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Ageing and the Long-run Fiscal Sustainability of Health Care across Levels of Government

Pietrangelo de Biase, Sean Dougherty and Luca Lorenzoni

OECD WORKING PAPERS ON FISCAL FEDERALISM

June 2022 No. 38

OECD
BETTER POLICIES FOR BETTER LIVES

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Abstract

Ageing and the long-run fiscal sustainability of health care across levels of government

OECD economies are undergoing a seemingly inevitable process of population ageing that has been changing income and consumption patterns. Notably, the demand for health services is expected to increase, while labour forces are projected to shrink. Both factors are projected to negatively impact the sustainability of health systems – the former through an increase in government expenditures on health and the latter through a decrease in government revenues. As health systems and their funding streams tend to be at least partially decentralised in most OECD countries, this fiscal pressure is expected to be asymmetric across levels of government. The objective of this paper is to provide order-of-magnitude estimates of the possible effects of population ageing on government finances across OECD countries, and to discuss reforms to fiscal federalism and intergovernmental relations with the purpose of funding expenditures at all levels of government.

Keywords: Fiscal federalism, intergovernmental relations, demographics, tax policy, revenue buoyancy

JEL classification: H51, H71, J11

Résumé

Vieillissement de la population et viabilité budgétaire à long terme de la santé à tous les échelons de l'administration

Les économies de l'OCDE connaissent un phénomène de vieillissement de leur population qui semble inévitable et qui modifie la structure des revenus ainsi que les modes de consommation. En particulier, on s'attend à voir augmenter la demande de services de santé, tandis que les populations actives vont aller en diminuant. Ces deux facteurs conjugués devraient avoir des conséquences négatives sur la viabilité des systèmes de santé, le premier via une hausse des dépenses publiques de santé et le deuxième sous la forme d'une baisse des recettes de l'État. Dans la mesure où les systèmes de santé et leurs mécanismes de financement sont souvent partiellement décentralisés dans la plupart des pays de l'OCDE, cette pression budgétaire va s'exercer de manière asymétrique aux différents niveaux de l'administration. La présente étude a pour objectif de fournir une estimation de l'ampleur des conséquences possibles du vieillissement de la population sur les finances publiques dans les pays de l'OCDE, et de proposer des moyens de réformer le fédéralisme budgétaire et les relations entre les différentes administrations de façon à pouvoir assurer le financement des dépenses à tous les échelons de la puissance publique.

Mots-clés : Fédéralisme budgétaire, relations entre les différentes administrations, démographie, politique fiscale, dynamisme des recettes

Classification JEL : H51, H71, J11

Ageing and the long-run fiscal sustainability of health care across levels of government

By Pietrangelo de Biase, Sean Dougherty and Luca Lorenzoni[1]

1. Introduction

1. The main objective of this working paper is to provide an order of magnitude of the possible effects of population ageing on government finances across levels of government – with a particular focus on health spending trends – in order to assess the implications of population ageing on fiscal federalism and intergovernmental fiscal relations. Such an assessment is particularly relevant for health expenditure, which is projected to increase significantly in the next two decades (Lorenzoni et al., 2019). As a result, population ageing may also create vertical fiscal imbalances that could require fiscal federalism reforms such that government revenues can meet expenditure needs at all levels of government. This intergovernmental relations perspective complements a companion analysis which looks at the fiscal gap at the general government level, by analysing the distribution of this gap across levels of government.

2. This note integrates two studies. First, the impact of population ageing on government revenues from 2018 to 2040, based upon Dougherty & de Biase (forthcoming). Second, the impact of population ageing on public expenditures on health care from 2018 to 2040, based upon Lorenzoni et al. (forthcoming). The information in these two pieces is complemented with information gathered by the OECD Network on Fiscal Relations on tax autonomy (Dougherty et al., 2019), intergovernmental transfer dependency,[2] subnational spending power on health (Dougherty & Phillips, 2019) and the Economics Department's long-term GDP baseline (Guillemette & Turner, 2021). This paper also builds upon previous work by the OECD on the impact of population ageing across levels of government (Kim & Dougherty, 2020; Rouzet et al., 2019).

3. Similar to previous OECD studies, this piece has made certain simplifying assumptions that apply to all OECD countries in order to clarify broad policy implications. On the revenue side, no explicit reaction of policy makers to population ageing is modelled in the scenarios analysed. On the expenditure side, this piece assumes that expenditures will grow to meet the increasing demand for health services as the population ages and that this increase will affect levels of government proportionally to their share in general government health expenditure. One last simplifying assumption is that in order to enhance cross-country comparability, this study uses two aggregated levels of government, as is often done in OECD fiscal federalism studies (OECD, 2021): the central government and social security funds; and the local and regional/state governments.

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[1] This document was prepared for the 2021 Annual Meeting of the OECD Network on Fiscal Relations across Levels of Government and was shared with Working Party No. 1 of the OECD Economic Policy Committee. Preliminary results of the analysis were also shared with the OECD Health Committee. Helpful feedback was received in discussions with country delegates as well as experts, notably Bill Robson (C.D. Howe Institute) and Matt Crooke (Australian Treasury). We are also grateful for comments from David Bradbury, Luiz de Mello, Yannic Rehm, Catherine Macleod and Cameron Scott, as well as the OECD referees, Bert Brys, Sébastien Turban and Camila Vammalle. Finally, we thank Andoni Montes-Nebreda, Nicolas Miranda and Catherine Girodet for their invaluable help with the consolidation of functional national accounts data (COFOG).

[2] From the OECD Fiscal Decentralisation database (http://oe.cd/FDdb).

4. This paper is divided into five sections aside from this introduction: 1) background information on population ageing and fiscal federalism; 2) overview of revenues projections across levels of government; 3) overview of health expenditures projections across levels of government; and 4) analysis of future trends of both revenues and health expenditures across levels of government, with their policy implications.

Box 1. Summary of the main conclusions

- While government revenues tend to be negatively impacted by changes in the structure of the population and, thus, grow slightly less than GDP in most OECD countries over the next 20 years, health expenditures tend to increase significantly more than GDP. As a result, a growing mismatch between health demand and government revenues is expected to occur. This mismatch is not evenly distributed across levels of government.
- Central governments and social security funds revenues tend to be more heavily impacted by population ageing as they often rely more on taxes levied on labour income, such as personal income taxes and social security contributions. Subnational governments (SNGs), on the other hand, rely more on recurrent taxes on immovable property and non-tax revenues – both are not directly impacted by population ageing. These results are robust across two different scenarios for the relationship between government revenues and economic activity.
- Central governments from OECD countries tend to have a more important role in the provision of health care services than SNGs. Therefore, they are expected to carry the bulk of the burden of a future boost in health care demand. Nevertheless, there are notable exceptions, in which health care is heavily decentralised, such as in Denmark, Finland, Italy, Spain, Sweden and Switzerland.
- As central governments' expenditure and revenues are expected to be hit the most by population ageing, so also are their fiscal positions. This conclusion holds regardless of the scenario used for estimating the relationship between government revenues and economic activity. This illustrates that the factors that cause this imbalance across levels of government are not related to revenue buoyancy but rather to differences in the resilience of revenues to changes in the structure of the population and their role in the provision of health care services.
- When fiscal imbalances are expected to occur at the subnational level, raising sufficient revenues to meet increasing spending needs may be challenging, as SNGs often have limited tax autonomy, depend at least partially on intergovernmental transfers, usually face borrowing constraints, and have limited discretion over their health budgets.
- Reforms aimed at dealing with the fiscal impact from population ageing have to take into account an intergovernmental dimension. As levels of government have different revenue mixes and health expenditure tends to be shared across levels of government, it is crucial for measures to target the level of government expected to be affected by population ageing. A higher degree of centralisation or decentralisation of health care spending responsibilities is also an option to deal with asymmetries across levels of government.

2. Background

2.1. Population ageing and public finances

5. Population ageing is a term related to a demographic transition that involves an increase in the fraction of the population that is older as a result (mostly) of an increase in life expectancy and a decline in fertility rates. Due to population ageing, the portion of the population that is in an age group that is able and likely to work decreases. This demographic change will produce changes in the organisation of society

such as a shift from labour income towards asset and pension income[3] and in consumption baskets towards a higher use of health care services. Annex A provides information on population ageing across OECD countries.

6. Although the impact of these demographic changes on GDP growth is uncertain,[4] it seems clear that population ageing will affect economic aggregates unevenly. Shifts caused by population ageing, even if neutral in terms of economic activity, can affect government revenues and expenditures in a non-neutral manner. These impacts are the main objects of the studies whose projections are analysed in this piece – Dougherty & de Biase (forthcoming) and Lorenzoni et al. (forthcoming).

7. On the revenue side, a decrease in the workforce and a potential increase in productivity as a result of rising capital per worker and technological advances are expected to asymmetrically affect tax bases. As countries and levels of government rely on these to a varying extent, the vulnerability of their revenue sources to population ageing will likely differ. Different consumption patterns over the life cycle, such as a higher consumption of health goods and services in older ages, may also affect tax revenues, depending on the sector-specific tax policy in place. For a better understanding of the impact of population ageing on government revenues, see Annex B, based on Dougherty & de Biase (forthcoming).

8. On the expenditure side, this paper focuses on the impact of population ageing on health expenditures. As health consumption tends to peak at older ages, the older the population the higher the projected growth in expenditure on health care. In addition, future trends in health expenditures from public sources are expected to be affected by rising incomes, productivity constraints and the impact of new technologies (see Annex C, based on Lorenzoni et al., forthcoming).

2.2. Asymmetric impact across levels of government

9. The fiscal impact of population ageing on government revenues and health expenditures is expected to be asymmetric across levels of government. On the revenue side, subnational governments (SNGs) tend to rely on a different revenue mix than central governments, which leads to differences in vulnerability to population ageing. On the expenditure side, OECD countries differ substantially with regard to the degree of decentralisation in health care responsibilities. This fiscal imbalance across levels of government might require additional reforms to intergovernmental relation frameworks, in addition to the reforms needed to raise the additional revenues to fund the projected growth in health care demand.

2.2.1. Comparing subnational and central revenue portfolios

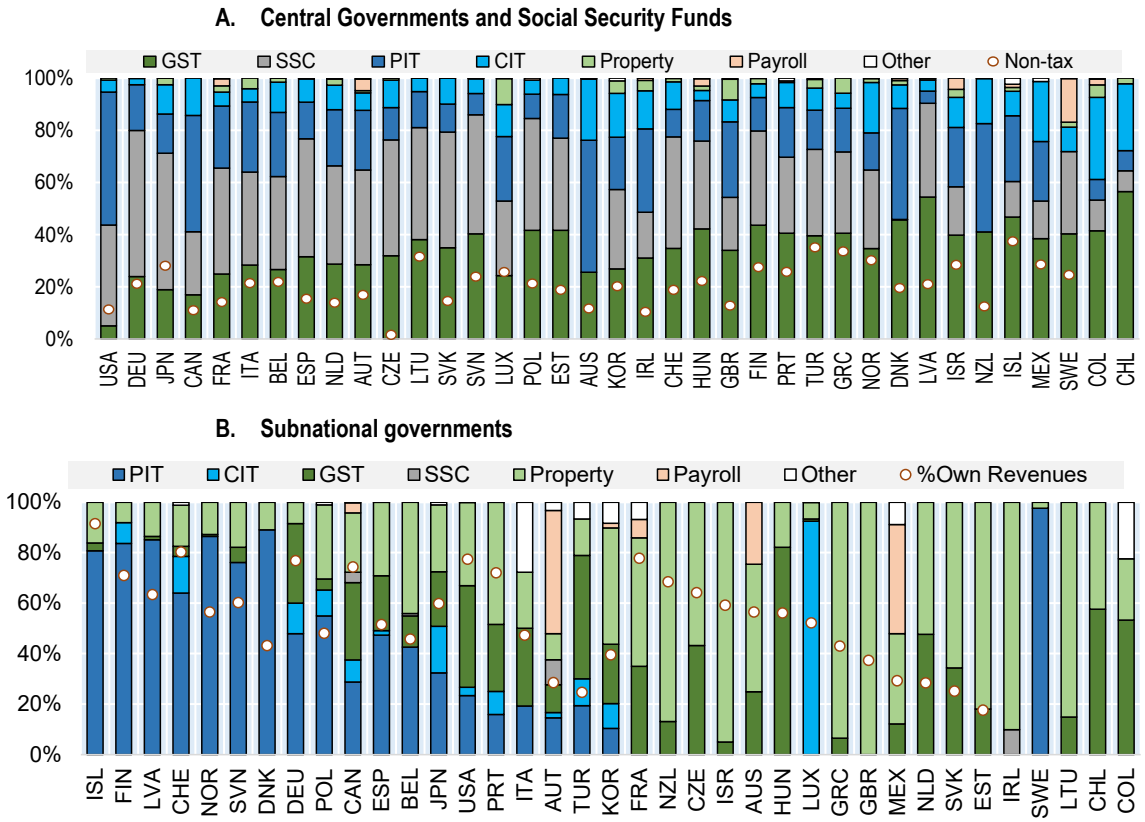
10. Figure 1 shows the composition of tax revenues of different levels of government in OECD

[3] This assumption is based on an analysis of the age profiles for labour income (see Dougherty & de Biase, forthcoming). It is worth adding, though, that a decrease in the labour share of income has been observed over recent decades simultaneous with population ageing, but the evidence of causality is, for now, unclear (OECD, 2015). In any case, it seems prudent to at consider the possibility that the elasticity of substitution between labour and capital is below one, and as such, this assumption would imply examining measures aimed at making fiscal policies more resilient to ageing and, thus, could "insure" governments against such a risk.

[4] The literature regarding the net overall effect of population ageing on economic activity is inconclusive. For instance, Maestas et al. (2016) estimated the elasticity of GDP growth with respect to ageing in US states and concluded that, as a result of slower growth in labour productivity and the workforce, a 10% increase in the fraction of the elderly (over 60 years old) decreases GDP growth in per capita terms by 5.5%. In the same vein, Daniele et al. (2020) concludes that in many regions actual productivity growth has been lower than that required for population ageing to have a neutral effect on per capita GDP levels. Acemoglu & Restrepo (2017), on the other hand, found that there is no negative relationship between population ageing and GDP growth in per capita terms, possibly because of an endogenous response of technology related to a faster adoption of robots by countries undergoing a more rapidly ageing population.

countries. An analysis of the chart confirms the theoretical expectations[5] that SNGs tend to rely more on immobile tax bases through property taxation than central governments and social security funds (CGSS). In contrast, CGSS tend to rely significantly more on tax types that have labour income as tax base (PIT and SSC) – on average in OECD countries 50% of CGSS tax revenues come from PIT or SSC, while for SNGs this percentage is 28% (almost half). As these type of taxes are expected to be impacted the most by population ageing (see Dougherty & de Biase, forthcoming), CGSS revenues tend to be more vulnerable to population ageing.

Figure 1. Tax revenue composition across levels of government in OECD countries (% of tax revenues)



Note 1: PIT, CIT, SSC and GST refer to personal income tax, corporate income tax, social security contributions, and goods and service tax. Non-tax revenues were not computed for Colombia and Chile due to lack of data in the OECD System of National Accounts. Own Revenues in panel B refer to the percentage of SNGs revenues that do not come from intergovernmental grants from upper levels of government Income taxes unallocable between PIT and CIT were, for the purpose of this graph, allocated to PIT and CIT proportionally to their shares as a percentage of income taxes. Values of 2018. Data on own revenues is missing for Ireland, Sweden, Lithuania, Chile and Colombia. Negative revenue values were assumed to be zero. *Note 2:* Merging central governments with social security funds (SSF), in practice, leads to an allocation of social security contributions to the central level. Aside from France – whose SSF relies substantially on other sources of tax income (PIT represent roughly 40% of all SSF revenues in France) – in no OECD country does the SSF rely significantly on any other source of tax income. *Note 3:* Countries ordered primary by the reliance on labour income (SSC+PIT for the central government with SSF and SSC+PIT times percentage of own income for SNGs) and secondary by the share of own revenues while tax types ordered by relevance within each panel.
Source: OECD Revenue Statistics and Fiscal Decentralisation database.

[5] SNGs and central governments have different tax mixes since mobile tax bases are more prone to tax competition across jurisdictions, which can lead to distortionary effects if those taxes are ascribed to SNGs. For instance, jurisdictions can lower their tax rates and provide tax benefits to encourage taxpayers to move to their jurisdiction, which increases this jurisdiction's tax revenues but reduces tax revenues in aggregate (Blöchliger & Pinero, 2011). Therefore, large and immobile tax bases are more commonly ascribed to lower levels of governments.

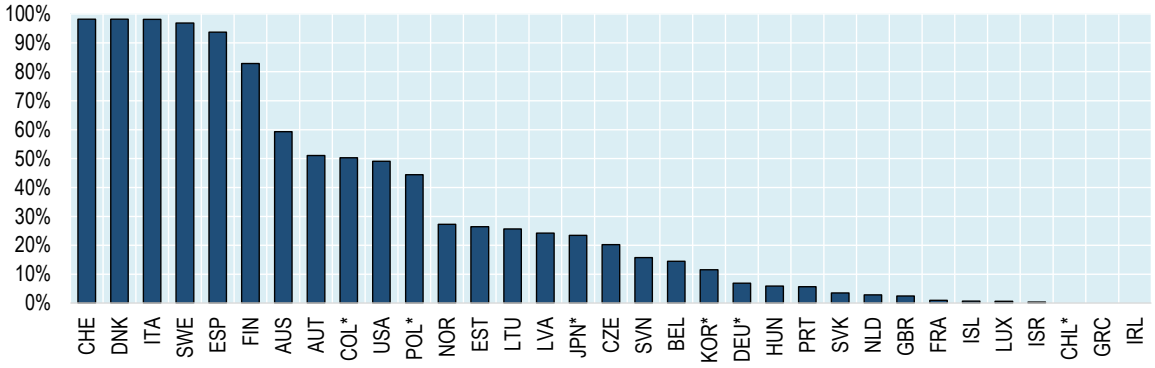
2.2.2. Comparing health expenditure responsibilities at central and subnational levels

11. As the expected increase in health care demand due to population ageing and the change in productivity in the health sector are likely invariant to the level of government, the key factor that affects the increase in health care spending across levels of government is their role in providing health services. The more health-related activities that are assigned to a level of government, the more it will be impacted in absolute terms by increases in health care demand.

12. Figure 2 shows the degree of decentralisation of health care expenditure in OECD countries (measured as SNGs' health expenditure as a share of general government's health expenditure).[6] At least four groups of countries can be identified based on the decentralisation health care expenditure:

- Health care is provided mainly by SNGs (decentralisation of health care expenditure higher than 80%): Switzerland, Italy, Denmark, Sweden, Spain and Finland.
- Health care provision is shared somewhat evenly across levels of government (decentralisation between 40% and 60%): Australia, Austria, Colombia, the United States and Poland.
- SNGs have a small but relevant role in health care provision (decentralisation between 10% and 30%): Estonia, Norway, Lithuania, Latvia, Japan, Czech Republic, Slovenia, Belgium and Korea.
- SNGs have a minor role in health care provision (decentralisation less than 10%): Germany, Netherlands, Hungary, Portugal, Slovakia, Great Britain, Iceland, France, Luxembourg, Israel, Greece and Ireland.

Figure 2. SNGs' health expenditure as a percentage of general government (as of 2019 – pre COVID-19)



Note: Consolidated data is shown for countries without asterisks. Consolidation was performed in each level of government by subtracting the values of property income, other current transfers and capital transfers paid to other levels of government. As a result, the data shown here capture the health care expenditures "expended by" the respective level of government, regardless of their source of funding (*i.e.,* expenditures funded by earmarked or non-earmarked transfers from higher levels of government are considered to be a subnational expenditure even if the funding comes from elsewhere). All the health expenditure data in this report follow this same principle, unless stated otherwise.
Source: OECD System of National Accounts.

[6] These data measure the purpose of government expenditure, as defined by the Classification of the Functions of Government (COFOG). This classification aims at having comparable statistics on government expenditure broken down by purpose, which might diverge from the official data provided by countries due to the assumptions used in the harmonisation procedure. For instance, in the case of Australia, official government data shows that SNGs' health expenditure as a percentage of general government as less than using the harmonized COFOG data, due to differences in the scope of health expenditure in the classification (Australian Institute of Health and Welfare, 2021). Countries can also diverge in the consolidation approach used. Here, we used the "expended by" approach, which means that SNGs expenditures cover expenditures financed by transfers from the central government (see Annex D).

13. In countries in the 1st group, SNGs are expected to suffer the most from the impact of population ageing on health care. In countries in the 2nd and 3rd group, this cost is expected to be shared across all levels of government. In countries in the 4th group, central government and social security funds will absorb most of the fiscal impact from higher health care expenditures. This heterogeneity in the structure of revenues and in the allocation of responsibilities across levels of government[7] suggest that policies aimed at alleviating fiscal pressure from population ageing need to have an intergovernmental dimension. As fiscal pressures from population ageing are asymmetric across levels of government, solutions that disregard this fact may leave governments at some levels unable to meet increasing demand for health goods and services. Intergovernmental relations are, thus, crucial for discussing how to absorb the fiscal impact from population ageing (this is the norm with fiscal reforms – as government revenues and expenditures are, to some extent, decentralised in OECD countries, most fiscal reforms need to have an intergovernmental dimension).[8] The next sections of this paper will make overall estimations of these fiscal impacts across levels of government and lay out potential policy reforms to overcome fiscal challenges caused by population ageing.

3. Impact of population ageing on levels of government

3.1. Revenues

14. Dougherty & de Biase (forthcoming) project revenues across levels of government in 2040 considering the long-term revenue buoyancy and the impact of changes in the structure of the population as a result of population ageing (see Annex B for a summary of the methodology adopted). The former captures how revenues grow in the long-term with a 1% increase in GDP.[9] The latter refers to the impact of variations in patterns of labour income, asset income and private consumption over the life cycle as people get older.[10]

15. Figure 3 depicts these two impacts for both the central government (including social security funds) and subnational governments across countries. Buoyancy effects are positive for all OECD countries across all levels of government, as GDP[11] is expected to increase, and government revenues tend to grow

[7] It is worth noting that values shown from OECD *Revenue Statistics* may differ from countries' official data on these same subjects. This is because the data explored here result from an application of consistent methodologies across countries aimed at having harmonised and comparable data – the methodology used for creating these harmonised datasets can be found in both OECD (2018) and Eurostat (2019).

[8] See Blöchliger & Vammalle (2012) for a collection of fiscal reforms made by OECD countries that involved this intergovernmental dimension.

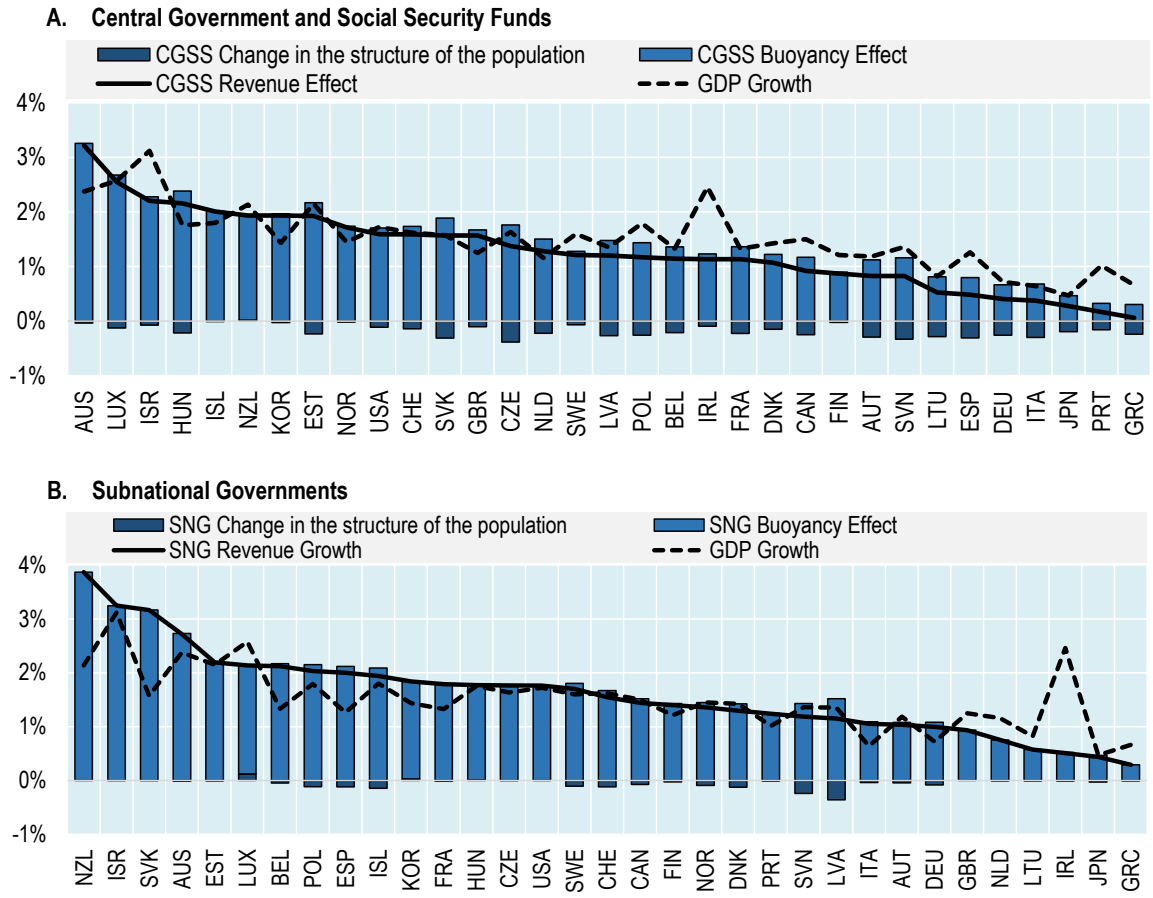
[9] Buoyancy estimates capture how revenues vary in the long-term without controlling for tax policy changes – for more information on buoyancies see Dougherty & de Biase (forthcoming). In this piece, buoyancies were estimated considering the 1990-2018 period, depending on data availability.

[10] Note that the labour income age profiles are provided by the National Transfer Accounts (United Nations, 2013), which are used as an input to this study, do not cover pension income. This absence may overestimate the impact of changes in the structure of the population on government revenues. In addition, both the buoyancy and population structure effects are distinct, and a specific treatment is done so that the impact of population growth is only considered in the buoyancy effect. More specifically, the changes in the structure of the population effect regards only the changes in the distribution of the population across age groups – and their income and consumption patterns – whereas the buoyancy effect captures all changes in GDP, including those related to population growth. For details on the forecasting method see Annex B and Dougherty & de Biase (forthcoming).

[11] For details on GDP forecast see Guillemette & Turner (2021).

in line with GDP. The size of this effect, however, varies across countries and levels of governments, often being larger for subnational governments (average annual growth rate of 1.7%) than for central governments (average growth rate of 1.5%, roughly identical to the expected growth in GDP). In other words, as SNGs revenues are slightly more buoyant than those of the central government and, therefore, revenues of the former are expected to increase more than revenues of the latter with economic growth.[12]

Figure 3. Changes in the structure of the population and buoyancy effects on government revenues (annual real growth between 2018 to 2040)



Note: Revenue effect is a combination of two multiplicative effects: the change in the structure of the population and the buoyancy effect. Central governments encompass social security funds, while subnational governments encompass both state/regional governments and local governments.
Source: Based on Dougherty & de Biase (forthcoming).

[12] According to Dougherty & de Biase (forthcoming), these differences in tax buoyancy coefficients across levels of government can potentially be explained by the fact that the taxes under the property tax and GST/VAT headings differ across levels of government and, as result of this contrast in tax bases, they also react disparately to GDP movements. Regarding property taxes, SNGs rely more on recurrent taxes on immovable property, while central governments use more financial transactions and inheritance taxes. Similarly, concerning GST/VAT, by-and-large central governments rely on taxes on production, sales and transfers, while SNGs tend to make more use of taxes on goods and services.

16. Regarding the effects on government revenues of the changes in the structure of the population as a result of population ageing, central governments rely more on personal income taxes (PIT) and social security contributions (SSC), both of which depend strongly on labour income, while SNGs tend to rely more on recurrent taxes on immovable property and non-tax revenues. Consequently, central governments are expected to experience a larger decrease in their revenues in the long term as a result of population ageing. More specifically, changes in the structure of the population are expected to reduce the annual growth of government revenues by 0.17% and 0.05% in the central and subnational level (OECD average), respectively.

17. It is worth noting that the size of the buoyancy effect is substantially larger than the size of the changes in the structure of population due to ageing (see Figure 3). This means that policies aiming at increasing GDP growth and/or the government revenues buoyancy can have a substantial effect on government revenues in the long term – potentially larger than policies aiming at reducing the impact of population ageing. Box 2 discusses these fiscal policies.

Box 2. Fiscal policies to increase resilience of revenues to population ageing

Countries have many options to make their government's revenue mix more resilient to population ageing. In principle, this can be obtained at least through two channels: 1) adoption of more growth-friendly taxes, so output increases, boosting revenue collection for multiple taxes and 2) adoption of reforms so that tax revenues are less affected by population ageing. Some suggestions of how to use these channels (alone or in combination) are explored below:

Growth-friendly channel

- Broader tax bases tend to reduce distortions and, thus, increase output growth. Therefore, all types of taxes can become more efficient by reducing exemptions. In terms of political economy, it can be particularly valuable to reduce intergenerational issues to remove PIT and SSC exemptions when applied to pensioners (for more on the political economy aspects of the relation between taxation and population ageing, see OECD, 2015 and Colin & Brys, 2020).

Population ageing resilience channel

- VAT/GST revenues are largely invariant to population ageing while having an average buoyancy, being, therefore, more resilient to population ageing than most other taxes. In countries in which consumption is not already highly taxed, VAT/GST rates can be increased to boost resilience to population ageing. In countries in which consumption is highly taxed, there might remain scope to broaden the consumption tax base.
- Revenues from the PIT, SSCs and payroll taxes tend to be impacted the most by population ageing, as their tax bases involve labour income.[13] The direct negative impact of ageing on total labour income might partly be offset by rising wage levels as a result of increased demand for certain types of workers. Overall, labour income tax revenues might be made more resilient by raising labour force participation by, for instance, encouraging women, the elderly and foreign or immigrant workers to join the labour force. Another option is to tax pensions under PIT and health SSCs and, thus, minimise the decrease in tax revenues that will happen when people retire. An increase in productivity and, thus, wages can also minimise this effect; this could be stimulated through tax policies that incentivise human capital formation and adaptation to the future work environment.

Both channels

- Property taxes are not only highly invariant to population ageing, but are also growth-friendly (Cournède et al., 2018), being, therefore, a particularly good type of tax for governments to increase their reliance on in order to increase their resilience to population ageing.
- Corporate income taxes (CIT) are the only type of tax (considered in this study) whose buoyancy has been significantly larger than the rest (on average)[14] and, simultaneously, also is resilient to population ageing (*i.e.,* CIT revenues do not tend to decrease with population ageing, like taxes on labour income that are affected by the reduction in the size of the labour force). Nevertheless, CIT is considered a distortionary tax and, thus, an over-reliance on CIT may have a negative effect on economic output (Cournède et al., 2018). Therefore, in this case there might be a trade-off between resilience to population ageing and economic output, which makes it difficult to assess the long-term impact of an increase in CIT rates on total tax revenues.

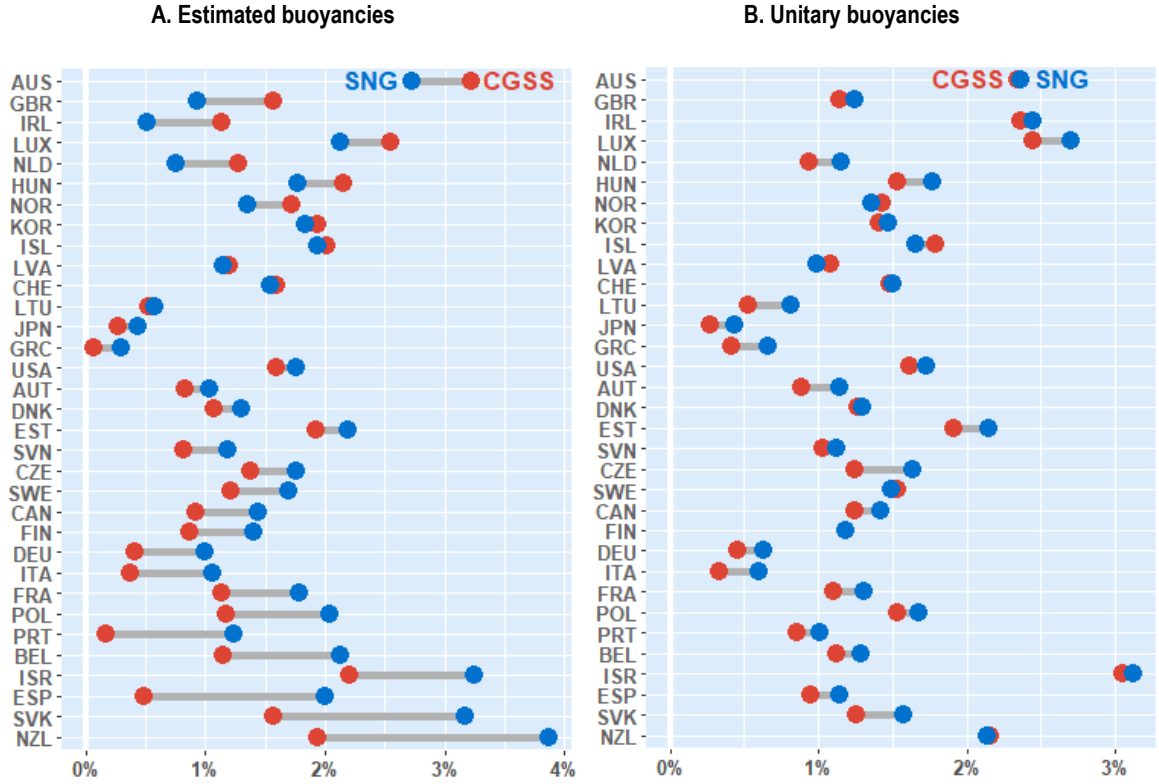
Source: Dougherty & de Biase (forthcoming) and Cournède et al., (2018).

18. Figure 4 contrasts more explicitly the differences in the projected annual growth in revenues across levels of government. Panel A, which takes into account buoyancy effects, shows that in 22 out of 33 OECD countries[15] SNGs revenues are projected to grow more than those from CGSS (in this group, the average difference in the real growth rate of revenues is 0.7 percentage points). In contrast, in 11 countries CGSS revenues are expected to increase more than those of SNGs by an average margin of 0.3 percentage points in their annual growth rates.

[14] This result is in line with most of the literature on tax buoyancy – Belinga et al., (2014), Dudine & Jalles (2017), Mourre & Princen (2015) and Deli et al. (2018). Nonetheless, a notable exception is Lagravinese et al., (2020), who find that long-run buoyancy coefficients are below one for all types of taxes, including CIT, whose buoyancy coefficient was the lowest. The model employed to compute buoyancy effects considered data between the 1990s and 2018, capturing, therefore, overall trends in the tax base, such as those related to automation and digitalisation of the economy. These differences across studies suggest that there are substantial uncertainties with regard to buoyancy coefficients, as they can vary depending on the model design used to estimate them and on the period used to make the estimations. Note that the definition of CIT used here does not include capital income at the personal level due to data aggregation issues. Therefore, when forecasting government revenues, one should be cautious with buoyancy coefficients and, ideally, use multiple scenarios for buoyancy in order to take into account uncertainties (for an analysis of multiple scenarios for buoyancy see Dougherty & de Biase, forthcoming).

[15] Only OECD countries with data available in OECD *Revenue Statistics* were considered.

Figure 4. Government revenue growth in real terms from 2018 to 2040 across levels of government (annual real growth rate)



Note: Same revenue information from Figure 3 but with a different visualisation. Ordered by the differences in revenue growth across levels of government. Central governments encompass social security funds, while subnational governments encompass both state/regional governments and local governments.
Source: Based on Dougherty & de Biase (forthcoming).

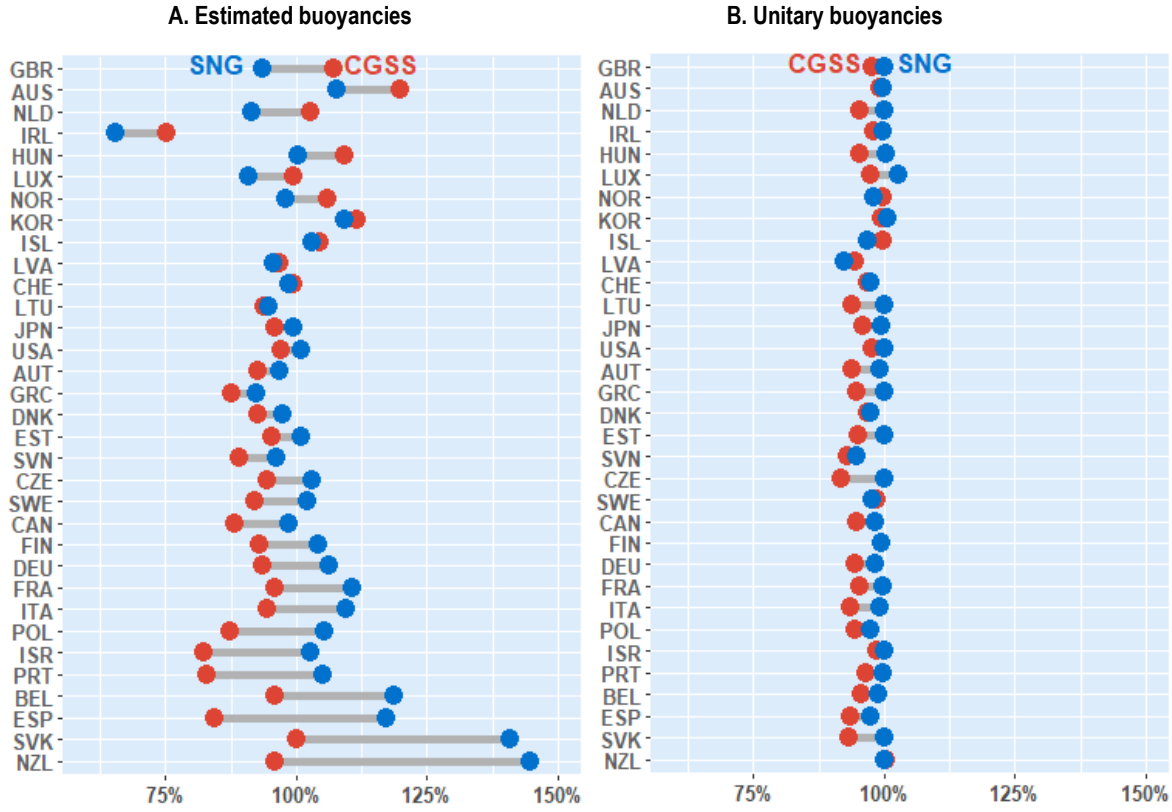
19. Since buoyancy effects tend to be significantly larger than the effects from changes in the structure of the population, most of the differences across levels of government can be accounted for through differences tax buoyancy across levels of government. Hence, as a complement to this analysis, Figure 4, Panel B shows a scenario in which the tax buoyancy of all levels of government are set to unity and, thus, differences across levels of government can be attributed only to changes in the structure of the population and its interaction with tax revenues.

20. In this scenario of unitary buoyancy, SNGs revenues also tend to grow more than central governments', but the differences are significantly smaller in this case. More precisely, in 27 countries SNGs revenues are projected to grow more than those of central governments, but the average difference in the annual growth rate for the countries is this group is only 0.17 percentage points. In the group of 6 countries in which CGSS revenues are projected to increase more than SNGs revenues, this difference in the annual growth rate is a meagre 0.06 percentage points. Therefore, regardless of the scenario for buoyancy, SNGs are expected to be less impacted by population ageing in the future than central governments. Nonetheless, this asymmetry across levels of government is larger in the scenario that assumes that past buoyancy coefficients remain constant until 2040.

21. When considering revenues in 2040 as a share of GDP (Figure 5), it becomes clear that most of the revenue growth can be attributed to the projected increase in GDP. If the sensitivity of revenues to GDP remains the same in the next 20 years (scenario 1, shown in Figure 5, Panel A), central governments and SNGs revenues are expected to increase, on average, 4% less and 3% more than GDP, respectively.

22. At the CGSS level, this slower growth of government revenues in comparison to GDP growth results from the fact that the mean buoyancy for CGSS revenues is 0.97 (which means that their revenues tend to grow 3% less than GDP growth) and that the effects from the changes in the structure of the population are negative for most countries at that level of government. The opposite occurs at the subnational level of government, as SNGs' revenue buoyancy coefficient is, on average, 1.09 and the negative impact from the changes in the structure of the population are not as large as at the central and social security level. More specifically, the average annual GDP growth is 1.51% while the average growth in CGSS and SNG revenues is 1.28% and 1.61%, respectively (refer to Figure 3).

Figure 5. Government revenue growth as a share of GDP growth across levels of government (2018 to 2040)



Note: Central governments encompass social security funds, while subnational governments encompass both state/regional governments and local governments.
Source: Based on Dougherty & de Biase (forthcoming).

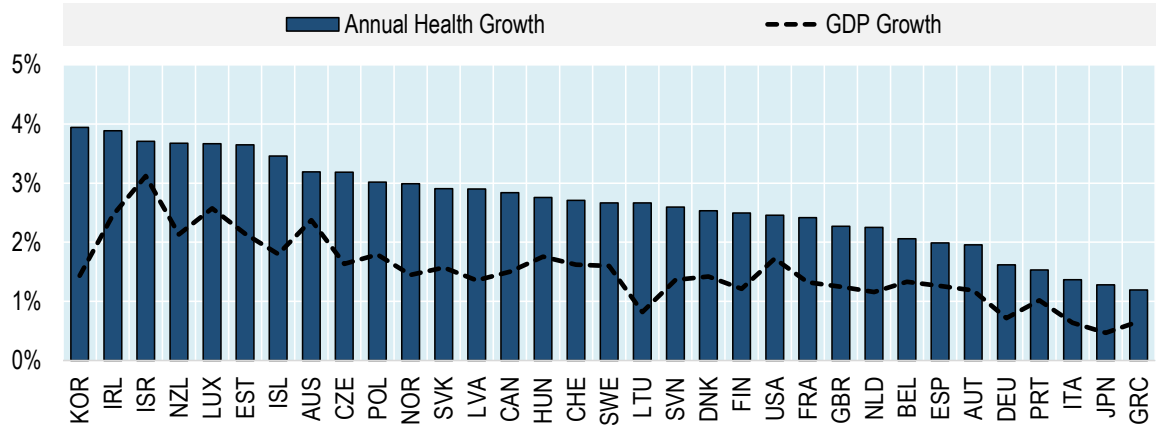
23. If the long-run revenue buoyancy follows the theoretical expectation of being unitary, then all differences between revenue and GDP growth can be attributed to changes in the structure of the population and its relation to tax revenues. These changes tend to have a negative impact on revenues as a result of a reduction in labour income and, in some cases, different patterns of consumption over the life

cycle. The former is related to PIT and SSC, while the latter to good and services taxes (GST/VAT). In this scenario, central governments and SNGs' revenues are expected to increase, on average, 3.8% and 1.1% less than GDP[16] (Figure 5, Panel B).

3.2. Health expenditures

24. While government revenues tend to be negatively impacted by changes in the structure of the population and, thus, grow slightly less than GDP in most OECD countries over the next 20 years (for details, see the discussion in the previous subsection), health expenditures tend to increase significantly more than GDP.[17] Figure 6 shows that health spending from public sources is projected to grow 2.7% annually in real terms, 1.2 percentage points more than the projected GDP annual growth rate of 1.5% (OECD averages).

Figure 6. Growth in health care expenditure from public sources in excess of GDP growth (annual % growth in real terms)



Source: Based on Lorenzoni et al. (forthcoming).

25. When it comes to imbalances across levels of government, the overall conclusion is that central government finances (including social security funds) are expected to be put under slightly more pressure by population ageing than SNGs'. Figure 7 shows the expected increase in the health-to-total expenditure[18]

[16] It is worth noting that as the model kept the effect from population ageing separate from the buoyancy effect and combined both through a multiplicative effect (see Annex B), it is possible for the model to forecast a revenue growth below or above GDP growth for any level of government (including the general government level) as a result of the impact from population ageing. In other words, only the buoyancy effect will be equal to GDP growth and, thus, any deviation between the revenue and GDP growth can be attributed to the population ageing effect.

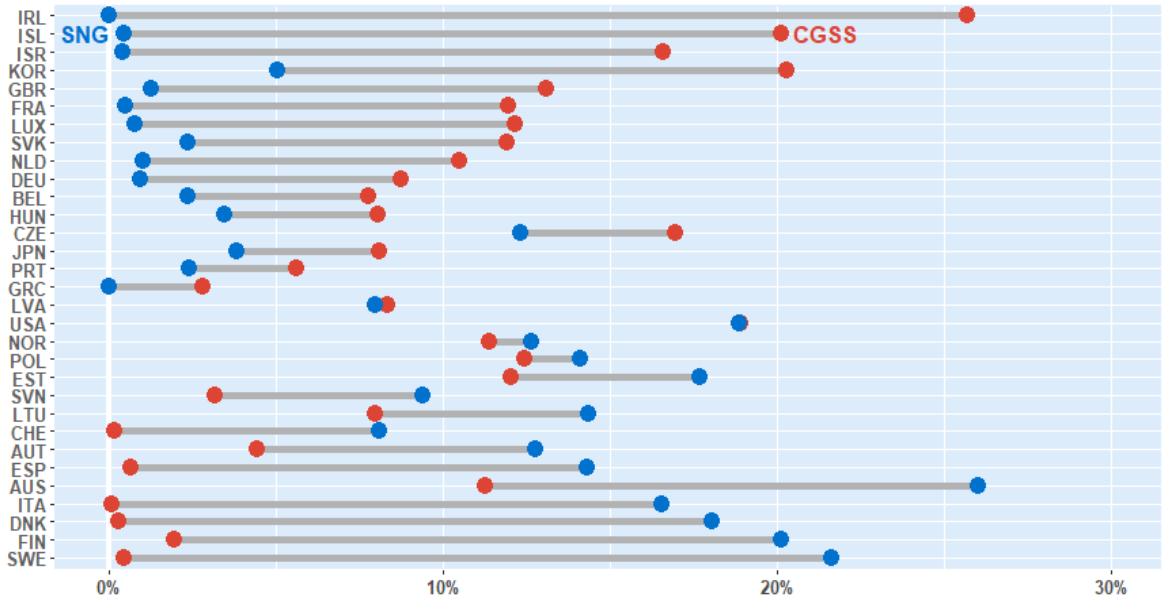
[17] Health expenditure figures are consolidated where possible – see Figure 2 for an explanation of how consolidation was performed, and to know which countries have (un)consolidated figures.

[18] Total expenditure refers to all government expenditure in that level of government with all government functions – that is, transaction code "TLYCG" in the System of National Accounts classification.

ratio from 2018 to 2040.[19] In 18 out of 31 countries[20], the central government is expected to experience a higher rise in their health to total expenditure ratio in comparison to SNGs. This difference is particularly high (more than 10 percentage points) in 7 relatively more centralised countries, such as Iceland, Ireland, Israel, Korea, United Kingdom, France and Luxembourg (refer to Figure 2).

26. In contrast, in only 6 OECD countries this ratio is expected to increase 10 percentage points more at the subnational level than at the central level: Sweden, Denmark, Finland, Spain, Italy and Australia (countries in which health care tends to be decentralised); and in 5 countries (Austria, Switzerland, Lithuania, Slovenia and Estonia) it is expected to increase 5 percentage points more for SNGs than for the central government.

Figure 7. Increase in the ratio of health expenditure to total (in percentage points) from 2018 to 2040



Note: Total expenditure refers to all government expenditure in that level of government with all government functions – that is, transaction code "TLYCG" in the System of National Accounts classification. Expenditure on government functions other than health were assumed to remain constant in the period. Ordered by the differences in increase in health expenditure to total expenditure ratio across levels of government. Central governments encompass social security funds, while subnational governments encompass both state/regional and local governments. Health care expenditure is consolidated for the same countries.
Source: Based on Lorenzoni et al. (forthcoming).

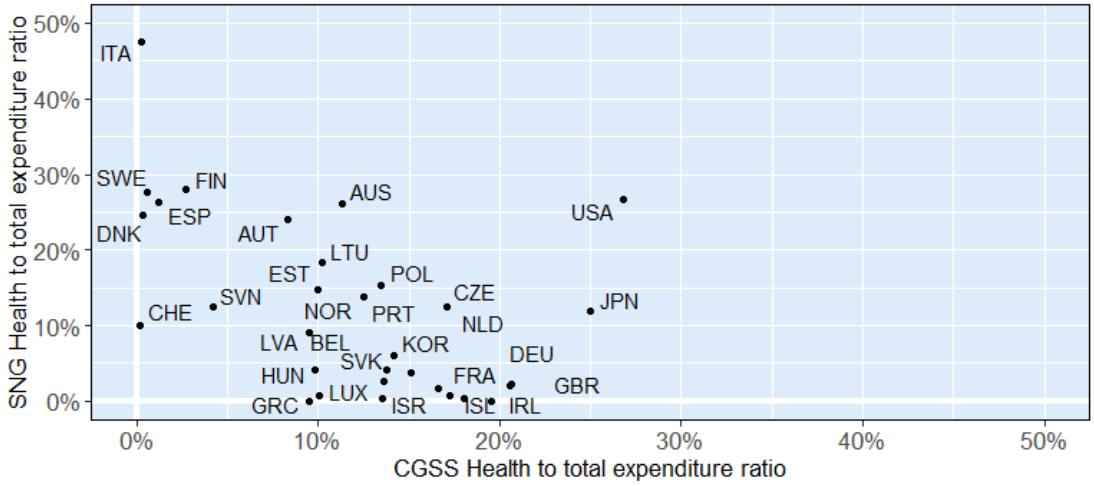
27. As the boost in health care demand due to population ageing and the change in productivity in the health sector are likely invariant to the level of government, the key factor that affects the increase in health care costs heterogeneously across levels of government is their role in providing health services. The more health-related activities are assigned to a level of government, the more it will be impacted by future boosts to health care demand.

[19] Other expenditures were assumed to stay stable in real terms in the same period. Although this assumption is not realistic, it highlights the potential increase in health care expenditure in relative terms in an intuitive manner for cross-countries comparisons.

[20] Canada and New Zealand were dropped from this analysis as these countries do not have data on the health expenditure function in the OECD System of National's Accounts Classification of Government the Functions of Government (COFOG).

28. The growth in the health-to-total expenditure ratio is affected by two components: the overall expected increase in health expenditure (Figure 6) and the current health expenditure to total expenditure ratio of the respective level of government (Figure 8, below). Health care expenditure tends to represent roughly the same share of the budget of the central and of subnational governments (on average 11.8% and 12.1% for CGSS and SNGs, respectively). Nevertheless, this analysis of the average OECD country masks the fact that in some OECD countries health care is heavily decentralised, such as Denmark, Finland, Italy, Spain, Sweden and Switzerland. In these countries, the burden of a rise in health care demand will affect SNGs significantly more than central governments.

Figure 8. Health expenditure in real terms growth from 2018 to 2040 and health expenditure ratio



Note: The increase in health demand is assumed to boost health expenditure proportionally across levels of government and, thus, the heterogeneity in the vulnerability to health expenditure across levels of government comes from the share of health expenditure in the budget. Central governments encompass social security funds, while subnational governments encompass both state/regional and local governments.
Source: Based on Lorenzoni et al. (forthcoming).

29. These projections refer to the baseline scenario from Lorenzoni et al. (forthcoming). It is possible to rein in the projected growth in health expenditure through a variety of policy measures (Box 3).

3.3. Combined impact of population ageing on government revenues and health expenditures

30. The growth in health spending from public sources is projected to be higher than the increase in government revenues in all OECD countries for the central government (except for Australia in which growth rates are expected to be roughly the same), and in all OECD countries but Belgium, Slovakia and Spain for SNGs (Figure 9). This means that the health expenditure-to-revenue ratio is expected to rise in virtually all OECD countries at all levels of government. Figure 9 also shows that for some combinations of countries and levels of government (*e.g.,* the central governments of Iceland, Ireland and Poland), not only health expenditure is expected to grow substantially more than revenues but also that they already represent a large portion of their budgets and, thus, fiscal pressures due to population ageing are projected to be particularly large.

31. Finally, by combining the projected government revenues and health expenditure growth rates, it is possible to assess the trend in the health expenditure-to-revenue ratio in 2040. While Figure 9 showed that this ratio is expected to rise in virtually all OECD countries and levels of governments, Figure 10 shows the expected increase contrasting the central government with SNGs. This figure also covers the two scenarios for revenues: one considering estimated buoyancy and the other unitary buoyancy.

32. When the estimated buoyancies are used in the projections, central governments' fiscal positions are expected to be hit the most, with an average increase of 5.4 percentage points in the health expenditure-to-revenue ratios, against 2.8 percentage points for SNGs. When the unitary buoyancy scenarios are considered, these average values change respectively to 5.3 and 3.4, respectively. Therefore, regardless of the scenario used for buoyancy, central governments tend to be more impacted by population ageing. This can be explained by the fact that they tend to: 1) rely on sources of income that are more impacted by population ageing, such as PIT and SSC, while SNGs tend to rely more on property taxes and non-tax revenues (including intergovernmental transfers), and 2) be responsible for the majority of the expenditure in health care.

Box 3. Making health systems more efficient and resilient

Projection results demonstrate the impact that policymakers can have on reducing the growth of health expenditures. In a 'cost pressure' scenario, annual growth in public spending on health averages 2.7% across the OECD, compared with only 2.1% if countries implement policies that promote healthier lifestyles (both of which are still below the projected GDP annual growth rate of 1.6%). More than half of the additional resources needed to strengthen health systems may come from policies that target prevention and healthy lifestyles. If policies that enhance efficiency are also implemented in these countries, around 70% of the investments needed to strengthen health systems may be financed through the bending of the health spending curve due to better prevention, healthy ageing and reduction of low-value care.

A range of cost containment policies has historically been effective at offsetting, at least to some extent, these upward pressures on health spending. Proven policy examples that can increase productivity include policies on workforce health, pharmaceuticals and new technologies. For example, new laws and regulations that extend the scope of practice for non-physicians can produce cost savings with no adverse effects on quality of care (James, Berchet, and Muir 2017). For pharmaceuticals, price, market entry, and prescription regulations have all helped increase penetration of generics in the market, thereby saving costs (Socha-Dietrich et al., 2017). Health Technology Assessments (HTAs) have the potential to ensure cost-ineffective new technologies are not introduced, and existing cost-ineffective interventions are discontinued Auraaen et al., 2016). More broadly, stronger price regulation can be effective in reducing health spending (Lorenzoni et al., 2018).

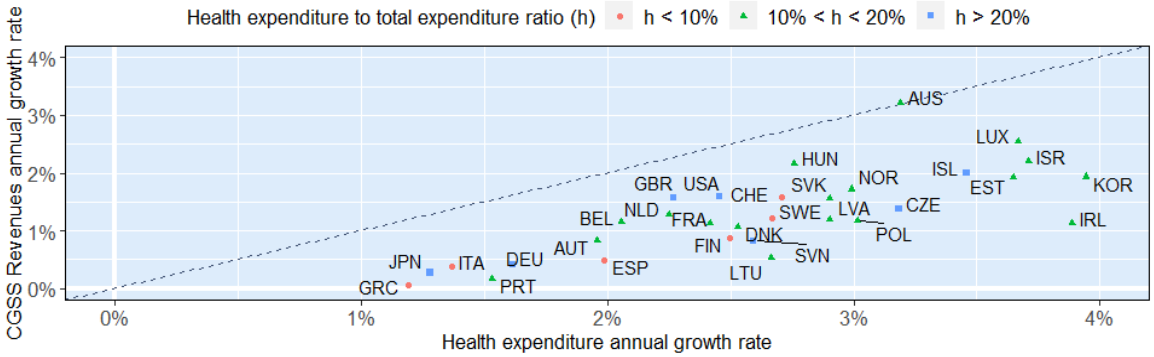
There is also considerable scope to better harness technological progress, focusing on those that have the potential to increase productivity. This includes optimising the administrative structure of the public health system across levels of government (Dougherty, Lorenzoni, et al., 2021). Moreover, digitalisation can support new delivery methods that save money, notably in the form of telemedicine and robotic tools for some limited procedures; as well as improving the quality and usefulness of health data (Hashiguchi et al., 2021).

Promoting healthier lifestyles requires action both within and beyond the health sector. Curbing the major risk factors of smoking, alcohol consumption, and obesity can reduce associated treatment costs. For example, alcohol prevention policies – such as brief GP interventions; taxation; and regulations on opening hours, advertising and drink-driving – have been shown to reduce costs compared to when associated illnesses are treated when they appear (OECD, 2021). Similarly, a range of fiscal, regulatory and communication policies have been cost-effective in reducing rates of smoking, obesity and other major risk factors (OECD, 2017; World Health Organization, 2015).

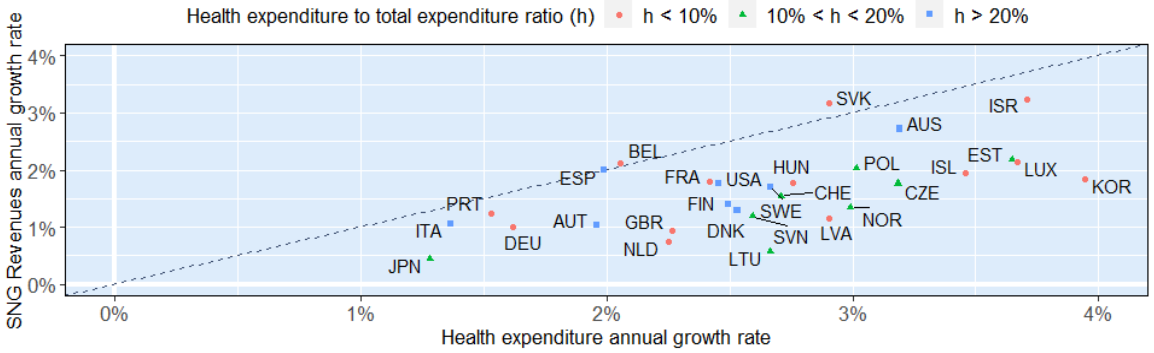
Source: Lorenzoni et al. (forthcoming).

Figure 9. Comparison of health expenditure and government revenues growth from 2018 to 2040

A. Central Government and Social Security Funds



B. Subnational Government



Note: Diagonal dashed line added as a reference for equal growth between revenues and expenditures. Countries in which SNGs have no role in the provision of health care were excluded from the second panel. Central governments encompass social security funds, while subnational governments encompass both state/regional governments and local governments.
Source: Based on Dougherty & de Biase (forthcoming) and Lorenzoni et al. (forthcoming).

33. The four quadrants in Figure 10 identify countries in which:

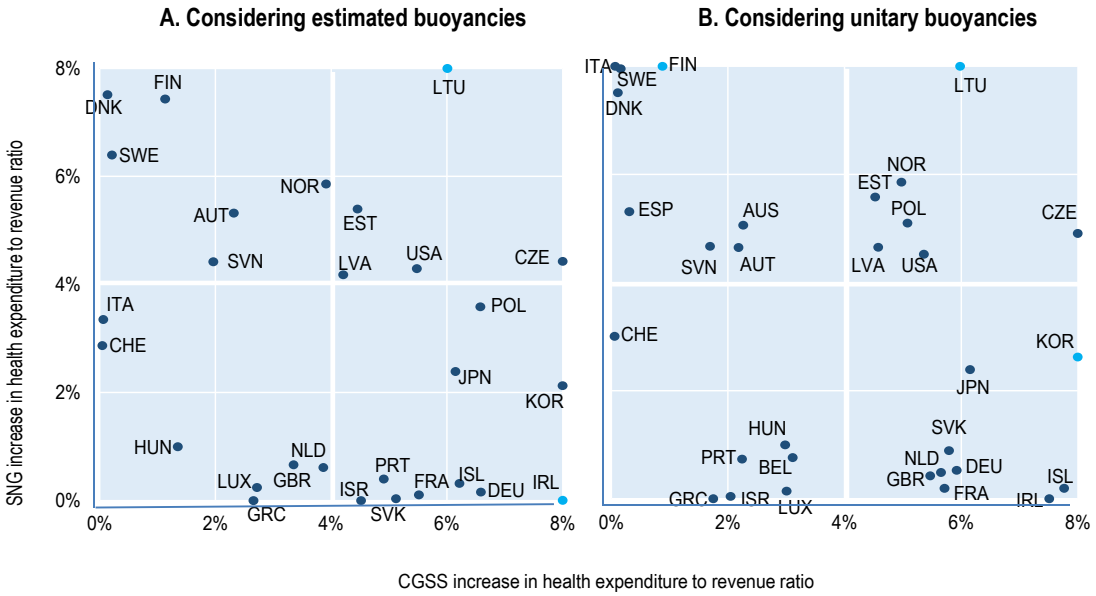
- all levels of government will face substantial relatively more fiscal pressure from population ageing (top right quadrant)
- SNGs are expected to absorb relatively more this fiscal shock than central governments (top left)
- central governments are expected to absorb relatively more this fiscal shock than SNGs (bottom right), and
- both levels of government are expected to be relatively less fiscally impacted by population ageing in comparison to other OECD countries (bottom left).

34. Countries may shift quadrants depending on the scenario considered for revenue buoyancy. The majority of the countries, though, remain in the same group in both scenarios.

3.4. Policy implications for fiscal federalism

35. Population ageing is one of the most foreseeable challenges that governments will have to face in the future. This allows policymakers to act preemptively, minimising the risk of a more acute situation in the future. This section lays outs potential measures to make governments more resilient to population ageing considering the intergovernmental dimension.

Figure 10. Increase in the health expenditure-to-revenue ratio from 2018 to 2040 (percentage points)



Note: Central governments encompass social security funds, while subnational governments encompass both state/regional governments and local governments. In Panel A, values for the central government of Ireland (15%) and of SNGs from Lithuania (10%) were set to 8% to fit in the plot (light blue). In Panel B, values for the central government of Korea (11%) and of SNGs from Lithuania (9%) and from Finland (9%) were set to 8% to fit in the plot (light blue).
Source: Based on Dougherty & de Biase (forthcoming) and Lorenzoni et al. (forthcoming).

36. Boxes 2 and 3 already discussed options to make government revenues more resilient to population ageing and to reduce health expenditure pressures through better health policies, respectively. Nonetheless, the discussion in these boxes ignored the intergovernmental dimension of the problem. Although measures on the health expenditure side tend to work regardless of the decentralisation of health care, they alone are likely insufficient to deal with fiscal pressures and, thus, measures on the revenue side are necessary.

37. Disregarding the intergovernmental dimension when designing revenue-sided measures is risky, as levels of government have different revenue mixes and expenditure assignments. For instance, a policy recommendation of boosting property taxes to increase revenues to meet future health care expenditures is not going to achieve the desired goal if property tax revenues are assigned to SNGs, while health care expenditures are assigned to central government or social security funds – such a reform would have to be bundled with a further decentralisation of health care or centralisation of revenue sources to be effective. Conversely, boosting corporate income taxes, which is mainly a central tax, in countries in which health care is decentralised, will only have the desired impact if the reform is bundled with a further centralisation of health care expenditure or further decentralisation of revenues (not necessarily CIT revenues, as this could include increases in intergovernmental grants).

38. In addition, when health care is decentralised, policymakers have to deal with another source of vulnerability to fiscal shocks that SNGs face – their lack of autonomy in raising revenues and, therefore, meet additional spending needs. First, SNGs rely substantially on intergovernmental transfers over which they have little to no control. In addition, as Colin & Brys (2020) highlight, formulas for defining the distribution of revenues from intergovernmental transfers do not systematically account for expenditure pressures from demographic changes and, therefore, this proportion of SNGs' revenues are not expected to increase in line with increasing spending needs arising from population ageing. Second, even in proportion to the revenues for which they supposedly control, they may lack the autonomy to raise tax rates or change tax bases/reliefs (Dougherty et al., 2019). Third, SNGs are often subject to borrowing

constraints (Vammalle & Bambalaite, 2021) and cannot easily gather funding to meet spending needs. Fourth and lastly, the central government often exert some control over the subnational budget and, thus, the spending power of SNGs is limited (Dougherty & Phillips, 2019).

39. A framework for designing revenues and intergovernmental relation policies aimed at making the fiscal system more resilient to population ageing can be based on the quadrants of Figure 10:

- 1st quadrant (top right): In these countries, both central governments and SNGs will face significant pressure from population ageing. As a result, reforms need to improve the fiscal situation of both lower and upper levels of government. On the tax revenue side, measures that boost the reliance on property taxation (for SNGs) can be particularly useful, also as their revenues generally are shared across levels of government and are a source of revenue relatively invariant to population ageing. Overall reforms aimed at increasing tax buoyancy or reliance of tax revenues to population ageing without changing the revenue mix also have the potential to improve the fiscal situation of both levels of governments (*e.g.,* increase labour force participation, increasing productivity, etc.). Further adjustments to the (de)centralisation of health care and/or size of intergovernmental grants might be needed in case fiscal imbalances remain at one level of government.
- 2nd quadrant (top left): In this quadrant there are countries in which health care is decentralised and SNGs tend to rely more on labour income than property taxation (Panel A). When considering unitary buoyancies, then countries in which SNGs rely on property taxation also join the group (Panel B).[21] Overall, boosting (or introducing) property taxes can be an effective measure to make SNGs' revenues more resilient to ageing. Increasing SNG reliance on GST/VAT revenues can have a similar effect, which can also be done through tax sharing arrangements, since GST/VAT is usually collected by central governments.[22] Boosting subnational autonomy can also be important so SNGs can adjust their revenues to meet health expenditure needs. Although it is preferred for SNGs to have their own sources of revenues rather than relying on intergovernmental transfers (Forman et al., 2020), boosting intergovernmental transfer can be an option to provide revenues to SNGs to meet a higher demand for health care. These new transfers can be earmarked to health care, but overall, it is preferred that they are not.[23] Lastly, in case central governments can afford more expenditures, health care can be further centralised.
- 3rd quadrant (bottom left): Countries in this quadrant are expected to be relatively less impacted by population ageing than the other OECD countries. However, some more incremental reforms might be necessary in the long-run in case imbalances are observed.
- 4th quadrant (bottom right): In this quadrant there are countries in which the central government (with social security funds) are expected to be hit the most by population ageing. In this situation, reforms that make the central government revenue mix more resilient to population ageing might be necessary. For most countries, these are related to increasing the reliance on good and service taxes (GST/VAT), as this type of tax is often managed at the central level and is resilient to population ageing; or to boost PIT and SSC resilience to population ageing (see Box 2). Another (less obvious) option is to decentralise health care along with an increase in property taxation and subnational autonomy. Decentralisation of health care can, alone, improve the efficiency of the health system (see Box 4), while recurrent taxes on immovable property (mainly a subnational tax) tend to be a growth-friendly tax (Cournède et al., 2018) and, thus, can impact revenues through higher output growth.

[21] Dougherty & de Biase (forthcoming) found that property taxes at the subnational level tend to be more buoyant than at the central level.

[22] Australia is an example of country in which GST/VAT revenues are centrally collected and shared with states.

[23] Bergvall et al. (2006) argue that general-purpose grants tend to be more efficient instruments than earmarked grants. The authors argue, though, that earmarked grants are efficient in risk-sharing and co-operation projects.

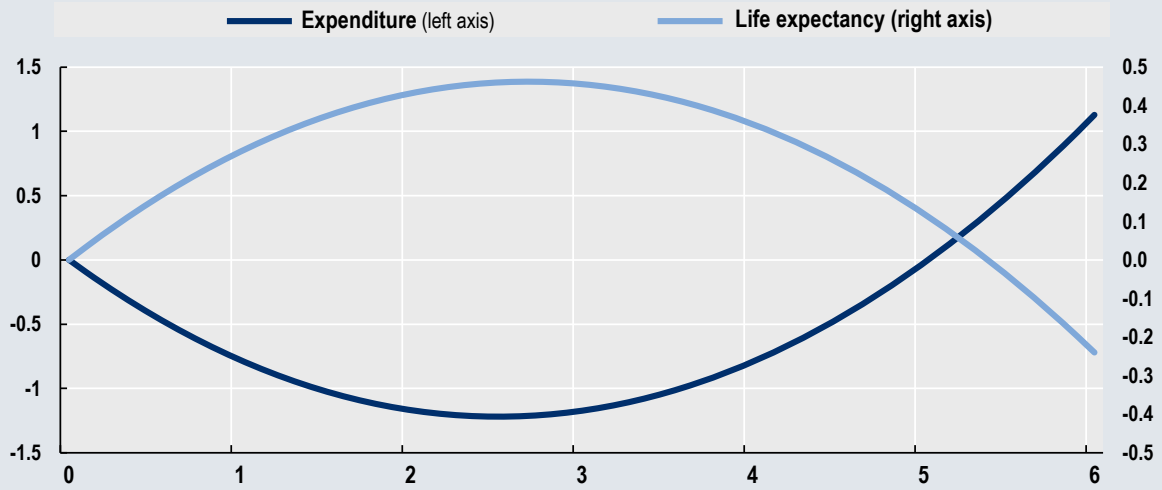
Box 4. Decentralisation of health care

The impact of decentralisation on the performance of health care systems

Adopting a certain level of decentralisation in health care can lead to better performance of health care systems. As a result, optimising the decentralisation of health care is an option for making health systems more efficient without resorting to boosting expenditures.

Dougherty, Lorenzoni, et al. (2021) examined empirically the relationship between the degree of administrative decentralisation across levels of government in health care decision-making and health care spending, life expectancy and hospital costs. They concluded that there is a non-linear effect of administrative decentralisation on health expenditure and health efficiency, in which a moderate degree of decentralisation seems to be preferred in a typical country, since it saves public resources and improves life-expectancy outcomes as compared with high centralisation or high decentralisation. This conclusion is summarised by Figure 11, below.

Figure 11. Marginal effect of decentralisation on public spending and life expectancy



Source: Dougherty, Lorenzoni, et al. (2021)

Spanish health care decentralisation

Spain serves as an example of how health care can be decentralised efficiently (Costa-Front, 2013). Spain, as a result of its new constitution in the late 1970s, devolved health care responsibilities to regions (autonomous communities) over the 1980s and early 2000s. This decentralisation was made in waves, with regions more capable of absorbing responsibilities being preferred in a first moment.

This decentralisation involved a system that almost fully financed by central taxes that are transferred to each region through block grants according to insularity and demographics. Regions can, though, decide the share of resources devoted to health. An equalisation fund is also used to correct for horizontal imbalances across regions.

Another source of regional convergence in the provision of health care regards incentives for policy experimentation and diffusion of innovations. As health care information is highly visible in Spain, regions have incentives to innovate or copy successful innovations. As funds are equalised, it is, in principle, possible to adopt successful policies designed by other regions. Regional inequalities in access to health care have, therefore, decreased by one-third after its devolution.

40. Health care expenditure figures reported in this paper were consolidated to capture the "expended by" perspective, regardless of their source of funding.[24] Therefore, expenditures funded by earmarked or non-earmarked transfers from upper levels of government are qualified as subnational expenditures even if the funding comes from upper levels of government. In this perspective, projected budget imbalances between revenues and health care expenditures are attributed to the level of government in charge of spending. A different perspective attributes health expenditures to the level of government that is funding these expenditures – in other words, imbalances between the projected health care expenditures and intergovernmental transfers employed to fund these expenditures should be the responsibility of the funder. From this standpoint, the central government is significantly more impacted by population ageing than SNGs, as they have to raise the revenues to increase intergovernmental transfers to fund health care expenditures. Annex D explores this alternative perspective.

41. To conclude, it is worth acknowledging that values shown in this paper are based on projections, which are conditional on a set of simplifying assumptions (see Annexes B and C for details) and applied to harmonised data produced by the OECD *Revenue Statistics* and System of National Accounts (COFOG), which might differ from the official data published by countries. In order to better calibrate such policies to the national context, it is recommended for countries to establish institutional mechanisms aimed at monitoring potential future fiscal imbalances, including those caused by population ageing. With such tools, policymakers are likely to become more aware of population ageing's fiscal risks and, thus, act in a more informed manner to alleviate its fiscal impact. Box 5 shows Australia's example on this matter.

[24] Consolidation was performed by subtracting the values of property income, other current transfers and capital transfers paid to other levels of government.

Box 5. Australia's long-term fiscal sustainability monitoring

One good practice in public financial management is to have institutional mechanisms aimed at analysing sources of fiscal risks in the medium and long-term. In line with this, Australia's budget law requires that different levels of government publish every five years a report on the sustainability of the government's fiscal position over the next 40 years by calculating future paths for debt under various scenarios. The long-run path for the debt-to-GDP ratio depends on three factors: economic growth, interest rates and the government's budget balance. The long-term growth of the economy depends on population, participation and productivity, and, therefore, are linked to demographic changes and population ageing. The projections are made on a 'no policy change' basis, meaning that it illustrates how the fiscal position might evolve in the absence of new government policies.

The most recent of these reports showed that Australia's fiscal position is expected to weaken over the coming years, with spending being expected to grow in the long-run and, although it may stabilise, it will stabilise at a higher level than today's. Health care, old age care and interest payments (as a result of the stock of debt from the COVID-19 crisis) are expected to increase the most, while a few other expenditures are expected to decrease. On the revenue side, Australia's report, in line with the results presented here, estimates that tax revenues are going to grow faster than the economy due to their progressivity.

As a result of these forecasts, Australia is planning to increase personal income tax rates in the future and to focus more on having a holistic view of the fiscal system, considering all sources of revenues, expenditures and levels of government, as some fiscal issues are better tackled through vertical (across levels of government) versus horizontal (across government divisions) cooperation. The report also reinforces the idea that demographic changes are relatively foreseeable, which may facilitate government action.

Australia therefore offers an example of how embedding monitoring of fiscal sustainability across levels of government into the budget cycle can lead to policies well calibrated to tackle future challenges related to population ageing.

Source: Australia's Parliamentary Budget Office (2021).

References

Acemoglu, D., & Restrepo, P. (2017). Secular stagnation? The effect of aging on economic growth in the age of automation. *American Economic Review*, *107*(5), 174–179. https://doi.org/10.1257/aer.p20171101

Ane Auraaeni, Fujisawai, R., Lagasneriei, G. de, & Parisi, V. (2016). How OECD health systems define the range of good and services to be financed collectively. *OECD Health Working Papers No. 90*. https://doi.org/https://doi.org/10.1787/5jlnb59ll80x-en

Australia's Parliamentary Budget Office. (2021). *Fiscal Sustainability: Long-term budget scenarios*.

Australian Institute of Health and Welfare. (2021). Health Expenditure Australia 2019-20. *AIHW, Australian Government*.

Belinga, V., Benedek, D., Mooij, R. A., & Norregaard, J. (2014). Tax Buoyancy in OECD Countries. *IMF Working Papers*, *14*(110), 1. https://doi.org/10.5089/9781498305075.001

Bergvall, D., Charbit, C., Kraan, D.-J., & Merk, O. (2006). Intergovernmental transfers and decentralised public spending. *OECD Working Papers on Fiscal Federalism 3*, 1–76.

Blöchliger, H., & Pinero, J. C. (2011). Tax Competition Between Sub-central Governments. *OECD Economics Department Working Papers*, *13*. https://doi.org/10.1787/5k97b1120t6b-en

Blöchliger, H., & Vammalle, C. (2012). *Reforming Fiscal Federalism and Local Government: Beyond the Zero-Sum Game* (OECD Fisca). OECD Publishing. https://doi.org/http://dx.doi.org/10.1787/9789264119970-en

Colin, C., & Brys, B. (2020). Population ageing and sub-central governments: Long-term fiscal challenges and tax policy reform options. In *Ageing and Fiscal Challenges across Levels of Government*. OECD Publishing. https://doi.org/https://doi.org/10.1787/2bbfbda8-en.

Cournède, B., Fournier, J.-M., & Hoeller, P. (2018). Public finance structure and inclusive growth. *OECD Publishing*, *25*, 1–47. https://econpapers.repec.org/RePEc:oec:ecoaab:25-en

Daniele, F., Honiden, T., & Lembcke, A. C. (2020). Ageing and productivity growth in OECD regions: Combatting the economic impact of ageing through productivity growth. In *Ageing and Fiscal Challenges across Levels of Government*. OECD Publishing. https://doi.org/https://doi.org/10.1787/2bbfbda8-en.

Deli, Y., Rodriguez, A., Kostarakos, I., & Varthalitis, P. (2018). Dynamic tax revenue buoyancy estimates for a panel of OECD countries. *ESRI Working Paper, No. 592*. http://hdl.handle.net/10419/193929%0AStandard-Nutzungsbedingungen:

Dougherty, S., Harding, M., & Reschovsky, A. (2019). Twenty years of tax autonomy across levels of government : measurement and applications. *OECD Working Papers on Fiscal Federalism*, *29*.

Dougherty, S., Lorenzoni, L., Marino, A., & Murtin, F. (2019). *The impact of decentralisation on the performance of health care systems: A non-linear relationship*. *2*.

Dougherty, S., & Phillips, L. (2019). The spending power of sub-national decision makers across five policy sectors. *OECD Working Papers on Fiscal Federalism, No. 25.*, *2*. https://www.oecd-ilibrary.org/taxation/the-spending-power-of-sub-national-decision-makers-across-five-policy-sectors_8955021f-en

Dougherty, S., De Biase, P., & Lorenzoni, L. (2022). Can we fund the future? Impact from population ageing on government revenues and health spending across levels of government. *OECD Working Papers on Fiscal Federalism, forthcoming*.

Dudine, P., & Jalles, J. T. (2017). How Buoyant Is the Tax System? New Evidence from a Large Heterogeneous Panel. *IMF Working Papers*. https://doi.org/10.1002/jid.3332

Eurostat. (2019). *Manual on sources and methods for the compilation of COFOG statistics — Classification of the Functions of Government (COFOG) — 2019 edition*. https://doi.org/10.2785/110841

Forman, K., Dougherty, S., & Blöchliger, H. (2020). Synthesising good practices in fiscal federalism: Key recommendations from 15 years of country surveys. *OECD Economic Policy Paper 28*, *28*. https://www.oecd-ilibrary.org/economics/synthesising-good-practices-in-fiscal-federalism_89cd0319-en

Guillemette, Y., & Turner, D. (2021). The long game: fiscal outlooks to 2060 underline need for structural reform. *OECD Economic Policy Paper 29*.

Hashiguchi, T. C. O., Slawomirski, L., & Oderkirk, J. (2021). Laying the foundations for artificial intelligence in health. *OECD Health Working Papers*. https://dx.doi.org/10.1787/3f62817d-en%0Ahttps://www.oecd-ilibrary.org/docserver/3f62817d-en.pdf?expires=1624982276&id=id&accname=guest&checksum=C988F45F5DA24638AA06A2717914E3C7

James, C., Berchet, C., & Muir, T. (2017). Addressing operational waste by better targeting the use of hospital care. *OECD Tackling Wasteful Spending on Health*. https://doi.org/https://doi.org/10.1787/9789264266414-en

Johansson, Å., Heady, C., Arnold, J., Brys, B., & Vartia, L. (2008). Tax and Economic Growth. *OECD Economics Department Working Papers 620*, *620*. www.oecd.org/eco/working_papers

Kim, J., & Dougherty, S. (2020). *Ageing and Fiscal Challenges across Levels of Government* (OECD Fisca). OECD Publishing. https://www.oecd.org/germany/ageing-and-fiscal-challenges-across-levels-of-government-2bbfbda8-en.htm

Lagravinese, R., Liberati, P., & Sacchi, A. (2020). Tax buoyancy in OECD countries: New empirical evidence. *Journal of Macroeconomics*, *63*(October 2019). https://doi.org/10.1016/j.jmacro.2020.103189

Lorenzoni, L., Murtin, F., Springare, L. S., Auraaen, A., & Daniel, F. (2018). Which policies increase value for money in health care? *OECD Health Working Papers, No. 104*. https://doi.org/https://doi.org/10.1787/18152015

Lorenzoni, Luca, Dougherty, S., & Biase, P. De. (2022). Will resilient health systems be financially sustainable? *OECD Health Working Papers*, *Forthcoming*.

Lorenzoni, Luca, Marino, A., Morgan, D., & James, C. (2019). Health Spending Projections to 2030: New results based on a revised OECD methodology. *OECD Health Working Paper No. 110*, 1–46. http://www.oecd.org/els/health-systems/health-working-papers.htm

Maestas, N., Mullen, K., & Powell, D. (2016). The Effect of Population Aging on Economic Growth, the Labor Force and Productivity. *RAND Labor & Population Working Paper*. https://doi.org/10.7249/wr1063-1

Mourre, G., & Princen, S. (2015). Tax Revenue Elasticities Corrected for Policy Changes in the EU. *EC Discussion Paper 018*. https://doi.org/10.2765/622532

OECD (2015). Fiscal Sustainability of Health Systems. In *Fiscal Sustainability of Health Systems*. OECD Publishing. https://doi.org/10.1787/9789264233386-en

OECD (2017). Obesity Update. *OECD Publishing, Paris*.

OECD (2018). *Revenue Statistics: Interpretative Guide*. 159–188. https://doi.org/10.1787/rev_stats-2018-8-en

OECD (2021). Preventing Harmful Alcohol Use. *OECD Health Policy Studies, OECD Publishing, Paris*. https://doi.org/https://doi.org/10.1787/6e4b4ffb-en

Socha-Dietrich, K., James, C., & Couffinhal, A. (2017). Reducing ineffective health care spending on pharmaceuticals. *OECD, Tackling Wasteful Spending on Health*.

United Nations. (2013). *National Transfer Accounts Manual: Measuring and Analysing the Generational Economy*. http://www.ntaccounts.org/doc/repository/NTA manual 2013.pdf

Vammalle, C., & Bambalaite, I. (2021). Fiscal Rules for Subnational Governments: The Devil's in the Details. *OECD Working Papers on Fiscal Federalism*, *35*.

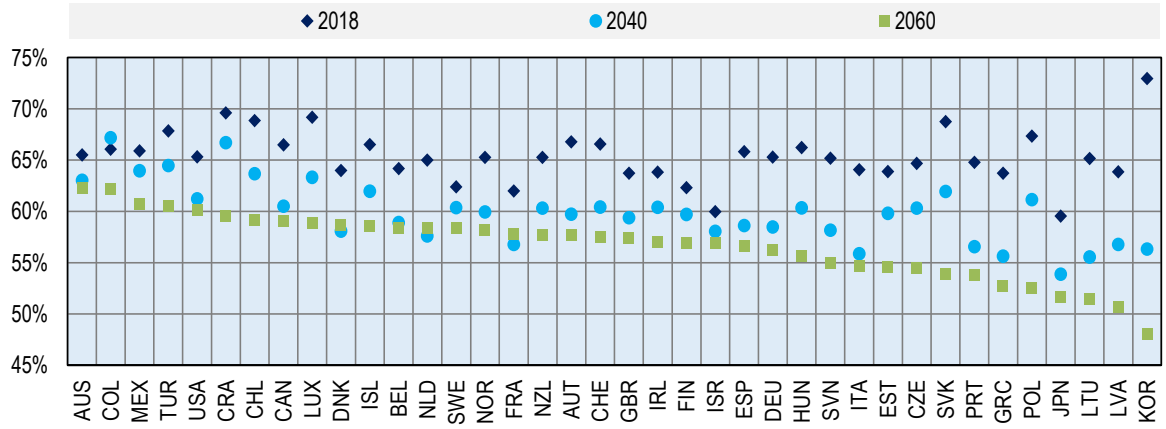
World Health Organization. (2015). Promoting health, preventing disease. The economic case. In D. McDaid, F. Sassi, & S. Merkur (Eds.), *European Observatory on Health Systems and Policies*.

Annex A: Population ageing across OECD countries

42. Although all OECD countries are expecting their population to age, as the current values and trajectories of life expectancy and fertility rates differ across countries, population ageing is in different stages across countries. One way to measure the degree of population ageing is to analyse the fraction of the working-population. Figure A1 shows the fraction of the working-age population in OECD countries. In 34 out of 38 countries, the fraction of the working-age population is expected to shrink between 2018-2040 and between 2040-2060. Exceptions are 1) Colombia, where this fraction is projected to increase in the period 2018-2040; and 2) Denmark, France and Netherlands, where this fraction is expected to increase in the period 2020-2040. It is worth noting that in no OECD country the fraction of the working-age population is expected to increase between 2018-2060 – the size of this decrease, though, varies significantly: from 17% and 25% (Korea) to 2% and 3% (Israel) respectively in 2018-2040 and 2018-2060.

43. As in some countries the fraction of the working-population is still growing and is expected to decrease only in some decades, while in others this fraction has been already decreasing for some time, in a given period population ageing can have opposite effects depending on the country. Nevertheless, at some point a given country is likely to suffer all the consequences from population ageing – first an increase in the working age population and, afterwards, a decrease, all in combination with rising health care demand. Given the sustained decrease in fertility rates and increase in life expectancy, the decrease of the working-age population fraction, at least to some extent, seems inevitable to all countries.

Figure A1. Working-age population as a percentage of total population



Source: Author based on OECD Population Projections.

Note: Working age population is defined as those aged 15 to 64.

Annex B: Projecting government revenues

44. The government revenues projections comes from Dougherty & de Biase (forthcoming). This projections model uses 1) an error correction model (ECM) with the purpose of capturing the dynamic relationship between revenues from different levels of government and GDP; and 2) a model based on National Transfer Account data to estimate the impact of population ageing on government revenues.

Error correction model

45. An ECM assumes that there is a long-run and short-run relationship between tax revenues and GDP and that short-term deviations from the long-run relationship are continuously adjusting towards the long-run relationship at a certain speed. Hence, four coefficients are estimated: the short-run buoyancy, the long-run buoyancy, the speed of adjustment coefficients and the intercept. As in this study the authors were projecting government revenues in 2040, long-run buoyancy is the coefficient of interest.

46. More precisely, the following variation of an auto-regressive distributed lag (ARDL) model is estimated using ordinary least squares (1-stage approach):

$$\Delta ln(R_{c,l,i}) = \varphi_{c,l} + \alpha_{c,l} ln(R_{c,l,i-1}) + \beta_{c,l}\, ln\left(GDP_{c,i-1}\right) + \rho_{c,l} \Delta ln(GDP_{c,i}) + D_{c,i} + \epsilon_{c,l,i} \qquad (1)$$

47. Where *R*, *D*, *c*, *l* and *i* refer to government revenues, dummy for negative real GDP growth, country, level of government and time, respectively. φ is an intercept, ρ is the short-run buoyancy, α is the speed of adjustment and $-\beta/\alpha$ is the long-run buoyancy (the coefficient of interest). Variables are in real terms (deflated by GDP deflator).

48. This model allows for heterogeneity of all estimated parameters, including their variances, as coefficients are estimated independently for every combination of country and level of government. This heterogeneity can be explained theoretically and empirically by at least three reasons.

National Transfer Account model

49. In order to capture the effects from population ageing on different revenue items, Dougherty & de Biase (forthcoming) used data from the National Transfer Account (NTA), which is a dataset with country-specific age profiles for aggregates from the System of National Accounts, and from OECD demographic projections. The general idea is that as people age they will change their consumption habits and income sources, both of which are major tax bases and, hence, affect tax revenues. This impact is captured by the following equation:

$$\Delta R_{c,i} = {\sum_a p_{c,i,a} r_{c,b,a}} \Big/ {\sum_a p_{c,b,a} r_{c,b,a}} - 1 \qquad (2)$$

50. Where ΔR refers to the growth rate for a government revenue item or a proxy for it (*e.g.,* a tax base in the case of taxes), p to the population and r to the respective revenue item or its proxy on per capita terms. The subscripts c, i, b and a refer to the country, the current year of the projections, the base year of the projections and the age group, respectively. It is worth noting that this equation has $r_{c,b}$ both in the numerator and denominator, which means that it assumes that the age profile remains constant over time, an assumption that the authors found to be plausible in relatively short periods of time.

Combining both models

51. In order to combine the buoyancy and the population ageing effect, these authors employed the following equation:

$$\Delta TR_{c,l,i} = \left(\left(1 + \sum_{a=i}^{n} \Delta R_{c,l,i} * w_{a,l} \Big/ \sum_{a=1}^{n} w_{a,l}\right) / (1 + \Delta Pop_{c,i}) * \left(1 + \Delta GDP_{c,i} * \theta_{c,l,i}\right)\right) - 1 \qquad (3)$$

52. Where TR refers to total government revenues (real terms), ΔR refers to the population ageing effect (as calculated by equation 2), w refers to the portion of total revenues represented by the respective revenue item a, ΔGDP refers to GDP growth in real terms, θ refers to the buoyancy for total government revenues and ΔPop refers to population growth. The subscripts c, l and i refer to country, level of government, and time, respectively. $\theta_{c,l,i}$ only changes with time in the 3rd scenario of buoyancy converging to unity.

53. The division between the population ageing effect and population growth was employed to avoid double counting the effects from population growth, as those are already captured by GDP growth. As a result, the blue equation can be interpreted as the effect from the changes in the structure of the population while the green equation the total buoyancy effect, considering population growth.

Annex C: Projecting health expenditures

54. The government health expenditure projections come from Lorenzoni et al. (2022), whose methodology is summarised below.

55. The impact of income, productivity constraints and time-specific effects on health care expenditure is estimated through panel regressions run on historical data (2000-2018) for 33 OECD countries. The base specification uses demography, potential GDP per capita, productivity and a time factor to estimate health expenditure. The main regressand for the model is public current health expenditure per capita, in real terms and in national currency. While capital investment in the health care system (*e.g.,* building, machinery and software) is relevant in the future production of health care services, spending on capital items is not included within the scope of the current model as it refers to a different timing of consumption. Additional controls for demography and technology, as measured by the share of people aged 65 or more in the total population and research and development (R&D) expenditure in the general economy respectively, are also included in the analyses. The regression model uses log-differenced data for all variables. The preferred specification uses random effects.

56. The income effect is measured by the income elasticity of health spending, which captures the percentage change in health expenditure in response to a given percentage change in income as proxied by potential GDP per capita. In the preferred specification, the estimate for the income elasticity of health spending from public sources is 0.872. For projections, this means a 1% increase in potential GDP brings about an average 0.872 % increase in health spending. It is important to note this does not necessarily imply that health expenditure as a share of GDP will decrease, since the income effect does not factor in growth in health spending resulting from all other drivers.

57. Potential productivity constraints are measured by the “Baumol variable”, a proxy that captures the impact of lower productivity growth in the health sector relative to other sectors of the economy on health spending. The theory that productivity is inherently different across sectors in the economy was developed by the economist Baumol. He posited that some sectors of the economy are non-progressive, meaning they do not benefit from technological advancements as much as other sectors do. Such sectors, including health and education, do not displace labour at the same rate (or at all) when new technologies are implemented, as compared to progressive sectors of the economy. Indeed, new technologies can have the opposite effect, as they come with increased costs (more specialised training required) or increased volumes (more staff required). The Baumol effect states that as productivity and wages rise together in progressive sectors of the economy, the health sector (being non-progressive) will experience only wage increases in order to keep up with the rest of the economy.

58. The authors used historical country-specific average growth in wages in real terms in the overall economy as the projection proxy of the Baumol effect, and multiply it by the coefficient estimated in the panel regression for the Baumol variable. This implies a 1% increase in wage growth in real terms in the total economy is translated into a 0.47 % increase in health spending from public sources, all else equal.

59. Lastly, the authors estimated technological progress in the health sector. Two proxies for technological progress are used in the regression model. First, expenditure growth on R&D is included. This proxy variable was not significant in regressions for health spending from public

sources – in line with the literature – but it did significantly affect other drivers in some of the specifications. Second, time-specific fixed effects are included. This captures systematic growth that is not taken into account from all other parameters within the model, reflecting in part technological progress. The resulting variable is a year-specific growth for all years in the panel, which are subsequently averaged using a linear weighting that gives more weight to years closer to the base year of the projection and less weight to years further away. The coefficient for this time-specific effect is 0.004, implying a 0.4% increase in health spending for each year, all else equal. The impact of technological progress on health spending is therefore estimated though the time-specific coefficient, while also acknowledging that some of its effect might be endogenously captured by the coefficients for demography, income and productivity.

Data variables	Notations	Parameters	Functions
i = potential GDP per capita	*pc* = per capita	ϵ = income elasticity	α = income effect
x = *individual* health expenditure	*g* = age group (five years)	η = Baumol coefficient	β= Baumol effect
y = *collective* health expenditure	*t* = year	θ = time coefficient	γ= time effect
p = population		*w* = real wages growth in the general economy	μ = death-related costs
π = number of deaths			τ = expenditure ratio: non-survivors / survivors

60. Health spending is projected for each country, year and age group. Health spending is initially split into individual (X) and collective (Y) expenditure.

61. The income effect is calculated by multiplying the income elasticity by the country-specific projected potential GDP per capita growth:

$$\alpha = x_{\{(t-1,pc,g)\}} * \left(\left(\frac{\{i_{\{(t)\}} - i_{\{(t-1)\}}\}}{\{i_{\{(t-1)\}}\}} \right) * \epsilon \right)$$

62. The Baumol effect is calculated by multiplying the Baumol coefficient by the country-specific average annual wage growth:

$$\beta = x_{\{(t-1,pc,g)\}} * \left(\eta * (\Delta w_t)\right)$$

63. To calculate the death-related cost effect, the survivors ϕ for the base year (t−1) for each age group are calculated by subtracting the number of deaths from the total population:

$$\phi_{\{(t-1),g\}} = \rho_{\{(t-1),g\}} - \pi_{\{(t-1),g\}}$$

64. The death-related cost effect is calculated by multiplying the given expenditure for each age group by the population weighted by the share of survivors in that year:

$$\mu = x_{\{(t-1),pc,g\}} * \frac{\{\phi_{\{(t-1),g\}}\}}{\{\phi_{\{(t-1),g\}} + (\pi_{\{(t-1),g\}} * \tau)\}}$$

65. The time effect is a fixed parameter, multiplied for each year and age group by a random weight between 0.5 and 1.5:

$$\gamma = x_{\{(t-1),pc,g)\}} * (\theta * [0.5 - 1.5]_{a.t})$$

66. The drivers' effects are summed to the per capita expenditure:

$$X_{\{(t-1),pc,g)\}} = x_{\{(t-1),pc,g\}} + \alpha + \beta + \mu + \gamma$$

67. The projections for individual health expenditure is obtained by multiplying the per capita expenditure of each age group by the population by age group of the following year:

$$X_{\{(t),g\}} = x_{\{(t-1),pc,g\}} * \rho_{t,g}$$

68. The expenditure is then summed over all age groups to obtain the total individual health expenditure for year *t*:

$$X_t = \sum_{g=1}^{n} X_{\{(t),g\}}$$

69. The collective health expenditure is projected to grow with respect to all drivers, except death-related costs:

$$Y_{\{(t-1),pc\}} = Y_{\{(t-1),pc\}} + \alpha + \beta + \gamma$$

70. The projections for collective health expenditure is obtained by multiplying the per capita expenditure by the population of the following year:

$$Y_t = Y_{\{(t-1),pc\}} * \rho_t$$

71. The projected collective expenditure is then summed to the projected individual expenditure to obtain the projected total health expenditure in year t:

$$HCE_t = X_t + Y_t$$

72. The total expenditure resulting from the above calculations is then used as the baseline for the following year, iteratively for all years of the projections.

3.5. Assumptions

73. In the health spending projections model the following assumptions are made:

- the coefficient of the Baumol variable is capped to 0.01 to 2040. This means that the real annual wage growth would decrease linearly to 0.01 from 2018 to 2040 if its mean observed value from 2000 to 2018 for a country is higher than 0.01. If the mean observed value for a country is negative, then the coefficient of the Baumol variable is set to 0. This is the case for Greece, Italy, Japan, Portugal and Spain. For Chile, Colombia, Costa Rica, Mexico and Türkiye, due to non-availability of time series on wages, the coefficient of the Baumol variable is set to the mean observed across reporting countries (= 0.014).
- DRC are assumed to be ten times higher than costs for survivors. This expenditure ratio reflects the mid-point of values reported in the literature. This value of ten is then adjusted over time to reflect country-specific gains in life expectancy. Such dynamic DRCs are used as a proxy to model healthy ageing.
- the share of individual and collective health expenditure over total current health expenditure is kept constant over time at its 2018 value.
- projections are not modelled based on alternative demographic scenarios.

The table below shows the values of the coefficient of the drivers by scenario.

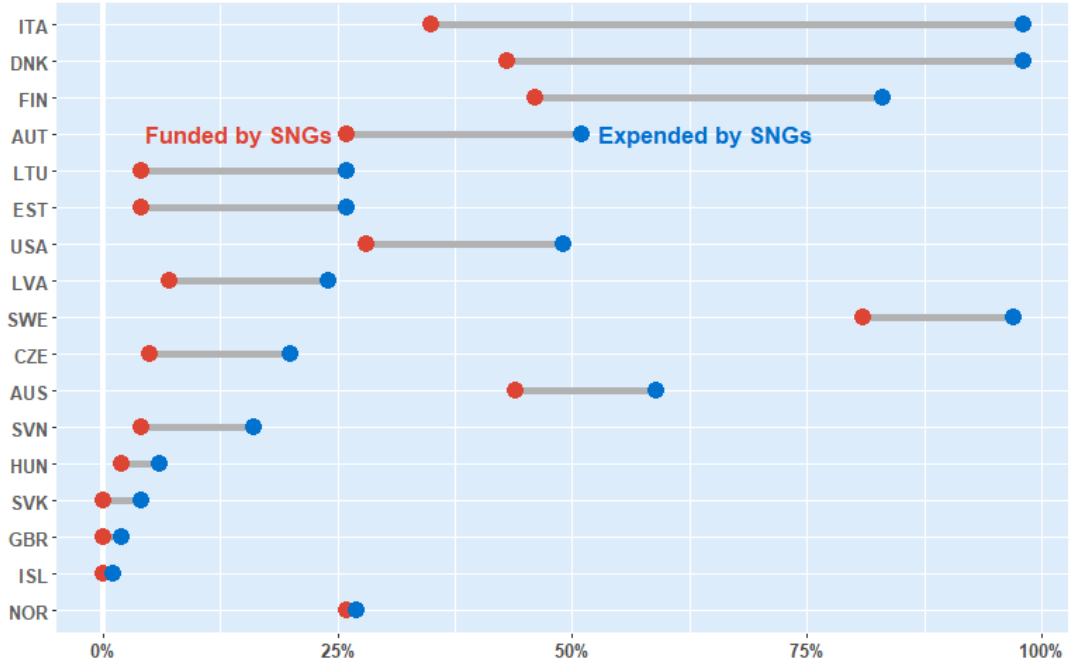
	Income elasticity		*Baumol effect*			
Scenario	*2018*	*2040*	*2018*	*2040*	*healthy ageing multiplier*	*Time effect*
Base	0.872	0.872	0.47	0.423	0.5	0.004
Cost control		0.785		0.376	0.5	
Cost pressure		0.959		0.47	0.5	
Healthy ageing		0.872		0.423	1	

Annex D: The perspective of the funder for health care expenditures

74. Health care expenditures can be consolidated by subtracting the values of property income, other current transfers and capital transfers *paid to* other levels of government ("expended by" approach) or *received from* other levels of government ("funded by" approach). The latter consolidation methodology tends to reduce SNGs' health expenditure as a share of general government, while the former tends to reduce the central government's share, as most intergovernmental transfers are from the central government to lower levels of government.

75. Figure D1 shows that the difference between these two perspectives can be significant in countries in which a substantial portion of healthcare is funded by the central government and expended by SNGs (Italy, Denmark, Finland, Austria, Estonia, United States, Lithuania, Latvia, Sweden, Czech Republic, Australia and Slovenia).

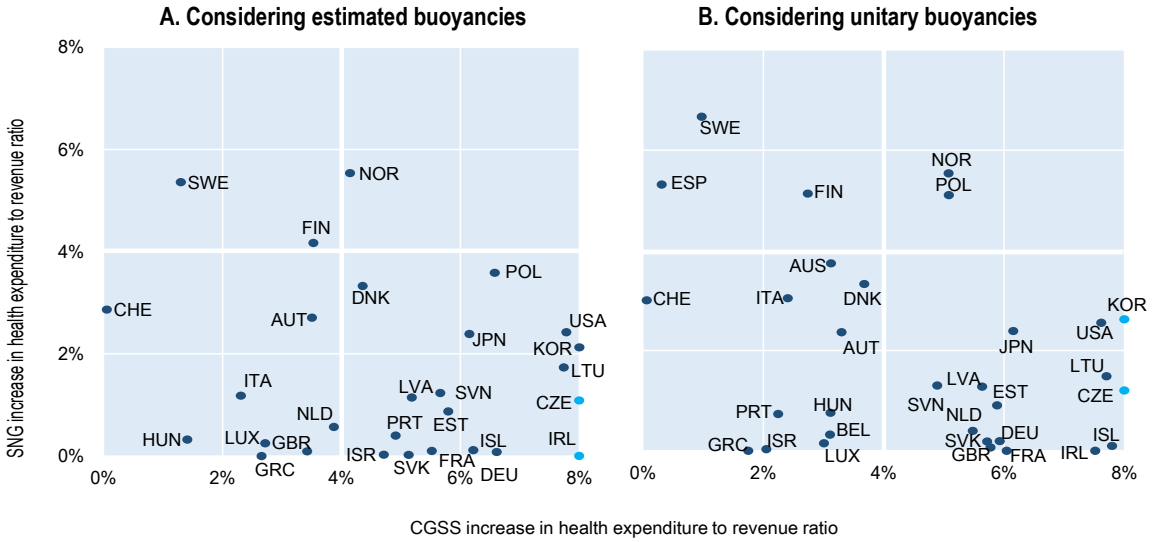
Figure D1. SNGs' health expenditure as a percentage of general government's



Note: Only countries with differences between these two approaches are shown. Pre-COVID-19 values are from 2018.
Source: OECD System of National Accounts

76. Figure D2 shows the four quadrants explored by Figure 10 but using the "funded by" consolidation approach instead of the "expended by" perspective. It is evident that the number of countries in the first and second quadrant, both quadrants that represent where SNGs' fiscal positions will be heavily impacted by population ageing, diminished significantly (from 11 to 3 countries considering the estimated buoyancies and from 15 to 5 considering the unitary buoyancies). In contrast, the number of countries in the fourth quadrant increased from 10 to 17 and 9 to 15 in the estimated / unitary buoyancies scenarios, which indicates that the central government is the level of government that will be fiscally impacted the most by population ageing in the "funded by" perspective.

Figure D2. Increase in the health expenditure-to-revenue ratio from 2018 to 2040 (percentage points) – "*funded by*" perspective



Note: Central governments encompass social security funds, while subnational governments encompass both state/regional governments and local governments. In Panel A, values for the central government of Ireland (15%) and Czech Republic (10%) were set to 8% to fit in the plot (light blue). In Panel B, values for the central government of Czech Republic (10%) and Korea (10%) were set to 8% to fit in the plot (light blue).
Source: Based on Dougherty & de Biase (forthcoming) and Lorenzoni et al. (forthcoming).

77. In the "funded by" perspective, central governments would be responsible for the fiscal adjustments necessary to cover their own health care expenditures and SNGs health care expenditures funded by intergovernmental grants, while SNGs will have to make the necessary fiscal adjustment to cover only the portion of the expenditures funded by themselves. In the "expended by" perspective, the main difference is that the central governments would leave the intergovernmental transfer system untouched and, thus, SNGs would be responsible for a stronger adjustment that should also cover the asymmetries between the growth of health care expenditures and intergovernmental transfers channelled to fund health care (not necessarily earmarked to health care).

78. In a summary, based on these approaches, it can be said that the "expended by" approach, therefore, reflects a "no policy change" scenario for intergovernmental transfers, which is likely to happen (or even to be happening at this moment) for a period in which SNGs are able to fund the gradual increases in health care expenditures themselves or to ignore the need to increase health care expenditures as the impact on public services is not yet substantial. At some point, with higher pressures to increase health care expenditures, as SNGs suffer from limited autonomy to raise revenues (Dougherty, Harding, et al., 2019), it is likely that some SNGs will lack sufficient ammunition to raise the necessary revenues to fund the expenditure growth caused by population ageing. In this case, central governments might opt to step in to compensate for the asymmetry between the growth of health care expenditure and intergovernmental grants and, thus, the "funded by" approach could better reflect the fiscal burden of population ageing across levels of government. Therefore, the "expended by" approach can be interpreted as the immediate scenario, without changes to fiscal federalism, while the "funded by" could be considered a longer-term scenario, when intergovernmental transfers are adjusted in proportion to the growth in health care demand. Yet another possibility is that central governments could opt to compensate SNGs for even health expenditures that they do not fund.