OECD Economics Department Working Papers

Drivers of public debt reductions: Lessons from past episodes in OECD countries

By: Álvaro Pina, Mauricio Hitschfeld and Takashi Miyahara

No. 1841

OECD

OECD Economics Department Working Papers

Drivers of public debt reductions: Lessons from past episodes in OECD countries

No. 1841

ABSTRACT/RÉSUMÉ

Drivers of public debt reductions: Lessons from past episodes in OECD countries

We analyse 34 debt reduction episodes since the late 1970s in OECD countries, focussing on the contribution from the change (often an increase) in the primary balance. This change is decomposed into three components (cyclical, discretionary and one-off) as well as into a detailed set of budget items on both revenue and expenditure sides, using an updated version of the OECD Public Finance Dataset. Favourable cyclical conditions have been the main driver of declining debt-to-GDP ratios, both through denominator effects and through an improvement in primary balances. Discretionary fiscal consolidation efforts, mostly on the expenditure side, have been a more modest driver of debt reduction during the episodes themselves, but have taken place on a larger scale in the run-up to the episodes. During debt reduction episodes, overall expenditure restraint appears to have been accompanied by growth-friendly shifts in the composition of public spending, mainly to the benefit of human capital formation. This reflects broader trends, such as the generalised increase in health expenditure, but also containment of spending on pensions and subsidies. On the revenue side, corporate income taxes have made the largest contribution to the improvement in primary balances.

JEL: E62, E65, H20, H50, H63

Keywords: public debt, debt decomposition, fiscal consolidation, budgetary composition

Facteurs de réduction de la dette publique : enseignements tirés des épisodes passés dans les pays de l'OCDE

Nous analysons 34 épisodes de réduction de la dette depuis la fin des années 1970 dans les pays de l'OCDE, en nous concentrant sur la contribution de la variation (souvent une augmentation) du solde primaire. Ce changement est décomposé en trois composantes (cyclique, discrétionnaire et ponctuelle) ainsi qu'en un ensemble détaillé de postes budgétaires tant du côté des recettes que des dépenses, à l'aide d'une version mise à jour de l'ensemble de données de l'OCDE sur les finances publiques. Des conditions cycliques favorables ont été le principal moteur de la baisse des ratios dette/PIB, à la fois par des effets de dénominateur et par une amélioration des soldes primaires. Les efforts discrétionnaires d'assainissement budgétaire, principalement du côté des dépenses, ont été un moteur plus modeste de réduction de la dette au cours des épisodes eux-mêmes, mais ont été déployés à plus grande échelle dans la période précédant ces épisodes. Lors des épisodes de réduction de la dette, la modération de l'ensemble des dépenses semble s'être accompagnée de changements dans la composition des dépenses publiques favorables à la croissance, principalement au profit de la formation du capital humain. Ces changements reflètent de certaines évolutions observées plus largement, comme l'augmentation généralisée des dépenses de santé, mais aussi la maîtrise des dépenses liées aux régimes de pensions et aux subventions. Du côté des recettes, ce sont les impôts sur les sociétés qui ont le plus contribué à l'amélioration des soldes primaires.

JEL: E62, E65, H20, H50, H63

Mots clés : dette publique, décomposition de la dette, consolidation budgétaire, composition budgétaire

Table of contents

FIGURES

TABLES

Drivers of public debt reductions: Lessons from past episodes in OECD countries

By Álvaro Pina, Mauricio Hitschfeld and Takashi Miyahara[1]

1. Introduction

Public debt stands at historically high levels and on current policies is set to increase further. Overall OECD general government gross financial liabilities are estimated to have reached 112% of GDP at the end of 2024, almost 40 percentage points higher than in 2007, before the global financial crisis (OECD, 2025). In the absence of any offsetting fiscal policy adjustment, the ratio of public debt to GDP in the median G7 country could rise substantially further by 2040 (OECD, 2023; Guillemette and Château, 2023), reflecting inter alia increasing debt service costs and ageing-related expenditure. Higher outlays on defence and climate change mitigation and adaptation will further compound fiscal pressures. In dealing with these challenges and striving to preserve debt sustainability, governments can draw on the lessons from past episodes in which countries have achieved large and sustained reductions in their debt-to-GDP ratios.

This paper identifies 34 debt reduction episodes since the late 1970s in OECD member states, with 25 countries having experienced at least one episode during this period. On average, these debt reduction episodes have lasted 9 years, with a total decline of 27 percentage points in the debt-to-GDP ratio. The drivers of the debt reduction and the evolution of different revenue and expenditure components during these episodes are explored in detail. The most widely-used debt decomposition relates changes in the debt-to-GDP ratio to the primary balance, the "snowball effect" (based on the growth rate-debt interest rate differential) and a residual stock-flow adjustment. We extend this in two main dimensions:

- First, we decompose the headline primary balance into three different components – the impact of the economic cycle, "one-off" (non-recurrent) operations affecting public revenue or spending, and the underlying primary balance. The latter excludes cyclical and one-off factors, and can be used to assess the fiscal stance and fiscal consolidation efforts.

[1] Álvaro Pina and Mauricio Hitschfeld are members of the OECD Economics Department. Takashi Miyahara is a member of the OECD Statistics and Data Directorate, but was at the Economics Department when most of the research leading to this paper was carried out. Álvaro Pina is also affiliated with ISEG Lisbon School of Economics & Management, Universidade de Lisboa; ISEG Research; and UECE – Research Unit on Complexity and Economics. Comments by Ben Conigrave, Alain de Serres, Nigel Pain, Sébastien Turban (all from the OECD Economics Department) and participants at seminars or presentations given at the OECD, the IMF and the ESCB (European System of Central Banks) 2025 Public Finance Workshop are gratefully acknowledged. Isabelle Fakih and Elisabetta Pilati provided excellent editorial support.

- Second, drawing on an update of the OECD Public Finance Dataset (Cournède et al., 2014; Bloch et al., 2016), we perform a detailed disaggregation of primary revenue and primary expenditure changes during debt reduction episodes, identifying which budget items have borne the brunt of the adjustment and which have been comparatively spared.

Several key findings emerge from the analysis:

- Reductions in the debt-to-GDP ratio have typically required a primary surplus to be achieved and sustained over several years, as well as above-trend GDP growth.
- Improved cyclical conditions have been the most widespread source of improvements in the primary balance during debt reduction episodes. The contribution from fiscal consolidation during the episodes, measured by improvements in the underlying primary balance, has been comparatively modest and essentially on the expenditure side.
- Declines in underlying primary expenditure as a share of potential GDP during the episodes have often stemmed from pensions, subsidies, unemployment benefits, and wages and intermediate consumption unrelated to health or education (hereafter referred to as "other wages and intermediate consumption"). In contrast, expenditure on education, families and children, investment and healthcare has been largely spared.
- Although underlying primary expenditure has declined (relative to potential GDP), its composition appears to have become more growth-friendly during debt reduction episodes. Spending on healthcare, families and children and, to a smaller extent, education and public investment typically account for a greater share of expenditure, while the share of subsidies and unemployment benefits has declined (even after removing the impact of the economic cycle). The equity-friendliness of expenditure has seen mixed developments, as it tends to improve with higher shares of spending on healthcare, families and children and education but to worsen when unemployment support becomes less important.
- Revenue has typically accounted for only a small part of the primary balance improvements during debt reduction episodes, with an average negative contribution across episodes in both actual and underlying terms. However, proceeds from cyclically-adjusted corporate income taxes have increased in virtually all cases relative to potential GDP, and often by significant amounts. In contrast, cyclically-adjusted personal income taxes and social security contributions have tended to decline.
- Sizeable fiscal consolidation, mainly on the expenditure side, has often taken place in the run-up to debt reduction episodes, with the debt-to-GDP ratio only starting to decline sometime after consolidation has begun. This finding is corroborated by a separate analysis of action-based consolidation datasets. The conclusions about which budget items bear most of the adjustment do not change significantly when taking these consolidation efforts into account, though public investment now appears to have been less preserved.
- The dynamics of some components of underlying primary expenditure and revenue as a share of potential GDP differ significantly between debt reduction episodes (including the run-up years) and other periods. Typically, there is stronger restraint in pensions and subsidies during debt reduction episodes (broadly neutralising the upward trend in the former) and stronger rises in corporate tax receipts. In contrast, there is little difference in the growth of health expenditure.

The analysis and findings in this paper can be related to different strands of empirical research on fiscal policy. Many studies have examined the drivers of public debt by performing accounting decompositions of changes in the debt-to-GDP ratio, including debt ratio reductions (Mauro and Zilinsky, 2016; Eichengreen et al., 2019; Rawdanowicz et al., 2021; Panizza and Powell, 2023). While sharing a common conceptual framework, debt decompositions can be implemented in a variety of ways to analyse particular debt drivers, such as interest costs (Hall and Sargent, 2011; Das and Ghate, 2022) or the stock-flow adjustment (Campos et al., 2006; Schuster et al., 2024). We focus instead on the primary balance,

providing a novel contribution by disaggregating it into multiple expenditure and revenue items and disentangling cyclical and discretionary components.

The finding that GDP growth outweighs discretionary fiscal consolidation as a driver of declining debt-to-GDP ratios echoes earlier studies. In a different debt decomposition framework, Mauro and Zilinsky (2016) also document the importance of strong growth in primary surpluses. With a SVAR approach, Ando et al. (2023) and Patel and Peralta-Alva (2024) find that improvements in primary balances are often unaccompanied by a reduction in debt ratios and that GDP growth outweighs discretionary fiscal policy changes as a driver of those ratios. Our analysis of the dynamics of detailed expenditure and revenue components during debt reduction episodes also adds to the literature on the composition of the public finances (Cournède et al., 2014; Fournier and Johansson, 2016) and highlights the scope for budgets to become more growth-friendly during periods of debt reduction.

The remainder of this paper is organised as follows. Section 2 sets out the identification of debt reduction episodes and a number of accounting decompositions of changes in the debt-to-GDP ratio. Section 3 decomposes changes in primary revenue and primary expenditure over each debt reduction episode into several budget items, highlighting which ones have been adjusted the most and associated developments in the composition of the public finances. Because substantial consolidation efforts have often taken place in the run-up to debt reduction episodes, Section 4 repeats the previous analyses by taking changes in revenue and expenditure over each episode relative to the whole of that run-up period (instead of the single year immediately before the episode starts). It also examines the extent to which action-based consolidation efforts identified in the literature coincide with the set of debt reduction episodes or their run-up periods. Section 5 examines whether developments in the different expenditure and revenue items during debt reduction episodes (and their run-up periods) differ from those in the rest of the sample or, on the contrary, largely reflect persisting trends. Section 6 offers some concluding remarks and suggests avenues for further work.

2. Identifying debt reduction episodes and the drivers of debt dynamics

Debt reduction episodes are defined as ones that persist for a minimum of five years and bring down the gross general government debt-to-GDP ratio by at least 10 percentage points.[2] These thresholds are arbitrary but ensure a focus on cases of sustained and substantial decreases in debt ratios while avoiding the risk of an excessively small sample. Temporary and small debt ratio reversals are allowed from one year to the next during such episodes, but all episodes start in a year after the peak in the debt ratio and end when the debt-to-GDP ratio bottoms out.[3] The analysis covers the period from the late 1970s to 2019, though data availability is limited for some OECD countries. In all, 25 separate countries have experienced at least one period of sustained debt reduction during this time.[4]

[2] Throughout this paper, government debt is defined as general government gross financial liabilities (variable GGFL in the OECD Economic Outlook Database Documentation), which differs from the Maastricht definition.

[3] Reversals cannot exceed 2 years or a cumulative 5 percentage points. Only one potential episode (Italy, 1979-1983) is excluded because these reversal thresholds are exceeded.

[4] The dataset for this paper starts in 1976, therefore excluding the episodes of debt reduction after World War II (Eichengreen et al., 2019). In addition, a few post-1970s debt reduction episodes that meet the required threshold for inclusion (Switzerland, 1978-1990; Israel, 1990-2000; Hungary, 1994-2001) have not been incorporated due to data limitations precluding the debt decomposition presented in Figure 1 below.

Accounting decompositions of changes in the debt-to-GDP ratio (d) typically consider three components (Rawdanowicz et al., 2021): the primary balance-to-GDP ratio b (hereafter the "primary balance"), the interaction of debt and the differential between the implicit nominal interest rate on debt (i) and nominal GDP growth g (the so called "snowball effect"), and a residual stock-flow adjustment as a share of GDP (hereafter the "stock-flow adjustment", a). The latter summarises changes in gross debt unaccounted for by the budget balance.[5]

$$\Delta d_t = \frac{i_t - g_t}{1 + g_t} d_{t-1} - b_t + a_t \qquad [1]$$

Equation [1] can also be written in terms of annual averages over the length of each debt reduction episode, denoted as lasting from year 1 to year *k*, with d_0 denoting the debt stock prevailing at the start of the episode (Annex A provides details on the derivations):

$$\frac{d_k - d_0}{k} = \frac{\sum_{t=1}^{k} \frac{i_t - g_t}{1+g_t} d_{t-1}}{k} - \frac{\sum_{t=1}^{k} b_t}{k} + \frac{\sum_{t=1}^{k} a_t}{k} \qquad [2]$$

The average primary balance over each debt reduction episode in [2] can be further decomposed into the initial balance at the time when the debt ratio peaks (year 0) and the average primary balance change over the length of the episode relative to the initial value. Likewise, the aggregate snowball effect can be expressed in real terms and split to show separate impacts due to the real interest rate on debt (r, with inflation measured by the GDP deflator) and real GDP growth (g*).

$$\frac{d_k - d_0}{k} = \frac{\sum_{t=1}^{k} \frac{r_t}{1+g_t^*} d_{t-1}}{k} - \frac{\sum_{t=1}^{k} \frac{g_t^*}{1+g_t^*} d_{t-1}}{k} - b_0 - \left(\frac{\sum_{t=1}^{k} b_t}{k} - b_0 \right) + \frac{\sum_{t=1}^{k} a_t}{k} \qquad [3]$$

The decomposition of each debt reduction episode is shown in Figure 1. Several aspects are worth highlighting from this and Table 1:

- Taking a simple average across the 34 episodes, the annual reduction in the debt ratio is 3.2 percentage points, mainly accounted for by GDP growth (yellow bars, contributing 2.1 percentage points per annum on average) and primary balance improvements (light blue bars, contributing 2.0 percentage points per annum on average).[6]
- In all but three episodes the primary balance (sum of light blue and grey bars) is on average in surplus (i.e. less than 0 in Figure 1), thus contributing to a reduction in the debt ratio. In around four-fifths of the episodes this is due to improvements in the primary balance during the episode itself and, less frequently (in about two-fifths of the episodes), to a positive starting value of the primary balance.
- In about two-thirds of the episodes, and in all but one of the 14 episodes that have begun since the year 2000, the snowball effect (sum of orange and yellow bars) contributes positively to debt reductions. GDP growth has on average been stronger than in other periods, reflecting favourable cyclical conditions during debt reduction episodes (see below), and the real interest rate has often been only marginally positive or even negative.

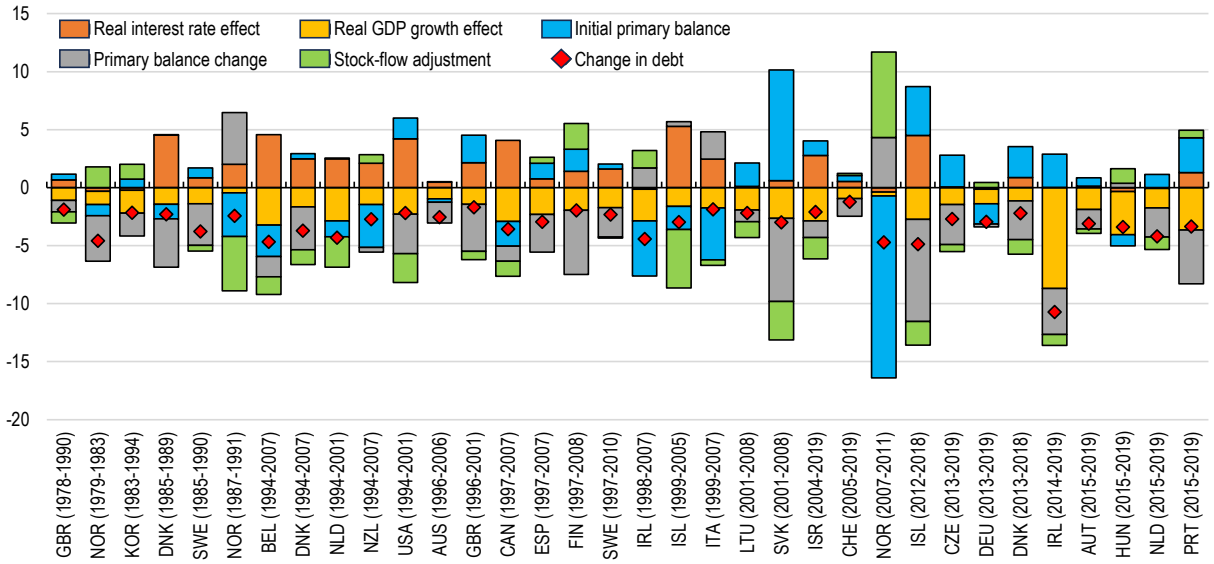
[5] Examples are valuation effects and purchases or sales of financial assets by the general government. In this paper, the stock-flow adjustment also includes, with a negative sign, the interest receipts of general government.

[6] Table 1 shows a slightly different average for the annual reduction in the debt ratio (3.0 percentage points). This is computed across all relevant (country,year) observations (300 in total), whereas the 3.2 average is computed across episodes, which last for a variable number of years.

- The stock-flow adjustment has contributed to debt reduction in 21 out of the 34 episodes, and by an average 0.5 percentage points per year across all episodes. The inclusion of government interest receipts (see footnote 5) largely explains this, but the remainder also lowers debt in a significant number of episodes (14). When it does not, it increases gross debt the most in countries with large government financial assets, such as Finland or Norway.[7]

Figure 1. Decomposition of the average annual change in the debt ratio during debt reduction episodes

Per cent of GDP



Note: The chart shows the average annual change in the debt ratio over the length of each episode and its decomposition according to equation [3] in the text. Episodes are ordered chronologically by starting year. A negative bar indicates that the particular factor has helped to lower debt over the period shown.
Source: OECD Economic Outlook 115 database; and authors' calculations.

GDP growth has on average been significantly higher – by over 1.3 percentage points – during debt reduction episodes than in the rest of the sample (Table 1). In contrast, real interest rates have, if anything, been slightly more unfavourable (i.e., higher) during episodes than outside them, the difference mainly stemming from somewhat lower inflation. While the distribution of interest receipts across years inside and outside debt reduction episodes has been very similar, the remainder of the stock-flow adjustment has on average been debt-increasing, and significantly more so, in years outside debt reduction episodes.

[7] One possibility is that these debt-increasing stock-flow adjustments were mainly induced by purchases of financial assets, rather than by less benign drivers, such as the materialisation of contingent liabilities (IMF, 2024). A detailed analysis of the stock-flow adjustment is beyond the scope of this paper.

Table 1. Summary statistics for selected debt decomposition variables

	Obs.	Mean	Std. dev	p5	Median	p95
Change in debt/GDP (% pts.)						
Full sample	1,078	1.15	5.48	-5.90	0.47	10.83
DRE	300	-3.03***	3.37	-8.38	-2.39	0.71
non-DRE	778	2.77	5.28	-3.17	1.85	12.41
Real GDP growth (%)						
Full sample	1,078	2.72	2.94	-1.41	2.66	7.15
DRE	300	3.69***	2.70	0.48	3.28	8.79
non-DRE	778	2.34	2.95	-2.64	2.46	6.83
Real interest rate (%)						
Full sample	1,078	2.23	3.75	-3.42	2.26	7.50
DRE	300	2.55*	3.36	-2.66	2.28	7.44
non-DRE	778	2.11	3.89	-4.18	2.25	7.50
Nominal interest rate (%)						
Full sample	1,078	5.54	3.54	1.33	4.73	11.72
DRE	300	5.60	3.41	1.53	4.92	11.55
non-DRE	778	5.51	3.60	1.25	4.62	11.87
Inflation (%)						
Full sample	1,078	3.31	3.60	-0.48	2.35	10.35
DRE	300	3.02*	2.82	0.09	2.27	8.54
non-DRE	778	3.42	3.85	-0.67	2.40	10.88
Stock-flow adjusment (% GDP)						
Full sample	1,078	0.72	4.19	-4.47	0.44	7.33
DRE	300	-0.49***	3.19	-5.91	-0.51	3.90
non-DRE	778	1.19	4.43	-3.90	0.84	7.93
Interest receipts (% GDP)						
Full sample	1,078	-1.19	1.32	-3.86	-0.69	-0.15
DRE	300	-1.27	1.44	-4.84	-0.75	-0.14
non-DRE	778	-1.16	1.27	-3.77	-0.67	-0.17
Stock-flow adjusment (rest) (% GDP)						
Full sample	1,078	1.91	4.45	-3.02	1.35	8.46
DRE	300	0.77***	3.35	-3.40	0.48	5.29
non-DRE	778	2.35	4.73	-2.86	1.70	9.25

Note: DRE denotes debt reduction episodes. Interest rates are those implicit on public debt and inflation is measured by the GDP deflator. Interest receipts are taken with a minus sign (see footnote 5). The annual dataset used starts in 1976 and covers OECD countries and years with available data to implement the debt decomposition set out in equation [3]. When data only exists for some of the years of a debt reduction episode (see footnote 4), the corresponding observations have been excluded. The asterisks indicate the statistical significance of the difference in means between the DRE and non-DRE subsamples: * p<0.10, ** p<0.05, *** p<0.01.

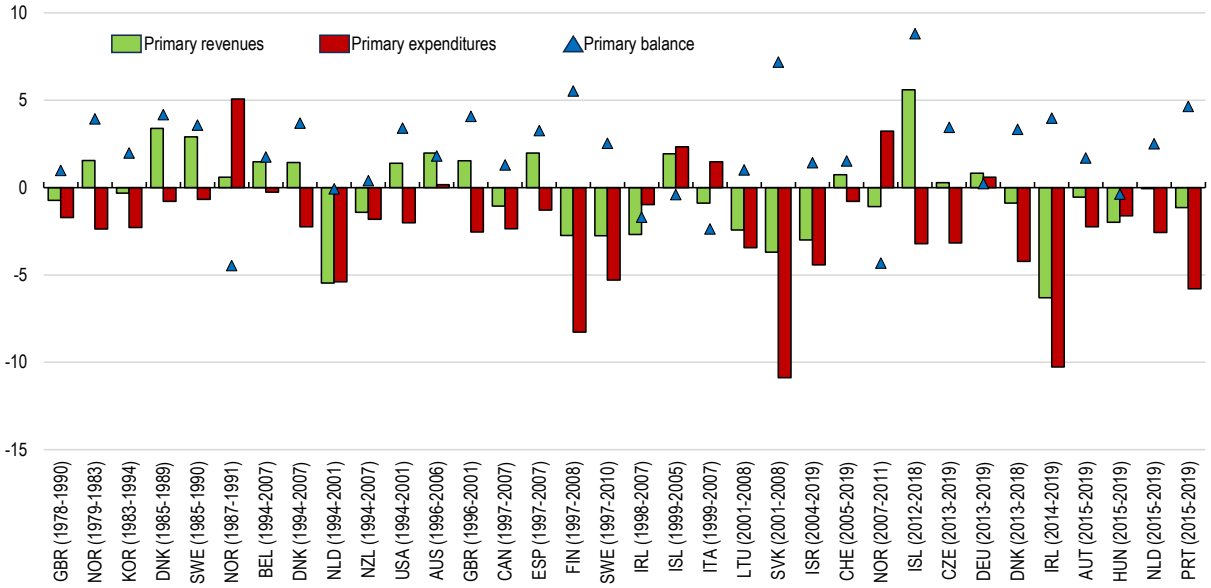
Decomposing changes in primary balances: revenue versus expenditure

Improvements in the primary balance during debt reduction episodes have clearly been an important source of debt ratio reductions. This raises the question of whether such improvements have occurred mainly through lower primary expenditure to GDP, or from increases in primary revenue to GDP. The separate contributions from expenditure and revenue to the identified change in the primary balance during the 34 debt reduction episodes are shown in Figure 2.

- The major source of the improvements in the primary balance has been a decline in the share of primary expenditure in GDP (shown as a red bar less than 0 in Figure 2). Such declines have occurred in over 80% of the 34 debt reduction episodes.
- Increases in the primary revenue-to-GDP ratio (shown as a green bar above 0 in Figure 2) have occurred in fewer than half of the debt reduction episodes, and mostly for episodes that began in the 1980s and 1990s. This issue is discussed further in Section 5, with evidence that stronger revenue increases are more likely to be associated with consolidation efforts that do not result in sustained debt reductions, particularly personal income tax increases.
- Taking a simple average across all 34 episodes, primary expenditure and primary revenue decreased by 2.4 and 0.3 percentage points of GDP, respectively.

Figure 2. Primary expenditure restraint has occurred in most debt reduction episodes

Difference between annual average over debt reduction episode and initial value, per cent of GDP



Note: The chart shows the change in the primary balance, defined as the average primary balance over the length of each episode minus its initial value, and its decomposition into the changes in primary revenue and primary expenditure. The change in the primary balance (triangles) is the same as in Figure 1 (grey bars) but, unlike in Figure 1, a positive value now indicates an improvement which helps to lower debt. Episodes are ordered chronologically by starting year. Negative red bars denote expenditure decreases and positive green bars denote revenue increases, both contributing to a better balance.
Source: OECD Economic Outlook 115 database and authors' calculations.

Decomposing changes in primary balances: consolidation, cyclical factors and one-offs

Improvements in the primary balance during debt reduction episodes can occur through discretionary fiscal consolidation efforts (measured by increases in the underlying primary balance as a share of potential GDP) or through other factors, such as improved cyclical conditions or favourable one-off factors.

To shed light on this question, the primary balance-to-GDP ratio (b) can be rewritten as

$$b_t = b_t^U + c_t + noo_t, \qquad [4]$$

where b^U denotes the underlying primary balance (i.e., the primary balance corrected for the cycle and for one-offs), *noo* denotes the amount of net one-offs (both relative to potential output), and c is an approximation to the primary balance's cyclical component (see Annex A).[8] It follows that the average annual change in the primary balance over each debt reduction episode relative to its initial value (in year 0, when the debt ratio peaks) is given by:

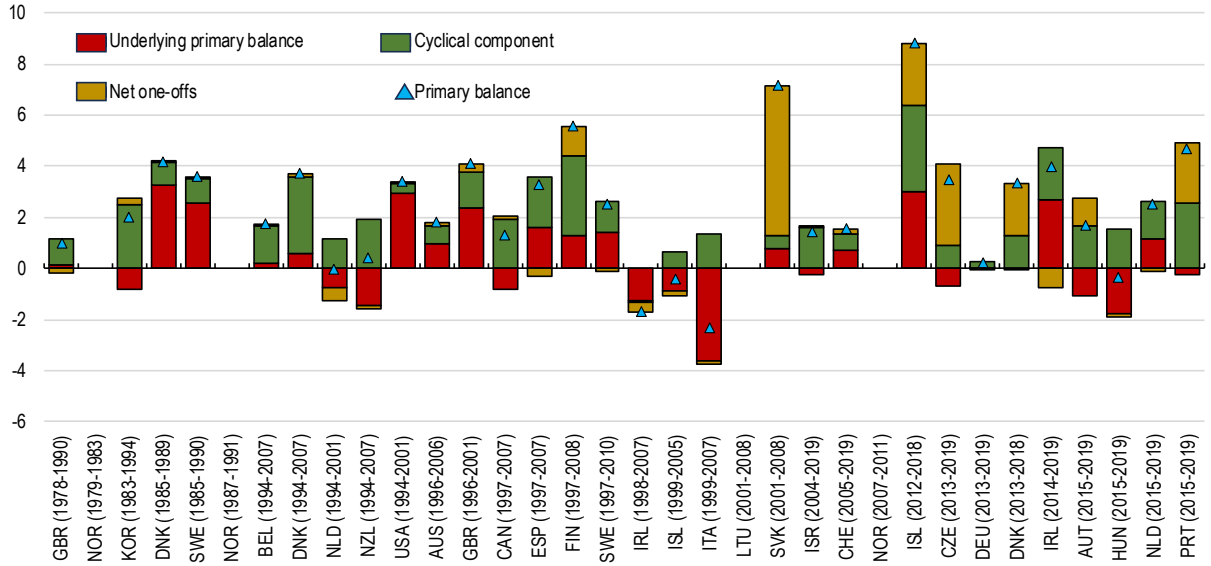
$$\frac{\sum_{t=1}^{k} b_t}{k} - b_0 = \left(\frac{\sum_{t=1}^{k} b_t^U}{k} - b_0^U\right) + \left(\frac{\sum_{t=1}^{k} c_t}{k} - c_0\right) + \left(\frac{\sum_{t=1}^{k} noo_t}{k} - noo_0\right) \qquad [5]$$

[8] The exact expression of c_t is given by $c_t = cc_t - b_t gap_t$, where cc is the cyclical component of the primary balance as a share of potential GDP and gap is the output gap. The term $b_t gap_t$ will typically be very small, making c close to cc and in general increasing with the output gap. See Price et al. (2015) and OECD (2024) for further details on the cyclical adjustment of budget balances.

This decomposition is shown in Figure 3 for 30 episodes.[9]

Figure 3. Cyclical conditions have tended to improve primary balances during debt reduction episodes

Difference between annual average over debt reduction episode and initial value, per cent of actual or potential GDP



Note: The chart shows the change in the primary balance as a share of GDP, defined as the average primary balance over the length of each episode minus its initial value, and its decomposition into the changes in the underlying primary balance, net one-offs (both as a share of potential GDP) and the cyclical component of the (primary) budget balance. The change in the primary balance (triangles) is the same as in Figure 1 (grey bars) but, unlike in Figure 1, a positive value now indicates an improvement which helps to lower debt. Episodes are ordered chronologically by starting year.
Source: OECD Economic Outlook 115 database; and authors' calculations.

- The most frequent source of improvement in the primary balance (relative to the initial value) during debt reduction episodes has been an upturn in cyclical conditions (the green bar in Figure 3). Such an upturn took place in all but one of the 30 episodes shown and made the primary balance rise by an average 1.4 percentage points across all episodes.
- The role of fiscal consolidation during episodes, measured by improvements in the underlying primary balance (the red bar in Figure 3), has been comparatively modest: consolidation took place in a small majority of episodes (17 out of 30) and, in these cases, by an average 1.5% of potential GDP.
- Budget one-offs (the brown bar in Figure 3) play a minor role in most episodes, but have tended to become larger over time, making an important contribution to an improved primary balance in a few countries. This was often driven by either a large negative one-off in the year preceding the start of the episode (e.g. Portugal in 2014, mainly reflecting bank recapitalisation) or a large positive one-off during the episode (e.g. Iceland in 2016, due to "Stability Contributions" made by the estates of the failed banks).

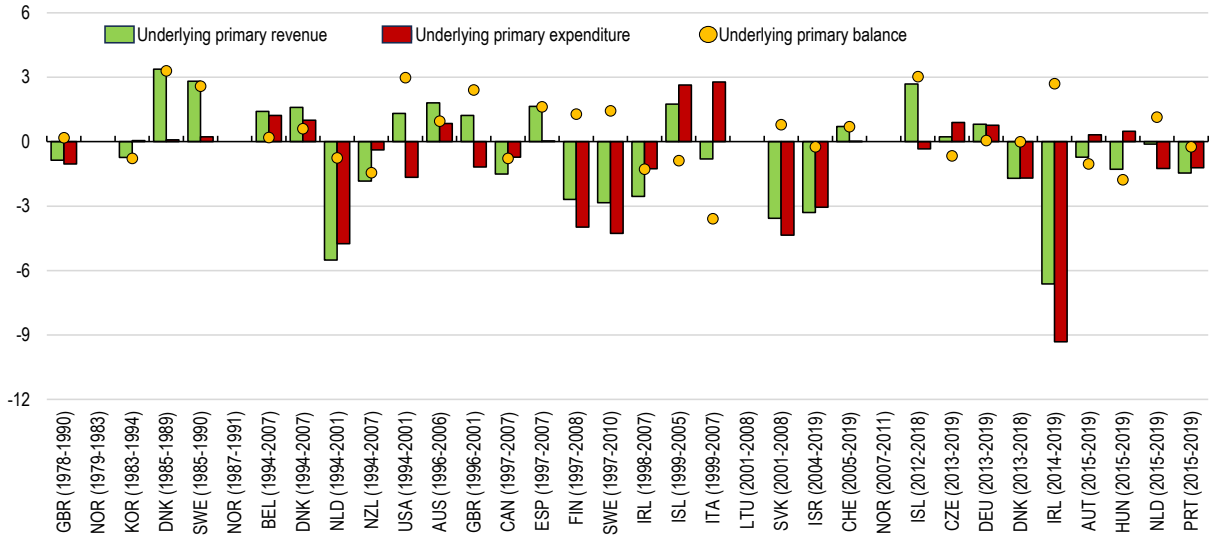
[9] The decomposition cannot be computed for four of the 34 debt reduction episodes, due to missing data for the output gap and the underlying primary balance in some years for Lithuania, and because in the OECD Economic Outlook the headline primary balance and the underlying primary balance for Norway are defined with reference to different economic perimeters (total and mainland economy, respectively).

Decomposing changes in underlying primary balances: revenue versus expenditure

A given improvement in the underlying primary balance can stem either from expenditure reductions or from increases in taxation. This issue has long been analysed in the literature on fiscal consolidation (Alesina and Perotti, 1995; Alesina et al., 2018). The separate contributions from underlying primary revenue and underlying primary expenditure to the identified change in the underlying primary balance (as a share of potential GDP) during each of the 30 debt reduction episodes are shown in Figure 4.[10]

Figure 4. Fiscal consolidation during debt reduction episodes has often been moderate and tilted towards expenditure

Difference between annual average over debt reduction episode and initial value, per cent of GDP



Note: The chart shows the change in the underlying primary balance, defined as the average underlying primary balance over the length of each episode minus its initial value, and its decomposition into the changes in underlying primary revenue and underlying primary expenditure. Episodes are ordered chronologically by starting year. As in Figure 2, negative red bars denote expenditure decreases and positive green bars denote revenue increases, both contributing to a better balance.
Source: OECD Economic Outlook 98 database; OECD Economic Outlook 115 database; AMECO database, European Commission's Directorate General for Economic and Financial Affairs; and authors' calculations.

- Relative to revenue increases, expenditure reductions have taken place slightly more often (16 vs 13 episodes) and on average more forcefully across the episodes concerned (averaging 2.5 vs 1.6 percentage points of potential GDP).
- Taking a simple average across all 30 episodes, underlying primary expenditure and underlying primary revenue decreased by 1 and 0.6 percentage points of potential GDP, respectively.

[10] Underlying primary revenue and expenditure are adjusted for the cycle and for one-offs. While the adjustment of revenue and expenditure for the cycle is set out in the OECD Economic Outlook 115 database, the adjustment for one-offs in not. Since 2015, net one-offs in OECD Economic Outlook databases have not been split into their revenue and expenditure components. To perform this split, we have resorted to earlier Economic Outlook databases as well as to other sources (Annex B).

3. Composition matters: expenditure and revenue components during debt reduction episodes

The changes in primary expenditure and revenue during debt reduction episodes can be further decomposed to identify which budget items have borne the brunt of the adjustment and which ones have been comparatively spared. Such an analysis provides insights into whether debt reduction episodes have tended to witness shifts in the composition of expenditure and taxation, or whether there have been across-the-board changes in either expenditure or taxation.

An updated version of the OECD Public Finance Dataset is used to separate public expenditure and revenue into economically meaningful components, both in nominal and in underlying terms (i.e., adjusted for the cycle and for one-offs). Relative to Bloch et al. (2016), a number of adjustments have been made to the definition of particular items to better match the scope of the analysis, increase the number of observations for some components and take better account of specific circumstances related to one-off operations.

The methodology for cyclical adjustment is the same as that used by Bloch et al. (2016), with the cyclical components of different revenue categories and of primary current expenditure estimated in the OECD Economic Outlook allocated to the corresponding revenue and expenditure items of the OECD Public Finance Dataset. Annex C provides details. Computations of budget items in underlying terms are inherently uncertain, reflecting both the estimation of the output gap and the assumed sensitivities of different revenue and expenditure categories to cyclical fluctuations.

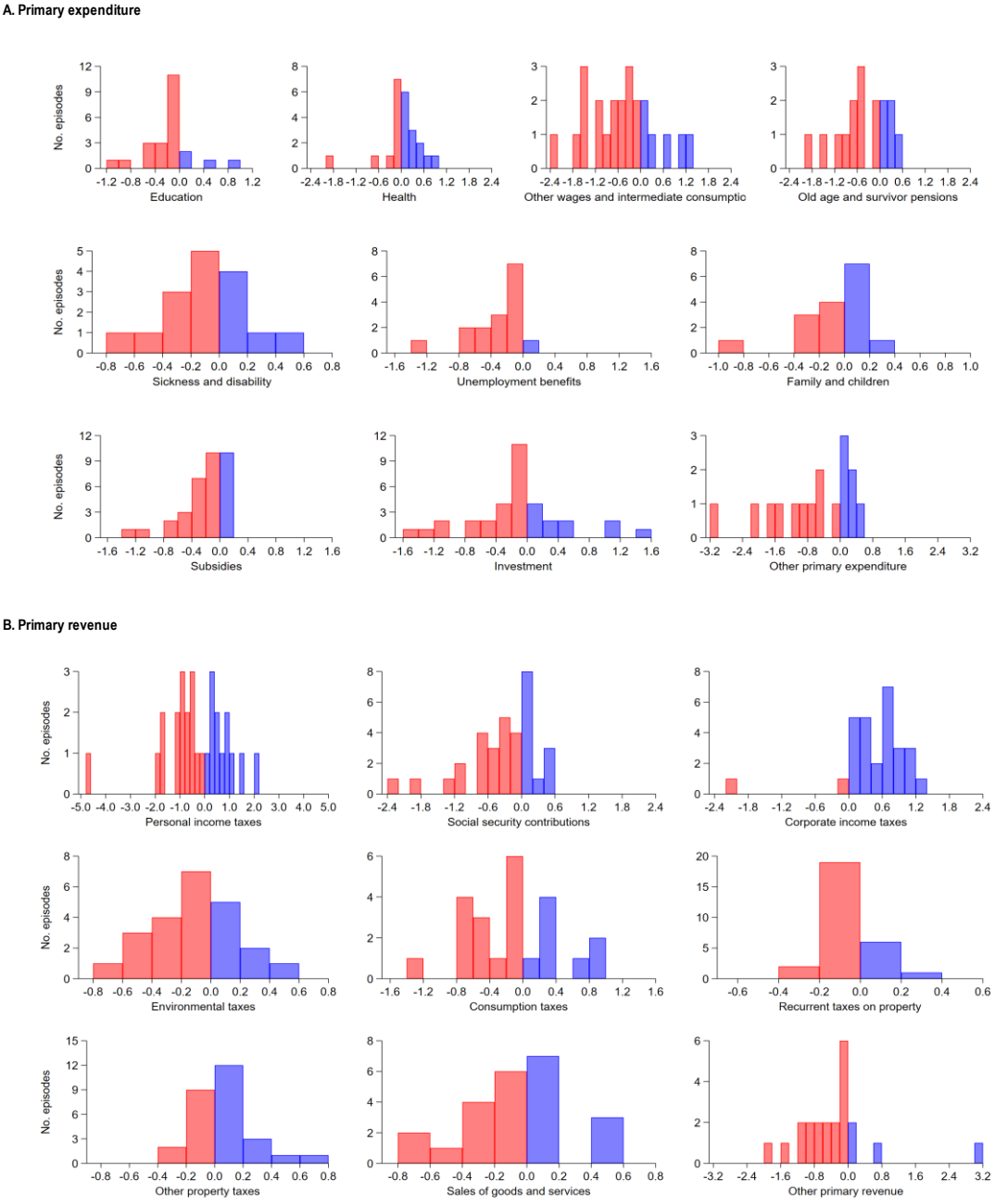
For each debt reduction episode, the change in headline primary expenditure and primary revenue as a share of GDP (red bars and green bars in Figure 2) is disaggregated into 10 and 9 components, respectively. These are presented in detail in Annex D (Tables D.1 and D.2) and their distribution across episodes is summarised in Figure 5:

- All categories of primary spending have declined relative to GDP during a majority of past debt reduction episodes, with the exception of spending on healthcare and on family and children. Declines have been particularly widespread in the case of spending on unemployment benefits, which has risen relative to GDP during only one episode.
- Reductions in spending as a share of GDP have on average been largest in pensions and two broad spending categories: other wages and intermediate consumption (including, for instance, the wages of those employed in general public services, defence or public order and safety); and other primary expenditure (which mainly comprises non-social current transfers and capital transfers).
- Corporate income taxes as a share of GDP increased in over 90% of all debt reduction episodes. This stands in sharp contrast to most other primary revenue components, which have declined relative to GDP in a majority of episodes.
- Increases in revenue from corporate income taxes relative to GDP have not only been widespread but also often large, averaging 0.5 percentage points over debt reduction episodes with available data. Personal income taxes, social security contributions and other primary revenue are the categories of revenue with the largest declines as a share of GDP across episodes.[11]

[11] Other primary revenue is a residual item mainly consisting of current and capital transfers received, as well as non-interest property income, which is large and often volatile in many countries.

Figure 5. Distribution of changes in budget components: debt reduction episodes versus previous year

Changes in ratios to GDP, percentage points, number of episodes



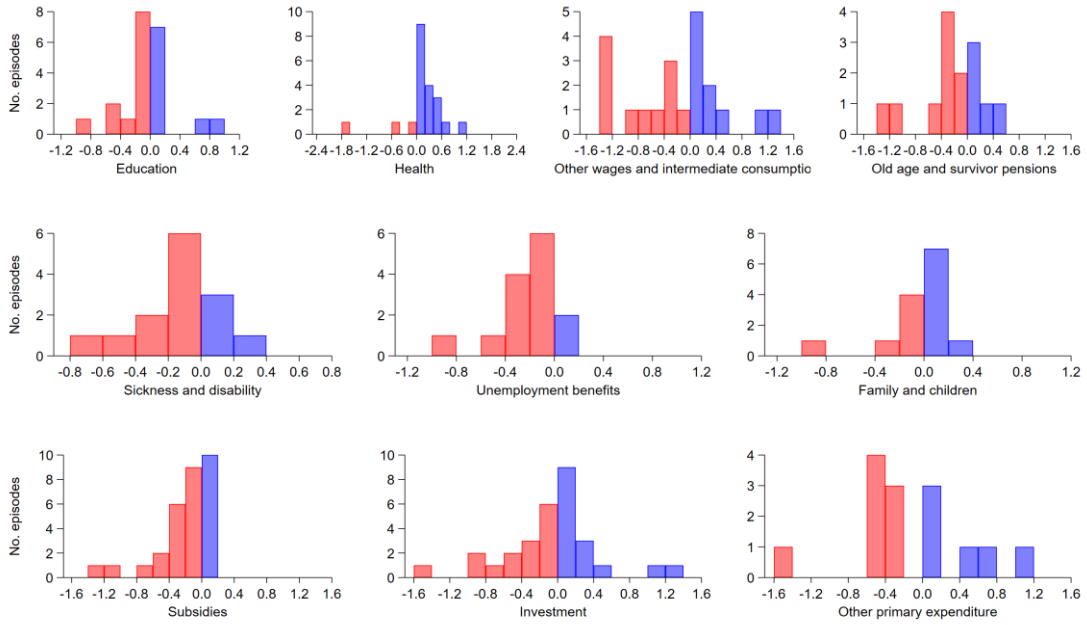
Note: The chart is based on Tables D.1 and D.2 and shows the distribution of changes in primary expenditure and revenue components as a share of GDP. Changes are defined as the average of a given component over the length of each episode minus its initial value. Blue (red) bars denote positive (negative) changes.

Source: OECD Economic Outlook 115 database; OECD Public Finance Dataset; and authors' calculations.

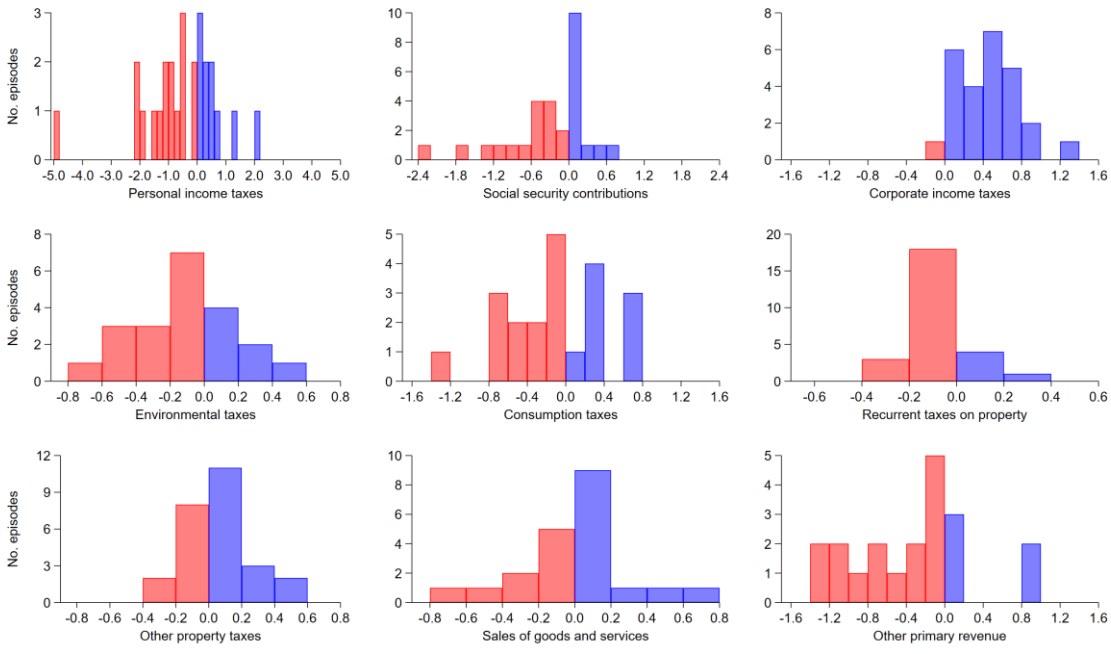
Figure 6. Distribution of changes in underlying budget components: debt reduction episodes versus previous year

Changes in ratios to potential GDP, percentage points, adjusted for the cycle and for one-offs, number of episodes

A. Underlying primary expenditure



B. Underlying primary revenue



Note: The chart is based on Table D.3 and D.4 and shows the distribution of changes in underlying primary expenditure and revenue components (i.e., components adjusted for the cycle and for one-offs) as a share of potential GDP. Changes are defined as the average of a given component over the length of each episode minus its initial value. Blue (red) bars denote positive (negative) changes.

Source: OECD Economic Outlook 98 database; OECD Economic Outlook 115 database; AMECO database, European Commission's Directorate General for Economic and Financial Affairs; and authors' calculations.

The corresponding distributions of the changes in underlying expenditure and revenue components are shown in Figure 6. (Full results are reported in Annex D, Tables D.3 and D.4.) These remove cyclical developments and one-off factors from the series shown in Figure 5.

- Underlying expenditure reductions as a share of potential GDP are generally smaller and less numerous than those of their unadjusted counterparts as a share of actual GDP. This suggests that the widespread decline in nominal ratios to GDP (Figure 5, Panel A) partly reflects the improved cyclical conditions observed in virtually all debt reduction episodes (see Figure 3). Since the difference between actual and cyclically-adjusted nominal expenditure is modest and confined to a few items (Annex C), the different results in the two decompositions mostly stem from the different denominators (actual versus potential GDP).
- It remains the case that spending on unemployment benefits generally falls in underlying terms, though often by less than in unadjusted terms.
- On average, pensions, other wages and intermediate consumption, subsidies and other primary expenditure continue to contribute to expenditure restraint.[12]
- In contrast, underlying spending on healthcare has increased during a vast majority of episodes, though often moderately. Expenditure increases and reductions are broadly balanced for education, investment, and for families and children.
- On the revenue side, differences between changes in underlying and nominal terms (Figure 6 versus Figure 5) tend to be much smaller than for expenditure. In particular, increases in revenue from corporate income taxes remains common to almost all debt reduction episodes, with their magnitude only somewhat moderated by cyclical adjustment.
- Personal income taxes, social security contributions and other primary revenue are again found to have the largest declines across episodes. Reductions in receipts from personal income taxes often become larger in underlying terms.[13]

An indicator for compositional changes in expenditure and revenue

In addition to changes in individual expenditure (revenue) items as a share of GDP, it is also of interest to see what has happened to the composition of total primary expenditure (revenue) during fiscal adjustments. To address this, the following indicator is computed for each primary expenditure component (denoted e_i):

$$\left(\prod_{t=1}^{k} \frac{e_{i,t}}{e_t}\right)^{1/k} \Big/ \frac{e_{i,0}}{e_0} \qquad [6]$$

As before, debt is defined to peak in year 0 and the debt reduction episode runs from year 1 to k. Total primary expenditure as a share of GDP is denoted by e and each of its components by e_i (i = 1, …, 10). A value of the indicator above (below) one means that on average over the episode spending component i has gained (lost) share or weight in primary expenditure relative to year 0.[14] Similar indicators can be computed for primary revenue and for underlying primary expenditure and revenue (as a share of potential GDP). In underlying terms, their distribution across episodes is summarised in Figure 7, with full results in Annex D (Tables D.5 and D.6).

[12] Reductions in these components tend nonetheless to be smaller than in unadjusted terms, especially in the case of other primary expenditure, where large decreases have sometimes been associated to one-offs.

[13] This is largely a consequence of the elasticity of direct taxes on households w.r.t. the output gap exceeding one in most countries (Price et al., 2015).

[14] The choice of a geometric average implies that results would be the same if budget items were taken in nominal terms instead of as a share of GDP.

Compositional changes in underlying primary expenditure and revenue are broadly in line with the evidence on which components tend to increase or decrease as a share of potential GDP. The main difference concerns pensions and the category other wages and intermediate consumption. These two large components of spending contribute to expenditure restraint, but often without reductions in their shares of total spending. Thus:

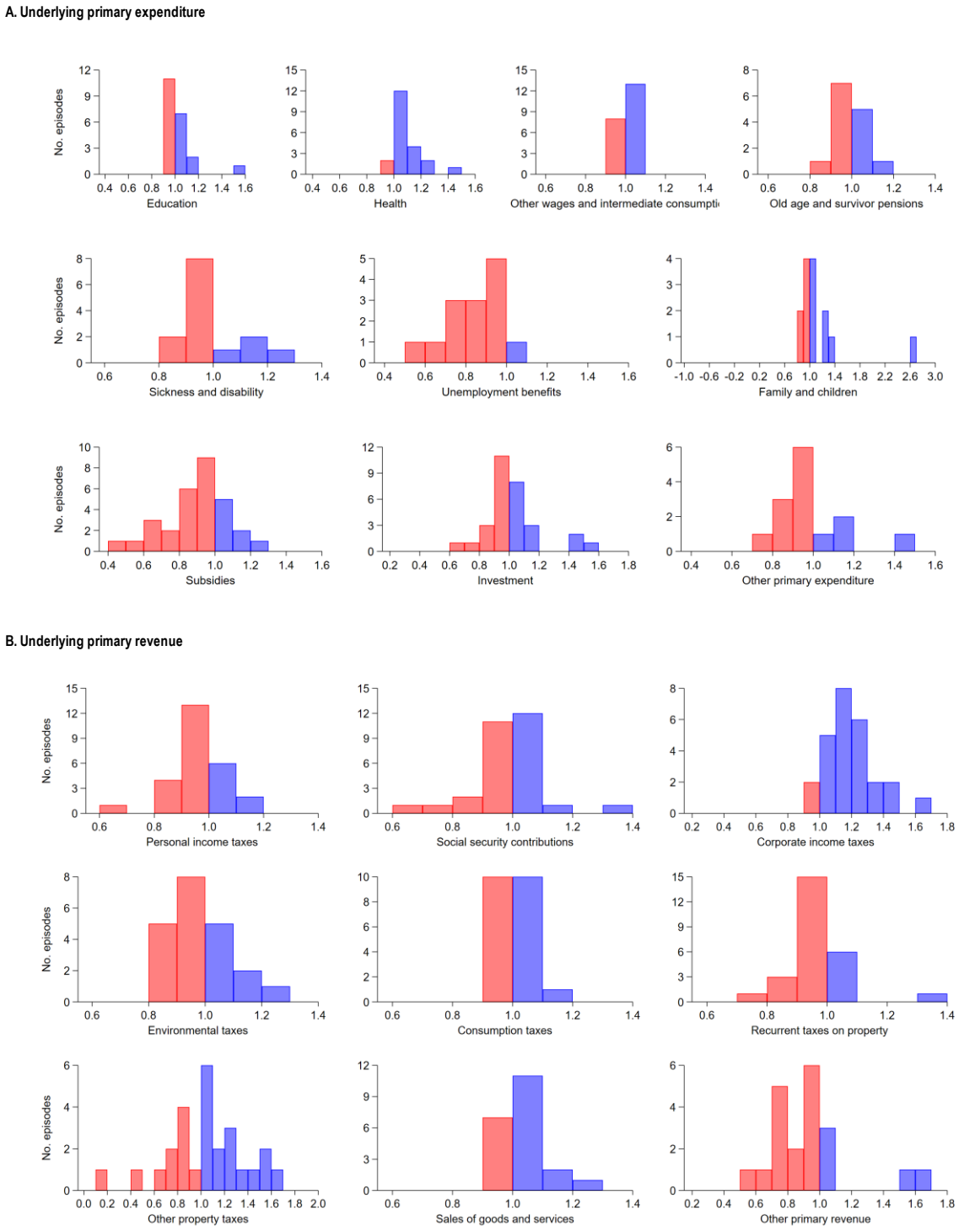
- The share of subsidies and unemployment benefits in total underlying primary expenditure tends to decline during debt reduction episodes. The opposite tends to happen with spending on healthcare, family and children and, to a smaller extent, education and public investment.
- The share of corporate income taxes in total underlying primary revenue tends to rise significantly during debt reduction episodes, at the expense of most other items. Among the largest revenue components (often personal income taxes, social security contributions and consumption taxes), it is mainly personal income taxes that tend to have lower shares.

Overall, the analysis so far suggests that expenditure restraint during debt reduction episodes has often been accompanied, and likely made more sustainable, by growth-friendly shifts in the composition of public spending. On average, public investment has mostly been spared during debt reduction episodes, becoming marginally smaller as a share of potential GDP but inching towards a larger share of underlying primary expenditure. Spending on education, health, and families and children has also been generally preserved and sometimes even increased. This is regarded as both growth and equity-friendly (Cournède et al., 2014; Fournier and Johansson, 2016) and can help human capital formation. Pensions have broadly accompanied restraint in primary expenditure as a whole. In contrast, the shares of expenditure on subsidies and unemployment benefits have been reduced considerably. These items are generally not growth-enhancing though they can be very important for the incomes and living standards of poorer households, and thus their reduction could potentially undo the equity gains from human capital-enhancing compositional shifts. However, such an assessment requires closer examination of the policy measures taken in each debt reduction episode, which is beyond the scope of the current paper.

The impact on growth and equity of the documented compositional shifts in revenue during debt reduction episodes is even harder to assess in the absence of more detailed information. Increases in corporate income tax yields tend to harm growth and decrease inequality, though growth costs may be minimised if revenue increases mostly stem from base broadening (Cournède et al., 2014; Akgun et al., 2017). At the same time, lower personal income tax yields tend to enhance growth, with impacts on inequality largely dependent on their incidence along the income distribution.

Figure 7. Distribution of changes in shares of underlying budget components: debt reduction episodes versus previous year

Adjusted for the cycle and for one-offs, number of episodes (1 = no change in share)



Note: The chart is based on Table D.5 and D.6. Changes in shares are defined according to equation [6]. Blue (red) bars denote values above (below) one, which imply that the component in question has gained (lost) share or weight in total underlying primary expenditure or revenue.
Source: OECD Economic Outlook 98 database; OECD Economic Outlook 115 database; AMECO database, European Commission's Directorate General for Economic and Financial Affairs; and authors' calculations.

4. Consolidation efforts in the run-up to debt reduction episodes

The analysis so far has focused on changes in expenditure and taxation during debt reduction episodes. However, it could be the case that fiscal consolidation mostly takes place in the run-up to a debt reduction episode, rather than during the episode itself. What drives debt dynamics is ultimately the level of the primary balance, not its change. If a country starts off debt reduction efforts with a large primary deficit, a few years of deficit reduction may need to go by before the debt ratio begins to decrease.

To analyse this issue, and assess the robustness of the findings during debt reduction episodes, we explore whether a larger improvement in the underlying primary balance (b^U) is obtained when comparing the average b^U over the debt reduction episode with the average of b^U m years prior to the episode. (Previously we looked only at b^U in the year immediately preceding the episode.) Formally, we maximise w.r.t. m (m = 1, 2, …, 5) the difference

$$\frac{\sum_{t=1}^{k} b_t^U}{k} - \frac{\sum_{t=0}^{m-1} b_{-t}^U}{m}. \qquad [7]$$

The maximum change in the underlying primary balance obtained and its decomposition into revenue and expenditure are shown in Figure 8.

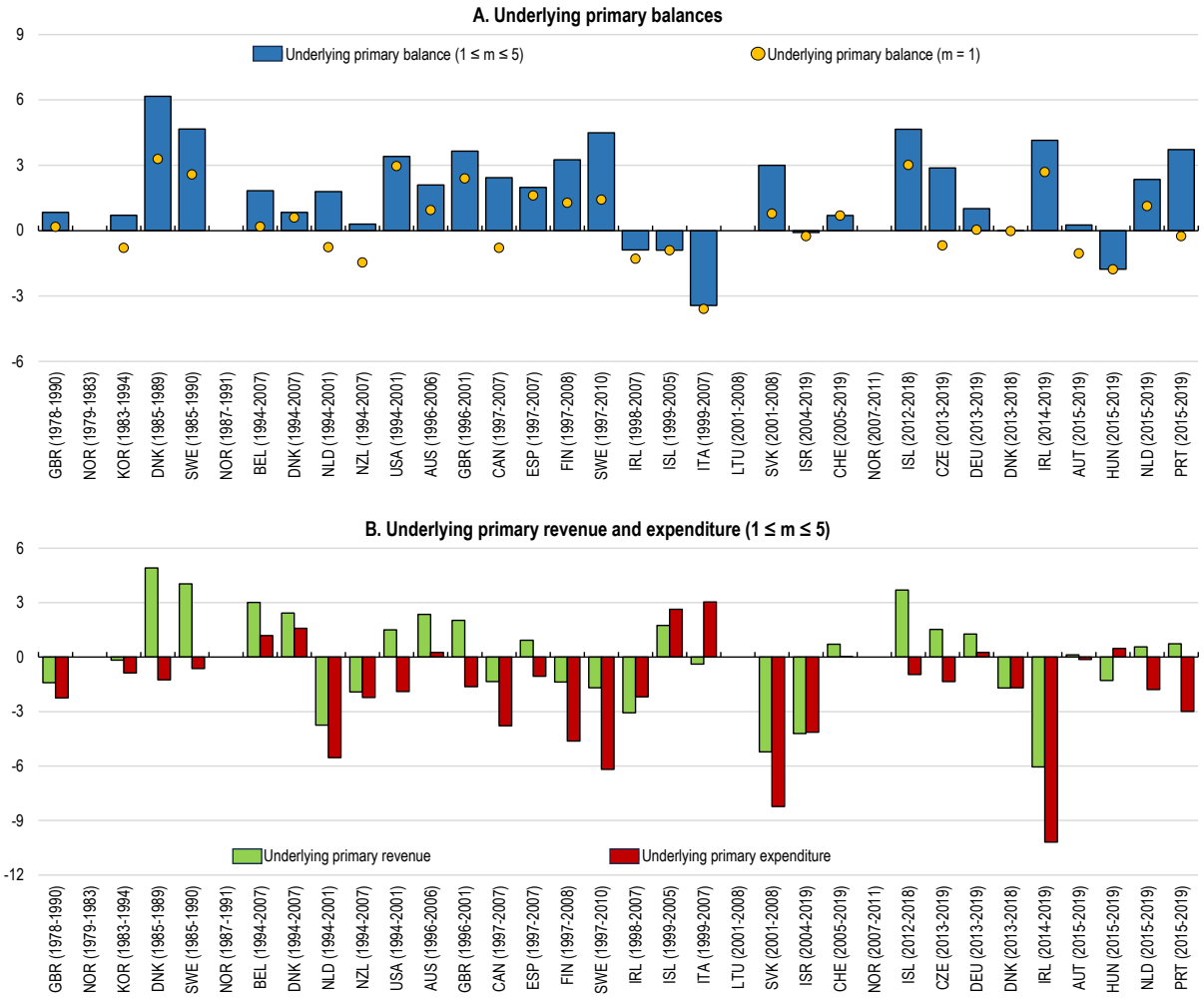
- Consolidation efforts often do take place in the run-up to a debt reduction episode. In 13 episodes the improvement in the underlying primary balance is maximised with m = 5, and in another four episodes with m = 4, against just four episodes with m = 1 (the method used in the preceding section). An improvement in the underlying primary balance as a share of potential GDP was observed in 24 out of 30 episodes and in these averaged 2.6 percentage points. With m = 1 (Sections 2 and 3), improvements averaging 1.5 percentage points took place in 17 episodes only. Across all 30 episodes, the average improvement in the underlying primary balance becomes 1.8 percentage points (setting 1 ≤ m ≤ 5), up from 0.4 percentage points (m = 1).
- Overall, consolidation becomes somewhat more tilted towards expenditure when taking account of adjustments in the years before debt reduction episodes begin. Expenditure reductions have taken place more often than revenue increases (22 vs 16 episodes setting 1 ≤ m ≤ 5; 16 vs 13 episodes with m = 1) and on average more forcefully (3.0 vs 2.0 percentage points of potential GDP in the episodes concerned, against 2.5 vs 1.6 percentage points with m = 1).
- Across all 30 episodes, underlying primary expenditure decreased by an average 1.9 percentage points of potential GDP while underlying primary revenue remained broadly unchanged.

The importance of fiscal adjustment in the run-up to debt reduction episodes is also confirmed using consolidation efforts identified through the action-based or narrative approach (Adler et al., 2024; Alesina et al., 2018; Devries et al., 2011), albeit with a smaller sample (17 OECD economies only). A number of years of budget consolidation in action-based datasets coincide with the debt reduction episodes we identify or their run-up period (defined as above). However, the action-based dataset suggests that consolidation efforts shortly before these debt reduction episodes are substantially larger, and more tilted towards expenditure, than during the episodes themselves (Figure 9).[15]

[15] Over half of the action-based consolidation efforts (measured in percent of GDP) do not have a clear link to debt reduction episodes, in that they do not take place either in the run-up to or during an episode. This is consistent with recent findings that increases in primary balances are often unaccompanied by a reduction in debt ratios (Ando et al., 2023).

Figure 8. Sizeable consolidation has often taken place in the run-up to debt reduction episodes

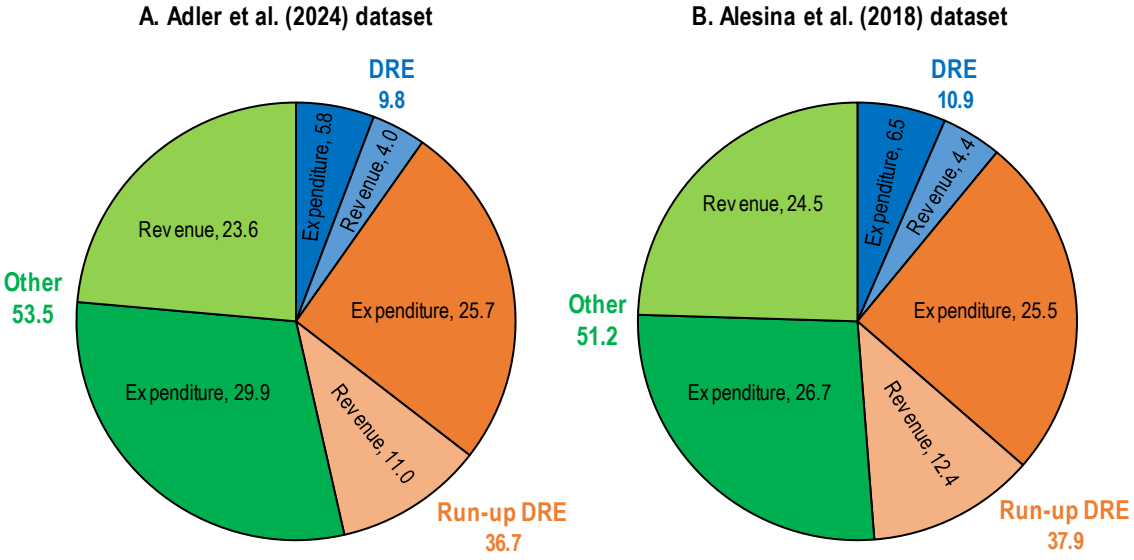
Difference between annual average over debt reduction episode and annual average in run-up period or initial value, per cent of potential GDP



Note: Panel A shows the change in the underlying primary balance, defined as the average underlying primary balance over the length of each episode minus its average in some or all of the five years prior to the debt reduction episode, so that the difference is maximised (bars), and minus its initial value (circles, which repeat those in Figure 4). Panel B shows the decomposition of the bars in Panel A into the changes in underlying primary revenue and underlying primary expenditure. Episodes are ordered chronologically by starting year. As in Figures 2 and 4, negative red bars denote expenditure decreases and positive green bars denote revenue increases, both contributing to a better balance.
Source: OECD Economic Outlook 98 database; OECD Economic Outlook 115 database; AMECO database, European Commission's Directorate General for Economic and Financial Affairs; and authors' calculations.

Figure 9. Action-based consolidation efforts have been substantial in the run-up to debt reduction episodes

Distribution of the total amount of action-based fiscal consolidation, per cent



Note: DRE denotes debt reduction episodes. The action-based datasets used have a narrower country coverage than the sample used to identify debt reduction episodes – 17 OECD countries during 1978-2020 in Adler et al. (2024) and 16 OECD countries during 1981-2014 in Alesina et al. (2018). The (few) years of consolidation identified in these datasets that are not present in the sample used for debt reduction episodes are excluded. For the Alesina et al. (2018) dataset, we date fiscal adjustments according to their year of implementation, not announcement.
Source: Alesina et al. (2018); Adler et al. (2024); OECD Economic Outlook 115 database; and authors' calculations.

The composition of consolidation in run-up years to debt reduction episodes

The revised changes in underlying primary expenditure and revenue shown in Figure 8, Panel B, can again be disaggregated into their components. Figure 10 shows the distribution across debt reduction episodes of changes in expenditure and revenue items, and Tables D.7 and D.8 in Annex D contain the complete set of results. The main changes from including adjustments in the run-up to debt reduction episodes are:

- Larger reductions (as a share of potential GDP) in the category other wages and intermediate consumption, and in public investment.
- In contrast, there is a smaller contribution from restraint in pensions spending (Figure 10 versus Figure 6).
- The previous findings on the strong adjustment of spending on subsidies and unemployment benefits, and the relative preservation of expenditure on healthcare as well as education, family and children, remain broadly unchanged.
- This is also true on the revenue side, although increases in corporate income taxes become somewhat larger, and decreases in personal income taxes somewhat smaller (Figure 10 versus Figure 6).

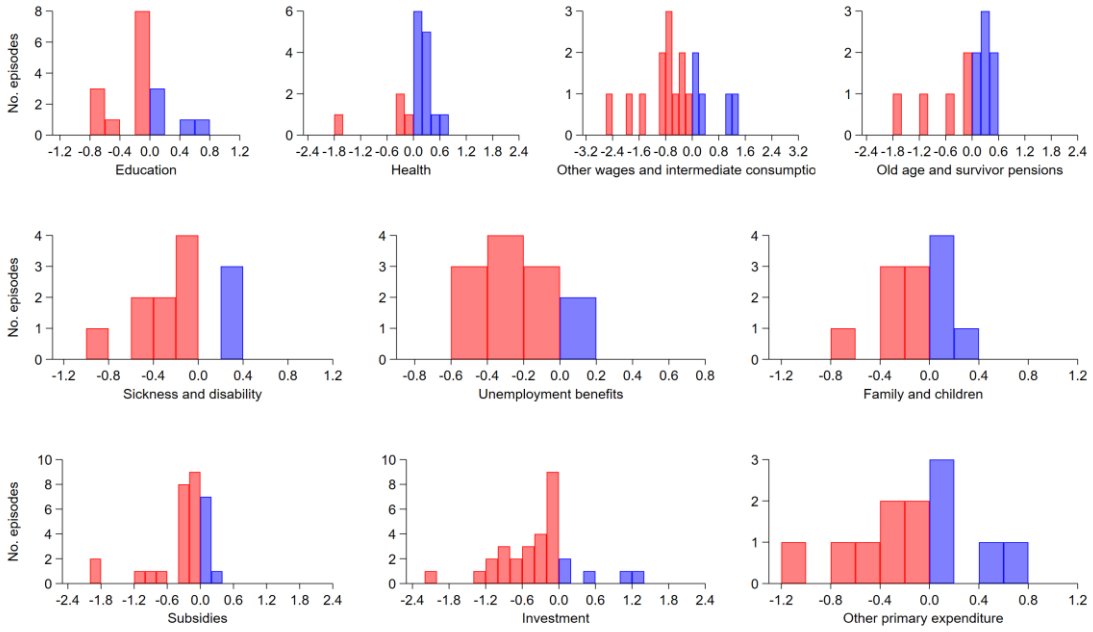
Changes in the composition of underlying primary expenditure and revenue when comparing each debt reduction episode with the respective m year-long run-up period are shown in Figure 11, with full results in Tables D.9 and D.10 in Annex D. The changes are assessed using a revised version of [6]:

$$\left(\prod_{t=1}^{k}\frac{e_{i,t}}{e_t}\right)^{1/k}\Big/\left(\prod_{t=0}^{m-1}\frac{e_{i,-t}}{e_{-t}}\right)^{1/m} \qquad [8]$$

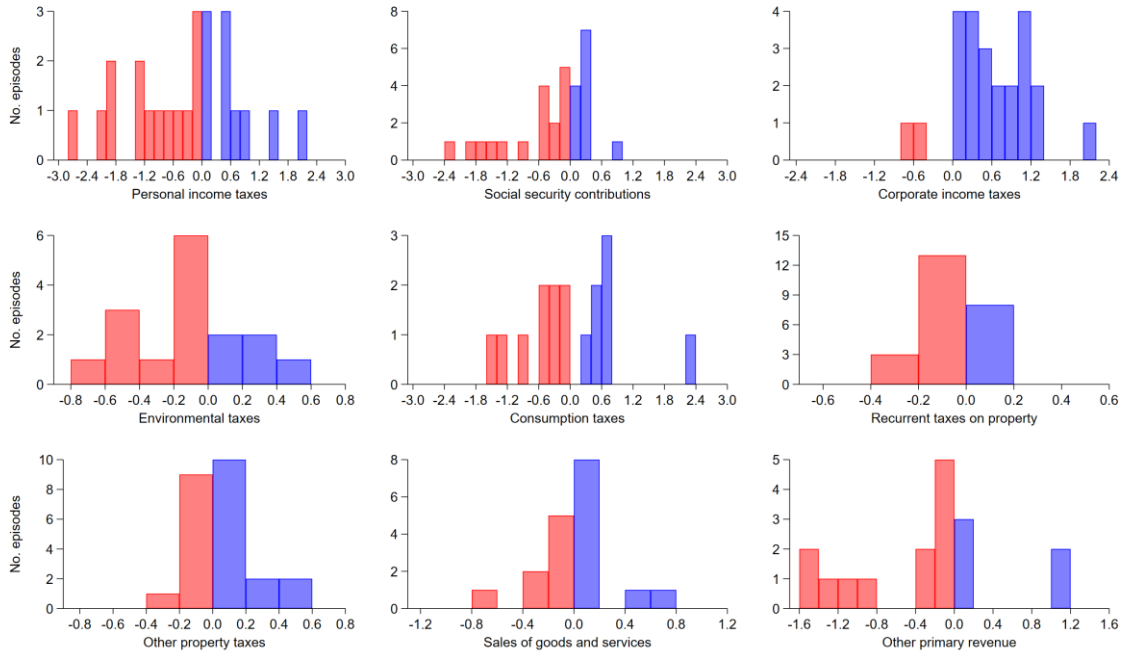
Figure 10. Distribution of changes in underlying budget components: debt reduction episodes versus some or all of the previous five years

Changes in ratios to potential GDP, percentage points, adjusted for the cycle and for one-offs, number of episodes

A. Underlying primary expenditure



B. Underlying primary revenue



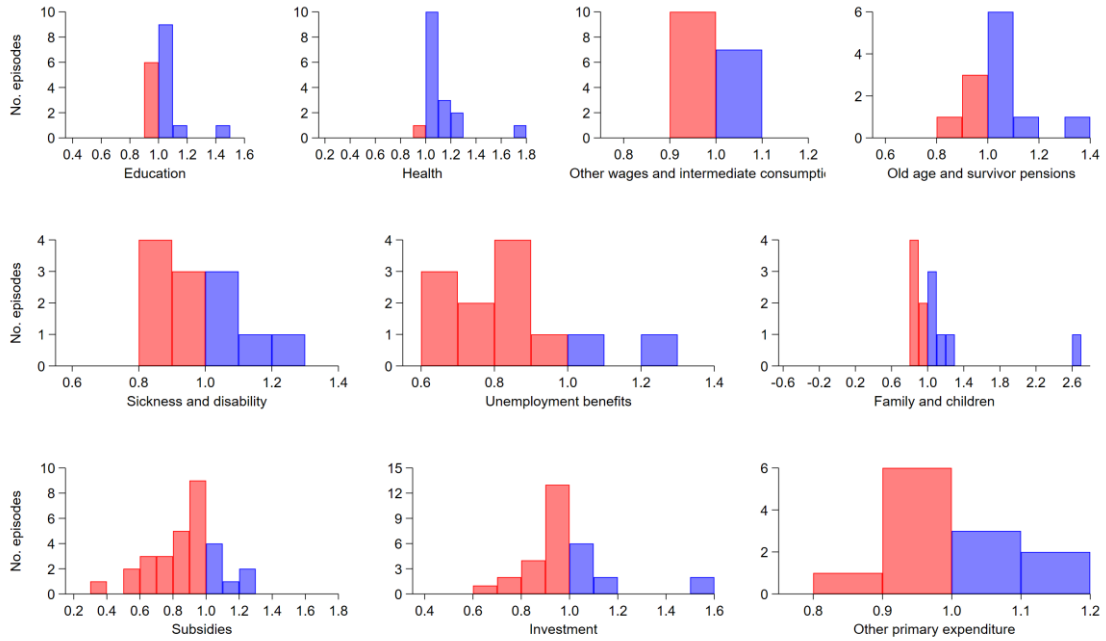
Note: The chart is based on Table D.7 and D.8. It shows the distribution of changes in underlying primary expenditure and revenue components as a share of potential GDP. Changes are defined as the average of a given component over the length of each episode minus its average in some or all of the previous five years. Blue (red) bars denote positive (negative) changes.

Source: OECD Economic Outlook 98 database; OECD Economic Outlook 115 database; AMECO database, European Commission's Directorate General for Economic and Financial Affairs; and authors' calculations.

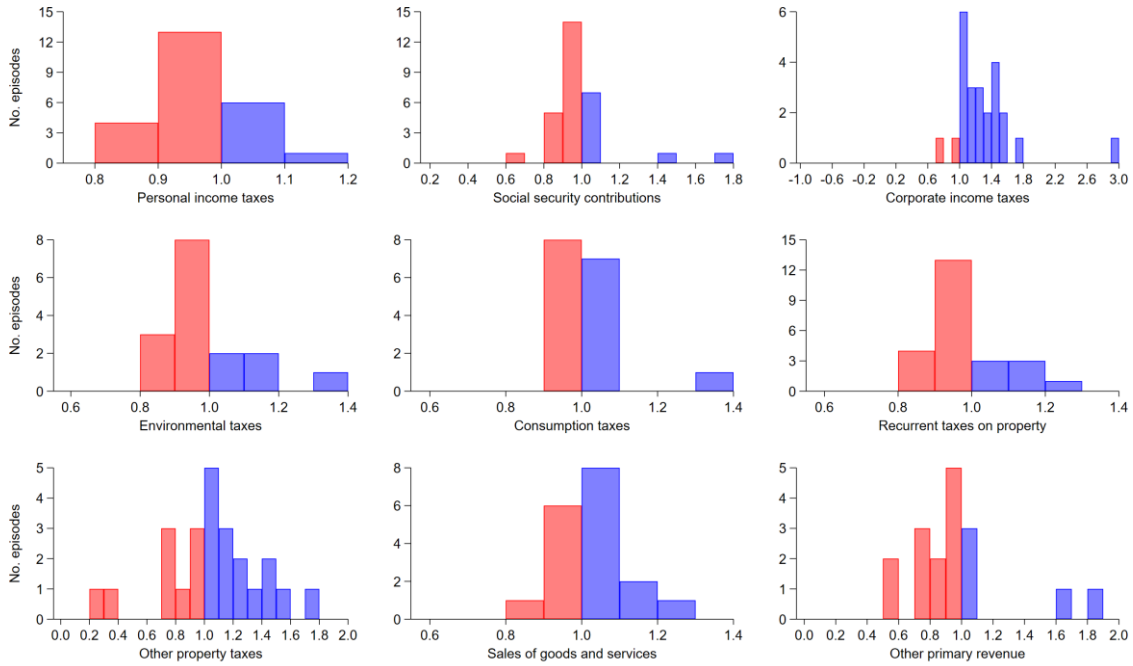
Figure 11. Distribution of changes in shares of underlying budget components: debt reduction episodes versus some or all the previous five years

Adjusted for the cycle and for one-offs, number of episodes (1 = no change in share)

A. Underlying primary expenditure



B. Underlying primary revenue



Note: The chart is based on Table D.9 and D.10. Changes in shares are defined according to equation [8]. Blue (red) bars denote values above (below) one, which imply that the component in question has gained (lost) share or weight in total underlying primary expenditure or revenue.
Source: OECD Economic Outlook 98 database; OECD Economic Outlook 115 database; AMECO database, European Commission's Directorate General for Economic and Financial Affairs; and authors' calculations.

The findings for most expenditure and revenue components remain unchanged from those summarised at the end of section 3. The main differences between Figure 11 and Figure 7 are that pensions now tend to gain weight in underlying primary expenditure, whereas the opposite happens with public investment. However, investment has not in general been singled out for disproportionately large spending reductions. Among the 12 debt reduction episodes with a full breakdown of expenditure, the one in Portugal (2015-19) stands out as the exception rather than the rule, with a large decline in the share of investment as a result of consolidation in the wake of the euro area sovereign debt crisis (Pina, 2016). Investment was in the upper half of primary expenditure components by changes in share in five of those episodes, including the latest one in Ireland (2014-19), where the share of investment in expenditure increased after large initial reductions.

The standard debt decomposition set out in Section 2 provides a consistent accounting framework to identify and compare the different factors driving the behaviour of the debt-to-GDP ratio during debt reduction episodes. However, if improvements in the underlying primary balance during episodes are part of a broader consolidation effort, debt decompositions may underestimate the role of fiscal consolidation in putting the debt ratio on a downward trajectory. The inclusion of years prior to debt reduction periods shows that budget consolidation does often start a few years before the debt ratio begins to decline, and that on average the amount of consolidation in the run-up to debt reduction episodes exceeds that during the episodes themselves. Nonetheless, almost all of the findings about the composition of consolidation during debt reduction episodes continue to hold when incorporating run-up periods, other than for public investment. Due to investment reductions as a share of potential GDP that typically occur before debt begins to fall (compare Figure 10 with Figure 6), the share of public investment in underlying primary expenditure declines in most debt reduction episodes, though such declines are mostly small.

5. How different are the dynamics of expenditure and revenue components in debt reduction episodes?

It is also of interest to see whether developments in the different expenditure and revenue items over debt reduction episodes (and their run-up periods) differ from developments in other periods or whether they mainly reflect a continuation of longstanding trends. For instance, the rise in health spending in most episodes could simply be part of the general increase in health expenditure over time (Guillemette, 2019; Smith et al., 2022). Equally, the reductions in public investment often found shortly before debt reduction episodes can be compared to those in other consolidation efforts that did not ultimately result in lower debt.

Some summary statistics of the full-sample dynamics of the several expenditure and revenue components are shown in Table 2:

- On the expenditure side, strong upward trends in healthcare and pensions stand out, averaging 0.06% of potential GDP per year. In contrast, subsidies, unemployment benefits and public investment have tended to decline as a share of potential GDP, though in the latter case the decline fails to reach statistical significance.
- On the revenue side, upward trends are largest on average in social security contributions and sales of goods and services (mainly user charges for various public services). Corporate income taxes as a share of potential GDP have also risen, but by a very small margin.

Table 2. Summary statistics for underlying expenditure and revenue components

Components in % of potential GDP, annual change

	Obs.	Mean	Std. dev	p5	Median	p95
EXPENDITURE ITEMS						
Education	712	-0.002	0.165	-0.241	-0.001	0.225
Health	712	0.059***	0.238	-0.248	0.055	0.376
Other wages and intermediate consumption	712	-0.009	0.334	-0.507	-0.004	0.501
Old age and survivor pensions	564	0.062***	0.312	-0.365	0.046	0.537
Sickness and disability	564	0.003	0.169	-0.225	0.010	0.180
Unemployment benefits	547	-0.015***	0.134	-0.260	-0.005	0.172
Family and children	547	0.005	0.132	-0.194	-0.001	0.224
Subsidies	943	-0.016***	0.167	-0.257	-0.014	0.207
Investment	943	-0.019	0.501	-0.768	-0.012	0.744
Other primary expenditure	547	-0.012	0.556	-0.854	-0.003	0.720
REVENUE ITEMS						
Personal income taxes	823	-0.011	0.543	-0.886	0.020	0.706
Social security contributions	943	0.028**	0.393	-0.597	0.019	0.568
Corporate income taxes	823	0.007	0.407	-0.704	0.037	0.588
Environmental taxes	749	-0.005	0.177	-0.240	-0.015	0.279
Consumption taxes	749	0.005	0.415	-0.635	-0.001	0.618
Recurrent taxes on property	823	0.011***	0.102	-0.099	0.000	0.133
Other property taxes	823	0.001	0.141	-0.174	0.000	0.186
Sales of goods and services	699	0.016**	0.203	-0.229	0.016	0.318
Other primary revenue	669	0.013	0.435	-0.616	-0.005	0.629

Note: The annual dataset used covers at most 1976-2019 and 32 OECD countries (Norway is excluded, see note 9). For several items, some observations have been dropped so that the sample exactly coincides with that used in the regression analysis below (Tables 3-6). The asterisks indicate whether the means are statistically different from zero: * p<0.10, ** p<0.05, *** p<0.01 using a one-sample t-test.
Source: Authors' calculations.

We then estimate the following panel equation to assess whether on average the annual change in expenditure or revenue components differs across selected subsamples, controlling for country and time fixed effects:

$$\Delta X_{jt} = \alpha + \beta DRE_{jt}^{+} + \delta CONSOL_{jt} + \gamma_j + \theta_t + \varepsilon_{jt} \qquad [9]$$

X is a given underlying expenditure or revenue component as a share of potential GDP and *j* denotes country. The first subsample of interest, for which a dummy variable DRE^{+} is equal to 1, corresponds to debt reduction episodes and their run-up years (defined as in the preceding section). The second subsample of interest corresponds to consolidation efforts which have failed to deliver a sustained decline in the debt ratio. For this purpose, another dummy variable (*CONSOL*) is added, taking value 1 in years unrelated to debt reduction episodes (i.e., with $DRE^{+} = 0$) where the estimated underlying primary balance as a share of potential GDP improves, indicating a fiscal consolidation ("consolidation years with no sustained debt reduction" in what follows). The remainder of the sample comprises years in which there was no fiscal consolidation and no sustained debt reduction ("baseline years" hereafter). The parameters of interest are β, which measures the annual change in the public finance item *X* during debt reduction episodes and their run-ups relative to baseline years, and δ, which measures the annual change in *X* during consolidation years with no sustained debt reduction relative to baseline years.

Table 3. Annual change in expenditure items, difference relative to baseline years

Equation [9], underlying expenditure items in % of potential GDP

	Education	Health	Other wages and intermediate consumption	Old age and survivor pensions	Sickness and disability	Unemployment benefits	Family and children	Subsidies	Investment	Other primary expenditure
DRE⁺ (β)	-0.047**	-0.059*	-0.145***	-0.105**	-0.027	-0.020	-0.028***	-0.044***	-0.153***	-0.101**
	[0.019]	[0.054]	[0.005]	[0.018]	[0.374]	[0.233]	[0.002]	[0.003]	[0.000]	[0.016]
CONSOL (δ)	-0.064***	-0.097***	-0.221***	-0.076*	-0.030	-0.032*	-0.022	-0.042**	-0.364***	-0.237***
	[0.002]	[0.000]	[0.000]	[0.072]	[0.174]	[0.062]	[0.217]	[0.016]	[0.000]	[0.001]
Test $\beta = \delta$	[0.423]	[0.257]	[0.102]	[0.453]	[0.917]	[0.413]	[0.769]	[0.900]	[0.000]***	[0.007]***
Observations	712	712	712	564	564	547	547	943	943	547
Countries	30	30	30	28	28	27	27	32	32	27
R^2	0.109	0.110	0.145	0.124	0.061	0.068	0.075	0.070	0.165	0.076
Adjusted R^2	0.056	0.057	0.094	0.083	0.017	0.024	0.031	0.025	0.124	0.032

Note: The annual dataset used covers at most 1976-2019 and 32 OECD countries (Norway is excluded, see note 9). All specifications include constant, country fixed effects and time fixed effects. Standard errors are clustered at the country level. Values in brackets correspond to the p-values. * p<.10 ** p<.05 *** p<.01.
Source: Authors' calculations.

Table 4. Annual change in revenue items, difference relative to baseline years

Equation [9], underlying revenue items in % of potential GDP

	Personal income taxes	Social security contributions	Corporate income taxes	Environmental taxes	Consumption taxes	Recurrent taxes on property	Other property taxes	Sales of goods and services	Other primary revenue
DRE⁺ (β)	0.072	-0.056	0.096***	0.015	0.074*	-0.005	0.029**	-0.011	0.006
	[0.115]	[0.131]	[0.005]	[0.326]	[0.089]	[0.587]	[0.019]	[0.495]	[0.815]
CONSOL (δ)	0.240***	0.041	0.113***	0.053***	0.133**	0.015	0.036***	-0.054**	0.033
	[0.000]	[0.378]	[0.004]	[0.003]	[0.028]	[0.243]	[0.009]	[0.029]	[0.492]
Test $\beta = \delta$	[0.001]***	[0.008]***	[0.639]	[0.014]**	[0.233]	[0.124]	[0.568]	[0.069]*	[0.540]
Observations	823	943	823	749	749	823	823	699	669
Countries	32	32	32	32	32	32	32	29	29
R^2	0.093	0.081	0.146	0.133	0.071	0.109	0.091	0.052	0.107
Adjusted R^2	0.058	0.036	0.114	0.102	0.038	0.076	0.056	-0.006	0.065

Note: The annual dataset used covers at most 1976-2019 and 32 OECD countries (Norway is excluded, see note 9). All specifications include constant, country fixed effects and time fixed effects. Standard errors are clustered at the country level. Values in brackets correspond to the p-values. * p<.10 ** p<.05 *** p<.01.
Source: Authors' calculations.

Results are reported in Tables 3 and 4 (Annex E provides some robustness analysis by dropping time fixed effects and experimenting with a different definition of consolidation years with no sustained debt reduction). The β estimates for the different spending items are always negative and often statistically significant, in line with the overall expenditure restraint prevailing in debt reduction episodes and their run-up periods. This is also the case for the coefficients on spending in consolidation years with no sustained debt reduction. Nonetheless, there are interesting differences:

- Relative to baseline years, most spending items display milder restraint in debt reduction episodes and their run-up periods than in consolidation years without sustained debt reduction, though spending on pensions, subsidies and families and children are exceptions. However, the difference between coefficients β and δ is often not statistically significant.
- The largest decline relative to baseline years is in public investment, in both debt reduction episodes (plus run-ups) and consolidation years with no sustained debt reduction. In addition, investment declines are significantly larger in the latter years than in debt reduction episodes.
- In a simpler model with allowance made only for debt reduction episodes (plus run-ups) but not for consolidation years without sustained debt reductions, the β coefficient on public investment is statistically insignificant (Annex E, Table A.E.5).

On the revenue side, a majority of the β and δ estimates are positive, with the coefficients for consolidation years without debt reductions being generally larger and more often statistically significant. A few findings are noteworthy:

- There are significant increases in corporate tax receipts, consumption taxes and other property taxes in both debt reduction episodes (and run-ups) and consolidation years without sustained debt reduction relative to baseline years. In debt reduction episodes, the increase relative to baseline is largest for corporate income tax yields.
- The largest and most statistically significant differential between consolidation years with no sustained debt reduction and both debt reduction episodes and baseline years is for annual changes in personal income taxes.
- The differences in annual changes for social security contributions and environmental taxes between consolidation years with no sustained debt reduction and debt reduction episodes (plus run-ups) are also positive and statistically significant.

These results provide additional perspective on the earlier findings. The increase in health spending observed in most debt reduction episodes (Figure 10) seems to reflect, but not exceed, the general upward trend in this category of expenditure. In contrast, the relative stability of pension outlays during episodes and their run-up years (Figure 10) departs from the overall growing trajectory in this spending item and is likely to reflect non-negligible restraint efforts. Subsidies also seem to be the target of significant restraint efforts during episodes and run-ups, which come on top of a broader declining trend (Table 2). Debt reduction episodes and their run-ups are, on average, more protective of public investment than consolidation years with no sustained debt reduction (Sutherland *et al.*, 2012; Ardanaz *et al.*, 2021).

The strong increases in corporate income taxes during debt reduction episodes documented in earlier sections match the econometric evidence of stronger revenue raising from those taxes in episodes and their run-ups than in baseline years (Table 4), coupled with the marginally upward trend of this revenue stream in the full sample (Table 2). As for other direct taxes, the overall relative stability during episodes found in earlier sections is echoed by the much smaller annual changes in episodes and their run-ups than in consolidation years with no sustained debt reduction (Table 4). Overall, revenue increases are more of a feature of consolidation efforts which fail to durably bring down debt ratios than of debt reduction episodes, particularly increases in personal income taxes.

6. Concluding remarks

This paper has analysed 34 debt reduction episodes, taking place between the late 1970s and the late 2010s across 25 OECD Member States. In each case, the respective roles of cyclical factors, "one-off" operations and discretionary budget interventions affecting the underlying primary balance have been identified, along with more granular analysis regarding the contribution of multiple expenditure and revenue components during debt reduction episodes. One insight is that favourable cyclical conditions have been a key driver of debt reductions in most cases, with governments refraining from procyclical expansions. While discretionary measures to improve the underlying primary balance have played a more modest role *during* debt reduction episodes, they have often contributed by preparing the ground in the *run-up* to episodes.

Looking forward, reductions in the debt-to-GDP ratio may be harder to achieve, as governments face mounting spending pressures from ageing, defence and climate change mitigation and adaptation. Furthermore, the benefits from having interest rates below GDP growth cannot be relied upon in the coming years (Arslanalp and Eichengreen, 2023). New circumstances and challenges call for new approaches to fiscal adjustment, where a larger contribution from revenue increases will likely be required.

Nonetheless, faced with unprecedented debt sustainability pressures, governments can draw lessons from past episodes in which countries have achieved large and sustained reductions in their debt ratios and changed the composition of public expenditure. A key policy insight is that governments should take advantage of good times to rebuild fiscal buffers and bring down debt ratios. Another major insight from past episodes is that it is possible to make significant savings in particular spending items such as subsidies and certain transfers, including pensions. Any such changes will need to be accompanied by improvements to the overall targeting and design of spending programmes to maintain support for those who need it most.

7. References

Adler, G., C. Allen, G. Ganelli and D. Leigh (2024). An Updated Action-based Dataset of Fiscal Consolidation. IMF Working Papers, WP/24/210, International Monetary Fund.

Akgun, O., B. Cournède and J.-M. Fournier (2017), The effects of the tax mix on inequality and growth, OECD Economics Department Working Papers, No. 1447, OECD Publishing,

Alesina, A., Azzalini, G., Favero, C., Giavazzi, F., & Miano, A. (2018). Is it the "How" or the "When" that Matters in Fiscal Adjustments? IMF Economic Review, 66, 144-188. https://doi.org/10.1057/s41308-017-0047-z

Alesina, A., & Perotti, R. (1995). Fiscal expansions and adjustments in OECD countries. Economic Policy, 10(21), 205-248. https://doi.org/10.2307/1344590

Ando, S, P Mishra, N Patel, A Peralta-Alva & A Presbitero (2023), 'Fiscal Consolidation and Public Debt', CEPR Discussion Paper No. 18548. CEPR Press, Paris & London. https://cepr.org/publications/dp18548

Ardanaz, M., E. Cavallo, A. Izquierdo and J. Puig (2021), Growth-friendly fiscal rules? Safeguarding public investment from budget cuts through fiscal rule design, Journal of International Money and Finance, 111.

Arslanalp, S. and B. Eichengreen (2023), "Living with High Public Debt", paper presented to the Federal Reserve Bank of Kansas City's Jackson Hole Symposium, August 2023.

Bloch, D., Fournier, J.-M, D. Gonçalves and Á. Pina (2016), "Trends in Public Finance: Insights from a New Detailed Dataset", OECD Economics Department Working Papers, No. 1345, OECD Publishing, Paris.

Campos, C., D. Jaimovich and U. Panizza (2006), "The unexplained part of public debt", Emerging Markets Review, 7, 228-243.

Cournède, B., A. Goujard and Á. Pina (2014), "Reconciling Fiscal Consolidation with Growth and Equity", OECD Journal: Economic Studies, vol. 2013/1.

Das, P. and C. Ghate (2022), "Debt decomposition and the role of inflation: A security level analysis for India", Economic Modelling, 113.

Devries, M. P., Guajardo, M. J., Leigh, M. D. & Pescatori, M. A. (2011). A new action-based dataset of fiscal consolidation. IMF Working Papers, WP/11/128, International Monetary Fund. https://doi.org/10.5089/9781455264407.001

Eichengreen, B., A. El-Ganainy, R. Esteves and K. Mitchener (2019), Public Debt Through the Ages, IMF Working Paper WP/19/6, International Monetary Fund.

Fournier, J.-M. and Å. Johansson (2016), "The Effect of the Size and the Mix of Public Spending on Growth and Inequality", OECD Economics Department Working Papers, No. 1344, OECD Publishing, Paris.

Guillemette, Y. and J. Château (2023), Long-term scenarios: incorporating the energy transition, OECD Economic Policy Paper No. 33, December.

Guillemette, Y. (2019), "Recent improvements to the public finance block of the OECD's long-term global model", OECD Economics Department Working Papers, No. 1581, OECD Publishing, Paris.

Hall, G. and T. Sargent (2011), "Interest Rate Risk and Other Determinants of Post-WWII US Government Debt/GDP Dynamics", American Economic Journal: Macroeconomics 3 (July 2011): 192–214.

IMF (2024), Fiscal Monitor: Putting a Lid on Public Debt. Washington DC, October.

Joumard, I., M. Minegishi, C. André, C. Nicq and R. Price (2008), "Accounting for One-off Operations when Assessing Underlying Fiscal Positions", OECD Economics Department Working Papers, No. 642, OECD Publishing, Paris.

Mauro, P. and J. Zilinsky (2016), "Reducing Government Debt Ratios in an Era of Low Growth", Policy Brief 16-10, Peterson Institute for International Economics.

OECD (2025), OECD Economic Outlook, Volume 2025 Issue 1, No. 117, OECD Publishing, Paris.

OECD (2024), OECD Economic Outlook. Database Documentation. Volume 2024 Issue 1, OECD Publishing, Paris.

OECD (2023), OECD Economic Outlook, Volume 2023 Issue 2, OECD Publishing, Paris, https://doi.org/10.1787/7a5f73ce-en.

Panizza, U. and A. Powell (2023), "Reducing Public Debt: What Works Best?", in A. Powell and O. Valencia (eds.), Dealing with Debt: Less Risk for More Growth in Latin America and the Caribbean, Inter-American Development Bank.

Patel, N. and A. Peralta-Alva (2024), High Public Debts: Are Shocks or Discretionary Fiscal Policy to Blame?, 29 March, mimeo.

Pina, Á. (2016), "Making Public Finances More Growth and Equity-friendly in the Euro Area", OECD Economics Department Working Papers, No. 1316, OECD Publishing, Paris.

Price, R., T-T. Dang and J. Botev (2015), "Adjusting fiscal balances for the business cycle: New tax and expenditure elasticity estimates for OECD countries", OECD Economics Department Working Papers, No. 1275, OECD Publishing, http://dx.doi.org/10.1787/5jrp1g3282d7-en.

Rawdanowicz, Ł., Turban, S., Haas, J., D. Crowe and V. Millot (2021), "Constraints and demands on public finances: Considerations of resilient fiscal policy", OECD Economics Department Working Papers, No. 1694, OECD Publishing, Paris.

Schuster, F., M. Alnasaa, L. Bounader, I. Jung, J. Menkulasi and J. da Mota (2024), "Debt Surges—Drivers, Consequences, and Policy Implications", IMF Working Paper 2024/50, International Monetary Fund, Washington, DC.

Smith, S. D., J. P. Newhouse and G. A. Cuckler (2022), Health Care Spending Growth Has Slowed: Will the Bend in the Curve Continue?, NBER Working Paper No. 30782, December.

Sutherland, D., P. Hoeller and R. Merola (2012), “Fiscal consolidation: Part 1. How much is needed and how to reduce debt to a prudent level?”, OECD Economics Department Working Papers, No. 932, OECD Publishing, Paris.

Annex A. The Algebra of Debt Decompositions

This annex sets out the mathematical derivations behind the debt decomposition equations of Section 2. Equations are numbered as in the main text. We start from equation [1], repeated below, where d, b and a are the ratios to GDP of gross debt, the primary balance and the stock-flow adjustment, i is the implicit nominal interest rate on debt and g the rate of nominal GDP growth:

$$\Delta d_t = \frac{i_t - g_t}{1+g_t} d_{t-1} - b_t + a_t \qquad [1]$$

Summing the terms in this equation over the full length of the debt reduction episode (year 1 to year k), one gets:

$$\sum_{t=1}^{k} \Delta d_t = \sum_{t=1}^{k} \frac{i_t - g_t}{1+g_t} d_{t-1} - \sum_{t=1}^{k} b_t + \sum_{t=1}^{k} a_t,$$

where the left-hand side simplifies to $d_k - d_0$.

Taking annual averages (i.e. dividing by the number of years in the episode, k), one obtains:

$$\frac{d_k - d_0}{k} = \frac{\sum_{t=1}^{k} \frac{i_t - g_t}{1+g_t} d_{t-1}}{k} - \frac{\sum_{t=1}^{k} b_t}{k} + \frac{\sum_{t=1}^{k} a_t}{k} \qquad [2]$$

The implicit nominal interest rate on debt (i) can be written as a function of a corresponding real interest rate (r) and inflation (π). With the real interest rate defined as $1 + r_t = (1 + i_t) / (1 + \pi_t)$, where inflation is measured by the GDP deflator, one can write:

$$i_t = \pi_t + r_t(1 + \pi_t).$$

Likewise, one can write nominal GDP growth (g) as a function of real GDP growth (g*) and inflation:

$$g_t = \pi_t + g_t^*(1 + \pi_t).$$

Then, $i_t - g_t = r_t\,(1 + \pi_t) - g_t^*(1 + \pi_t)$.

Decomposing each of the first two terms on the right-hand side of equation [2] into two terms yields

$$\frac{d_k - d_0}{k} = \frac{\sum_{t=1}^{k} \frac{r_t(1+\pi_t)}{1+g_t} d_{t-1}}{k} - \frac{\sum_{t=1}^{k} \frac{g_t^*(1+\pi_t)}{1+g_t} d_{t-1}}{k} - b_0 - \left(\frac{\sum_{t=1}^{k} b_t}{k} - b_0\right) + \frac{\sum_{t=1}^{k} a_t}{k} \quad ,$$

which simplifies to

$$\frac{d_k - d_0}{k} = \frac{\sum_{t=1}^{k} \frac{r_t}{1+g_t^*} d_{t-1}}{k} - \frac{\sum_{t=1}^{k} \frac{g_t^*}{1+g_t^*} d_{t-1}}{k} - b_0 - \left(\frac{\sum_{t=1}^{k} b_t}{k} - b_0\right) + \frac{\sum_{t=1}^{k} a_t}{k} \qquad [3]$$

To derive equation [4], one starts by noting that the nominal primary balance (B) can be decomposed into the cyclically-adjusted primary balance (B^A) and the cyclical component (CC). In turn, B^A can be further decomposed into the underlying primary balance (B^U) and net one-offs (NOO). Then:

$$B_t = B_t^U + CC_t + NOO_t$$

Dividing both members of the equation above by potential GDP (Y*) and denoting by lower-case letters ratios to actual GDP (Y), in the case of B, and to potential GDP, in the case of B^U, CC and NOO, one can write:

$$b_t + b_t\left(\frac{Y_t}{Y_t^*} - 1\right) = b_t^U + cc_t + noo_t$$

The term in brackets is the output gap (denoted below by gap). Defining c as the following approximation to the cyclical component of the primary balance as a share of potential GDP,

$$c_t = cc_t - b_t gap_t$$

one obtains

$$b_t = b_t^U + c_t + noo_t \qquad [4]$$

Summing the terms in this equation over the full length of the debt reduction episode (year 1 to year k), dividing by k and taking the difference to year 0 yields

$$\frac{\sum_{t=1}^{k} b_t}{k} - b_0 = \left(\frac{\sum_{t=1}^{k} b_t^U}{k} - b_0^U\right) + \left(\frac{\sum_{t=1}^{k} c_t}{k} - c_0\right) + \left(\frac{\sum_{t=1}^{k} noo_t}{k} - noo_0\right) \qquad [5].$$

Annex B. Revenue and Expenditure One-offs

Although there is no universal definition of one-offs, they can be understood as large and non-recurrent fiscal operations, concerning either revenue or expenditure, which affect headline budget balances but do not lead to a sustained change in the budgetary position (Joumard et al., 2008). One-offs should therefore be excluded, or corrected for, when computing structural or underlying budget balances.

OECD Economic Outlooks up to No. 98 (November 2015) contained estimates of budgetary one-offs on both revenue and expenditure sides, but afterwards only net estimates (NOO, the difference between revenue and expenditure one offs) have been reported. However, analysing developments in underlying primary revenue and expenditure requires that estimates of one-off operations on both sides of the budget are separately available. This annex explains how those estimates have been constructed.

To ensure consistency with the OECD Economic Outlook 115 (EO115) database, constructed revenue and expenditure one-offs (ROO and EOO, respectively) should observe

$$NOO_t = ROO_t - EOO_t,$$

with NOO sourced from EO115. The revenue-expenditure split has resorted to one-off estimates from the OECD Economic Outlook 98 (EO98) database and the annual macro-economic database (AMECO) of the European Commission's Directorate General for Economic and Financial Affairs. EO98 contains historical estimates up to 2014 and contemporary estimates and projections, subject to greater uncertainty, for 2015-17.[1] AMECO contains one-off revenue and expenditure data for the 27 EU countries, with coverage for all economies from 2010 onwards.[2]

In general terms, the approach adopted has been to take revenue and expenditure one-offs, when available, from EO98 or AMECO, adjusting them by equal amounts to match noo in EO115. Whenever the latter is (exactly) zero, roo and eoo are also assumed to be zero. The role played by EO98 estimates is strongest up to 2014 and vanishes after 2017. Figure A.1.1. provides full details (with noo denoting, as before, NOO as a share of potential output). [3]

The largest net one-offs in EO115, defined as those in the extreme percentiles of the distribution of variable noo over all of the debt reduction episodes considered plus the five preceding years, have been analysed on an individual basis whenever they differed from EO98 values. This has led to departures from the rules

[1] We compute ROO_{EO98} as (TKTRG – TKTRGU) + TRGOE and EOO_{EO98} as (TKPG – TKPGU) + TPGOE. TKTRG(U) denotes (underlying) capital tax and transfers receipts, TRGOE other exceptional transfers received, TKPG(U) (underlying) capital transfers paid and other capital payments, and TPGOE other exceptional transfers.

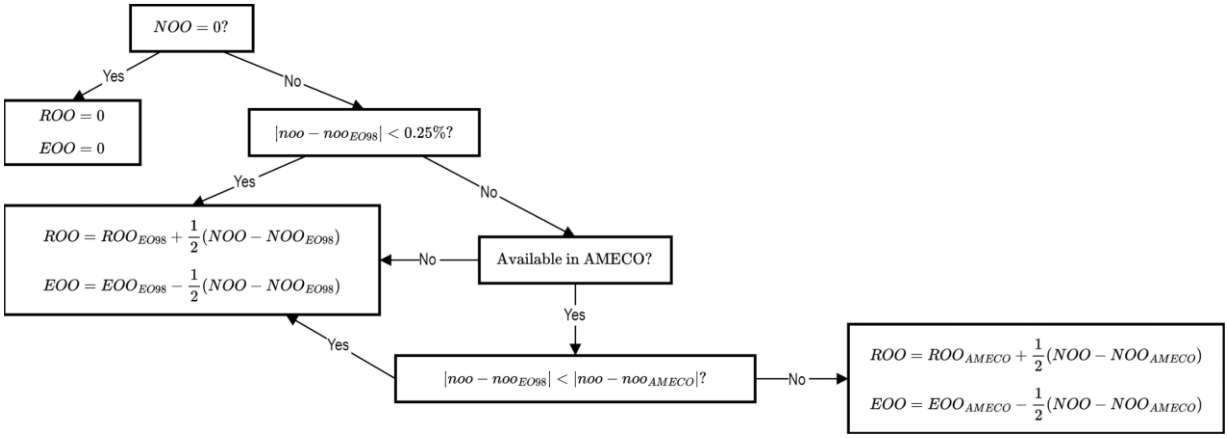
[2] AMECO Autumn 2023 (November 2023) - https://economy-finance.ec.europa.eu/economic-research-and-databases/economic-databases/ameco-database_en

[3] Estimates of one-offs in 1976-79 for the UK, needed for a more complete analysis of the 1978-90 debt reduction episode, have been obtained in a different way. NOO data from EO115 starts in 1980 only, but EO98 had data for (TKTRG – TKTRGU) and (TKPG – TKPGU) in earlier years. Assuming TRGOE = 0 and TPGOE = 0, we have computed ROO_{EO98} and EOO_{EO98} in 1976-79 (see note 15) and estimated ROO and EOO in those years by starting from their 1980 values and assuming the same annual changes in percent of potential GDP as for ROO_{EO98} and EOO_{EO98}.

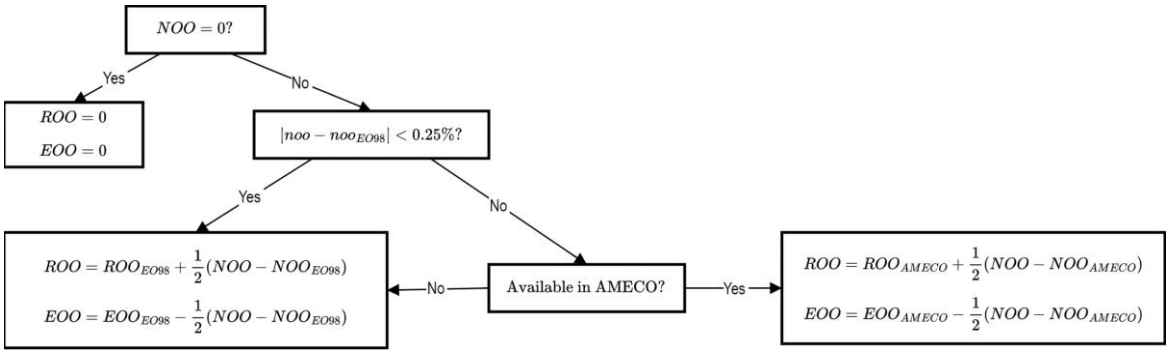
outlined in the previous paragraph in two cases (Denmark in 2014 and Iceland in 2016), where the gap between NOO in EO115 and EO98 was fully allocated to the revenue side (ROO).

Figure A B.1. Decision trees for estimates of revenue and expenditure one-offs

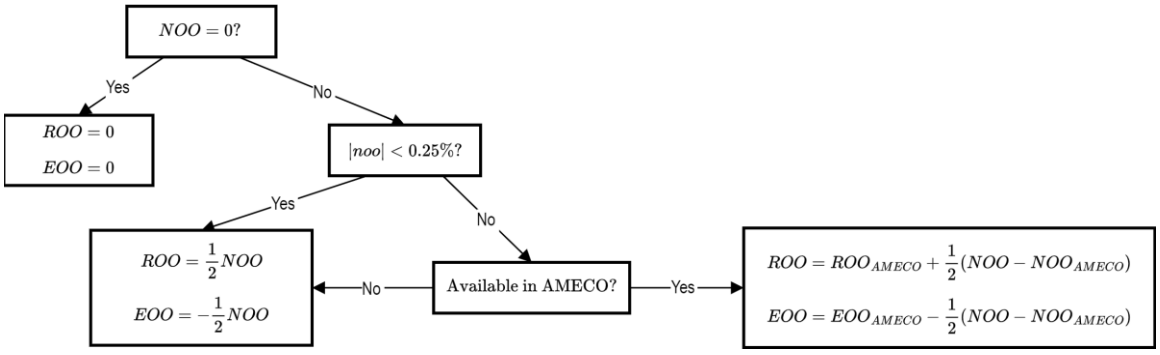
A. Up to 2014



B. From 2015 to 2017



C. After 2017



Source: Authors' elaboration.

Annex C. The OECD Public Finance Dataset

The analysis carried out in this paper uses an updated version of the OECD Public Finance Dataset. The new version is consistent with the OECD Economic Outlook 115 database and contains a few adjustments relative to the standard methodology (Bloch et al., 2016). These adjustments aim to better align the dataset with the scope of the analysis, increase in some cases the number of observations (i.e. available years per country and item) and refine the correction of budget balances for large one-offs.

1. Expenditure items

Public spending continues to be disaggregated into 11 items that do not overlap, and the OECD National Accounts Classification of the Functions of Government (COFOG) and Economic Outlook 115 databases are the sources for all items. Since the availability of COFOG data according to the 2008 System of National Accounts (SNA) has improved, imputations using older COFOG data (according to the 1993 SNA) or the OECD Social Expenditure Database (SOCX) are no longer applied, which simplifies the construction of the dataset and arguably reduces measurement error. The following table summarises the different expenditure items, the changes made relative to Bloch et al. (2016) and whether items are adjusted for the cycle:

Variable	Expenditure item	Change	Adjusted for the cycle?
Item 1	Education	Same as Bloch et al. (2016)	No
Item 2	Health	Same as Bloch et al. (2016)	No
Item 3	Other wages and intermediate consumption[1]	Inclusion of wages and intermediate consumption from item 5 and item 7	No
Item 4	Old-age and survivor pensions	Same as Bloch et al. (2016)	No
Item 5	Sickness and disability	Exclusion of wages and intermediate consumption	No
Item 6	Unemployment benefits	Same as Bloch et al. (2016)	Yes
Item 7	Family and children	Exclusion of wages and intermediate consumption	Yes
Item 8	Subsidies	Same as Bloch et al. (2016)	No
Item 9	Investment	Same as Bloch et al. (2016)	No
Item 10	Other primary expenditure	Inclusion of non-interest property income paid	Yes
Item 11	Interest paid	Exclusion of non-interest property income paid	No

Restricting item 11 to interest payments, rather than property income payments, simplifies the computation of primary expenditure, which becomes the sum of items 1 to 10. Removing wages and intermediate consumption from items 5 and 7 implies that COFOG level II data is no longer needed to compute item 3. This increases the number of observations for that item, as the availability of COFOG level II data is smaller than that for COFOG level I. [2]

[1] Wages and intermediate consumption not included in items 1 (education) and 2 (health).

[2] The amounts of wages and intermediate consumption in items 5 and 7 were often very small.

2. Revenue items

The revenue data continues to be disaggregated into 10 items that do not overlap and come from four sources: the OECD Revenue Statistics, the OECD Economic Outlook 115 database, OECD Annual National Accounts and OECD Environmental Related Tax Revenue Database.[3] The following table summarises the different expenditure items, the changes made relative to Bloch et al. (2016) and whether items are adjusted for the cycle:

Variable	Revenue item	Change	Adjusted for the cycle?
Item 1	Personal income taxes	Same as Bloch et al. (2016)	Yes
Item 2	Social security contributions	Same as Bloch et al. (2016)	Yes
Item 3	Corporate income taxes	Same as Bloch et al. (2016)	Yes
Item 4	Environmental taxes	Same as Bloch et al. (2016)	Yes
Item 5	Consumption taxes	Same as Bloch et al. (2016)	Yes
Item 6	Recurrent taxes on property	Same as Bloch et al. (2016)	Yes
Item 7	Other property taxes	Same as Bloch et al. (2016)	Yes
Item 8	Sales of goods and services	Same as Bloch et al. (2016)	No
Item 9	Other primary revenue	Inclusion of non-interest property income received	No
Item 10	Interest received	Exclusion of non-interest property income received	No

Restricting item 10 to interest receipts, rather than property income receipts, simplifies the computation of primary revenue, which becomes the sum of items 1 to 9.[4]

3. Correction of budget balances for one-offs

Budgetary one-offs often concern capital transfers and by default are therefore assumed to be reflected in expenditure item 10 and revenue item 9. For the largest one-offs, however, we have checked whether this rule-of-thumb assumption was warranted and, when it was not, we have subtracted ROO or EOO from the correct item instead when computing expenditure and revenue in underlying terms.

This exercise has been done for the extreme percentiles of the distribution of variable not over all debt reduction episodes considered plus the five preceding years. The table below summarises the corrections made.

Country	Change
Denmark	Revenue one-offs are subtracted under item 1 instead of item 9 in 2013, 2014 and 2015 *

* Though only the 2014 one-off belongs to the extreme percentiles, a similar correction has been implemented also for 2013 and 2015.

[3] Combining data from different sources can be a source of measurement error due to different data vintages or methodologies. For both expenditure and revenue, totals are sourced from the OECD Economic Outlook 115 database and one item of each (items 10 and 9, respectively) is computed as a residual so that the sum of items equals the respective total. When this leads to a negative value for the residual item in a given country and year, sources giving rise to discrepancies with the OECD Economic Outlook 115 database are dropped.

[4] In addition, a correction has been made for Iceland in 2016, when a very large revenue one-off was classified under “non-recurrent taxes on property” (4500) in the OECD Revenue Statistics but under “capital transfers, receivable” (D9R), which is part of revenue item 9, in the OECD Annual National Accounts. Due to a methodological detail (see paragraph 67 in Bloch et al., 2016), this would considerably distort revenue items 1 and 3 to 7. The one-off amount was thus subtracted at the outset (i.e., before applying the adjustment described in paragraph 67 in Bloch et al., 2016) from the source value (“non-recurrent taxes on property” in the OECD Revenue Statistics).

Annex D. Changes in expenditure and revenue composition during debt reduction episodes – detailed results

Table A D.1. Decomposition of the change in primary expenditure: average over each debt reduction episode relative to initial value

Changes in ratios to GDP, percentage points

Episode	Episode length (years)	Education	Health	Other wages and intermediate consumption	Old age and survivor pensions	Sickness and disability	Unemployment benefits	Family and children	Subsidies	Investment	Other primary expenditure	Total change in primary expenditure
GBR (1978-1990)	13	--	--	--	--	--	--	--	-0.63	-1.50	--	-1.71
NOR (1979-1983)	5	--	--	--	--	--	--	--	-0.75	-1.25	--	-2.37
KOR (1983-1994)	12	-0.51	0.27	-0.98	--	--	--	--	-0.14	-0.43	--	-2.29
DNK (1985-1989)	5	--	--	--	--	--	--	--	0.01	0.17	--	-0.78
SWE (1985-1990)	6	--	--	--	--	--	--	--	-0.19	-0.72	--	-0.68
NOR (1987-1991)	5	--	--	--	--	--	--	--	0.02	0.45	--	5.07
BEL (1994-2007)	14	--	--	--	--	--	--	--	0.05	-0.31	--	-0.26
DNK (1994-2007)	14	--	--	--	--	--	--	--	-0.05	-0.12	--	-2.25
NLD (1994-2001)	8	--	--	--	--	--	--	--	-0.47	-0.04	--	-5.39
NZL (1994-2007)	14	--	--	--	--	--	--	--	-0.04	1.18	--	-1.81
USA (1994-2001)	8	0.00	0.05	-0.77	--	--	--	--	-0.08	-0.36	--	-2.01
AUS (1996-2006)	11	--	--	--	--	--	--	--	-0.02	-0.01	--	0.17
GBR (1996-2001)	6	-0.15	-0.01	-0.21	-0.17	-0.22	-0.07	-0.20	-0.22	-0.29	-1.01	-2.54
CAN (1997-2007)	11	--	--	--	--	--	--	--	0.02	0.17	--	-2.35
ESP (1997-2007)	11	-0.20	-0.05	-0.21	-0.65	-0.09	-0.56	0.06	0.10	0.31	0.00	-1.29
FIN (1997-2008)	12	-0.86	-0.16	-1.06	--	--	--	--	-0.53	-0.27	--	-8.27
SWE (1997-2010)	14	0.05	0.06	-1.54	--	--	--	--	-1.35	-0.67	--	-5.29
IRL (1998-2007)	10	-0.40	0.40	-0.48	-1.07	-0.05	-0.30	-0.23	-0.30	1.13	0.32	-0.98
ISL (1999-2005)	7	0.59	0.64	1.12	-0.09	0.31	-0.08	0.12	0.02	-0.48	0.18	2.33
ITA (1999-2007)	9	-0.09	0.87	0.32	--	--	--	--	-0.11	0.22	--	1.48
LTU (2001-2008)	8	-0.49	-0.30	-2.28	-1.82	0.43	-0.01	0.18	-0.03	1.40	-0.51	-3.44
SVK (2001-2008)	8	0.88	0.43	-1.40	--	--	--	--	-1.06	-0.15	--	-10.88
ISR (2004-2019)	16	-0.05	-0.09	-1.73	--	--	--	--	0.06	-1.08	--	-4.42
CHE (2005-2019)	15	-0.02	0.04	-0.03	0.03	-0.38	-0.37	0.13	-0.38	-0.05	0.25	-0.78
NOR (2007-2011)	5	-0.03	0.28	1.29	0.41	0.12	0.05	0.06	0.00	0.54	0.53	3.24
ISL (2012-2018)	7	-0.14	0.17	-0.45	0.23	0.08	-0.71	-0.13	-0.23	-1.17	-0.87	-3.21
CZE (2013-2019)	7	-0.03	-0.18	0.07	-0.55	-0.08	-0.04	-0.13	0.01	-0.15	-2.10	-3.17
DEU (2013-2019)	7	-0.03	0.33	0.16	0.10	0.11	-0.12	0.02	-0.06	0.01	0.08	0.59
DNK (2013-2018)	6	-0.15	-0.13	-1.12	0.28	-0.18	-0.68	-0.09	-0.25	-0.17	-1.72	-4.22
IRL (2014-2019)	6	-1.07	-1.92	-1.54	-1.55	-0.72	-1.36	-0.93	-0.41	-0.02	-0.75	-10.27
AUT (2015-2019)	5	-0.12	0.12	-0.09	-0.41	-0.13	-0.14	-0.10	0.06	0.10	-1.52	-2.24
HUN (2015-2019)	5	-0.19	-0.02	0.61	-0.80	-0.54	-0.18	-0.20	-0.29	-0.07	0.05	-1.61
NLD (2015-2019)	5	-0.27	-0.62	-0.37	-0.56	-0.40	-0.29	0.30	0.06	-0.04	-0.40	-2.57
PRT (2015-2019)	5	-0.45	0.05	-0.72	-0.84	0.09	-0.57	0.05	-0.22	-0.14	-3.04	-5.79
Min	5	-1.07	-1.92	-2.28	-1.82	-0.72	-1.36	-0.93	-1.35	-1.50	-3.04	-10.88
Max	16	0.88	0.87	1.29	0.41	0.43	0.05	0.30	0.10	1.40	0.53	5.07
Average	9	-0.16	0.01	-0.50	-0.47	-0.10	-0.34	-0.07	-0.22	-0.11	-0.66	-2.35
Median	8	-0.14	0.05	-0.45	-0.48	-0.08	-0.23	-0.04	-0.10	-0.09	-0.46	-2.24
St. Dev	4	0.40	0.52	0.90	0.65	0.30	0.36	0.28	0.33	0.63	1.01	3.33

Note: The table decomposes the change in primary expenditure as a share of GDP, defined as average primary expenditure over the length of each episode minus its initial value, into several expenditure components as defined in the OECD Public Finance Dataset. In some earlier episodes not all components can be identified due to data limitations. Episodes are ordered chronologically by starting year.
Source: OECD Economic Outlook 115 database; OECD Public Finance Dataset; and authors' calculations.

Table A D.2. Decomposition of the change in primary revenue: average over each debt reduction episode relative to initial value

Changes in ratios to GDP, percentage points

Episode	Episode length (years)	Personal income taxes	Social security contributions	Corporate income taxes	Environmental taxes	Consumption taxes	Recurrent taxes on property	Other property taxes	Sales of goods and services	Other primary revenue	Total change in primary revenue
GBR (1978-1990)	13	--	-0.44	--	--	--	--	--	--	--	-0.73
NOR (1979-1983)	5	--	-0.65	--	--	--	--	--	--	--	1.55
KOR (1983-1994)	12	--	0.54	--	--	--	--	--	-0.05	--	-0.32
DNK (1985-1989)	5	--	-0.25	--	--	--	--	--	--	--	3.39
SWE (1985-1990)	6	--	0.05	--	--	--	--	--	--	--	2.90
NOR (1987-1991)	5	--	-0.26	--	--	--	--	--	--	--	0.59
BEL (1994-2007)	14	-0.09	-0.71	1.01	--	--	0.23	0.27	--	--	1.48
DNK (1994-2007)	14	-0.50	0.13	0.81	--	--	-0.10	-0.13	--	--	1.44
NLD (1994-2001)	8	-4.65	-1.09	0.69	--	--	-0.02	0.14	--	--	-5.46
NZL (1994-2007)	14	-0.94	0.03	0.79	--	--	-0.06	-0.09	--	--	-1.42
USA (1994-2001)	8	1.44	-0.05	0.10	--	--	-0.15	0.06	-0.03	0.12	1.39
AUS (1996-2006)	11	0.50	0.00	0.88	-0.07	0.23	-0.02	0.18	--	--	1.99
GBR (1996-2001)	6	0.22	0.10	0.78	0.13	-0.11	0.11	0.29	0.06	-0.05	1.53
CAN (1997-2007)	11	-0.89	-0.02	0.44	-0.22	-0.44	-0.20	0.03	--	--	-1.06
ESP (1997-2007)	11	-0.54	0.50	1.35	-0.09	0.73	0.05	0.62	0.01	-0.66	1.98
FIN (1997-2008)	12	-1.76	-1.88	1.06	0.02	-0.43	0.00	0.03	-0.56	0.77	-2.74
SWE (1997-2010)	14	-0.49	-2.37	0.68	-0.22	0.80	-0.38	0.05	-0.70	-0.13	-2.76
IRL (1998-2007)	10	-1.04	-0.29	0.31	-0.42	-0.76	-0.10	0.50	-0.02	-0.86	-2.68
ISL (1999-2005)	7	2.17	0.19	0.16	-0.54	0.29	-0.03	-0.09	-0.01	-0.21	1.93
ITA (1999-2007)	9	-0.32	-0.10	-0.04	-0.44	-0.14	0.04	0.09	0.12	-0.09	-0.88
LTU (2001-2008)	8	-0.95	-0.76	1.11	0.03	-0.78	-0.09	0.00	-0.25	-0.74	-2.42
SVK (2001-2008)	8	-0.79	-1.08	0.11	-0.11	-0.74	-0.05	-0.08	0.04	-0.99	-3.70
ISR (2004-2019)	16	-1.68	-0.55	0.69	0.41	-0.76	-0.04	0.40	-0.28	-1.20	-3.00
CHE (2005-2019)	15	0.30	0.04	0.67	-0.10	-0.10	-0.01	-0.32	0.41	-0.15	0.74
NOR (2007-2011)	5	0.71	0.58	-2.09	-0.22	-0.10	0.04	0.00	0.40	-0.41	-1.09
ISL (2012-2018)	7	1.06	-0.32	0.80	0.04	0.84	-0.03	-0.07	0.12	3.17	5.60
CZE (2013-2019)	7	0.36	0.14	0.28	-0.19	0.03	-0.02	-0.03	-0.28	-0.01	0.29
DEU (2013-2019)	7	0.60	0.20	0.18	-0.28	-0.17	-0.01	0.15	0.13	0.02	0.82
DNK (2013-2018)	6	0.93	-0.25	0.31	-0.12	-0.23	0.05	0.02	-0.19	-1.41	-0.88
IRL (2014-2019)	6	-1.93	-1.26	0.39	-0.68	-1.33	-0.28	-0.26	-0.69	-0.26	-6.30
AUT (2015-2019)	5	-0.72	0.05	0.42	-0.07	-0.08	-0.01	-0.05	0.08	-0.17	-0.55
HUN (2015-2019)	5	0.09	-0.51	0.12	0.25	-0.43	-0.04	-0.17	0.51	-1.80	-1.99
NLD (2015-2019)	5	0.91	-0.73	0.73	0.02	0.24	-0.04	0.11	-0.18	-1.13	-0.07
PRT (2015-2019)	5	-1.04	-0.18	0.30	0.26	0.22	-0.03	0.16	-0.26	-0.55	-1.14
Min	5	-4.65	-2.37	-2.09	-0.68	-1.33	-0.38	-0.32	-0.70	-1.80	-6.30
Max	16	2.17	0.58	1.35	0.41	0.84	0.23	0.62	0.51	3.17	5.60
Average	9	-0.32	-0.33	0.47	-0.11	-0.14	-0.04	0.06	-0.07	-0.31	-0.34
Median	8	-0.41	-0.22	0.56	-0.10	-0.11	-0.03	0.03	-0.02	-0.24	-0.43
St. Dev	4	1.31	0.64	0.61	0.26	0.54	0.11	0.21	0.31	0.97	2.49

Note: The table decomposes the change in primary revenue as a share of GDP, defined as average primary revenue over the length of each episode minus its initial value, into several revenue components as defined in the OECD Public Finance Dataset. In some earlier episodes not all components can be identified due to data limitations. Episodes are ordered chronologically by starting year.
Source: OECD Economic Outlook 115 database; OECD Public Finance Dataset; and authors' calculations.

Table A D.3. Decomposition of the change in underlying primary expenditure: average over each debt reduction episode relative to initial value

Changes in ratios to potential GDP, adjusted for the cycle and for one-offs, percentage points

Episode	Episode length (years)	Education	Health	Other wages and intermediate consumption	Old age and survivor pensions	Sickness and disability	Unemployment benefits	Family and children	Subsidies	Investment	Other primary expenditure	Total change in underlying primary expenditure
GBR (1978-1990)	13	--	--	--	--	--	--	--	-0.60	-1.42	--	-1.04
NOR (1979-1983)	5	--	--	--	--	--	--	--	--	--	--	--
KOR (1983-1994)	12	-0.18	0.34	-0.34	--	--	--	--	-0.12	0.08	--	0.05
DNK (1985-1989)	5	--	--	--	--	--	--	--	0.03	0.22	--	0.09
SWE (1985-1990)	6	--	--	--	--	--	--	--	-0.15	-0.65	--	0.23
NOR (1987-1991)	5	--	--	--	--	--	--	--	--	--	--	--
BEL (1994-2007)	14	--	--	--	--	--	--	--	0.10	-0.25	--	1.22
DNK (1994-2007)	14	--	--	--	--	--	--	--	0.04	0.02	--	0.99
NLD (1994-2001)	8	--	--	--	--	--	--	--	-0.44	0.05	--	-4.75
NZL (1994-2007)	14	--	--	--	--	--	--	--	-0.03	1.29	--	-0.39
USA (1994-2001)	8	0.04	0.09	-0.69	--	--	--	--	-0.08	-0.33	--	-1.65
AUS (1996-2006)	11	--	--	--	--	--	--	--	0.00	0.03	--	0.85
GBR (1996-2001)	6	-0.06	0.11	0.03	0.00	-0.15	-0.03	-0.11	-0.20	-0.22	-0.53	-1.17
CAN (1997-2007)	11	--	--	--	--	--	--	--	0.06	0.28	--	-0.73
ESP (1997-2007)	11	-0.07	0.12	0.06	-0.37	-0.02	-0.02	0.09	0.14	0.45	-0.35	0.02
FIN (1997-2008)	12	-0.57	0.15	-0.39	--	--	--	--	-0.44	-0.07	--	-3.97
SWE (1997-2010)	14	0.14	0.14	-1.30	--	--	--	--	-1.30	-0.59	--	-4.27
IRL (1998-2007)	10	-0.41	0.41	-0.49	-1.10	-0.06	-0.32	-0.24	-0.31	1.17	0.07	-1.26
ISL (1999-2005)	7	0.66	0.72	1.24	-0.06	0.32	-0.03	0.15	0.04	-0.42	0.01	2.63
ITA (1999-2007)	9	0.03	1.04	0.56	--	--	--	--	-0.07	0.31	--	2.78
LTU (2001-2008)	8	--	--	--	--	--	--	--	--	--	--	--
SVK (2001-2008)	8	0.90	0.49	-1.31	--	--	--	--	-1.04	-0.11	--	-4.35
ISR (2004-2019)	16	0.12	0.07	-1.35	--	--	--	--	0.08	-0.88	--	-3.06
CHE (2005-2019)	15	0.05	0.04	0.09	0.13	-0.34	-0.30	0.15	-0.32	0.00	0.51	0.01
NOR (2007-2011)	5	--	--	--	--	--	--	--	--	--	--	--
ISL (2012-2018)	7	0.19	0.56	0.21	0.35	0.19	-0.38	0.05	-0.15	-0.91	-0.44	-0.33
CZE (2013-2019)	7	0.05	-0.03	0.26	-0.40	-0.04	0.02	-0.07	0.06	-0.06	1.11	0.89
DEU (2013-2019)	7	-0.02	0.36	0.20	0.14	0.12	-0.10	0.03	-0.06	0.02	0.05	0.77
DNK (2013-2018)	6	-0.04	0.02	-0.85	0.41	-0.13	-0.40	-0.01	-0.21	-0.10	-0.38	-1.69
IRL (2014-2019)	6	-0.89	-1.61	-1.25	-1.28	-0.63	-0.97	-0.83	-0.37	0.09	-1.58	-9.32
AUT (2015-2019)	5	0.00	0.31	0.16	-0.02	-0.08	0.01	0.00	0.09	0.18	-0.33	0.32
HUN (2015-2019)	5	-0.06	0.12	1.01	-0.54	-0.45	-0.13	-0.07	-0.23	0.12	0.72	0.48
NLD (2015-2019)	5	-0.14	-0.41	-0.08	-0.37	-0.29	-0.04	0.36	0.09	0.05	-0.44	-1.25
PRT (2015-2019)	5	-0.24	0.31	-0.32	-0.23	0.14	-0.29	0.13	-0.19	-0.06	-0.47	-1.21
Min	5	-0.89	-1.61	-1.35	-1.28	-0.63	-0.97	-0.83	-1.30	-1.42	-1.58	-9.32
Max	16	0.90	1.04	1.24	0.41	0.32	0.02	0.36	0.14	1.29	1.11	2.78
Average	9	-0.02	0.16	-0.22	-0.24	-0.10	-0.21	-0.03	-0.19	-0.06	-0.15	-0.97
Median	8	-0.02	0.14	-0.08	-0.15	-0.07	-0.11	0.01	-0.10	0.01	-0.34	-0.36
St. Dev	4	0.37	0.50	0.73	0.49	0.26	0.26	0.27	0.33	0.53	0.65	2.47

Note: The table decomposes the change in underlying primary expenditure as a share of potential GDP, defined as average underlying primary expenditure over the length of each episode minus its initial value, into several expenditure components as defined in the OECD Public Finance Dataset. In some earlier episodes not all components can be identified due to data limitations. Episodes are ordered chronologically by starting year.

Source: OECD Economic Outlook 98 database; OECD Economic Outlook 115 database; AMECO database, European Commission's Directorate General for Economic and Financial Affairs; and authors' calculations.

Table A D.4. Decomposition of the change in underlying primary revenue: average over each debt reduction episode relative to initial value

Changes in ratios to potential GDP, adjusted for the cycle and for one-offs, percentage points

Episode	Episode length (years)	Personal income taxes	Social security contributions	Corporate income taxes	Environmental taxes	Consumption taxes	Recurrent taxes on property	Other property taxes	Sales of goods and services	Other primary revenue	Total change in underlying primary revenue
GBR (1978-1990)	13	--	-0.40	--	--	--	--	--	--	--	-0.86
NOR (1979-1983)	5	--	--	--	--	--	--	--	--	--	--
KOR (1983-1994)	12	--	0.56	--	--	--	--	--	0.11	--	-0.74
DNK (1985-1989)	5	--	-0.24	--	--	--	--	--	--	--	3.38
SWE (1985-1990)	6	--	0.07	--	--	--	--	--	--	--	2.81
NOR (1987-1991)	5	--	--	--	--	--	--	--	--	--	--
BEL (1994-2007)	14	-0.17	-0.60	0.91	--	--	0.23	0.26	--	--	1.41
DNK (1994-2007)	14	-0.47	0.18	0.54	--	--	-0.10	-0.13	--	--	1.60
NLD (1994-2001)	8	-4.84	-0.95	0.57	--	--	-0.03	0.12	--	--	-5.51
NZL (1994-2007)	14	-1.07	0.08	0.57	--	--	-0.08	-0.09	--	--	-1.84
USA (1994-2001)	8	1.37	-0.05	0.08	--	--	-0.16	0.06	0.01	0.12	1.32
AUS (1996-2006)	11	0.31	0.00	0.85	-0.08	0.21	-0.03	0.17	--	--	1.80
GBR (1996-2001)	6	0.02	0.15	0.70	0.11	-0.17	0.07	0.28	0.10	-0.03	1.22
CAN (1997-2007)	11	-1.30	0.04	0.42	-0.24	-0.52	-0.26	0.02	--	--	-1.51
ESP (1997-2007)	11	-0.70	0.62	1.27	-0.12	0.62	0.04	0.59	0.07	-0.74	1.64
FIN (1997-2008)	12	-2.05	-1.68	0.75	0.03	-0.39	0.00	0.02	-0.24	0.87	-2.69
SWE (1997-2010)	14	-0.54	-2.34	0.65	-0.26	0.68	-0.39	0.05	-0.62	-0.07	-2.84
IRL (1998-2007)	10	-1.02	-0.29	0.31	-0.42	-0.76	-0.10	0.49	-0.02	-0.73	-2.55
ISL (1999-2005)	7	2.07	0.19	0.13	-0.54	0.28	-0.03	-0.09	0.03	-0.23	1.74
ITA (1999-2007)	9	-0.46	0.07	-0.16	-0.45	-0.18	0.03	0.07	0.19	0.08	-0.81
LTU (2001-2008)	8	--	--	--	--	--	--	--	--	--	--
SVK (2001-2008)	8	-0.82	-1.04	0.08	-0.12	-0.76	-0.05	-0.08	0.08	-0.87	-3.57
ISR (2004-2019)	16	-1.83	-0.53	0.51	0.41	-0.76	-0.07	0.39	-0.18	-1.24	-3.30
CHE (2005-2019)	15	0.14	0.08	0.63	-0.10	-0.09	-0.02	-0.33	0.47	-0.08	0.71
NOR (2007-2011)	5	--	--	--	--	--	--	--	--	--	--
ISL (2012-2018)	7	0.51	-0.30	0.61	0.03	0.79	-0.07	-0.08	0.28	0.91	2.68
CZE (2013-2019)	7	0.23	0.20	0.28	-0.19	0.01	-0.02	-0.03	-0.21	-0.05	0.22
DEU (2013-2019)	7	0.56	0.24	0.16	-0.28	-0.17	-0.01	0.15	0.15	0.01	0.81
DNK (2013-2018)	6	0.07	-0.24	0.17	-0.11	-0.21	0.05	0.02	-0.11	-1.34	-1.70
IRL (2014-2019)	6	-2.18	-1.27	0.41	-0.69	-1.36	-0.29	-0.27	-0.59	-0.38	-6.63
AUT (2015-2019)	5	-0.97	0.17	0.32	-0.08	-0.12	-0.02	-0.05	0.19	-0.18	-0.72
HUN (2015-2019)	5	-0.05	-0.46	0.11	0.24	-0.49	-0.05	-0.17	0.63	-1.05	-1.29
NLD (2015-2019)	5	0.69	-0.55	0.59	0.03	0.25	-0.06	0.11	-0.08	-1.10	-0.11
PRT (2015-2019)	5	-1.48	-0.17	0.24	0.26	0.22	-0.05	0.15	-0.10	-0.52	-1.46
Min	5	-4.84	-2.34	-0.16	-0.69	-1.36	-0.39	-0.33	-0.62	-1.34	-6.63
Max	16	2.07	0.62	1.27	0.41	0.79	0.23	0.59	0.63	0.91	3.38
Average	9	-0.54	-0.28	0.45	-0.12	-0.14	-0.06	0.06	0.01	-0.33	-0.56
Median	8	-0.47	-0.11	0.47	-0.11	-0.17	-0.04	0.04	0.03	-0.21	-0.73
St. Dev	4	1.33	0.65	0.32	0.27	0.54	0.12	0.22	0.29	0.62	2.42

Note: The table decomposes the change in underlying primary revenue as a share of potential GDP, defined as average underlying primary revenue over the length of each episode minus its initial value, into several revenue components as defined in the OECD Public Finance Dataset. In some earlier episodes not all components can be identified due to data limitations. Episodes are ordered chronologically by starting year.
Source: OECD Economic Outlook 98 database; OECD Economic Outlook 115 database; AMECO database, European Commission's Directorate General for Economic and Financial Affairs; and authors' calculations.

Table A D.5. Changes in shares of components of underlying primary expenditure: average over each debt reduction episode relative to initial value

(1 = no change in share)

Episode	Episode length (years)	Education	Health	Other wages and intermediate consumption	Old age and survivor pensions	Sickness and disability	Unemployment benefits	Family and children	Subsidies	Investment	Other primary expenditure
GBR (1978-1990)	13	--	--	--	--	--	--	--	0.68	0.69	--
NOR (1979-1983)	5	--	--	--	--	--	--	--	--	--	--
KOR (1983-1994)	12	0.95	1.46	0.95	--	--	--	--	0.47	1.01	--
DNK (1985-1989)	5	--	--	--	--	--	--	--	1.01	1.06	--
SWE (1985-1990)	6	--	--	--	--	--	--	--	0.95	0.88	--
NOR (1987-1991)	5	--	--	--	--	--	--	--	--	--	--
BEL (1994-2007)	14	--	--	--	--	--	--	--	1.01	0.87	--
DNK (1994-2007)	14	--	--	--	--	--	--	--	1.00	0.99	--
NLD (1994-2001)	8	--	--	--	--	--	--	--	0.80	1.13	--
NZL (1994-2007)	14	--	--	--	--	--	--	--	0.93	1.57	--
USA (1994-2001)	8	1.06	1.07	0.98	--	--	--	--	0.89	0.97	--
AUS (1996-2006)	11	--	--	--	--	--	--	--	0.97	0.98	--
GBR (1996-2001)	6	1.01	1.06	1.04	1.04	0.96	0.94	0.96	0.69	0.92	0.93
CAN (1997-2007)	11	--	--	--	--	--	--	--	1.06	1.11	--
ESP (1997-2007)	11	0.98	1.02	1.01	0.95	0.99	0.99	1.26	1.14	1.12	0.89
FIN (1997-2008)	12	0.97	1.11	1.05	--	--	--	--	0.82	1.06	--
SWE (1997-2010)	14	1.11	1.11	0.98	--	--	--	--	0.59	0.95	--
IRL (1998-2007)	10	0.93	1.12	0.96	0.85	0.97	0.85	0.87	0.80	1.48	1.06
ISL (1999-2005)	7	1.05	1.03	1.05	0.91	1.22	0.82	1.05	0.96	0.85	0.94
ITA (1999-2007)	9	0.94	1.13	1.00	--	--	--	--	0.88	1.04	--
LTU (2001-2008)	8	--	--	--	--	--	--	--	--	--	--
SVK (2001-2008)	8	1.53	1.22	0.97	--	--	--	--	0.60	1.08	--
ISR (2004-2019)	16	1.11	1.10	0.95	--	--	--	--	1.21	0.91	--
CHE (2005-2019)	15	1.01	1.26	1.01	1.02	0.88	0.74	2.64	0.90	1.00	1.13
NOR (2007-2011)	5	--	--	--	--	--	--	--	--	--	--
ISL (2012-2018)	7	1.04	1.10	1.03	1.19	1.12	0.58	1.07	0.90	0.76	0.84
CZE (2013-2019)	7	0.99	0.97	1.01	0.93	0.96	1.06	0.93	1.00	0.95	1.43
DEU (2013-2019)	7	0.98	1.04	1.00	1.00	1.02	0.92	1.01	0.92	0.99	1.00
DNK (2013-2018)	6	1.02	1.04	0.97	1.09	0.99	0.82	1.02	0.93	1.01	0.97
IRL (2014-2019)	6	1.05	1.02	1.07	1.05	0.92	0.79	0.84	0.87	1.41	0.77
AUT (2015-2019)	5	0.99	1.04	1.01	0.99	0.95	1.00	0.99	1.06	1.05	0.93
HUN (2015-2019)	5	0.97	1.02	1.08	0.92	0.83	0.69	0.94	0.85	0.98	1.12
NLD (2015-2019)	5	1.00	0.97	1.02	0.97	0.95	0.98	1.36	1.12	1.05	0.93
PRT (2015-2019)	5	0.97	1.09	0.99	1.01	1.15	0.71	1.25	0.72	0.99	0.90
Min	5	0.93	0.97	0.95	0.85	0.83	0.58	0.84	0.47	0.69	0.77
Max	16	1.53	1.46	1.08	1.19	1.22	1.06	2.64	1.21	1.57	1.43
Average	9	1.03	1.09	1.01	0.99	0.99	0.85	1.16	0.89	1.03	0.99
Median	8	1.00	1.07	1.01	0.99	0.97	0.83	1.01	0.91	1.00	0.94
St. Dev	4	0.12	0.11	0.04	0.08	0.11	0.14	0.45	0.17	0.18	0.16

Note: Changes in shares are defined according to equation [6]. Values above (below) one imply that the expenditure component in question has gained (lost) share or weight in total underlying primary expenditure. In some earlier episodes not all components can be identified due to data limitations. Episodes are ordered chronologically by starting year.

Source: OECD Economic Outlook 98 database; OECD Economic Outlook 115 database; AMECO database, European Commission's Directorate General for Economic and Financial Affairs; and authors' calculations.

Table A D.6. Changes in shares of components of underlying primary revenue: average over each debt reduction episode relative to initial value

(1 = no change in share)

Episode	Episode length (years)	Personal income taxes	Social security contributions	Corporate income taxes	Environmental taxes	Consumption taxes	Recurrent taxes on property	Other property taxes	Sales of goods and services	Other primary revenue
GBR (1978-1990)	13	--	0.97	--	--	--	--	--	--	--
NOR (1979-1983)	5	--	--	--	--	--	--	--	--	--
KOR (1983-1994)	12	--	1.32	--	--	--	--	--	1.10	--
DNK (1985-1989)	5	--	0.79	--	--	--	--	--	--	--
SWE (1985-1990)	6	--	0.96	--	--	--	--	--	--	--
NOR (1987-1991)	5	--	--	--	--	--	--	--	--	--
BEL (1994-2007)	14	0.96	0.94	1.41	--	--	1.34	1.17	--	--
DNK (1994-2007)	14	0.95	1.07	1.20	--	--	0.88	0.81	--	--
NLD (1994-2001)	8	0.62	1.06	1.33	--	--	1.08	1.27	--	--
NZL (1994-2007)	14	0.98	1.11	1.20	--	--	1.00	0.42	--	--
USA (1994-2001)	8	1.10	0.95	0.99	--	--	0.90	1.16	0.96	1.05
AUS (1996-2006)	11	0.97	--	1.12	0.92	0.98	0.93	1.08	--	--
GBR (1996-2001)	6	0.96	0.99	1.23	1.01	0.94	0.99	1.57	1.03	0.93
CAN (1997-2007)	11	0.94	1.05	1.17	0.88	0.97	0.96	1.07	--	--
ESP (1997-2007)	11	0.86	1.01	1.61	0.90	1.04	1.02	1.40	1.00	0.74
FIN (1997-2008)	12	0.91	0.92	1.31	1.06	1.01	1.04	1.08	1.01	1.63
SWE (1997-2010)	14	1.02	0.65	1.25	0.98	1.11	0.79	1.09	0.92	1.01
IRL (1998-2007)	10	0.96	1.02	1.18	0.92	0.99	0.92	1.64	1.06	0.78
ISL (1999-2005)	7	1.13	1.02	1.05	0.81	0.98	0.93	0.80	0.96	0.84
ITA (1999-2007)	9	0.97	1.02	0.96	0.88	1.00	1.06	1.05	1.12	1.06
LTU (2001-2008)	8	--	--	--	--	--	--	--	--	--
SVK (2001-2008)	8	0.89	1.02	1.13	1.04	1.02	0.97	0.19	1.11	0.74
ISR (2004-2019)	16	0.86	1.00	1.29	1.29	1.01	1.06	1.56	1.02	0.76
CHE (2005-2019)	15	0.99	0.99	1.26	0.91	0.96	0.93	0.82	1.10	0.94
NOR (2007-2011)	5	--	--	--	--	--	--	--	--	--
ISL (2012-2018)	7	0.97	0.86	1.22	0.95	1.01	0.89	0.62	1.03	1.52
CZE (2013-2019)	7	1.05	1.01	1.08	0.93	1.00	0.91	0.89	0.94	0.96
DEU (2013-2019)	7	1.04	1.00	1.07	0.85	0.96	0.96	1.29	1.02	0.99
DNK (2013-2018)	6	1.04	0.82	1.09	1.00	1.01	1.07	1.08	1.00	0.54
IRL (2014-2019)	6	0.96	0.99	1.46	0.89	1.01	0.86	0.91	0.93	0.93
AUT (2015-2019)	5	0.93	1.03	1.15	0.99	1.00	0.95	0.89	1.06	0.91
HUN (2015-2019)	5	1.02	0.99	1.07	1.13	0.99	0.94	0.76	1.22	0.74
NLD (2015-2019)	5	1.10	0.97	1.23	1.01	1.03	0.94	1.23	0.98	0.62
PRT (2015-2019)	5	0.85	1.02	1.12	1.15	1.05	0.97	1.40	1.01	0.85
Min	5	0.62	0.65	0.96	0.81	0.94	0.79	0.19	0.92	0.54
Max	16	1.13	1.32	1.61	1.29	1.11	1.34	1.64	1.22	1.63
Average	9	0.96	0.98	1.20	0.98	1.00	0.97	1.05	1.03	0.93
Median	8	0.97	1.00	1.19	0.95	1.00	0.95	1.08	1.02	0.92
St. Dev	4	0.10	0.11	0.15	0.11	0.04	0.10	0.34	0.07	0.26

Note: Changes in shares are defined according to equation [6]. Values above (below) one imply that the revenue component in question has gained (lost) share or weight in total underlying primary revenue. In some earlier episodes not all components can be identified due to data limitations. Episodes are ordered chronologically by starting year.

Source: OECD Economic Outlook 98 database; OECD Economic Outlook 115 database; AMECO database, European Commission's Directorate General for Economic and Financial Affairs; and authors' calculations.

Table A D.7. Decomposition of the change in underlying primary expenditure: average over each debt reduction episode (DRE) relative to average over some or all of the previous five years

Changes in ratios to potential GDP, adjusted for the cycle and for one-offs, percentage points

Episode	Episode length (years)	Education	Health	Other wages and intermediate consumption	Old age and survivor pensions	Sickness and disability	Unemployment benefits	Family and children	Subsidies	Investment	Other primary expenditure	Total change in underlying primary expenditure	Years considered before the DRE
GBR (1978-1990)	13	--	--	--	--	--	--	--	-0.81	-2.10	--	-2.24	2
NOR (1979-1983)	5	--	--	--	--	--	--	--	--	--	--	--	--
KOR (1983-1994)	12	-0.03	0.43	-0.72	--	--	--	--	-0.20	-0.65	--	-0.88	3
DNK (1985-1989)	5	--	--	--	--	--	--	--	0.01	-0.28	--	-1.25	4
SWE (1985-1990)	6	--	--	--	--	--	--	--	0.01	-1.27	--	-0.63	5
NOR (1987-1991)	5	--	--	--	--	--	--	--	--	--	--	--	--
BEL (1994-2007)	14	--	--	--	--	--	--	--	-0.23	0.00	--	1.19	5
DNK (1994-2007)	14	--	--	--	--	--	--	--	-0.02	-0.06	--	1.59	2
NLD (1994-2001)	8	--	--	--	--	--	--	--	-0.62	-0.03	--	-5.53	5
NZL (1994-2007)	14	--	--	--	--	--	--	--	0.00	1.14	--	-2.23	4
USA (1994-2001)	8	0.05	0.20	-0.85	--	--	--	--	-0.04	-0.48	--	-1.90	2
AUS (1996-2006)	11	--	--	--	--	--	--	--	-0.12	-0.25	--	0.26	4
GBR (1996-2001)	6	--	--	--	--	--	--	--	-0.22	-0.35	--	-1.63	3
CAN (1997-2007)	11	--	--	--	--	--	--	--	-0.13	-0.08	--	-3.78	5
ESP (1997-2007)	11	--	--	--	--	--	--	--	0.12	-0.10	--	-1.05	3
FIN (1997-2008)	12	-0.66	0.24	-0.29	--	--	--	--	-1.19	-0.09	--	-4.62	5
SWE (1997-2010)	14	--	--	--	--	--	--	--	-1.91	-0.78	--	-6.18	5
IRL (1998-2007)	10	-0.51	0.33	-0.70	-1.09	-0.05	-0.28	-0.23	-0.15	1.21	-0.73	-2.19	2
ISL (1999-2005)	7	0.66	0.72	1.24	-0.06	0.32	-0.03	0.15	0.04	-0.42	0.01	2.63	1
ITA (1999-2007)	9	--	--	--	--	--	--	--	-0.33	0.42	--	3.04	5
LTU (2001-2008)	8	--	--	--	--	--	--	--	--	--	--	--	--
SVK (2001-2008)	8	0.54	0.23	-2.50	--	--	--	--	-1.82	-1.19	--	-8.23	5
ISR (2004-2019)	16	-0.18	-0.04	-1.54	--	--	--	--	0.09	-0.96	--	-4.13	3
CHE (2005-2019)	15	0.05	0.04	0.09	0.13	-0.34	-0.30	0.15	-0.32	0.00	0.51	0.01	1
NOR (2007-2011)	5	--	--	--	--	--	--	--	--	--	--	--	--
ISL (2012-2018)	7	-0.13	0.09	0.03	0.54	0.26	-0.40	-0.25	-0.24	-0.98	0.12	-0.95	4
CZE (2013-2019)	7	0.02	0.05	-0.48	0.24	-0.39	-0.09	-0.24	0.37	-0.98	0.16	-1.35	5
DEU (2013-2019)	7	-0.04	0.34	0.20	0.04	0.21	-0.24	0.01	-0.17	-0.05	-0.04	0.26	3
DNK (2013-2018)	6	-0.04	0.02	-0.85	0.41	-0.13	-0.40	-0.01	-0.21	-0.10	-0.38	-1.69	1
IRL (2014-2019)	6	-0.79	-1.71	-1.88	-1.66	-0.89	-0.55	-0.79	-0.33	-0.51	-1.08	-10.19	5
AUT (2015-2019)	5	-0.12	0.33	-0.13	0.20	-0.10	0.06	-0.15	0.00	0.08	-0.33	-0.13	5
HUN (2015-2019)	5	-0.06	0.12	1.01	-0.54	-0.45	-0.13	-0.07	-0.23	0.12	0.72	0.48	1
NLD (2015-2019)	5	-0.17	-0.40	-0.22	-0.06	-0.48	0.14	0.25	-0.09	-0.27	-0.49	-1.78	5
PRT (2015-2019)	5	-0.62	-0.23	-0.72	0.38	-0.02	-0.46	0.04	-0.17	-1.16	-0.04	-2.99	5
Min	5	-0.79	-1.71	-2.50	-1.66	-0.89	-0.55	-0.79	-1.91	-2.10	-1.08	-10.19	
Max	16	0.66	0.72	1.24	0.54	0.32	0.14	0.25	0.37	1.21	0.72	3.04	
Average	9	-0.12	0.04	-0.49	-0.12	-0.17	-0.22	-0.10	-0.30	-0.34	-0.13	-1.87	
Median	8	-0.06	0.12	-0.48	0.09	-0.11	-0.26	-0.04	-0.17	-0.26	-0.04	-1.49	
St. Dev	4	0.38	0.52	0.94	0.66	0.36	0.22	0.27	0.51	0.68	0.50	2.94	

Note: The table takes the change in the average underlying primary expenditure as a share of potential GDP over the length of each episode relative to its average in some or all of the previous five years and decomposes it into several expenditure components as defined in the OECD Public Finance Dataset. The set of previous years is chosen so that the improvement in the underlying primary balance is maximized (see Section 4 and Figure 8). In some earlier episodes not all components can be identified due to data limitations. Episodes are ordered chronologically by starting year.

Source: OECD Economic Outlook 98 database; OECD Economic Outlook 115 database; AMECO database, European Commission's Directorate General for Economic and Financial Affairs; and authors' calculations.

Table A D.8. Decomposition of the change in underlying primary revenue: average over each debt reduction episode (DRE) relative to average over some or all of the previous five years

Changes in ratios to potential GDP, adjusted for the cycle and for one-offs, percentage points

Episode	Episode length (years)	Personal income taxes	Social security contributions	Corporate income taxes	Environmental taxes	Consumption taxes	Recurrent taxes on property	Other property taxes	Sales of goods and services	Other primary revenue	Total change in underlying primary revenue	Years considered before the DRE
GBR (1978-1990)	13	--	-0.54	--	--	--	--	--	--	--	-1.40	2
NOR (1979-1983)	5	--	--	--	--	--	--	--	--	--	--	--
KOR (1983-1994)	12	--	0.98	--	--	--	--	--	0.17	--	-0.17	3
DNK (1985-1989)	5	--	-0.02	--	--	--	--	--	--	--	4.92	4
SWE (1985-1990)	6	--	-0.21	--	--	--	--	--	--	--	4.03	5
NOR (1987-1991)	5	--	--	--	--	--	--	--	--	--	--	--
BEL (1994-2007)	14	--	-0.09	--	--	--	--	--	--	--	3.02	5
DNK (1994-2007)	14	-0.11	0.22	0.72	--	--	-0.01	-0.15	--	--	2.42	2
NLD (1994-2001)	8	--	-0.93	--	--	--	--	--	--	--	-3.74	5
NZL (1994-2007)	14	-1.86	0.33	1.25	--	--	-0.29	-0.13	--	--	-1.92	4
USA (1994-2001)	8	1.41	-0.06	0.20	--	--	-0.21	0.07	0.06	0.13	1.51	2
AUS (1996-2006)	11	0.53	0.00	1.17	--	--	-0.15	0.13	--	--	2.35	4
GBR (1996-2001)	6	0.18	0.15	1.11	--	--	0.11	0.28	0.11	-0.05	2.03	3
CAN (1997-2007)	11	-1.32	-0.14	1.09	--	--	-0.40	0.03	--	--	-1.35	5
ESP (1997-2007)	11	-0.87	0.21	1.39	-0.14	0.64	0.01	0.58	--	--	0.94	3
FIN (1997-2008)	12	-1.86	-2.22	2.01	--	--	0.04	-0.06	0.13	1.07	-1.37	5
SWE (1997-2010)	14	-0.69	-1.96	1.09	--	--	-0.07	0.00	--	--	-1.69	5
IRL (1998-2007)	10	-1.07	-0.46	0.36	-0.46	-0.90	-0.14	0.54	-0.11	-0.81	-3.07	2
ISL (1999-2005)	7	2.07	0.19	0.13	-0.54	0.28	-0.03	-0.09	0.03	-0.23	1.74	1
ITA (1999-2007)	9	-0.24	-1.55	-0.76	-0.53	2.28	0.05	-0.07	--	--	-0.39	5
LTU (2001-2008)	8	--	--	--	--	--	--	--	--	--	--	--
SVK (2001-2008)	8	-1.34	-1.73	-0.58	0.07	-1.23	-0.07	-0.08	-0.07	-0.19	-5.22	5
ISR (2004-2019)	16	-2.64	-0.50	0.49	0.45	-0.56	0.00	0.31	-0.22	-1.53	-4.21	3
CHE (2005-2019)	15	0.14	0.08	0.63	-0.10	-0.09	-0.02	-0.33	0.47	-0.08	0.71	1
NOR (2007-2011)	5	--	--	--	--	--	--	--	--	--	--	--
ISL (2012-2018)	7	0.67	0.22	0.91	0.13	0.60	-0.09	0.10	0.14	1.02	3.70	4
CZE (2013-2019)	7	0.47	0.29	0.25	-0.13	0.67	0.03	0.01	-0.16	0.11	1.53	5
DEU (2013-2019)	7	0.97	0.27	0.23	-0.31	-0.20	-0.01	0.19	0.18	-0.04	1.27	3
DNK (2013-2018)	6	0.07	-0.24	0.17	-0.11	-0.21	0.05	0.02	-0.11	-1.34	-1.70	1
IRL (2014-2019)	6	-2.06	-1.25	0.51	-0.61	-1.51	-0.17	-0.05	-0.69	-0.22	-6.04	5
AUT (2015-2019)	5	-0.42	0.36	0.43	-0.07	-0.21	-0.02	-0.03	0.15	-0.07	0.12	5
HUN (2015-2019)	5	-0.05	-0.46	0.11	0.24	-0.49	-0.05	-0.17	0.63	-1.05	-1.29	1
NLD (2015-2019)	5	0.49	0.00	0.88	-0.02	0.53	0.15	0.06	-0.09	-1.44	0.57	5
PRT (2015-2019)	5	-0.10	-0.18	0.17	0.25	0.60	0.08	0.11	-0.21	0.01	0.73	5
Min	5	-2.64	-2.22	-0.76	-0.61	-1.51	-0.40	-0.33	-0.69	-1.53	-6.04	
Max	16	2.07	0.98	2.01	0.45	2.28	0.15	0.58	0.63	1.07	4.92	
Average	9	-0.32	-0.31	0.58	-0.12	0.01	-0.05	0.05	0.02	-0.28	-0.07	
Median	8	-0.10	-0.08	0.50	-0.10	-0.15	-0.02	0.02	0.04	-0.08	0.35	
St. Dev	4	1.15	0.75	0.62	0.31	0.91	0.13	0.21	0.28	0.75	2.70	

Note: The table takes the change in the average underlying primary revenue as a share of potential GDP over the length of each episode relative to its average in some or all of the previous five years and decomposes it into several revenue components as defined in the OECD Public Finance Dataset. The set of previous years is chosen so that the improvement in the underlying primary balance is maximized (see Section 4 and Figure 8). In some earlier episodes not all components can be identified due to data limitations. Episodes are ordered chronologically by starting year.

Source: OECD Economic Outlook 98 database; OECD Economic Outlook 115 database; AMECO database, European Commission's Directorate General for Economic and Financial Affairs; and authors' calculations.

Table A D.9. Changes in shares of components of underlying primary expenditure: average over each debt reduction episode (DRE) relative to average over some or all of the previous five years

(1 = no change in share)

Episode	Episode length (years)	Education	Health	Other wages and intermediate consumption	Old age and survivor pensions	Sickness and disability	Unemployment benefits	Family and children	Subsidies	Investment	Other primary expenditure	Years considered before the DRE
GBR (1978-1990)	13	--	--	--	--	--	--	--	0.64	0.62	--	2
NOR (1979-1983)	5	--	--	--	--	--	--	--	--	--	--	--
KOR (1983-1994)	12	1.03	1.72	0.94	--	--	--	--	0.38	0.93	--	3
DNK (1985-1989)	5	--	--	--	--	--	--	--	1.02	0.96	--	4
SWE (1985-1990)	6	--	--	--	--	--	--	--	1.02	0.81	--	5
NOR (1987-1991)	5	--	--	--	--	--	--	--	--	--	--	--
BEL (1994-2007)	14	--	--	--	--	--	--	--	0.86	0.97	--	5
DNK (1994-2007)	14	--	--	--	--	--	--	--	0.96	0.95	--	2
NLD (1994-2001)	8	--	--	--	--	--	--	--	0.73	1.12	--	5
NZL (1994-2007)	14	--	--	--	--	--	--	--	1.08	1.56	--	4
USA (1994-2001)	8	1.07	1.10	0.97	--	--	--	--	0.96	0.95	--	2
AUS (1996-2006)	11	--	--	--	--	--	--	--	0.90	0.92	--	4
GBR (1996-2001)	6	--	--	--	--	--	--	--	0.67	0.88	--	3
CAN (1997-2007)	11	--	--	--	--	--	--	--	1.00	1.08	--	5
ESP (1997-2007)	11	--	--	--	--	--	--	--	1.15	1.01	--	3
FIN (1997-2008)	12	0.97	1.14	1.07	--	--	--	--	0.60	1.07	--	5
SWE (1997-2010)	14	--	--	--	--	--	--	--	0.51	0.95	--	5
IRL (1998-2007)	10	0.93	1.13	0.96	0.87	1.00	0.89	0.90	0.94	1.55	0.88	2
ISL (1999-2005)	7	1.05	1.03	1.05	0.91	1.22	0.82	1.05	0.96	0.85	0.94	1
ITA (1999-2007)	9	--	--	--	--	--	--	--	0.74	1.07	--	5
LTU (2001-2008)	8	--	--	--	--	--	--	--	--	--	--	--
SVK (2001-2008)	8	1.45	1.26	0.94	--	--	--	--	0.51	0.92	--	5
ISR (2004-2019)	16	1.07	1.10	0.96	--	--	--	--	1.27	0.93	--	3
CHE (2005-2019)	15	1.01	1.26	1.01	1.02	0.88	0.74	2.64	0.90	1.00	1.13	1
NOR (2007-2011)	5	--	--	--	--	--	--	--	--	--	--	--
ISL (2012-2018)	7	1.00	1.04	1.03	1.35	1.18	0.60	0.82	0.86	0.77	1.06	4
CZE (2013-2019)	7	1.04	1.04	0.98	1.07	0.87	0.74	0.89	1.25	0.83	1.09	5
DEU (2013-2019)	7	0.98	1.04	1.02	1.00	1.07	0.86	1.00	0.83	0.97	0.98	3
DNK (2013-2018)	6	1.02	1.04	0.97	1.09	0.99	0.82	1.02	0.93	1.01	0.97	1
IRL (2014-2019)	6	1.10	1.03	1.00	1.02	0.85	1.00	0.88	0.92	1.14	0.92	5
AUT (2015-2019)	5	0.98	1.05	0.99	1.02	0.95	1.06	0.94	1.00	1.03	0.94	5
HUN (2015-2019)	5	0.97	1.02	1.08	0.92	0.83	0.69	0.94	0.85	0.98	1.12	1
NLD (2015-2019)	5	1.00	0.99	1.02	1.03	0.91	1.25	1.25	0.97	0.97	0.93	5
PRT (2015-2019)	5	0.94	1.04	0.99	1.11	1.06	0.63	1.14	0.78	0.71	1.07	5
Min	5	0.93	0.99	0.94	0.87	0.83	0.60	0.82	0.38	0.62	0.88	
Max	16	1.45	1.72	1.08	1.35	1.22	1.25	2.64	1.27	1.56	1.13	
Average	9	1.04	1.12	1.00	1.03	0.98	0.84	1.12	0.87	0.98	1.00	
Median	8	1.01	1.04	0.99	1.02	0.97	0.82	0.97	0.91	0.96	0.98	
St. Dev	4	0.12	0.17	0.04	0.12	0.13	0.19	0.49	0.21	0.19	0.09	

Note: Changes in shares are defined according to equation [8]. Values above (below) one imply that the expenditure component in question has gained (lost) share or weight in total underlying primary expenditure. The set of previous years is chosen so that the improvement in the underlying primary balance is maximized (see Section 4 and Figure 8). In some earlier episodes not all components can be identified due to data limitations. Episodes are ordered chronologically by starting year.

Source: OECD Economic Outlook 98 database; OECD Economic Outlook 115 database; AMECO database, European Commission's Directorate General for Economic and Financial Affairs; and authors' calculations.

Table A D.10. Changes in shares of components of underlying primary revenue: average over each debt reduction episode (DRE) relative to average over some or all of the previous five years

(1 = no change in share)

Episode	Episode length (years)	Personal income taxes	Social security contributions	Corporate income taxes	Environmental taxes	Consumption taxes	Recurrent taxes on property	Other property taxes	Sales of goods and services	Other primary revenue	Years considered before the DRE
GBR (1978-1990)	13	--	0.96	--	--	--	--	--	--	--	2
NOR (1979-1983)	5	--	--	--	--	--	--	--	--	--	--
KOR (1983-1994)	12	--	1.71	--	--	--	--	--	1.11	--	3
DNK (1985-1989)	5	--	0.89	--	--	--	--	--	--	--	4
SWE (1985-1990)	6	--	0.89	--	--	--	--	--	--	--	5
NOR (1987-1991)	5	--	--	--	--	--	--	--	--	--	--
BEL (1994-2007)	14	--	0.93	--	--	--	--	--	--	--	5
DNK (1994-2007)	14	0.95	1.07	1.29	--	--	0.95	0.77	--	--	2
NLD (1994-2001)	8	--	1.02	--	--	--	--	--	--	--	5
NZL (1994-2007)	14	0.94	1.48	1.50	--	--	0.90	0.35	--	--	4
USA (1994-2001)	8	1.10	0.95	1.04	--	--	0.88	1.19	0.97	1.06	2
AUS (1996-2006)	11	0.97	--	1.19	--	--	0.85	1.02	--	--	4
GBR (1996-2001)	6	0.96	0.96	1.45	--	--	0.98	1.54	1.02	0.89	3
CAN (1997-2007)	11	0.94	1.01	1.51	--	--	0.91	1.09	--	--	5
ESP (1997-2007)	11	0.86	0.99	1.77	0.91	1.07	1.00	1.43	--	--	3
FIN (1997-2008)	12	0.90	0.87	2.94	--	--	1.27	0.95	1.05	1.87	5
SWE (1997-2010)	14	1.00	0.68	1.45	--	--	0.97	1.00	--	--	5
IRL (1998-2007)	10	0.97	1.00	1.21	0.92	0.99	0.88	1.76	1.02	0.77	2
ISL (1999-2005)	7	1.13	1.02	1.05	0.81	0.98	0.93	0.80	0.96	0.84	1
ITA (1999-2007)	9	0.98	0.90	0.79	0.85	1.33	1.08	0.93	--	--	5
LTU (2001-2008)	8	--	--	--	--	--	--	--	--	--	--
SVK (2001-2008)	8	0.83	1.01	0.96	1.18	1.01	0.98	0.20	1.10	1.05	5
ISR (2004-2019)	16	0.81	1.03	1.31	1.34	1.05	1.11	1.48	1.03	0.72	3
CHE (2005-2019)	15	0.99	0.99	1.26	0.91	0.96	0.93	0.82	1.10	0.94	1
NOR (2007-2011)	5	--	--	--	--	--	--	--	--	--	--
ISL (2012-2018)	7	0.95	0.99	1.42	0.97	0.96	0.86	1.26	0.96	1.61	4
CZE (2013-2019)	7	1.09	0.98	1.03	0.92	1.04	1.14	1.01	0.92	0.99	5
DEU (2013-2019)	7	1.08	0.99	1.11	0.83	0.95	0.94	1.39	1.02	0.94	3
DNK (2013-2018)	6	1.04	0.82	1.09	1.00	1.01	1.07	1.08	1.00	0.54	1
IRL (2014-2019)	6	0.96	0.97	1.50	0.90	0.97	0.97	1.16	0.87	1.02	5
AUT (2015-2019)	5	0.96	1.02	1.18	0.97	0.98	0.93	0.93	1.03	0.96	5
HUN (2015-2019)	5	1.02	0.99	1.07	1.13	0.99	0.94	0.76	1.22	0.74	1
NLD (2015-2019)	5	1.05	0.99	1.36	0.98	1.06	1.20	1.14	0.96	0.55	5
PRT (2015-2019)	5	0.98	0.97	1.04	1.09	1.04	1.09	1.24	0.93	0.99	5
Min	5	0.81	0.68	0.79	0.81	0.95	0.85	0.20	0.87	0.54	
Max	16	1.13	1.71	2.94	1.34	1.33	1.27	1.76	1.22	1.87	
Average	9	0.98	1.00	1.31	0.98	1.02	0.99	1.05	1.02	0.97	
Median	8	0.97	0.99	1.24	0.94	1.00	0.96	1.05	1.02	0.94	
St. Dev	4	0.08	0.18	0.41	0.14	0.09	0.11	0.35	0.08	0.33	

Note: Changes in shares are defined according to equation [8]. Values above (below) one imply that the revenue component in question has gained (lost) share or weight in total underlying primary revenue. The set of previous years is chosen so that the improvement in the underlying primary balance is maximized (see Section 4 and Figure 8). In some earlier episodes not all components can be identified due to data limitations. Episodes are ordered chronologically by starting year.

Source: OECD Economic Outlook 98 database; OECD Economic Outlook 115 database; AMECO database, European Commission's Directorate General for Economic and Financial Affairs; and authors' calculations.

Annex E. Some robustness analysis on the dynamics of expenditure and revenue components during debt reduction episodes

Table A E.1. Annual change in expenditure items, difference relative to baseline years

Equation [9] without time fixed effects, underlying expenditure items in % of potential GDP

	Education	Health	Other wages and intermediate consumption	Old age and survivor pensions	Sickness and disability	Unemployment benefits	Family and children	Subsidies	Investment	Other primary expenditure
DRE⁺ (β)	-0.054***	-0.070**	-0.174***	-0.136***	-0.035	-0.022	-0.029***	-0.057***	-0.156***	-0.083**
	[0.009]	[0.035]	[0.000]	[0.003]	[0.188]	[0.202]	[0.007]	[0.001]	[0.000]	[0.015]
CONSOL (δ)	-0.078***	-0.121***	-0.244***	-0.086**	-0.042*	-0.035*	-0.033*	-0.038**	-0.378***	-0.206***
	[0.000]	[0.000]	[0.000]	[0.031]	[0.055]	[0.053]	[0.074]	[0.015]	[0.000]	[0.000]
Test $\beta = \delta$	[0.170]	[0.141]	[0.158]	[0.284]	[0.805]	[0.329]	[0.819]	[0.272]	[0.000]***	[0.009]***
Observations	712	712	712	564	564	547	547	943	943	547
Countries	30	30	30	28	28	27	27	32	32	27
R^2	0.0357	0.0395	0.0858	0.0292	0.0117	0.0114	0.0117	0.0175	0.0833	0.0208
Adjusted R^2	0.033	0.0368	0.0832	0.0257	0.00817	0.00778	0.00807	0.0154	0.0814	0.0172

Note: The annual dataset used covers at most 1976-2019 and 32 OECD countries (Norway is excluded, see note 9). All specifications include constant and country fixed effects. Standard errors are clustered at the country level. Values in brackets correspond to the p-values. * p<.10 ** p<.05 *** p<.01.
Source: Authors' calculations.

Table A E.2. Annual change in revenue items, difference relative to baseline years

Equation [9] without time fixed effects, underlying revenue items in % of potential GDP

	Personal income taxes	Social security contributions	Corporate income taxes	Environmental taxes	Consumption taxes	Recurrent taxes on property	Other property taxes	Sales of goods and services	Other primary revenue
DRE+ (β)	0.055	-0.084***	0.158***	0.013	0.074	-0.012	0.040**	-0.012	0.007
	[0.306]	[0.009]	[0.000]	[0.417]	[0.103]	[0.221]	[0.017]	[0.403]	[0.811]
CONSOL (δ)	0.261***	0.033	0.150***	0.058***	0.148***	0.016	0.044***	-0.050**	0.035
	[0.000]	[0.412]	[0.000]	[0.002]	[0.009]	[0.343]	[0.008]	[0.011]	[0.475]
Test $\beta = \delta$	[0.000]***	[0.002]***	[0.856]	[0.013]**	[0.130]	[0.074]*	[0.783]	[0.037]**	[0.496]
Observations	823	943	823	749	749	823	823	699	669
Countries	32	32	32	32	32	32	32	29	29
R^2	0.036	0.012	0.028	0.017	0.019	0.009	0.017	0.010	0.001
Adjusted R^2	0.034	0.010	0.026	0.014	0.016	0.007	0.015	0.007	-0.002

Note: The annual dataset used covers at most 1976-2019 and 32 OECD countries (Norway is excluded, see note 9). All specifications include constant and country fixed effects. Standard errors are clustered at the country level. Values in brackets correspond to the p-values. * p<.10 ** p<.05 *** p<.01.
Source: Authors' calculations.

Table A E.3. Annual change in expenditure items, difference relative to baseline years (with different definition of other consolidation years)

Equation [9] with different CONSOL definition, underlying expenditure items in % of potential GDP

	Education	Health	Other wages and intermediate consumption	Old age and survivor pensions	Sickness and disability	Unemployment benefits	Family and children	Subsidies	Investment	Other primary expenditure
DRE+ (β)	-0.035**	-0.044	-0.107**	-0.082**	-0.029	-0.019	-0.027***	-0.038***	-0.070**	-0.079**
	[0.043]	[0.119]	[0.015]	[0.047]	[0.346]	[0.217]	[0.002]	[0.002]	[0.013]	[0.033]
CONSOL (δ)	-0.064***	-0.117***	-0.248***	-0.041	-0.060**	-0.052***	-0.038*	-0.047**	-0.297***	-0.335***
	[0.006]	[0.001]	[0.000]	[0.277]	[0.015]	[0.008]	[0.092]	[0.029]	[0.000]	[0.000]
Test $\beta = \delta$	[0.292]	[0.095]*	[0.012]**	[0.341]	[0.235]	[0.049]**	[0.681]	[0.688]	[0.000]***	[0.000]***
Observations	712	712	712	564	564	547	547	943	943	547
Countries	30	30	30	28	28	27	27	32	32	27
R^2	0.106	0.114	0.147	0.117	0.071	0.078	0.081	0.071	0.135	0.091
Adjusted R^2	0.053	0.061	0.096	0.076	0.028	0.034	0.036	0.025	0.093	0.048

Note: The annual dataset used covers at most 1976-2019 and 32 OECD countries (Norway is excluded, see note 9). CONSOL takes value 1 in years unrelated to episodes (i.e., with DRE+ = 0) where the underlying primary balance as a share of potential GDP increases by at least 0.5 percentage points. All specifications include constant, country fixed effects and time fixed effects. Standard errors are clustered at the country level. Values in brackets correspond to the p-values. * p<.10 ** p<.05 *** p<.01.
Source: Authors' calculations.

Table A E.4. Annual change in revenue items, difference relative to baseline years (with different definition of other consolidation years)

Equation [9] with different CONSOL definition, underlying revenue items in % of potential GDP

	Personal income taxes	Social security contributions	Corporate income taxes	Environmental taxes	Consumption taxes	Recurrent taxes on property	Other property taxes	Sales of goods and services	Other primary revenue
DRE+ (β)	0.020	-0.049	0.073**	0.009	0.054	-0.003	0.018*	-0.003	0.028
	[0.635]	[0.133]	[0.015]	[0.524]	[0.147]	[0.736]	[0.072]	[0.840]	[0.295]
CONSOL (δ)	0.202***	0.094*	0.102**	0.069***	0.147**	0.032*	0.019*	-0.062**	0.146***
	[0.005]	[0.067]	[0.014]	[0.004]	[0.020]	[0.086]	[0.078]	[0.046]	[0.006]
Test $\beta = \delta$	[0.006]***	[0.002]***	[0.513]	[0.007]***	[0.129]	[0.057]*	[0.927]	[0.059]*	[0.019]**
Observations	823	943	823	749	749	823	823	699	669
Countries	32	32	32	32	32	32	32	29	29
R^2	0.0824	0.0858	0.143	0.138	0.0718	0.117	0.0844	0.0522	0.118
Adjusted R^2	0.0477	0.041	0.111	0.107	0.0384	0.0836	0.0497	-0.00543	0.0765

Note: The annual dataset used covers at most 1976-2019 and 32 OECD countries (Norway is excluded, see note 9). CONSOL takes value 1 in years unrelated to episodes (i.e., with DRE+ = 0) where the underlying primary balance as a share of potential GDP increases by at least 0.5 percentage points. All specifications include constant, country fixed effects and time fixed effects. Standard errors are clustered at the country level. Values in brackets correspond to the p-values. * p<.10 ** p<.05 *** p<.01.
Source: Authors' calculations.

Table A E.5. Annual change in expenditure items, difference in debt reduction episodes relative to rest of sample

Equation [9] without variable CONSOL, underlying expenditure items in % of potential GDP

	Education	Health	Other wages and intermediate consumption	Old age and survivor pensions	Sickness and disability	Unemployment benefits	Family and children	Subsidies	Investment	Other primary expenditure
DRE+	-0.019	-0.016	-0.046	-0.072*	-0.014	-0.007	-0.018*	-0.025*	0.013	0.002
	[0.292]	[0.586]	[0.258]	[0.062]	[0.612]	[0.630]	[0.099]	[0.054]	[0.622]	[0.954]
Observations	712	712	712	564	564	547	547	943	943	547
Countries	30	30	30	28	28	27	27	32	32	27
R^2	0.089	0.088	0.086	0.115	0.056	0.060	0.071	0.062	0.097	0.051
Adjusted R^2	0.036	0.035	0.033	0.076	0.014	0.017	0.028	0.017	0.053	0.007

Note: The annual dataset used covers at most 1976-2019 and 32 OECD countries (Norway is excluded, see note 9). For several items, some observations have been dropped so that the sample exactly coincides with that used in Table 3. All specifications include constant, country fixed effects and time fixed effects. Standard errors are clustered at the country level. Values in brackets correspond to the p-values. * p<.10 ** p<.05 *** p<.01.
Source: Authors' calculations.

Table A E.6. Annual change in revenue items, difference in debt reduction episodes relative to rest of sample

Equation [9] without variable CONSOL, underlying revenue items in % of potential GDP

	Personal income taxes	Social security contributions	Corporate income taxes	Environmental taxes	Consumption taxes	Recurrent taxes on property	Other property taxes	Sales of goods and services	Other primary revenue
DRE+	-0.034	-0.075***	0.046	-0.008	0.017	-0.011	0.013	0.012	-0.008
	[0.346]	[0.009]	[0.115]	[0.516]	[0.639]	[0.169]	[0.207]	[0.432]	[0.760]
Observations	823	943	823	749	749	823	823	699	669
Countries	32	32	32	32	32	32	32	29	29
R^2	0.067	0.079	0.136	0.121	0.058	0.106	0.082	0.042	0.106
Adjusted R^2	0.033	0.035	0.105	0.090	0.025	0.074	0.049	-0.015	0.066

Note: The annual dataset used covers at most 1976-2019 and 32 OECD countries (Norway is excluded, see note 9). For several items, some observations have been dropped so that the sample exactly coincides with that used in Table 4. All specifications include constant, country fixed effects and time fixed effects. Standard errors are clustered at the country level. Values in brackets correspond to the p-values. * p<.10 ** p<.05 *** p<.01.
Source: Authors' calculations.