure compliance with a given debt rule. It is computed under the hypothesis that after the consolidation, the structural primary balance would not change, except for ageing costs.

The $\overline{drg}$ indicator departs from an analogous indicator of the European Commission ("S1 indicator" in European Commission, 2022) in different dimensions. First, it frontloads the consolidation effort in the first year of the

projection period while the European Commission assumes that adjustment takes place over five years.[23] Second, it considers alternative configurations of the debt rule. Specifically, we allow for a debt target of 60 per cent to be reached in 20 years as provided for in the Stability and Growth Pact, together with a debt target of 60 per cent to be reached in 40 years or a target of 100 per cent to be reached in 20 years, while the European Commission assumes a debt target of 60 per cent to be reached in 15 years. Proposals based on a prolongation of the adjustment period and/or on a revision of the debt target have emerged in the recent debate on the reform of the European fiscal governance. They include, among others, Francová et al. (2021), Giavazzi et al. (2021), Hauptmeier and Kamps (2020), Cottarelli (2018) and Claeys et al. (2016).[24] Finally, since we assume a permanent adjustment effort, the focus is on the structural primary balance.[25]

Let t_0 denote the base year and let the debt-rule gap indicator ($\overline{drg}$) represent the change in the primary balance ratio which is required at time (t_0+1) to reach a debt target d_T^{targ} at time T under the assumption that the primary balance would not change between (t_0+1) and T, except for the cost of ageing.

23 We have experimented a five-year adjustment period with no remarkable consequences. According to European Commission (2022), the S1 indicator to be used in future assessments of medium-term fiscal sustainability will frontload the consolidation effort in the first year of the projection period (instead of five years) for consistency with the S2 indicator.

24 See Ufficio parlamentare di bilancio (2022a) for a brief survey.

25 In the projections for both indicators, the output gap is approximately zero in the base year and is assumed to be zero afterwards, so that structural and non-structural primary balances coincide. In the calculation of the S1 indicator (but not for the S2 indicator), the European Commission (2022) includes an estimate of the impact of investments related to the Recovery and Resilient Facility for the period up to 2026. Moreover, only for the S1 indicator (but not for the S2 indicator) the European Commission assumes a feedback impact on GDP resulting from the additional adjustment effort in place till 2030. Overlooking these assumptions does not change the estimate of the S1 indicator in a significant way. Thus, for the sake of consistency with the indicator and also for the sake of simplicity, we did not incorporate these effects in the analysis. A fully-fledged, less-mechanical model (e.g. a DSGE model) capturing these effects is beyond the scope of the paper. The extension is left to future analyses.

The $\overline{drg}$ indicator is given by:[26]

$$\overline{drg} = \frac{d_{t_0} \cdot \alpha_{t_0;T} - d_T^{targ}}{\sum_{i:t_0+1}^{T} \alpha_{i;T}} - \left(pb_{t_0} + \frac{\sum_{i:t_0+1}^{T} \Delta_{t_0} prop_i \cdot \alpha_{i;T}}{\sum_{i:t_0+1}^{T} \alpha_{i;T}} \right) + \frac{\sum_{i:t_0+1}^{T} \Delta_{t_0} ac_i \cdot \alpha_{i;T}}{\sum_{i:t_0+1}^{T} \alpha_{i;T}} \quad (*)$$

where $\alpha_{i;T} = \prod_{j=i+1}^{T} \frac{1+r_j}{1+g_j}$ is the "accumulation factor", $\Delta_{t_0} ac_i$ is the change in ageing costs as ratio of GDP with respect to the base year, and $\Delta_{t_0} prop_i$ is the change in government's property income as ratio of GDP with respect to the base year. The accumulation factor has an important role for debt dynamics: it captures the interplay of the gross implicit interest rate on public debt (r) and the output growth rate (g) in the evolution of the debt ratio. Changes in ageing costs capture the impact of population ageing on the structural primary balance over the projection period. Finally, property income represents the revenues flowing into the public budget from government financial assets; however, since they are almost constant over the projection period their impact on the sustainability indicator is negligible.

The first term on the right-hand side of Eq.(*) measures the (discounted) distance between the debt ratio in the base year and the debt target at time T, adjusted by the accumulation factor. The higher this distance, the larger the effort required, and especially so when the implicit interest rate is relatively high at the beginning of the forecasting period. The second term comprises the initial structural primary balance and the (discounted) impact of the flow of revenues from property incomes over the entire projection period. An improvement in the initial primary balance and/or an increase in prospective revenues – adjusted by the accumulation factor – reduce the consolidation

26 The Appendix contains all the steps for the derivation of the formula.

effort. Finally, the third term captures the (discounted) impact of ageing-related expenditures that materialize over the projection period. Prospective expenditures are adjusted as usual by the accumulation factor.

3.1.2 The debt-rule-gap indicators for Italy

Table 3.1 displays the values of three debt-rule gap indicators, all expressed in percent of GDP. The first indicator considers a debt target of 60 per cent to be reached in 20 years, as provided for in the Stability and Growth Pact; the second a debt target of 100 per cent to be reached in 20 years; and the last indicator has a debt target of 60 per cent to be reached in 40 years. In all cases, the base year for the calculation is 2023, so that adjustment would start in 2024 and afterwards the primary balance would remain unchanged, except for the cost of ageing. Notice that the consolidation would begin in the same year in which the general escape clause, that was introduced in 2020 in response to the Covid-19 crisis, is supposed to be repealed.

Table 3.1 Medium-term fiscal sustainability indicators (%GDP)

	Latest projections (spring 2022)	Pre-pandemics projections (autumn 2019)	Difference
Debt rule gap (drg) - Debt target = 60 per cent in 20 years	6.5	5.3	1.2
Debt rule gap (drg) - Debt target = 100 per cent in 20 years	4.5	3.4	1.0
Debt rule gap (drg) - Debt target = 60 per cent in 40 years	4.5	3.8	0.6

Source: own elaborations based on European Commission. Possible discrepancies are due to rounding.

The indicators are constructed under two alternative scenarios. In the first scenario, we use the latest long-term and interest rate projections of the European Commission (2022), updated with the Commission's Spring 2022 forecasts. The second scenario considers similar projections of the European Commission (2020b) but referred to the pre-pandemic period.

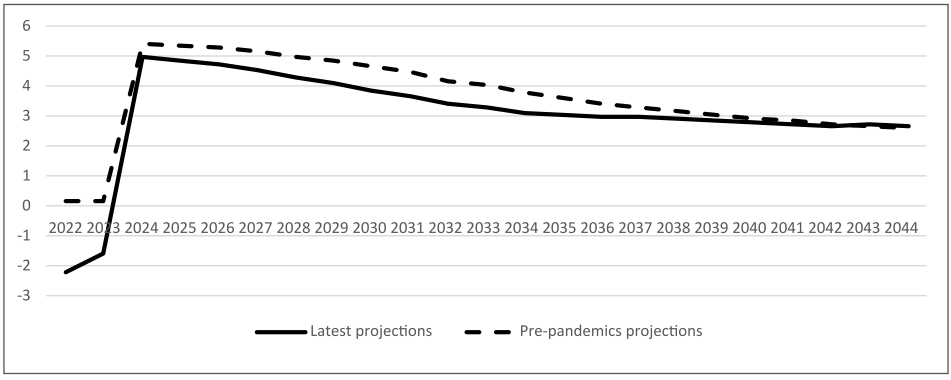
All indicators suggest that a remarkable consolidation effort would be required to reach the debt target, especially under the latest projections. A permanent adjustment of the primary surplus as high as 4.5 percentage points of GDP would be required in 2024 to reach a debt target of 60 per cent in 40 years or a debt target of 100 per cent in 20 years while at the same time financing the rising costs due to ageing. Under the current configuration of the debt rule in the Stability and Growth Pact, the permanent adjustment would be even larger, equal to 6.5.

Compared to the latest pre-pandemic projections, the consolidation effort increases in a non-negligible way for all configurations of the debt rule. The additional effort ranges between 0.6 percentage points of GDP in the case of the 60 per cent target in 40 years and 1.2 in the case of the 60 per cent target in 20 years. As it will be evident soon, the deterioration of the indicators is entirely due to the less favourable initial state of public finances compared to the period before the pandemic.

Indeed, a lower structural primary balance in 2023 in the latest projections imply that a more robust fiscal consolidation is required to reach a primary surplus of around 5 percent of GDP in 2024 (see figure 3.1 for the case of the 60-per-cent target in 20 years). In the case of the pre-pandemic projections, the more favourable initial level of the structural primary balance in the base year allows for a lower additional effort (although a slightly higher level of the structural balance compared to the current projections is required from 2024

until 2040 to compensate for the less favourable $r - g$, see below). In both projections, the deterioration of the structural primary balance after 2024 is due to rising age-related expenditures.

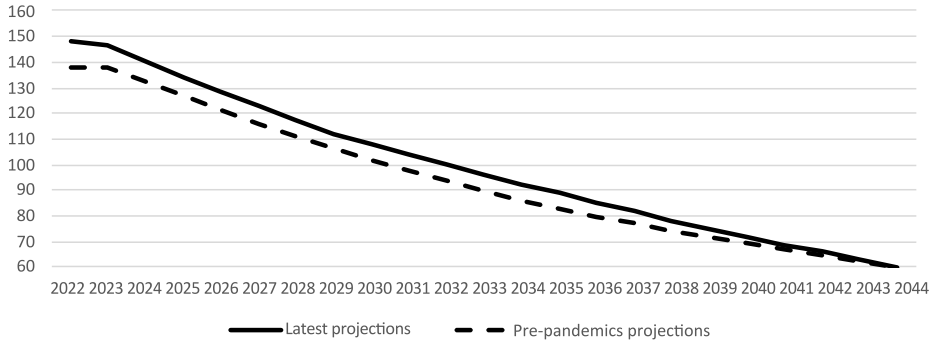
Figure 3.1 Structural primary balances consistent with "debt-rule scenario" - 60% in 20 years (%GDP)



Source: own elaborations based on European Commission.

A higher debt ratio in 2023 (figure 3.2) contributes to raise the indicator in the latest projections but, as apparent from the first term in Eq. (*), this is partly offset by a relatively more benign accumulation factor as the latest projections of the European Commission are more favourable in terms of the $(r - g)$ differential.

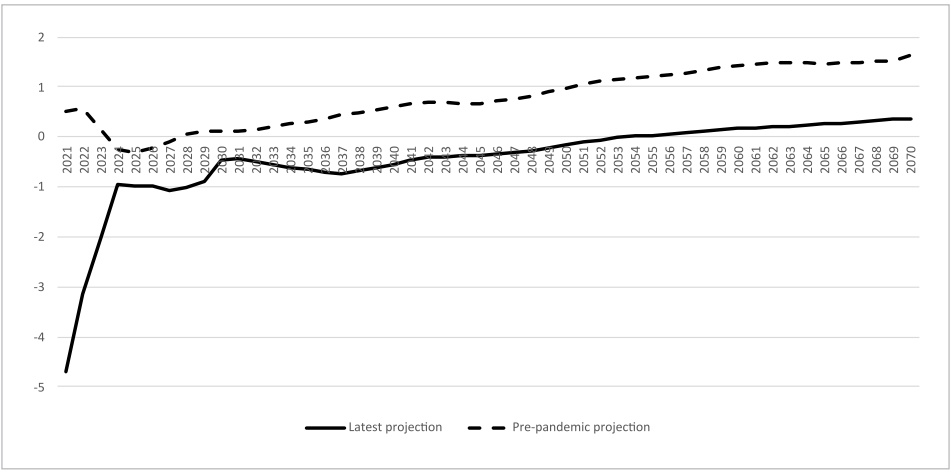
Figure 3.2 Debt dynamics consistent with "debt-rule scenario" - 60 % in 20 years (% GDP)



Source: own elaborations based on European Commission.

Indeed, the differential between the implicit average debt cost and nominal GDP growth is expected to remain negative until 2052 and stay below ½ percentage point afterwards (figure 3.3). In the pre-pandemic projection, instead, the differential turns positive much earlier, in 2027, and increases up to reach around 1½ percentage points by 2070. From 2024 to around 2045, this is due to two major factors: a more favourable nominal GDP growth in the latest projections because of a higher starting point (partial rebound after the pandemic and higher inflation) and a higher employment rate related to a more robust inflow of immigrants in the short-to-medium term assumed in the latest Eurostat demographic outlook. In the longer term (from 2045 to 2070), the differential is more favourable in the latest projections essentially because of convergence to a lower implicit interest rate by 2070 (around 3¾ per cent against around 5) in line with the "great moderation" hypothesis. Finally, notice that the deterioration of the $\overline{drg}$ indicator in the latest projections takes place despite more favourable projections for age-related expenditures (see Section 2).

Figure 3.3 Projections of the differential between implicit interest rate on debt (r) and GDP growth (g) (%)



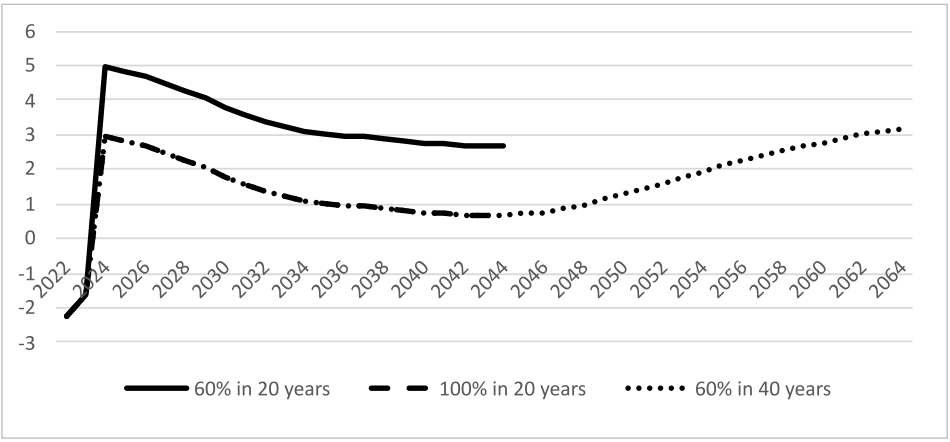
Source: own elaborations based on European Commission.

We now turn to examine the dynamics of adjustment implied by different configurations of the debt rule focusing on the latest projections (figure 3.4). First, notice that the structural adjustment effort and the required structural primary balances are almost identical for the two alternative configurations of a 100 per cent target in 20 years and a 60 per cent target in 40 years (table 3.1 and figure 3.4). This suggests that, given the assumptions on $(r-g)$ and the costs of ageing, the same consolidation plan can be implemented either by maintaining the same debt target but prolonging the convergence period or by revising upward the target (or by a combination of these two). What is important for sustainability is that the plan is credible and feasible: a sudden adjustment in a relatively short period of time and/or a very high level of the primary balance for a prolonged time could lead to "fiscal fatigue" unless sufficient room is provided for macroeconomic stabilisation and for

addressing the social implications of the adjustment effort.

Second, the magnitude of the adjustment is smaller compared to what is required in the current configuration of the debt rule in the Stability and Growth Pact. The difference between the required structural balances remains substantial over the entire projection period. Yet, even for less demanding configurations of the debt rule a primary surplus needs to be maintained for the entire horizon. This in turn reflects the toll from a high initial debt level.

Figure 3.4 Structural primary balances consistent with "debt rule scenarios" - latest projection (% GDP)



Source: own elaborations based on European Commission.

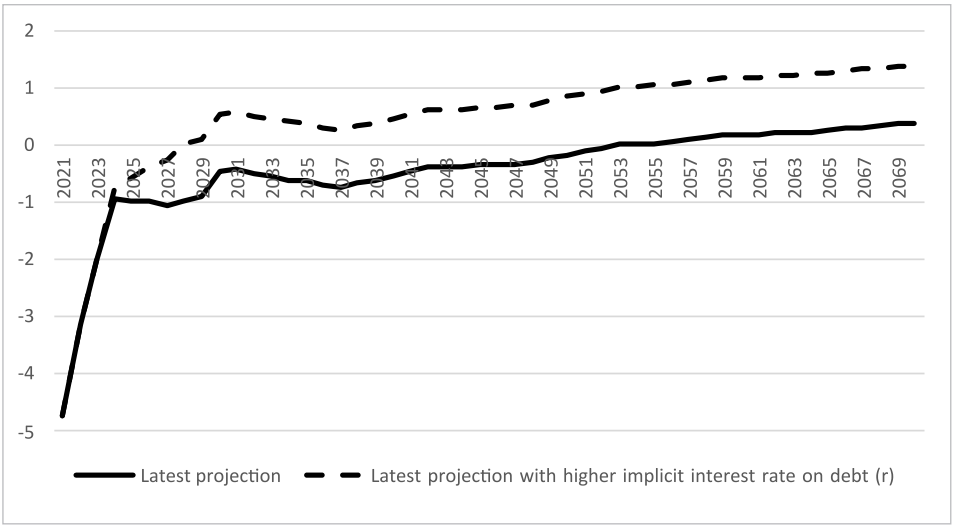
Initial debt conditions affect the adjustment path not only because they imply a large distance from target but also because of the so-called snowball effect (recall from the first term in equation (*) that the distance from target is adjusted by the accumulation factor). Other things equal, the fiscal effort needed to bridge the gap with the debt target increases with the differential

$(r - g)$. The latest projections of the European Commission foresee a negative differential until around 2050, and a rising but moderate differential of less than ½ per cent thereafter. These projections may appear optimistic in light of high uncertainty in macroeconomic outlooks and persistent pressures on inflation. Indeed, at least in the short-to-medium term, growth could be hampered for a number of reasons, like post-pandemic structural adjustments, geopolitical tensions, high energy prices and the costs of a faster-than-anticipated energy transition.[27] Inflation risks could drive up interest rates in the short and medium term, and financial uncertainty could fuel medium-to-long term risk premiums, implying a higher implicit interest rate on public debt than assumed in baseline projections.

It is therefore important to consider what would be the impact of a deterioration of the differential $(r - g)$. To this end, we augment the implicit interest rate on debt (r) in the baseline projection. Specifically, we assume that r increases by 20 basis points on an annual base for a period of five years, starting in 2024, and remains one percentage point higher than the baseline from 2029 onwards. The dynamics of $(r - g)$ in this alternative scenario is illustrated in figure 3.5 together with the baseline projection. The differential $(r - g)$ would become positive as early as in 2028, it would be above 1 percentage point by 2053 and just below 1½ percentage points by 2070.

27 See Ufficio parlamentare di bilancio (2022b).

Figure 3.5 Projections of the differential between implicit interest rate on debt (r) and GDP growth (g) (%)



Source: own elaborations on the basis of European Commission.

The values of the indicators under the alternative scenario are reported in Table 3.2. Compared to the baseline, all indicators deteriorate, requiring an additional fiscal effort in the range between 0.8 and 1 percentage point of GDP. In the case of the 60 per cent target to be reached in 20 years, the minimum fiscal effort would be equal to 7.3 percentage points of GDP. In the alternative configurations of the debt rule, the required fiscal effort would be lower, around 5.5 percentage points of GDP, but still significant.

Table 3.2 Medium-term fiscal sustainability indicators (%GDP)

	Latest projections with higher implicit interest rate on debt (r)	Latest projections (spring 2022)	Difference
Debt rule gap (drg) - Debt target = 60 per cent in 20 years	7.3	6.5	0.8
Debt rule gap (drg) - Debt target = 100 per cent in 20 years	5.5	4.5	1.0
Debt rule gap (drg) - Debt target = 60 per cent in 40 years	5.4	4.5	0.9

Source: own elaborations based on the European Commission.

3.2 Long-term fiscal sustainability indicator

The assessment of long-term fiscal sustainability is based on solvency indicators. As before, we briefly discuss the construction of these indicators and then provide estimates for Italy based on pre- and post-pandemic projections.

3.2.1 The solvency gap indicator

The solvency-gap indicator measures the minimum fiscal effort that is required to satisfy the government intertemporal budget constraint over the forecasting horizon. It draws on the "S2 indicator" of the European Commission (European Commission 2020b, 2022). In line with the literature on fiscal solvency, these indicators require that the debt ratio is eventually stabilized but they overlook a specific debt target. In other words, the requirement is that debt reaches a steady state by the end of the forecasting period no matter the value of the steady state debt ratio.

More specifically, let the solvency gap indicator ($\overline{sg}$) represent the change in the structural primary balance in year (t_0+1) that, if maintained indefinitely, would satisfy the government intertemporal budget constraint (IBC) even considering the impact of future fiscal costs from an ageing population.

The $\overline{sg}$ indicator is given by:[28]

$$\overline{sg} = \frac{d_{t_0}}{\sum_{i:t_0+1}^{2069} \frac{1}{\alpha_{t_0;i}} + \frac{1}{\alpha_{t_0;2069}} \cdot \left(\frac{1+g_{2070}}{r_{2070}-g_{2070}} \right)} - \left(pb_{t_0} + \frac{\sum_{i:t_0+1}^{2069} \frac{\Delta_{t_0} prop_i}{\alpha_{t_0;i}} + \frac{\Delta_{t_0} prop_{2070}}{\alpha_{t_0;2069}} \cdot \left(\frac{1+g_{2070}}{r_{2070}-g_{2070}} \right)}{\sum_{i:t_0+1}^{2069} \frac{1}{\alpha_{t_0;i}} + \frac{1}{\alpha_{t_0;2069}} \cdot \left(\frac{1+g_{2070}}{r_{2070}-g_{2070}} \right)} \right) + \frac{\sum_{i:t_0+1}^{2069} \frac{\Delta_{t_0} ac_i}{\alpha_{t_0;i}} + \frac{\Delta_{t_0} ac_{2070}}{\alpha_{t_0;2069}} \cdot \left(\frac{1+g_{2070}}{r_{2070}-g_{2070}} \right)}{\sum_{i:t_0+1}^{2069} \frac{1}{\alpha_{t_0;i}} + \frac{1}{\alpha_{t_0;2069}} \cdot \left(\frac{1+g_{2070}}{r_{2070}-g_{2070}} \right)} \qquad (**)$$

The first term of Eq. (**) captures the impact of the debt ratio that is to be stabilised in steady state, i.e. after 2070. It depends on the initial debt level as well as on the accumulation factors. Notice that a positive $(r-g)$ after 2070, as in our projections, is a sufficient condition for a higher initial debt ratio to require a higher structural adjustment, thus implying a higher $\overline{sg}$ indicator. In contrast, the second term suggests that a more favourable initial fiscal position, i.e. a higher initial structural primary balance, would require a lower adjustment effort and a lower $\overline{sg}$ indicator (as stressed earlier, the impact of changes in property incomes is almost nil). Finally, the third term indicates that rising fiscal costs related to ageing would require a higher

28 The Appendix contains all the steps for the derivation of the formula.

structural adjustment to ensure long-term solvency and a higher $\overline{sg}$ indicator. Also in this case, a sufficient condition for this to be the case, is that the $(r-g)$ differential is positive after 2070.

3.2.2 The solvency-gap indicator for Italy

The solvency gap indicator is calculated under the latest long-term projections by the European Commission as well as using the latest projections available before the pandemic. For consistency with the debt-rule gap indicators discussed above, the base year is 2023 so that the required additional fiscal effort is assumed to be implemented starting from 2024.

The results in table 3.3 imply that an overall moderate consolidation effort is needed to ensure long-term sustainability. An additional minimum structural adjustment of 1.6 percentage points of GDP is required under the latest projections, while the requirement is slightly higher, 1.9 percentage points, in the pre-pandemic scenario. A consolidation of this magnitude, especially if spread over a period of 3-4 years, might be implemented without dramatic consequences for the macroeconomic outlook. The slightly more favourable indicator emerging from the latest projection is due entirely to a more favourable outlook of the $(r-g)$ differential and of the fiscal costs of ageing, which more than compensate the impact of the (worse) initial state of public finances (see paragraph 3.1.2).

Table 3.3 Long-term fiscal sustainability indicator (%GDP)

	Latest projections (spring 2022)	Pre-pandemics projections (autumn 2019)	Difference
Solvency gap (sg)	1.6	1.9	-0.3
Average primary balance from 2024 to 2070 ensuring IBC	- 0.9	0.8	-1.7
"Steady state" primary balance from 2070 ensuring IBC	0.6	2.4	-1.8
"Steady state" debt from 2070 if IBC is ensured	172.9	154.7	18.2
Median primary balance since II World War (1946-2021)	- 0.6		
Median primary balance since unification (1862-2021)	0.9		

Source: own elaborations based on European Commission and Bank of Italy.

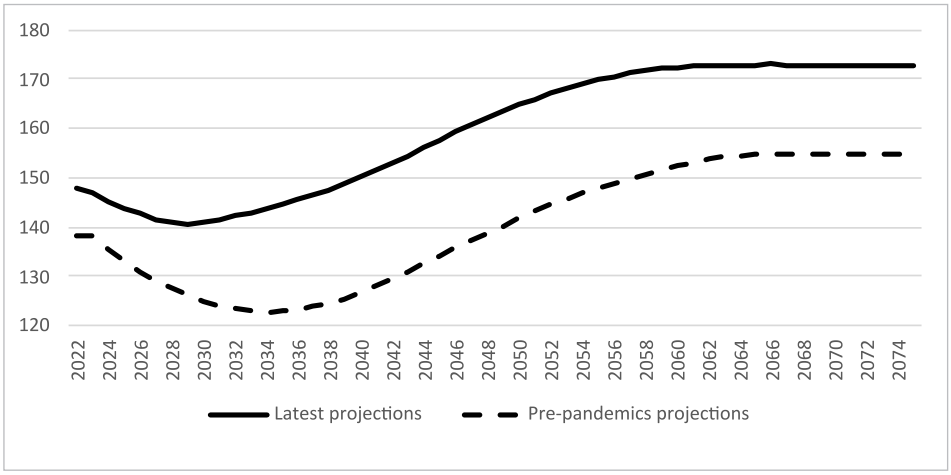
Notice that not only the required adjustment but also its dynamics have become more favourable in the latest projections compared to the pre-pandemic scenario. Up to 2070, a structural primary deficit equal to 0.9 percentage points of GDP on average is required to ensure solvency (even considering ageing-related expenditures), against a surplus of 0.8 under the pre-pandemic projections. Also using the latest projections, in the very long term, after 2070, a primary surplus of 0.6 percentage points should be maintained indefinitely. However, the comparable figure for the pre-pandemic projections is a surplus of 2.4 percentage points. The magnitude of the structural balance implied by the latest projections appears realistic in the historical context. Indeed, the average primary balance in Italy has been a surplus of 0.9 percentage points since unification and a deficit of 0.6 since World War II. On the contrary, the consolidation effort implied by the pre-pandemic projections appears overly ambitious as it would imply a high structural primary balance for an indefinite time.

The moderate consolidation effort implied by the latest projections might appear somewhat counterintuitive considering that the initial state of public

finances has deteriorated in the post-pandemic period (the initial debt ratio is higher and the primary balance is lower than in the pre-pandemic scenario). Yet, initial conditions are relatively less important for long-term sustainability: all is required for the inter-temporal budget constraint to be respected is that the debt ratio is eventually stabilized and remains stable in the long run, no matter at what level. This constitutes a major difference with respect to the debt rule gap indicator, where distance from the debt target more than offsets the effect of a more favourable dynamics for ageing-related expenditures and for the $(r-g)$ differential. As a matter of fact, the two indicators provide complementary information on the state of public finances. The debt-rule-gap indicator, by measuring the ability to comply with a specific debt rule, focuses on the adjustment path towards a given debt target in a relatively short period of time, and is actually a measure of medium-term sustainability. The solvency-gap indicator, on the contrary, ignores the need to reach a given debt target and focuses only on the adjustment effort needed to ensure solvency; it is thus a measure of long-term sustainability.

The debt dynamics consistent with the solvency requirement is illustrated in figure 3.6 for the pre- and post-pandemic projections. In both scenarios, the debt ratio stabilises in the long run (i.e. after 2070, assumed to be the "steady state" in the exercise), around very high levels (almost 155 per cent under the pre-pandemic projections and around 173 per cent with the latest projections). The stabilization implies an initial drop in the debt ratio, which is both more pronounced and more prolonged under the pre-pandemic projections. Over time, the debt ratio gradually converges toward the new steady state.

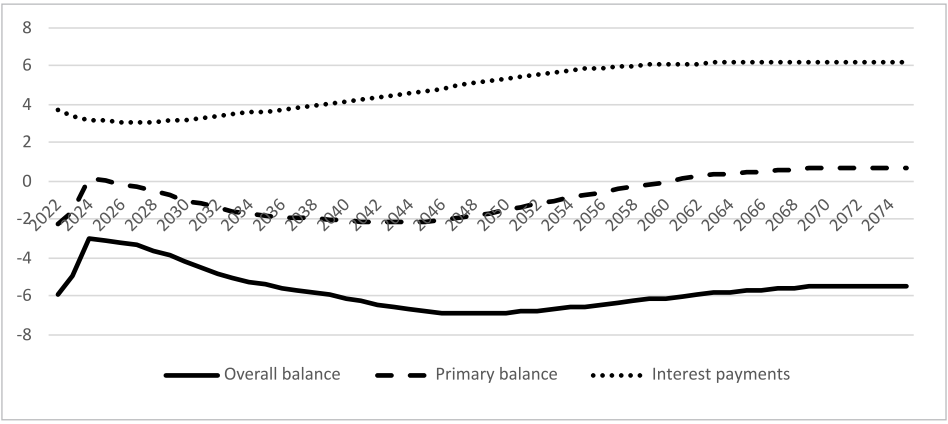
Figure 3.6 Debt dynamics consistent with "solvency scenario" (% GDP)



Source: own elaborations based on European Commission.

Notice that high debt levels in steady state imply large costs of debt service. Under the latest projections, in fact, the solvency scenario foresees that interest expenditure is around 6 percent of GDP on average for the period 2024-70 and would then remain as high as 7½ for an indefinite time (figure 3.7); this is true despite relatively low projected interest rates. As a consequence, the overall deficit would be large, while the debt service absorbs resources that could have more productive uses, like public investments in physical and human capital. In light of these considerations, a fiscal effort above the minimum required to ensure long-term solvency might be desirable from a policy perspective.

Figure 3.7 Fiscal aggregates consistent with "solvency scenario" – latest projections (% GDP)



Source: own elaborations based on European Commission.

Analogously to what we have done for the debt-rule-gap indicators, we now perform a sensitivity analysis of the solvency gap indicator with respect to a deterioration of the $(r-g)$ differential. Table 3.4 displays the results using the alternative projection for r illustrated in Figure 3.5.

A high implicit interest rate doubles the value of the solvency gap indicator compared to the baseline scenario. The minimum additional fiscal effort for ensuring solvency is now 3.2 percentage points of GDP, against a previous value of 1.6. A primary surplus of 0.7 per cent should be maintained on average until 2070, which seems still realistic in the historical context. The "steady state" primary balance ratio (i.e. from 2070 onwards), instead, would have to reach 2.2 per cent, a level that is high in historical comparison, especially considering that it would need to be maintained indefinitely. Moreover, the "steady state" debt ratio would still be very high, i.e. more than 165 per cent, despite a higher primary balance.

Table 3.4 Long-term fiscal sustainability indicators (%GDP)

	Latest projections with higher implicit interest rate on debt (r)	Latest projections (spring 2022)	Difference
Solvency gap (sg)	3.2	1.6	1.6
Average primary balance from 2024 to 2070 ensuring IBC	0.7	- 0.9	1.6
"Steady state" primary balance from 2070 ensuring IBC	2.2	0.6	1.6
"Steady state" debt from 2070 if IBC is ensured	165.7	172.9	-7.3
Median primary balance since II World War (1946-2021)	-0.6		
Median primary balance since unification (1862-2021)	0.9		

Source: own elaborations based on European Commission.

4. Concluding remarks

This paper has analysed the implications of the demographic transition for welfare expenditure and fiscal sustainability in Italy. It has first compared projections of ageing-related welfare expenditures accounting for various scenarios of demographic evolution, as well as for different vintages of Italian and European projections.

The key message in all projections is that ageing-related expenditure is expected to rise significantly in absolute value and in percentage of GDP over the coming decades. It is expected to return to values comparable to current levels only in the very long run, albeit with a much older population. These dynamics pose serious challenges for public finances. We stress that a trade-off materializes between the quantitative and qualitative adequacy of welfare

provisions and the sustainability of the welfare system. More resources will be required to finance increasing levels of welfare expenditure and satisfy the needs of an ageing population. The quest for resources is bound to be harsh.

Then, we have incorporated the projections of age-related expenditures to construct indicators of fiscal sustainability in the medium and long term. We argue that a remarkable consolidation effort would be required to reach a plausible debt target, especially under the demographic scenario in the latest projections. The permanent adjustment in the primary surplus that ensures reaching a debt ratio of 60 per cent in 40 years (or a debt target of 100 per cent in 20 years) is as high as 4.5 percentage points. A less demanding though still significant effort is required to ensure solvency. A structural adjustment in the primary balance in the order of 1.6 per cent of GDP would eventually stabilize debt, though at a very high level (173 per cent). These figures increase substantially when we account for uncertainty on macroeconomic outlooks and persistent pressures on inflation.

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Appendix. The calculation of the debt-rule-gap indicator and of the solvency-gap indicator

Debt-rule-gap indicator

The debt-rule gap indicator ($\overline{drg}$) measures the change in the structural primary balance that is required in the first year of the projection period to ensure compliance with a given debt rule. It is computed under the hypothesis that after the consolidation, the structural primary balance would not change, except for ageing costs.

The derivation of the debt-rule gap indicator starts from the equation of motion of public debt:

$$D_t = D_{t-1} - PB_t + IP_t + SFA_t \qquad (1)$$

where:

- D_t = public debt stock at the end of year t;
- PB_t = primary budget balance (i.e. overall budget balance net of interest expenditure) in year t;
- IP_t = interest expenditure on public debt at year t;
- SFA_t = stock-flow adjustment (i.e. the part of debt change that is not accounted for by the overall budget balance as defined in the European system of national accounts, ESA2010) at year t.

From Eq. (1), the dynamics of the debt ratio can be formulated as:

$$d_t = \frac{(1 - r_t)}{(1 - g_t)} \cdot d_{t-1} - pb_t + sfa_t \tag{2}$$

where:

d_t = debt ratio at the end of year t;
r_t = implicit interest rate on debt at time t, i.e. $r_t = \frac{IP_t}{D_{t-1}}$;
g_t = nominal GDP growth rate at time t;
pb_t = primary budget balance as a ratio of GDP (henceforth primary balance ratio) at time t;
sfa_t = stock-flow adjustment as a ratio of GDP at time t.

More compactly, Eq. (2) can be written as:

$$d_t = \gamma_t \cdot d_{t-1} - pb_t + sfa_t \tag{3}$$

where:

γ_t = growth-adjusted gross implicit interest rate at time t, i.e.

$$\gamma_t = \frac{(1 + r_t)}{(1 + g_t)}$$

By indicating year $t-1$ in Eq. (3) as the base year t_0 and by iterating forward Eq. (3) (and assuming for simplicity that stock-flow adjustments are equal to zero), the debt ratio in $T > t_0$ can be expressed as:

$$d_T = \alpha_{t_0;T} \cdot d_{t_0} - \sum_{i;t_0+1}^{T} \alpha_{i;T} \cdot pb_i \tag{4i}$$

where:

$$\alpha_{i;T} = \prod_{j:i+1}^{T} \gamma_j \qquad for\ t_0 \le i \le (T-1); \qquad and\ \alpha_{T;T} = 1 \tag{4ii}$$

is the "accumulation factor".

By recalling the definition of the debt rule gap indicator, the stream of primary balance ratios pb_j^{DR} that ensures reaching the debt target by year T, considering also ageing-related expenditures, can be written as follows:

$$pb_i^{DR} = pb_{t_0} + \Delta_{t_0} prop_i - \Delta_{t_0} ac_i + \overline{drg} \qquad for\ (t_0+1) \le i \le T \tag{5}$$

where:

$\Delta_{t_0} prop_i$ = change w.r.t. the base year t_0 of projected property income on government assets as a ratio of GDP;

$\Delta_{t_0} ac_i$ = change w.r.t. the base year t_0 of projected ageing-related costs as a ratio of GDP.

By substituting pb_i^{DR} of Eq.(5) into the right-hand side of Eq. (4i), the debt-ratio target d_T^{targ} can be expressed as:

$$\begin{aligned} d_T^{targ} = \alpha_{t_0;T} \cdot d_{t_0} - pb_{t_0} \cdot \sum_{i:t_0+1}^{T} \alpha_{i;T} - \sum_{i:t_0+1}^{T} \Delta_{t_0} prop_i \cdot \alpha_{i;T} + \\ + \sum_{i:t_0+1}^{T} \Delta_{t_0} ac_i \cdot \alpha_{i;T} - \overline{drg} \cdot \sum_{i:t_0+1}^{T} \alpha_{i;T} \end{aligned} \tag{6}$$

Thus, the debt rule gap indicator can be obtained by solving Eq. (6) for $\overline{drg}$:

$$\overline{drg} = \frac{d_{t_0} \cdot \alpha_{t_0;T} - d_T^{targ}}{\sum_{i:t_0+1}^{T} \alpha_{i;T}} - \left(pb_{t_0} + \frac{\sum_{i:t_0+1}^{T} \Delta_{t_0} prop_i \cdot \alpha_{i;T}}{\sum_{i:t_0+1}^{T} \alpha_{i;T}} \right) + \frac{\sum_{i:t_0+1}^{T} \Delta_{t_0} ac_i \cdot \alpha_{i;T}}{\sum_{i:t_0+1}^{T} \alpha_{i;T}} \qquad (7)$$

Solvency-gap indicator

Let the solvency gap indicator ($\overline{sg}$) represent the change in the structural primary balance in year ($t_0 + 1$) that, if maintained indefinitely, would satisfy the government intertemporal budget constraint even considering the impact of future ageing costs.

Solving Eq. (4i) for the debt ratio in the base year and considering an infinite time horizon gives:

$$d_{t_0} = \lim_{T \to \infty} \frac{d_T}{\alpha_{t_0;T}} + \sum_{i:t_0+1}^{+\infty} \frac{pb_i}{\alpha_{t_0;i}} \qquad (8)$$

By imposing the no-Ponzi-game condition (i.e. $\lim_{T \to \infty} \frac{d_T}{\alpha_{t_0;T}} = 0$), the intertemporal budget constraint (IBC) or solvency condition is obtained:

$$d_{t_0} = \sum_{i:t_0+1}^{+\infty} \frac{pb_i^{IBC}}{\alpha_{t_0;i}} \qquad (9)$$

where pb_i^{IBC} *for* $i \geqslant t_0 + 1$ represents the stream of primary balance ratios

that would ensure the respect of the IBC.

By considering the impact of demographics and government property incomes and recalling the definition of $\overline{sg}$, the stream of primary balance ratios ensuring the respect of the IBC can be represented as follows:

$$pb_i^{IBC} = pb_{t_0} + \Delta_{t_0} prop_i - \Delta_{t_0} ac_i + \overline{sg} \quad for\ i \geq (t_0 + 1) \tag{10}$$

Substituting the expression of pb_i^{IBC} from Eq. (10) into Eq. (9), the IBC can be expressed as:

$$d_{t_0} = (pb_{t_0} + \overline{sg}) \cdot \sum_{i:t_0+1}^{+\infty} \frac{1}{\alpha_{t_0;i}} + \sum_{i:t_0+1}^{+\infty} \frac{\Delta_{t_0} prop_i - \Delta_{t_0} ac_i}{\alpha_{t_0;i}} \tag{11}$$

so that the solvency gap indicator can be obtained by solving the above equation as follows:

$$\overline{sg} = \frac{d_{t_0}}{\sum_{i:t_0+1}^{+\infty} \frac{1}{\alpha_{t_0;i}}} - pb_{t_0} - \frac{\sum_{i:t_0+1}^{+\infty} \frac{\Delta_{t_0} prop_i}{\alpha_{t_0;i}}}{\sum_{i:t_0+1}^{+\infty} \frac{1}{\alpha_{t_0;i}}} + \frac{\sum_{i:t_0+1}^{+\infty} \frac{\Delta_{t_0} ac_i}{\alpha_{t_0;i}}}{\sum_{i:t_0+1}^{+\infty} \frac{1}{\alpha_{t_0;i}}} \tag{12}$$

To calculate $\overline{sg}$, one needs to estimate the accumulation factors in Eq. (12). To this end, we consider the projections of interest rates and growth rates up to 2070 in European Commission (2020b) and (2022). For the period after 2070, these variables are supposed to remain constant at the level reached in 2070. The same assumption is made for the changes in property incomes and ageing costs compared to the base year t_0, that are also needed to calculate the solvency gap indicator from Eq. (12).

In particular, notice that $\sum_{i:t_0+1}^{+\infty} \frac{1}{\alpha_{t_0;i}}$ in Eq. (12) can be decomposed into two parts as follows:

$$\sum_{i:t_0+1}^{+\infty} \frac{1}{\alpha_{t_0;i}} = \sum_{i:t_0+1}^{2069} \frac{1}{\alpha_{t_0;i}} + \sum_{i:2070}^{+\infty} \frac{1}{\alpha_{t_0;i}} \tag{13i}$$

The first term on the r.h.s. of Eq. (13i) can be calculated using the projections until 2069. The calculation of the second term draws on the following steps together with the assumption of constant values for interest rates and growth rates after 2070 (at 2070 values):

$$\begin{aligned}
\sum_{i:2070}^{+\infty} \frac{1}{\alpha_{t_0;i}} &= \sum_{i:2070}^{+\infty} \frac{1}{\prod_{j:t_0+1}^{i} \gamma_j} = \sum_{i:2070}^{+\infty} \frac{1}{\prod_{j:t_0+1}^{2069} \gamma_j \cdot \prod_{j:2070}^{i} \gamma_{2070}} = \\
&= \frac{1}{\prod_{j:t_0+1}^{2069} \gamma_j} \cdot \sum_{i:2070}^{+\infty} \left(\frac{1}{\gamma_{2070}} \right)^{i-2069} = \\
&= \frac{1}{\alpha_{t_0;2069}} \cdot \sum_{i:2070}^{+\infty} \left(\frac{1}{\gamma_{2070}} \right)^{i-2069} = \frac{1}{\alpha_{t_0;2069}} \cdot \left[\sum_{i:2069}^{+\infty} \left(\frac{1}{\gamma_{2070}} \right)^{i-2069} - 1 \right] = \\
&= \frac{1}{\alpha_{t_0;2069}} \cdot \left(\frac{1}{1 - \frac{1}{\gamma_{2070}}} - 1 \right) = \frac{1}{\alpha_{t_0;2069}} \cdot \left(\frac{1}{\gamma_{2070} - 1} \right) = \\
&= \frac{1}{\alpha_{t_0;2069}} \cdot \left(\frac{1}{\frac{1 + r_{2070}}{1 + g_{2070}} - 1} \right) = \frac{1}{\alpha_{t_0;2069}} \cdot \left(\frac{1 + g_{2070}}{r_{2070} - g_{2070}} \right)
\end{aligned}$$

Thus, Eq. (13i) becomes:

$$\sum_{i:t_0+1}^{+\infty} \frac{1}{\alpha_{t_0;i}} = \sum_{i:t_0+1}^{2069} \frac{1}{\alpha_{t_0;i}} + \frac{1}{\alpha_{t_0;2069}} \cdot \left(\frac{1 + g_{2070}}{r_{2070} - g_{2070}} \right) \tag{13ii}$$

Analogously, the (discounted) sums of the changes of property incomes and ageing costs compared to the base year can be expressed as:

$$\sum_{i:t_0+1}^{+\infty} \frac{\Delta_{t_0} prop_i}{\alpha_{t_0;i}} = \sum_{i:t_0+1}^{2069} \frac{\Delta_{t_0} prop_i}{\alpha_{t_0;i}} + \frac{\Delta_{t_0} prop_{2070}}{\alpha_{t_0;2069}} \cdot \left(\frac{1+g_{2070}}{r_{2070}-g_{2070}} \right) \tag{14}$$

$$\sum_{i:t_0+1}^{+\infty} \frac{\Delta_{t_0} ac_i}{\alpha_{t_0;i}} = \sum_{i:t_0+1}^{2069} \frac{\Delta_{t_0} ac_i}{\alpha_{t_0;i}} + \frac{\Delta_{t_0} ac_{2070}}{\alpha_{t_0;2069}} \cdot \left(\frac{1+g_{2070}}{r_{2070}-g_{2070}} \right) \tag{15}$$

Thus, using Eqs. (13ii), (14) and (15) and the projections of the relevant variables until year 2070, the solvency gap in Eq. (12) can be computed as follows:

$$\begin{aligned} \overline{sg} = & \frac{d_{t_0}}{\sum_{i:t_0+1}^{2069} \frac{1}{\alpha_{t_0;i}} + \frac{1}{\alpha_{t_0;2069}} \cdot \left(\frac{1+g_{2070}}{r_{2070}-g_{2070}} \right)} \\ & - \left(pb_{t_0} + \frac{\sum_{i:t_0+1}^{2069} \frac{\Delta_{t_0} prop_i}{\alpha_{t_0;i}} + \frac{\Delta_{t_0} prop_{2070}}{\alpha_{t_0;2069}} \cdot \left(\frac{1+g_{2070}}{r_{2070}-g_{2070}} \right)}{\sum_{i:t_0+1}^{2069} \frac{1}{\alpha_{t_0;i}} + \frac{1}{\alpha_{t_0;2069}} \cdot \left(\frac{1+g_{2070}}{r_{2070}-g_{2070}} \right)} \right) \\ & + \frac{\sum_{i:t_0+1}^{2069} \frac{\Delta_{t_0} ac_i}{\alpha_{t_0;i}} + \frac{\Delta_{t_0} ac_{2070}}{\alpha_{t_0;2069}} \cdot \left(\frac{1+g_{2070}}{r_{2070}-g_{2070}} \right)}{\sum_{i:t_0+1}^{2069} \frac{1}{\alpha_{t_0;i}} + \frac{1}{\alpha_{t_0;2069}} \cdot \left(\frac{1+g_{2070}}{r_{2070}-g_{2070}} \right)} \end{aligned} \tag{16}$$

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ECONOMIA ITALIANA 2022/3

Le implicazioni del cambiamento demografico sul sistema economico e finanziario italiano

Questa edizione di *Economia Italiana* – editor **Giorgio Di Giorgio e Maria Rita Testa,** entrambi della Luiss – analizza le conseguenze dell'invecchiamento della popolazione in Italia. Come scrivono gli editor, *"L'Italia non è un paese per giovani*". Negli anni a venire gli anziani sono destinati a diventare più di un terzo della popolazione, mentre i giovani dovrebbero ridursi a poco più di un decimo rispetto a una popolazione che
- nel prossimo cinquantennio a seconda di diversi autorevoli scenari centrali previsi
- perderà dai cinque ai diciassette milioni di individui. *"L'impatto sulla società sarà dirompente non solo per il cambiamento atteso futuro ma anche perché ad oggi le avvenute trasformazioni demografiche si sono scontrate con ben pochi risultati concreti e molto silenzio da parte delle istituzioni preposte a rispondere a siffatto cambiamento*".

Il primo contributo, di **Claudia Reiter, Anne Goujon e Maria Rita Testa,** mette in evidenza le future tendenze demografiche italiane: ***Italy's population prospects: future scenarios for the 21st century.*** Il saggio di **Lilia Cavallari, Flavio Padrini, Nicola Salerno e Lorenzo Toffoli** analizza l'impatto del potenziale aumento della spesa per le cure e per il welfare nel nostro paese, ***Ageing and the sustainability of public finance.*** Due contributi sono dedicati esplicitamente al tema delle pensioni. **Carlo Lallo e Sergio Ginebri** trattano ***Gli effetti regressivi inattesi del sistema pensionistico italiano nel prossimo futuro***. Il lavoro di **Elisa Bocchialini e Beatrice Ronchini** si occupa delle forti disparità di genere nei trattamenti pensionistici italiani, ***Il gender gap pensionistico: evidenze e prospettive dalla previdenza complementare.***
Il volume si chiude con il saggio di **Domenico Curcio, Giorgio Di Giorgio e Giuseppe Zito, *Scenari demografici, risparmio e sistema finanziario italiano***, che contiene anche una proposta per sostenere le pensioni di chi non ha possibilità di versare adeguati contributi.
Completano il volume l'intervento di **Stefano Micossi**, ***Le questioni di politica economica sempre rinviate***" e la rubrica di **Marco Valerio Morelli**, ***Il sistema pensionistico italiano appare non sostenibile nella società "silver" di domani.***

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