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## The effects of high inflation on public finances in the euro area

Based on the analysis by the Eurosystem members of the Working Group on Public Finance

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# Abstract

The recent spike in inflation, unprecedented in the history of the Economic and Monetary Union (EMU), has had major consequences for all areas of the economy, including public finances. This paper aims to provide a detailed assessment of the effects of high inflation on fiscal accounts in the euro area. Relying on the wealth of expertise in the Eurosystem – within the Working Group on Public Finance – it documents spending indexation arrangements in all euro area countries. Thanks to this knowledge, the ECB's fiscal projection platform, which is the primary evaluation tool for this study, establishes a realistic link between prices and fiscal variables. The results of this paper bring into question the conventional wisdom on the overall positive effects of inflation on fiscal accounts. Indeed, the simulations point to adverse effects from the recent inflation surge, mainly triggered by an external supply shock, on budget balances during 2022-24. This is even without taking into account the negative impact of inflation on the real economy, mainly through monetary policy tightening. The analysis also points to the important role of the denominator effect for debt-to-GDP ratios, which may fall even in the absence of benefits for the budget balance. Finally, the analysis reveals a high degree of heterogeneity across countries.

**Keywords:** macroeconomic simulations, euro area, inflation, fiscal policy

**JEL codes:** C3, E3, E6

# Non-technical summary

**Since mid-2021, the euro area has experienced unusually high inflation, at levels not seen since the inception of Monetary Union in 1999.** This surge in prices has had various economic effects, reducing disposable income, increasing inequality and affecting the fiscal position of euro area countries. While inflation usually helps fiscal accounts by reducing real government debt and improving deficits, this specific inflationary episode may be different. As inflation mainly originated outside the euro area and affected only certain prices, careful analysis is required to understand its impact on public finances.

**This paper examines the impact of recent high inflation on public finances in the euro area.** It focuses on the effects of the unexpected extraordinarily high inflation of 2022 on budget balances and debt-to-GDP ratios in subsequent years. The study carefully considers the unique nature of the inflation shock and the specific budgetary arrangements of each Member State, in order to determine whether the widely held view that inflation positively affects fiscal accounts holds true in this situation.

**This study adds specific knowledge of the Eurosystem to the ongoing conversation about the effects of high inflation on public finances.** It uses expertise from the Working Group on Public Finance of the European System of Central Banks to document how spending responds to prices in all euro area countries. As well as looking at standard indexation arrangements, the analysis takes due account of recent adjustments to public expenditure in response to high inflation.

**Inflation effects are evaluated on the basis of the ECB's fiscal projection platform, which is a partial equilibrium framework.** The platform, which has been enhanced for this study, provides a detailed view of countries' fiscal accounts and how public expenditure reacts to price changes, including in the current environment of high inflation. However, the paper's findings do not account for how the real economy or monetary policy will react to inflation. Against this backdrop, readers should interpret the results with caution, bearing in mind how the analysis is set up.

**The results of this paper challenge the common belief that inflation has positive effects on fiscal accounts.** They suggest that the recent inflation surge will actually affect budget balances negatively in 2022-24, particularly in 2024 when expenditure catches up with inflation. This is because the inflation mainly originated outside the euro area, affecting import and consumer prices, while domestic prices, like wages, did not increase as much. The situation led to limited gains in budget revenue, while budgets had to bear the increased prices over time. The conclusion might be even more negative if the study includes the impact of inflation on real macroeconomic variables and interest rates. Furthermore, the results indicate that the effects of inflation vary significantly from country to country. The ultimate impact depends on several factors, including the size and nature of the inflation surprise and the characteristics of the budgets.

**Even without positive effects on the budget balance, debt-to-GDP ratios are expected to decrease due to the recent high inflation, according to the partial equilibrium analysis.** This is due to the “denominator effect”, i.e. the increase in nominal GDP associated with the GDP deflator. The simulations show a reduction of over 3 percentage points for the euro area due to inflation by 2024. For countries with a high initial debt-to-GDP ratio and a significant inflation surprise in domestic prices, this denominator effect may be particularly sizeable. This analysis does not account, however, for the full impact of inflation on interest rates and real output, as well as the costs of all discretionary measures adopted by euro area governments between 2022 and 2023 in response to energy shocks and the surge in inflation.

# 1 Introduction

**Mid-2021 marked the beginning of a period of high inflation, which reached levels not seen since the inception of Monetary Union in 1999.** The suddenly soaring prices had major implications for the real economy, eroding the value of disposable income. They reshaped inequality across households as certain consumption baskets (in which food and energy had greater weight) were subject to particular pressure. Also, crucially, they left a mark on the fiscal positions of the euro area countries. Conventional wisdom suggests that inflation effects have benefits for fiscal accounts. With an unexpected surge in inflation, the real value of government debt tends to be eroded, to the detriment of bondholders. At the same time, deficits improve, at least in the near term, as the nominal bases on which taxes are paid react immediately, whereas government expenditures may show a delayed response. This reasoning should not be applied universally, particularly given the specific nature of the 2022 inflationary episode. In this case, the euro area inflation, at least initially, was external in origin and affected only selected price indices with import content. These circumstances call for a thorough examination of how the recent inflationary episode has affected public finances in the euro area.

**The main question that this paper attempts to address revolves around the effects of the ongoing high inflation on public finances in the euro area.** In concrete terms, the fiscal simulations at the centre of the study gauge the effects of unforeseen inflation erupting in 2022 on the budget balance and debt-to-GDP ratio in the euro area in subsequent years. The study focuses closely on the specific nature of the inflation shock and the characteristics of the budgets of each Member State. In this context, the aim of the paper is to ascertain whether the conventional wisdom on the positive effect of inflation on fiscal accounts applies in the current circumstances.

**This study contributes to the ongoing discussion on how high inflation impacts public finances.** Relying on the wealth of expertise within the Eurosystem (particularly on WGPF, the Working Group on Public Finance of the European System of Central Banks), the paper details spending indexation processes in all euro area countries. It not only considers the standard indexation arrangements but also takes due account of recent ad hoc adjustments in response to high inflation. A detailed account of how various spending categories in all euro area countries respond to price developments constitutes a contribution to the literature on its own.

**The evaluation of inflation effects relies on the macroeconomic simulations of the ECB's fiscal projection platform.** The tool contains a detailed representation of countries' fiscal accounts. For the purpose of the investigation, the platform has been extended to ensure that public expenditure items respond realistically to price dynamics. The extension was made possible by the WGPF's major efforts to collect the information on spending indexation arrangements in a harmonised manner. Country and variable-specific indexation arrangements take the form of equations (see the Appendix), which further enhance the fiscal projection platform. In the same

vein, some empirical analyses described in the paper, notably on strictly discretionary spending, enrich the toolbox.

**The findings of this paper are based on a partial equilibrium framework and should be interpreted accordingly.** While the ECB's fiscal projection platform contains a detailed representation of fiscal accounts, it does not show the endogenous reactions of macroeconomic variables, which are accounted for in the broad macroeconomic projection set-up.[1] Within this restrictive framework, an inflation shock does not affect the real economy, although, in reality, it would have adverse effects both directly and through a monetary policy reaction. Accordingly, the exercise conducted in the paper should be seen as providing estimates at the optimistic end of the spectrum.

**The results of this paper bring into question the conventional wisdom on the positive effects of inflation on fiscal accounts.** The simulations point to adverse effects caused by the recent surge in inflation on budget balances during 2022-24. The cost is particularly evident in 2024 once expenditure catches up with inflation, which occurs with a time lag. The lack of positive effects stems from the nature of the inflation shock. When it started in 2022, most of the price pressures in the euro area originated outside the area, affecting import prices and consumer prices. Domestic prices, particularly wages, did not increase as much, resulting in only limited gains on the revenue side of the budgets. At the same time, the budgets have to shoulder the burden of increased prices, especially within discretionary spending components, according to our modelling framework. This already gloomy assessment would worsen if the adverse results of the inflation shock on macroeconomic variables were added to the analysis.

**The results show a high degree of country heterogeneity in terms of inflation effects.** For some countries (e.g. Belgium and France) with a high share of spending indexation, inflation surprises can be particularly harmful. Other economies, such as Ireland and Estonia, may even benefit from an inflation shock in the short run, because the outlays within their budgets are relatively immune to price developments. The ultimate outcome is always a combination of multiple factors, such as the size and nature of the inflation surprise, as well as the characteristics of the budgets.

**Even in the absence of positive effects on the budget balance, debt-to-GDP ratios are estimated to fall in this partial equilibrium framework on the back of the recently observed high inflation.** The decrease in the ratios is due to the denominator effect, namely the increase in nominal GDP associated with the GDP deflator. The simulations show a decrease of more than 3 percentage points for the euro area attributable to inflation by 2024. For a country with a high initial debt-to-GDP ratio and a sizeable inflation surprise in domestic prices (as denoted by the GDP deflator), the denominator effect may be particularly pronounced.[2] In practice, however, debt dynamics are also impacted by the response of the interest rate

[1] To which the fiscal platform is linked through iterative processes in the context of the regular ECB fiscal and macroeconomic projections.

[2] For euro area simulations of the debt-to-GDP ratio in a general equilibrium framework and the related discussion, see also Bankowski et al. (2023).

increase following the monetary policy reaction, other real effects and the costs of all discretionary measures adopted by euro area governments between 2022 and 2023 in response to energy shocks and the surge in inflation. The overall change in the Eurosystem debt ratio projections for the euro area before and after the inflation shock, which reflect all the forces at play, was even moderately positive.

**The rest of the paper is organised as follows.** Section 2 reviews the empirical and theoretical literature on the relationship between inflation and public finances. Section 3 documents the reaction of various budgetary categories to price dynamics. In particular, it focuses on spending indexation by synthesising information collected through the WGPF. The fiscal simulations at the core of the analysis, including both the underlying assumptions and results, are described in Section 4. Finally, Section 5 contains a brief conclusion.

# 2 Literature review

**High inflation has been all but forgotten by studies conducted in the last couple of decades amid the prevailing environment of muted price growth.** Any analysis of the impact of price dynamics on public finances tended to centre on the theme of subdued inflation or even deflation. Attinasi et al. (2016) find evidence of an adverse impact on the fiscal balance resulting from a disinflation shock. The investigation, based on several countries in the euro area, suggests a deterioration of around 0.15 percentage points in the budget balance-to-GDP ratio in response to a temporary 1 percentage point fall in inflation. End et al. (2015) and Afonso and Jalles (2019) study the fiscal consequences of deflation using historical panel datasets. Both studies acknowledge that falls in prices have previously been associated with increases in government debt ratios.

**Following the recent inflation surge, the focus of analysis has switched from low to high inflation and its effects on public finances.** Multiple contributions have recently appeared on the topic, varying in terms of breadth and depth. One of the main questions asked in IMF (2023) is how inflation affects fiscal accounts and how its effects depend on the institutional features of the tax and benefit system. The report, which relies on historical data for 85 countries and local projections, points to minor temporary benefits for the fiscal balance. Moreover, it concludes that unexpected inflation leads to a fall in debt ratios, especially for indebted economies (0.6 percentage point debt ratio drop lasting for several years in response to a 1 percentage point inflation surprise). Other contributions, such as that of Holler and Reiss (2023), principally focus on individual economies. The study shows that while the current inflation shock has had a small positive short-run effect on the Austrian budget balance, it will be detrimental in the medium to long run. Finally, some analyses, such as that of García-Miralles and Martínez-Pagés (2023), have an even narrower focus, being devoted to a specific issue pertaining to one country. This study attempts to explain the spectacular rise in government revenue that took place in Spain amid the post-pandemic recovery. The analysis attributes just over half of the rise observed in 2022 to inflation.

**The economic literature includes valuable contributions that scrutinise the distinctive mechanisms by which inflation leaves a mark on public finances.** As explained in the guide of Escolano (2010), inflation affects virtually all fiscal aggregates.[3] First, inflation tends to boost government revenue by raising the nominal bases on which taxes are levied. Second, even if not immediately, inflation eventually exerts pressure to increase primary expenditure with a view to preserving the purchasing power of government outlays. Third, even abstracting from monetary policy reactions, inflation alters the financing cost of sovereigns through inflation-linked debt instruments, which are a feature of debt issuance in some euro area countries. Finally, inflation has profound implications for the real value of government

[3] Dynan (2022) elaborates on several channels through which the current increase in inflation affects fiscal aggregates. Although the presentation focuses on the United States, the mechanisms described are at play in all economies.

debt and debt-to-GDP ratios, not only through the budget balance but notably through the denominator effect. The following several paragraphs briefly describe studies of the specific channels through which inflation affects public finances.

**Inflation usually boosts government revenue, which tends to be higher than a one-to-one reaction to prices would suggest.** The excess of revenue growth beyond price dynamics is due to "fiscal drag". What happens in practice is that certain parameters of the tax system (e.g. tax thresholds set up in nominal terms) fail to fully adjust to inflation. As a result, taxpayers effectively face an increase in effective tax rates as they move into higher tax brackets, unless governments intervene through discretionary measures to mitigate this effect, as has recently been the case in several euro area countries.[4] According to Morris and Reiss (2020) this phenomenon explains a significant chunk of the increase in the revenue-to-GDP ratio in Germany recorded in the previous decade. Heinemann (2001), looking at OECD countries since 1965, estimates that substantial positive effects arise in the presence of inflation due to fiscal drag in personal income taxes and social contributions. Recently, Beer et al. (2023) have provided a comprehensive overview of sources (including the bracket creep often associated with fiscal drag), underlining the non-neutrality of tax systems with respect to inflation.[5]

**Inflation also effectively affects the course of primary expenditure, albeit not instantaneously.** Ultimately, governments must preserve (at least to some extent) the real value of the benefits they provide and adjust outlays to price dynamics. Expenditure updates may be automatic in the presence of indexation schemes. Checherita-Wesphal (2022) provides an overview of indexation schemes and other mechanisms for setting public wages and pensions across the euro area countries. While the study concludes that automatic price indexation of public wages is relatively limited in the euro area, public pensions are overwhelmingly automatically indexed, either fully or partially, to prices and (private-sector) wages.[6] As indexation schemes are predominantly backward-looking, primary spending usually only reacts to inflation after some time. The same applies to categories that are not formally linked to prices and for which discretionary adjustments are needed to maintain their real value. Spending envelopes temporarily remain insusceptible to inflation until they can be updated within a (usually) yearly budget.

**The standard reaction of monetary policy to inflation causes additional strain on the expenditure side through interest payments.** When inflation increases, a central bank will tend to tighten monetary policy, usually by raising nominal interest rates. As a result, any new and rolled-over government debt will be financed at the

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4 See Bankowski, Bouabdallah et al. (2022) for an overview.

5 Neutrality of a tax system with respect to inflation mainly means that the tax burden remains constant, regardless of the level of inflation. As well as the non-adjustment of tax parameters for inflation (e.g. bracket creep), Beer et al. (2023) also point to timing issues, such as the lag with which taxes are collected and refunded, as a source of non-neutrality. In particular, a significant collection lag in the presence of high inflation results in a loss of real tax revenue (the so-called "Tanzi effect", as first described by Tanzi (1977)).

6 OECD (2021) provides an overview of pension indexation rules for OECD countries and how they have changed in the last two decades. For most countries in which reforms have taken place, indexation schemes have become less favourable. The adjustments reflect the increasing role of indexation rules in ensuring the sustainability of pension systems. Nevertheless, the overarching objective of the schemes is consistent with their original intention of maintaining pension adequacy over time.

increased interest rate. The pass-through of the increase in the monetary policy rate to the effective interest rate on government debt is likely to be delayed, depending, first and foremost, on the debt structure and the average debt maturity. For countries that rely on inflation-linked debt instruments, the link to inflation may be very direct and the cost of debt servicing may surge, including on existing securities. Other factors impacting transmission include the sovereign risk premium, which depends on debt and deficit levels, as well as other private-sector vulnerabilities. Tujula and Wolswijk (2007) estimate, for OECD countries, that a 1 percentage point increase in the interest rate leads to a budgetary cost of 0.14% of GDP. More recently, IMF (2022) posits that, on average for the advanced economies, for each increase of 100 basis points in the policy rate, the effective interest rate on government debt will have risen by about 30 basis points one year later.

**While inflation leaves a footprint on the government's debt-to-GDP ratio via the budget balance, its main effects may materialise through the denominator effect.** Inflation usually entails additional growth in nominal GDP, increasing a government's ability to service a given nominal stock of debt. This effect tends to be significant, and it is likely to dominate higher interest costs, as concluded by Dynan (2022) for the United States and the calculations in Darvas (2022) for a group of advanced economies. Given the mechanics of the debt-to-GDP ratio, the larger the initial amount of outstanding debt, the bigger the decrease brought about by inflation. Multiple empirical studies confirm the beneficial role of inflation in previous debt-to-GDP ratio reductions. Bernardini et al. (2021) present high and unexpected inflation as one of the ways to reduce the debt-to-GDP ratio – a major force in bringing down the legacy debts of the Second World War. Fukunaga et al. (2019) provide a quantitative evaluation for the advanced economies, according to which a 1 percentage point inflation shock brings down the debt-to-GDP ratio by 0.5-1 percentage points. In a study assembling a comprehensive set of debt consolidation episodes, Eichengreen and Esteves (2022) also emphasise the instrumental role of inflation. However, many studies also warn against seeing inflation as a panacea in reducing public debt, especially under current circumstances. Eichengreen and Esteves (2022) point out that history also contains multiple examples of failure to inflate debts away (for example, in the 1920s). IMF (2022) points out that historical instances of high inflation helping to reduce public debt were heavily dependent on circumstances that are unlikely to be seen today: in particular, financial repression that depressed real returns on domestic sovereign bonds, even when inflation was anticipated (Reinhart and Sbrancia, 2015; Best et al., 2020). The negative effects of high inflation may be exacerbated when volatility is high and when inflation expectations are also affected.

**Another useful way of looking at the effects of inflation on public finances is through the concept of real (i.e. inflation-adjusted) government debt.** An unanticipated inflation shock erodes the real value of government debt, with bondholders bearing a loss. The flip side of the situation is that bond issuers (i.e. governments) realise a gain. Andreolli and Rey (2023) document that systematically falling short of the inflation target comes with significant fiscal costs, especially when debt stocks are large and maturities are long. One could make the opposite argument for circumstances in which inflation overshoots the target. Neely (2022)

emphasises, however, that such benefits might only materialise in the short run. Repeatedly surprising investors with excessive inflation will lead to an increase in inflation expectations and ultimately raise future borrowing costs. Also, Hilscher et al. (2022) argue that inflating away the value of government debt in the United States at the current juncture is unlikely. One of the reasons for this assessment lies in the concentration of domestically held government debt with short maturities.

**By now it is also widely acknowledged that not all types of inflation yield the same effects on public finances.** Several contributions distinguish between various sources of inflation, which is particularly relevant for the euro area in 2022, when the price pressures mainly came from outside in the form of energy price shocks. Amid the subdued price dynamics of the 2010s, de Cos et al. (2016) showed that, while internally driven deflationary shocks may worsen the government debt-to-GDP ratio, the opposite is true for external shocks, notably decreases in oil prices. More recently, a VAR-based analysis by Burriel and Odendhal (2023) conducted in the context of high inflation validates the findings on the impacts of oil shocks. The study concludes that inflation driven by imported energy prices adversely affects the budget balance over the medium term, despite some benefits in the short run. In a similar vein, the model-based analysis by Bénassy-Quéré (2022) reveals negative effects from inflation driven by oil prices on the primary balance, which build up over time. To emphasise the importance of the inflation source, the results contain simulations for a demand shock also driving up prices, which, by contrast, has a positive impact on the primary balance.

# 3 Effects of inflation on fiscal accounts

**As already set out in the literature overview, inflation affects both the revenue and the spending side of the budget balance, albeit with different degrees of complexity.** On the revenue side, price dynamics have direct impacts on macro bases, on which taxes are levied. Although fiscal drag may add some complexity, the relationship between prices and taxes should be, in principle, relatively clear. In the end, most of the reaction automatically materialises when price dynamics translate into nominal macro bases.

**The relationship between inflation and spending categories cannot be characterised as simply.** The way in which prices affect budgetary spending varies significantly across categories. For spending items such as wages or pensions, the impact usually depends on the legislative frameworks in place governing these categories (e.g. public sector wage arrangements and pension systems). For strictly discretionary spending, such as intermediate consumption, which can be set up somewhat freely, governments may have no choice but to accept the market prices of purchased goods/services. To make things even more complicated, an extraordinarily large inflation shock, such as the one currently in progress, may involve ad hoc government interventions that alter regular price-spending relationships.[7] All of this calls for a thorough investigation of how prices influence government expenditure in the euro area countries, which is the aim of this section.

**In order to gauge the direct effects of inflation on public finances in the euro area, this paper relies on the ECB fiscal projection platform.** This tool includes a wide range of fiscal variables for each Member State. Each fiscal category is modelled to react to price developments via a link to a nominal macro base (e.g. indirect taxes) or by incorporating prices in the relevant equations (e.g. pensions indexed to the cost of living). The platform provides insights into different reactions to price changes across countries, as well as delivering euro area aggregate figures. For the purposes of this analysis, multiple equations have been extended to adequately reflect the reaction of spending to price dynamics. After describing the revenue equations, the following subsections will be devoted to expenditure properties and the equations that characterise them.

**The following subsections build on a WGPF special questionnaire on inflation and public finances designed to assess how inflation alters the budget balance, particularly on the spending side**. As well as addressing selected aspects of revenue, the questionnaire mainly concentrates on the expenditure side, with a view to exploring the complexity of the relationship between inflation and various expenditure categories. The main aim of collecting this information is to understand the degree of standard price indexation of different spending

[7] Governments may take exceptional measures to offset the effects of high inflation, including high energy prices: this has been the case in the euro area since Russia's invasion of Ukraine. For an overview, see several ECB analyses on the subject, including Bankowski et al. (2023). Such effects are not covered in this analysis.

components. It also covers ad hoc initiatives recently undertaken by governments in response to high inflation.

## 3.1 Inflation and the revenue side of the budget

**On the revenue side, when assessed using the revenue-to-GDP ratio, inflation probably has a positive effect on public finances.**[8] As touched upon to some degree in the literature review (**Section 2**), this positive effect mainly occurs due to fiscal drag in the presence of a progressive tax system. Progressive income taxes mean that increases in income and wages, even if these are in line with overall price growth in the economy, raise the revenue-to-GDP ratio. This beneficial effect takes place because taxable income falls into the next tax brackets (i.e. the phenomenon of bracket creep) whenever the tax brackets are not fully adjusted for inflation. The more tax brackets in the system and the larger the dispersion between marginal tax rates, the more sizeable the fiscal drag.

**The information collected within the WGPF indicates that the taxation systems in the euro area countries do indeed entail fiscal drag.** This mainly applies to personal income taxes, for which progressive schemes are in place in virtually all countries. The progressivity is achieved through levying incremental marginal tax rates on increasing taxable income, stratified into brackets. While the number of brackets in the euro area countries is non-negligible, most countries do not index them automatically, thereby rendering their taxation susceptible to fiscal drag. Other tax categories are not affected by this issue to the same degree. Corporate taxes and social contributions are largely proportional, with the latter category often involving caps. Moreover, excise duties, including energy taxes, are often based on quantities and are therefore usually unaffected by price dynamics (**Table 1**).

8 One notable exception to the positive relationship between inflation and taxes is when tax liabilities are collected with a significant time lag. In the presence of a considerable lag between the taxable event and the moment the tax is actually paid, inflation, if high, reduces the real value of taxes (Escolano, 2010).

**Table 1**

Tax progressivity and other indexation aspects of taxes in 2022

| Tax type / Ctry. | Personal income tax | | | Corporate income tax | | | Social security contribution | | | Excise duties | | | o/w Energy taxes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Prog. | # br. | Ind. br. | Prog. | # br. | Ind. br. | Prog. | # br. | Ind. br. /caps | Prog. | # br. | Ind. br. /caps | Prog. | # br. | Ind. br. /caps |
| **AT** | P | 7 | YES/ NO | F | - | - | F (capped) | - | YES (caps*) | Fq | - | NO | Fq | - | NO |
| **BE** | P | 4 | YES/ NO | F | - | - | F | - | - | Fq | - | NO | Mixed* | - | NO |
| **CY** | P | 5 | NO | F | - | - | F (capped) | - | YES (caps) | Fq | - | NO | Fq | - | NO |
| **DE** | P | 5 | NO | F | - | - | F | - | YES | Fq | - | NO | Fq | - | NO |
| **EE** | P | 4 | NO | F | - | - | F | - | NO | Fq | - | NO | - | - | - |
| **ES** | P | 6 | NO | F | - | - | F (capped) | - | NO | Fq/F | - | NO | Fq/F | - | NO |
| **FI** | P* | 4 | NO | F | - | - | F | - | NO | Fq | - | NO | Fq | - | NO |
| **FR** | P | 5 | YES | P | - | NO | F/P | - | NO | Fq | - | NO | Fq | - | NO |
| **GR** | P | 5 | NO | F | - | - | F | - | NO | - | - | - | - | - | - |
| **IE** | P | 2 | NO | F | - | - | P | 2 | NO | Fq | - | NO | F | - | NO |
| **IT** | P | 4 | NO | F | - | - | F (capped) | - | YES (caps) | Fq | - | NO | Fq | - | NO |
| **LT** | P | 2 | YES | P | 2 | NO | F | - | NO | Fq | - | NO | Fq | - | NO |
| **LU** | P | 23 | NO | P | 2 | NO | F (capped) | - | NO | Fq/F | - | NO | Fq | - | NO |
| **LV** | P | 3 | NO | F* | - | - | F | - | NO | Fq* | - | NO | Fq* | - | NO |
| **MT** | P | 5 | NO | F | - | - | F (capped) | 3 | YES (both) | Fq | - | NO | Fq | - | NO |
| **NL** | P | 2 | YES | P | 2 | NO | F (capped) | - | YES (caps) | Fq | - | YES (tariff) | D | 4-5 | YES (tariff) |
| **PT** | P | 9 | NO | F* | - | - | F | - | NO | Fq | - | NO | Fq | - | NO |
| **SI** | P | 5 | NO | F | - | - | F | - | NO | Fq | - | NO | Fq | - | NO |
| **SK** | P | 2 | YES | F | - | - | F (capped) | - | NO | Fq | - | NO | Fq | - | NO |

Source: WGPF inflation questionnaires.
Notes: Abbreviations in table headings: Prog. – progressivity; # br. – Number brackets; and Ind. Br. – Indexation brackets.
Abbreviations in table values: P denotes a progressive tax system, D denotes regressive tax system, F denotes a flat tax or proportional system and Fq denotes a tax based on quantity.
Other notes applicable to specific countries:
AT: SSC* = Caps are automatically increased each year, income tax brackets are indexed to Consumer Price Index (CPI) inflation from 2023 onwards.
BE: energy taxes* = For excise duties on motor fuel: cliquet system: when prices drop, excise duties increase (and vice versa).
FI: PIT* = Progressive (CG), proportional (LG, effectively progressive due to deductions).
LV and EE: CIT* = 0% for reinvested and 20% for distributed profits; Excises* = 8 different tax bases & flat by individual product type, defined according to quantity; Energy taxes* = for oil products (per 1,000 units, differs by 14 product types) & natural gas (per MWh, differs by type: gas as heating for households, gas as heating for industries and gas as fuel).
MT: excises and energy taxes: fixed rates per quantity and type.
NL: energy taxes* = 4 brackets (gas), 5 (electricity).
PT: Although the general CIT rate is flat at 21%, there is a reduced rate applicable to the first €15,000 of SMEs' taxable income, as well as a State Surcharge levied on taxable income above €15 million. There are three income brackets for the determination of the State Surcharge. In practice, this rate structure is introduced progressivity in CIT collection.
SI: As an exception, the base for tobacco excise duties is mixed (quantity and price).

**The revenue equations in the ECB fiscal projection platform ought to emulate the property of the fiscal drag** (**Equation 1**)**.** In general, a tax variable $tax_t$ in the platform evolves as a function of the corresponding macro base $base_t$, the yield of any relevant tax measures $\text{measures}_t$ and the expert-judgement term $\text{ju}_t$.[9] The variable-specific coefficient $\xi$ in the equation is a tax elasticity that governs the force with which the dynamics in the macro bases translate into the growth of the relevant

[9] Tax measures in the equation are assessed on an ex ante basis (i.e. excluding any effects materialising through the macro bases as a result of the tax measure).

taxes. For categories that are prone to fiscal drag, the value of the coefficient significantly exceeds unity (e.g. 1.8 for direct taxes paid by households in countries with progressive tax systems). As a result, the fiscal drag property should be in principle captured by the revenue equations of the platform. That being noted, there are countries (e.g. Austria) that have recently introduced indexation of tax brackets through discretionary measures. In such cases, the elasticity parameter alone would not adequately capture the phenomenon of fiscal drag.

Equation 1

$$tax_t = tax_{t-1} \times (1 + \xi \Delta \ln (base_t)) + \text{measures}_t + \text{ju}_t$$

**During a period of exceptional economic developments, such as the ongoing post-pandemic recovery, other forces in tax dynamics may emerge.** They may appear, for instance, on the back of structural transformations in the post-pandemic world, such as increased reliance on electronic payments. Inevitably, these changes will result in deviations from historical relationships and bring sizeable residuals to the equations describing revenue dynamics. Without a full understanding of the underlying causes, the degree of persistence of these extraordinary factors will usually be highly uncertain.

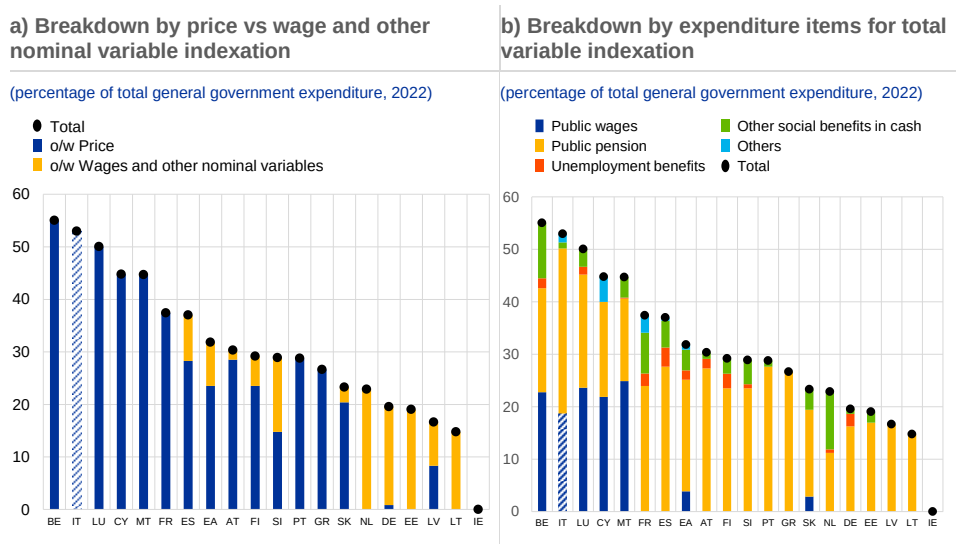
## 3.2 Expenditure properties in the euro area

**The information collected by the WGPF is a key input in understanding the sensitivity of government expenditure to inflation.** To this end, this subsection first builds a metric of inflation indexation of public spending for all euro area countries. The measure is defined as expenditure subject to indexation as a proportion of total expenditure. The definition considers various forms of indexation – by law or other effectively binding arrangements – irrespective of the benchmark price variable (e.g. HICP or wages). As the indexation schemes are primarily relevant for non-discretionary spending, the subsection subsequently sheds some light on how discretionary expenditure (i.e. intermediate consumption, social transfers in kind and government investment) reacts to prices.

**At the euro area aggregate, the share of public expenditure affected by automatic indexation in 2022 is estimated at about one-third (32%).** Most of the spending (23%) is linked to some form of CPI, while for the remainder (8%) some wage rates apply (e.g. economy-wide wages, minimum wage) (**Chart 1, Panel a)**). Most of the indexation, especially for pensions and wages, is retrospective, usually involving a one-year lag. In terms of the composition of indexed expenditure, pensions make up the biggest share (21%), followed at a distance by unemployment benefits and other social benefits in cash (6%) and public wages (4%) (**Chart 1, Panel b)**). Finally, the “other” category (1%) primarily refers to interest payments, which are affected by inflation-linked debt securities (see the discussion at the end of this subsection).

**Chart 1**

Public spending subject to forms of indexation in the euro area




Source: ECB calculations based on WGPF Inflation Questionnaires.
Notes: Shares in 2022 calculated based on June 2022 BMPE. In Italy, while public wages are also automatically indexed to inflation retrospectively, this is not done on an annual basis, but retrospectively at the end of the three-year wage agreement and based on national CPIs excluding energy (in the baseline projections, the adjustment for inflation is implemented in the year 2025). The budget law for 2023 changed the pension indexation mechanism for the period 2023-24, limiting the revaluation of the benefits exceeding certain thresholds. In Greece, automatic indexation of main pensions will apply as of 2023. In the case of Portugal, the figure depicts the share of public spending that is subject to some form of automatic price indexation.

**Spending indexation, as picked up by the constructed metric, involves substantial country heterogeneity (Chart 1).** The calculated shares point to a high degree of indexation in countries where, in addition to pensions, public wages are also indexed, as identified in ECB OP 299/2022. This is most notably the case in Belgium, Luxembourg, Cyprus and Malta, where growth in average public wages reflects the cost-of-living index.[10] At the other end of the spectrum are countries with a very low degree of indexation, or none. Ireland is the only country in the euro area without any spending indexation. Moreover, the indexation share of the Baltic countries and Germany is 20% at most.

**The price variable constituting the indexation benchmark and the composition of indexed spending are more homogenous across countries.** Consumer price indices dominate the picture as a reference variable for spending indexation. The notable exceptions are Estonia, Lithuania, Germany and the Netherlands, which rely on wages in their indexation schemes, particularly those applicable to pensions. Regarding the composition of indexed spending, public pensions account for the largest share in most countries. Even if they are small in terms of size, most economies feature some indexed unemployment benefits and other social benefits in cash.[11] The composition picture also clarifies that indexation arrangements are largely relevant for non-discretionary spending categories.

[10] In Italy, public wages are also automatically indexed to inflation. The wage adjustments, however, do not take place annually but retrospectively at the end of a three-year wage agreement and are based on national CPIs excluding energy.

[11] In the Netherlands, other social benefits constitute almost 50% of indexed spending, making this category exceptionally relevant for the picture of spending indexation, by contrast with other countries.

**Some government spending categories, such as intermediate consumption or government investment, which have not been discussed above, even though discretionary in nature, are not immune to price developments.** Governments are likely to have little control over prices relevant for these items. As most of the spending included in them consists of certain types of purchases – be it consumption or investment goods – governments are effectively price takers. In this context, the question arises of how the price dynamics prevailing in the economy affect the strictly discretionary spending of governments.

**The supplementary analysis attempts to determine a relationship between discretionary government expenditure and price developments.** In the absence of policy changes and major disturbances, it is reasonable to assume that strictly discretionary spending moves together with the size of the economy, as measured by nominal potential output (**Equation 2**). In this context, strictly discretionary spending $DiscSpending_t$ adjusted by real potential output (as represented by $TrendGDP_t$) follows prices (as captured by $CPI_t$).

**Equation 2**

Simple equation describing strictly discretionary spending

$$\Delta \ln(DiscSpending_t) - \Delta \ln(TrendGDP_t) = \Delta \ln(CPI_t)$$

Source: ECB staff.

When the economy experiences large price changes, however, the simple formula may be unable to capture the dynamics. Sizeable price surprises may take more than one year to translate into prices paid by governments, given nominal budget constraints and lasting contractual arrangements. In this context, a generalised version of the spending equation allowing for price propagation to be distributed over some time (**Equation 3**) is preferable to the simple equation. The coefficients ($\beta_1$ and $\beta_2$) on the contemporaneous and lagged price variables will provide information on how quickly market prices affect prices of goods/services purchased by the government.

**Equation 3**

Generalised equation describing strictly discretionary spending

$$\Delta \ln(DiscSpending_t) - \Delta \ln(TrendGDP_t) = \beta_0 + \beta_1 * \Delta \ln(CPI_t) + \beta_2 * \Delta \ln(CPI_{t-1}) + (1 - \beta_1 - \beta_2) * \Delta \ln(CPI_{t-2})$$

Source: ECB staff.

**A simple panel regression sheds light on how rapidly market prices affect prices paid by governments within strictly discretionary spending.** The regression aims to identify the coefficients of the extended strictly discretionary spending equation. On the left-hand side of the equation, the growth in nominal strictly discretionary spending, consisting of government investment, social benefits in kind and intermediate consumption, is reported net of real potential GDP growth to isolate the effect of the price change. CPI inflation in different periods

(contemporaneous and lagged by one and two years) serve as explanatory variables in the equation. The coefficients next to price variables are estimated, with a restriction guaranteeing that all price surprises will eventually have an effect on nominal expenditure.[12] The estimation is based on annual historical data spanning the period 1995-2019 and covering the first 12 euro area Member States. While, admittedly, previous trends may not be entirely representative of the current unprecedented environment of high inflation, they are nevertheless probably the most helpful resources in examining the effects of price changes.

**The estimation results do, indeed, suggest that market prices feed only gradually into prices paid by euro area governments.** Around 60% of a price change, as depicted by CPI inflation, affects nominal strictly discretionary spending contemporaneously (Table 2). Another 30% only materialises after one year and the remaining 10% only after two years. The constant in the equation turns out to be close to zero, which will not impair the long-term stability of the equation in the model. All estimated coefficients are significant at a 10% significance level. The findings of this analysis are integrated into the fiscal projection platform, which will be used to simulate the effects of inflation on public finances in the subsequent sections. The established link between discretionary spending and CPI will result in a significant reaction to inflation within this category.[13] In reality, governments may even reduce spending volumes in response to extraordinary price increases, but we would interpret such actions as fiscal measures, which remain outside the scope of this analysis.

[12] The restriction in the estimation is that the sum of the three coefficients on CPI inflation in different periods is equal to unity. This effectively means that only two of the three coefficients have to be estimated in the regression.

[13] The simulation exercise conducted by Cornille et al. (2023) highlights that estimates of the budgetary cost of inflation may change, depending on the assumptions made about the indexation of discretionary spending.

**Table 2**

Estimated coefficient of the strictly discretionary spending equation

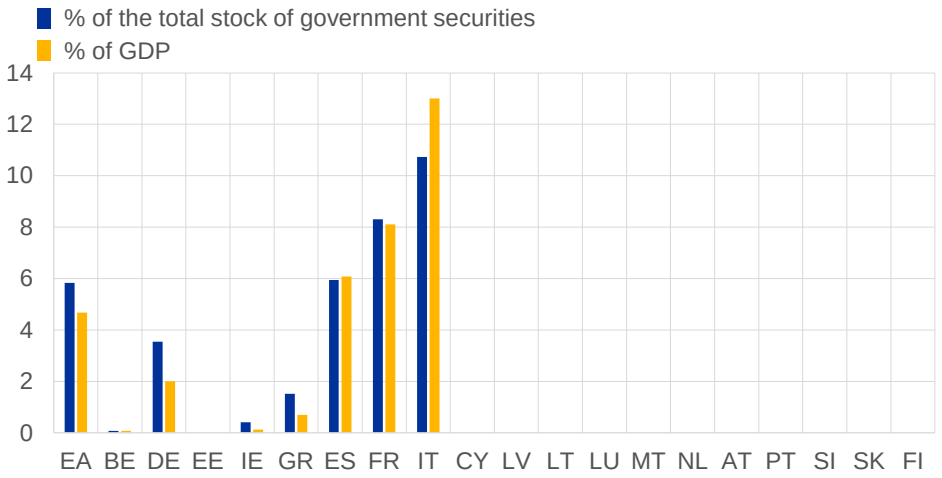
| Price variable | $\beta_0$ | $\beta_1 * CPI_t$ | $\beta_2 * CPI_{t-1}$ | $(1-\beta_1-\beta_2) * CPI_{t-2}$ |
|---|---|---|---|---|
| **CPI** | 0.004 | 0.59 | 0.30 | 0.11 |
| | (0.000) | (0.098) | (0.086) | |

Source: ECB calculations based on the historical annual data.
Note: The values in parentheses are p-value statistics associated with the regression coefficients.

**As well as primary expenditure, interest payments may also be directly affected by inflation.** This is most often the case in the presence of inflation-linked bonds. As indicated by the data on sovereign securities, the share of bonds linked to inflation in the total stock of government-issued securities in the euro area is small (around 6% in 2022), albeit non-negligible (**Chart 2**). The amount reflects the issuance of this type of security by only some Member States, most of which are large economies, such as Italy, France, Spain and Germany. In the event of an inflation surge, these countries will immediately face a rise in debt servicing cost, even in the absence of new issuances under the prevailing market conditions.

**Chart 2**

The amount of inflation-linked debt securities in 2022




Source: ECB Statistical Warehouse (CSEC and AMECO dataset).

## 3.3 Inflation and the spending side of the budget

**The version of the ECB fiscal projection platform used for the analysis described in this paper benefits from multiple equation extensions on the expenditure side.** The standard version of the platform contains a broadly similar set of spending rules across countries with a muted response to price developments. Such a set-up, while clearly incomplete, will not inflict much harm when forecasting with an assumption of very low inflation, such as that observed during the first two decades of EMU. In the high-inflation environment, however, this simple version will

miss major effects of prices on expenditure that are country and variable dependent. To address this shortcoming, the equations describing non-discretionary spending categories are extended to represent the standard indexation schemes, as well as ad hoc initiatives undertaken in response to high inflation, described in the previous subsection. Moreover, strictly discretionary spending is modelled homogenously across countries based on the empirical investigation described above. Finally, country-specific interest payment equations reflect the share of inflation-linked bonds, through which price dynamics directly affect the sovereign cost of financing.

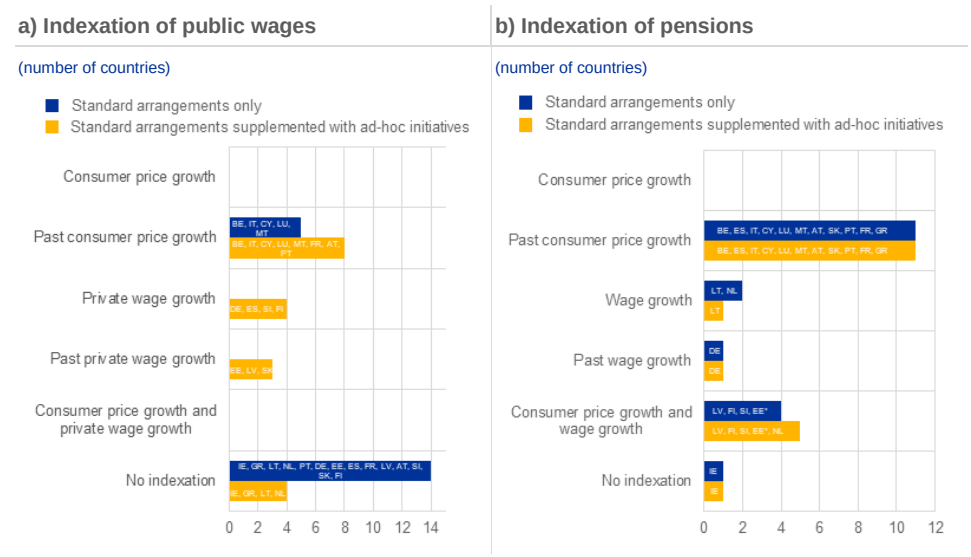
**The information collected within WGPF leaves no doubt that ad hoc initiatives going beyond automatic indexation have recently been adopted on a systematic scale.** As will become evident when looking at single categories, extraordinary arrangements have a particular effect on government wages and other (non-pension) social benefits. Given that the two categories remain largely non-indexed, recipients are exposed to heavy losses of purchasing power during high-inflation episodes, such as the one currently observed. In this context, governments have attempted to preserve the real values of outlays within these categories by temporarily fine-tuning existing spending arrangements. Regardless of the motivation behind these initiatives, they feature sufficiently frequently in the current fiscal policy course to merit due reflection in a model used to gauge the effects of inflation on public finances.

**Although most countries usually do not have price-indexed public wages, inflation can be an important reference in negotiations, especially when it is running at high levels.** Normally, a link between public wages and prices could only be observed for a handful of countries (**Chart 3, Panel a), blue bars**). More recently, however, with inflation running at high levels, there has been a tendency to try to preserve the real value of public wages (**Chart 3, Panel a), yellow bars**). In many countries, past inflation is used as a reference for wage setting. Linking public wages to contemporaneous and past private wage growth is also quite common (eight countries). Effectively, only three countries are left without any indexation of public wages. Non-indexation has become the exception rather than the rule. It is crucial to emphasise that the equations in the model attempt to represent country-specific arrangements. This is manifested in different coefficients governing the pass-through of price variables to public wages.

**Pensions are automatically price indexed in almost all countries that already have standard arrangements (Chart 3, Panel b), yellow bars).** Indexation is based on past inflation only for around half of the euro area countries. For most of the others, private wages also serve as a benchmark variable. Ireland is the only country with a pension system that involves no indexation. As most countries already regularly provided some form of indexed pensions, these benefits did not have to be adjusted on an ad hoc basis during the ongoing inflationary episode.

**Chart 3**

Indexation of wages and pensions



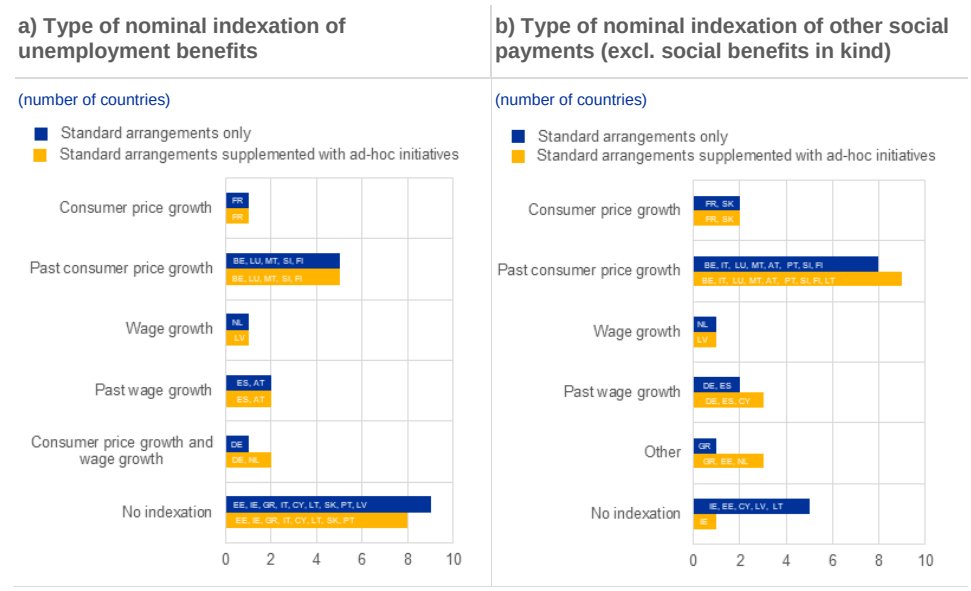

Source: Illustration based on WGPF Inflation Questionnaires.
Note: Appendix B outlines the arrangements for indexation of public expenditures.

**Unemployment benefits are indexed in around half of the Member States and the recent ad hoc policy initiatives do not change this proportion (Chart 4, Panel a)).** Countries that link benefits to price variables use past inflation in most cases. Wage variables to be used as a reference are only applicable to a limited degree. According to the information provided within WGPF, the indexation of unemployment benefits has been largely unchanged amid the high inflation. Latvia is an exception in this regard, as it has linked outlays to wage dynamics although they were not normally indexed.

**Finally, in the case of other non-pension social benefits (e.g. child allowances) the degree of indexation has recently increased noticeably, thereby effectively becoming the norm (Chart 4, Panel b)).** Even without any ad hoc policy actions, this spending category is indexed – in most cases to the lagged consumer price indices. There is, however, a handful of countries (i.e. the Baltic states, Cyprus and Ireland) that do not ensure any automatic adjustment of outlays on other social payments for price developments. The recent policy initiatives in response to high inflation leave Ireland as the only country without indexation within this category.

**Chart 4**

Indexation of unemployment benefits and other social transfers




Source: Illustration based on WGPF Inflation Questionnaires.
Note: Appendix B outlines the arrangements for indexation of public expenditures.

**The spending equations in the extended version of the ECB fiscal projection platform take into account the spending properties and indexation arrangements described so far.** The extensions notably apply to the following spending categories: government compensation of employees, pensions, other social transfers and unemployment benefits. All these variables are characterised by equations devised within the WGPF and laid out in the Appendix. Moreover, strictly discretionary spending evolves in the platform as captured by the estimated country-homogenous equation described in the previous subsection. Finally, the equations describing interest payments for France, Italy, Spain, Germany and Greece reflect the fact that the government debt of these countries involves inflation-linked instruments. The adjustment is crucial to ensure the direct transmission of inflation to the debt servicing cost, while, as mentioned before, the indirect transmission through marginal interest rates is not included.

## 3.4 Fiscal effects of stylised inflation shocks

**Simulating stylised inflation shocks helps us understand the link between prices and the budget balance in the ECB fiscal projection platform.** To this end, this subsection describes such simulations of stylised inflation shocks using the platform. The shocks are defined as a permanent increase in prices of 1% in 2022 (i.e. one-off inflation of 1% in 2022). To link the exercise to the economic situation prevailing in 2022, as well as a broad-based price increase, the simulations also involve an HICP-concentrated price increase. The former assumes that all price variables rise. With the latter, only consumer prices are modified, with wages and domestic prices left unchanged – a scenario emulating the situation in the euro area in 2022, when inflationary pressures were first imported.

**According to the platform, a broad-based inflation shock affecting all prices has somewhat positive effects on the budget balance (Chart 5, Panel a)).** As all prices in the economy, including wages, increase, the entire spectrum of taxes benefits. The reaction is particularly strong in the case of direct taxes because of the above-unitary elasticities representing the fiscal drag. As spending adjusts sluggishly, it erodes the initial budget balance benefits over time. For this reason, even though the effects are generally positive, they are mostly visible during the first year. This simulation validates the conventional wisdom about the positive impact of inflation on fiscal accounts.

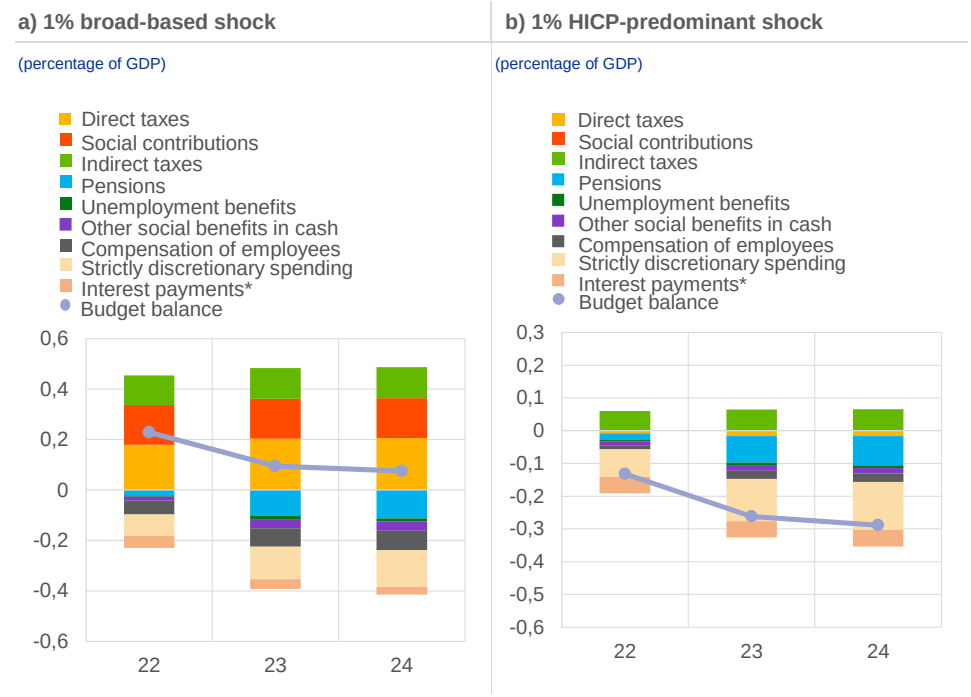
**The effects of the HICP-concentrated inflation shock, which are unfavourable for the budget balance, are dramatically different (Chart 5, Panel b)).** Inflation limited to consumer prices benefits only selected taxes, namely consumption taxes. Given that this type of inflation does not directly involve wages (at least initially), it leaves compensation-based taxes and social contributions unaffected. As a result, benefits on the revenue side are small enough to be easily outweighed by the spending reaction to inflation. This effect is even more pronounced as spending adjustments gain in scope over time.[14]

**The ability to handle various forms of inflation constitutes a strength of the ECB fiscal projection platform.** For many months, the inflation observed in the euro area was far from broad-based. As suggested by the tool, its implications for public finances may be dramatically different from those of broad-based inflation. Despite its strengths, the platform also comes with a set of limitations. In particular, as a partial equilibrium framework, the tool shows only direct links between prices and fiscal variables, and, as such, does not capture all the forces at play. Importantly, it does not cater for a monetary policy response to inflationary pressures, which would entail additional major consequences for the real economy and public finances.

[14] During the recent post-pandemic recovery, which coincided with the eruption of HICP-concentrated inflation in the euro area, government revenue in many countries grew strongly across the board (i.e. not only consumption taxes). However, it is difficult to build a case that this extraordinary increase is attributable solely to price dynamics. García-Miralles and Martínez Pagés (2023), who analyse this phenomenon in Spain, highlight its unexplained nature and suggest caution in interpreting the extra revenue as permanent.

**Chart 5**

Direct effect of a stylised inflation shock on the euro area budget balance




Sources: ECB staff calculations based on the December 2021 and December 2022 Eurosystem staff macroeconomic projections for the euro area.

Notes: The results reflect automatic and discretionary indexation of spending. The "Direct taxes" and "Social contributions" categories denote the impact on these items, which are paid by both households and firms. The "Interest payments*" category in this chart captures only the direct impact of the inflation revisions on interest payments related to inflation-indexed bonds. The calculations reflect existing indexations of income tax brackets in Belgium and Austria. The detailed panel charts are provided in **Figure B** and **Figure C** in the Appendix.

# 4 Fiscal simulations of the inflation surprise

**This section attempts to gauge the effects on public finances of the inflation surge observed in the euro area.** To this end, the analysis makes use of the extended ECB fiscal projection platform. The investigation relies on fiscal simulations of the pre-inflation and post-inflation scenarios for the 2022-24 horizon. After setting out how the analysis is structured, this section describes the results for both versions of the platform: the first, which reflects only standard spending indexation arrangements, and the second, which also considers ad hoc policy initiatives undertaken in response to high inflation.

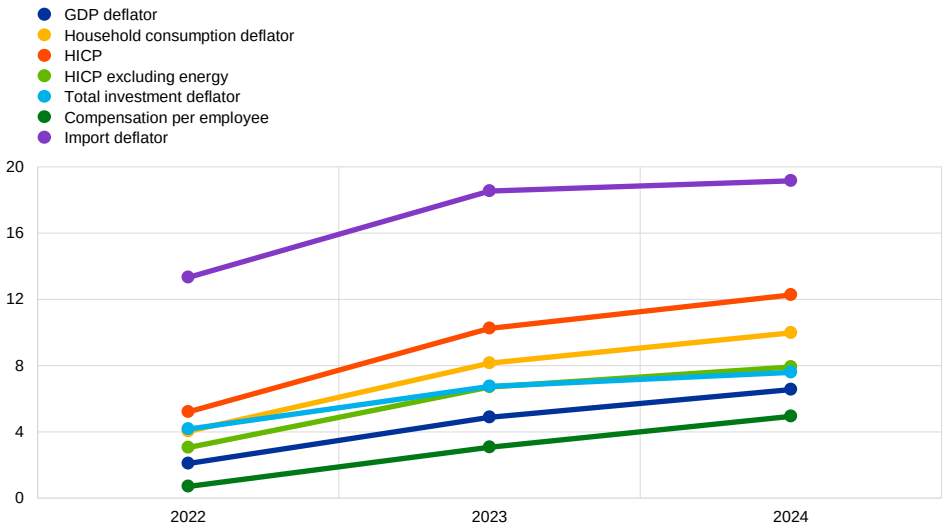
## 4.1 Major assumptions and simulation set-up

**The inflation surprise used in the simulation is proxied by the price forecast revisions since inflation started surging in the euro area.** In concrete terms, the revisions are based on the difference between December 2021 and December 2022 Eurosystem staff projections. The inflation outlook, particularly for 2022 and 2023, was significantly revised upwards between the two projection rounds (**Chart 6**). The HICP and the household consumption deflator – both with meaningful import content – have recorded considerable revisions. This is in contrast with limited revisions to domestic prices, such as average employee compensation and the GDP deflator. The distinction points to the mainly external nature of the inflation shock observed at the time, which was very far from broad-based.

**Chart 6**

Inflation surprise: revisions to price variables in the December 2022 versus December 2021 Eurosystem projection

(deviations in cumulative growth rates, percentage points)




Source: December 2021 and December 2022 Eurosystem staff macroeconomic projections for the euro area.

**While the inflation shock hit countries with different levels of intensity, broad dispersion in revisions across price variables is common.** The Baltic States and Slovakia were subject to particular inflationary pressures, probably due to their proximity to the war in Ukraine, as well as their dependence on Russian energy. Notwithstanding country characteristics, more limited revisions to domestic price variables (particularly average compensation of employees), compared with the variables that embed import prices, emerge as a common theme.

**The analysis in this paper attempts to separate out the direct effects of price revisions on public finances.** To this end, the simulations evaluate how the budget balance (and its components), as well as the debt-to-GDP ratio, are affected by the change in the macroeconomic assumptions limited to price variables only. The simulation set-up embeds the critical assumption that real variables are kept constant. In this context, price revisions translate one-to-one to nominal variables featuring in fiscal equations.

**To give due consideration to ad hoc spending adjustments by governments and to evaluate their role, the simulations incorporate two distinct scenarios.** One captures only the standard indexation mechanisms. The other also covers ad hoc initiatives undertaken by governments in response to high inflation, thereby giving a refined picture. As will become evident, going beyond the existing regular arrangements is pivotal for the results.

**The assumptions underlying the simulations and the application of a partial equilibrium tool warrant careful interpretation of the results.** First, the price revisions used in the simulations only proxy exogenous inflation shocks. Ultimately, the revisions also reflect other factors, such as monetary and fiscal policy, which

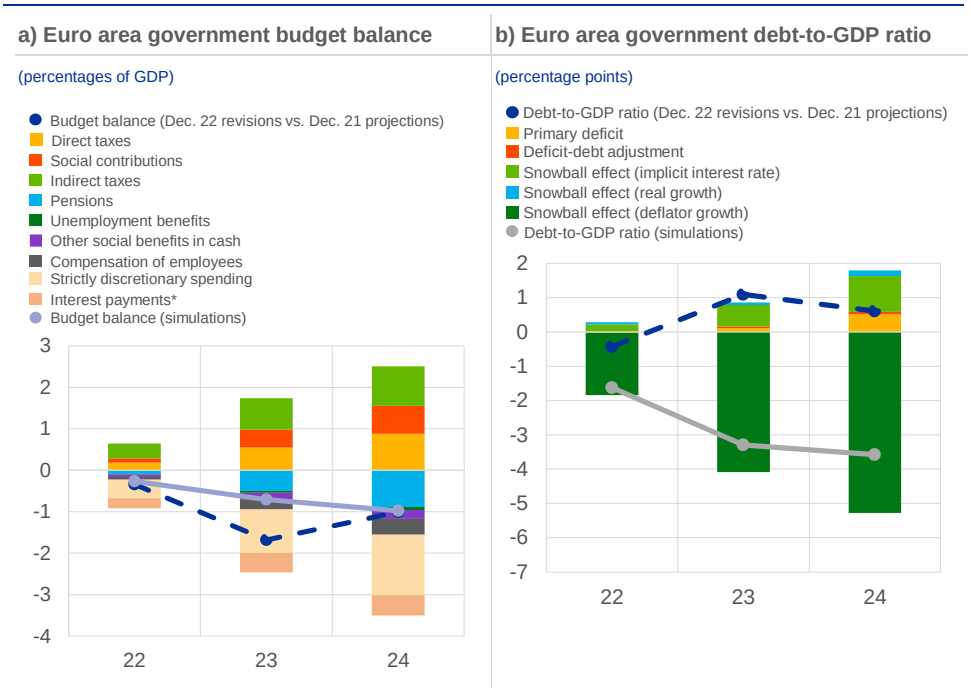
both attempted to tackle the inflationary dynamics. Second, by leaving real variables unchanged, the simulations capture only the most direct effects of prices on fiscal variables. In reality, inflation also influences real activity, including through monetary policy. Embedding at least the reaction of the ECB would expose additional indirect costs due to the dampening of real activity and worsening financing conditions for sovereigns. In this context, the direct effects discussed in the paper should be seen as benign.

## 4.2 Simulation results

**According to the simulations, the budget balance in the euro area is adversely affected by the recent inflation surge (Chart 7, Panel a)).** The limited, albeit instantaneous, rise in taxes and the partial reaction on the expenditure side only has a marginally negative overall effect on the budget balance in 2022. In subsequent years, however, spending pressures intensify due to lagged indexation arrangements. This more than offsets the revenue benefits, leading to a decrease of nearly 1% of GDP in the budget balance level in 2024. The finding brings into question the conventional wisdom that inflation should benefit fiscal accounts.

**Chart 7**

Direct effect of the inflation surprise on public finances considering standard and ad hoc indexation arrangements




Sources: ECB staff calculations based on the December 2021 and December 2022 Eurosystem staff macroeconomic projections.
Notes: Panel a): the grey budget balance line and the bars (its components) reflect the simulation results of the direct (partial) impact (automatic indexation and other adjustments) of the inflation surprise. These abstract from the indirect effects, such as the impact of monetary policy reaction on interest payments, output and tax bases. For example, the "Interest payments*" category in this chart captures only the direct impact of the inflation revisions on interest payments related to inflation-indexed bonds. All effects of indirect channels, including the full interest payment impact and discretionary fiscal policy reaction – together with other factors – are captured in the dotted line, which denotes total revisions in the budget balance-to-GDP ratio between the December 2022 and December 2021 projection vintages. The "Direct taxes" and "Social contributions" categories denote the impact on these items, which are paid by both households and firms. The calculations reflect existing indexations of income tax brackets in Belgium and Austria.

Panel b): The snowball effects in both charts refer to the change in the debt-to-GDP ratio due to the differential between the effective interest rate paid on the stock of debt and the nominal GDP growth (further decomposed in the chart into real GDP growth and GDP deflator growth). The figure illustrates the effect of the revisions to price variables on the debt-to-GDP ratio only, consistent with the methodology followed in the previous subsection. In this context, the category of "Snowball effect (implicit interest rate)" reflects only the direct impact of the inflation revisions on interest payments related to inflation-indexed bonds. The dotted line denotes revisions in the debt-to-GDP ratio between the December 2022 and December 2021 projection vintages, excluding the base effects of revisions of the debt ratio in the period analysed. Charts for individual euro area countries are presented in **Figure D** and **Figure E** in the Appendix.

**The adverse impact of price pressures on public finances derives from the nature of the inflation surprise.** The inflationary episode of 2022 predominantly originated from an external supply shock, manifested in particularly sharp increases in import prices. Consequently, domestic prices, such as average wages and the GDP deflator, experienced considerably lower upward pressures than consumer prices, which contain an import component. As a result, most direct taxes paid by households and social contributions, which are both linked to compensation, exhibit only moderate and delayed increases. The brisk growth in nominal private consumption translates into higher consumption taxes, but they only account for a limited share (around one-quarter for the euro area in 2021) of overall government revenue. From the point of view of tax proceeds, the composition of inflation is relatively unfavourable. Nevertheless, the response of the expenditure side is quite strong, as most of the indexation relies on consumer prices as a benchmark. Moreover, the budget balance has to rapidly shoulder the high cost of purchased goods and services falling into the strictly discretionary category (based on the link established in **Section 3**). The developments on the expenditure side easily outweigh the revenue gains.

**The euro area results do not necessarily represent national situations; hence, they should not be extrapolated to individual countries.** The findings for countries ought to reflect economy-specific macroeconomic situations, as well as the individual characteristics of their budgets (see the country budget composition in **Chart A in the Appendix**). All things being equal, countries with a more sizeable inflation surprise are likely to encounter greater price-induced budgetary implications. In the same vein, the budgets of countries with a larger amount of indexed expenditure are more sensitive to inflation surges. Finally, the nature of the inflation, namely the distribution of price pressures among different price variables, and how it corresponds to the composition of the tax base, plays an important role.

**Looking at country-specific results, the effects of inflation on national public finances show a high degree of heterogeneity (Figure D in the Appendix).** For example, Belgium and France register significant (around 1½% of GDP) inflation-induced costs for the budget. Both countries are characterised by a high share of indexed spending, mainly due to pensions. Moreover, France has been relying on the issuance of inflation-linked debt securities. On the other hand, there are countries, such as Lithuania, which even experience a favourable effect, according to the simulations. The country is not associated with large shares of indexed spending. At the same time, it benefits from the inflation-induced boost in taxes.

**The direct inflation effects on the debt-to-GDP ratio mainly materialise through the denominator effect, not the accumulation of budget balance effects.** The analysis suggests that the inflation shock will lead to a decrease in the euro area debt-to-GDP ratio of nearly 5 percentage points by 2024 **(Chart 7, Panel b))**. Most of the decrease is attributable to the denominator effect, as represented by the

"Snowball effect (deflator growth)" category. This element underlies the decrease in almost all euro area countries. Under certain conditions, namely a high starting value of the debt-to-GDP ratio and a sizeable inflation surprise within the GDP deflator, the denominator effect may lead to sizeable debt-to-GDP ratio drops. The simulations feature multiple cases of decreases of more than 10 percentage points (Cyprus, Lithuania and Portugal, **Figure E** in the Appendix).[15] It is important to bear in mind that in practice, debt dynamics are also affected by the response of the interest rate increase following the monetary policy reaction, other real effects and the costs of discretionary measures adopted by euro area governments between 2022 and 2023 in response to energy shocks and the surge in inflation. The change in the debt-to-GDP ratio outlook that reflects all the forces at play – the forecast revision between December 2021 and December 2022 – was even moderately positive **(Chart 7, Panel b)).**[16]

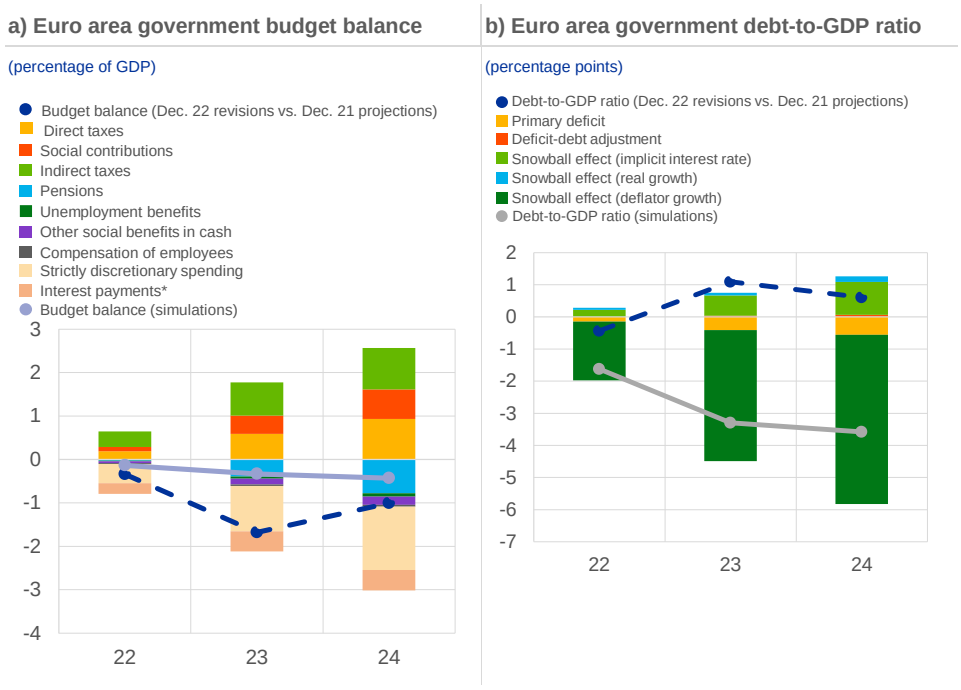
**Leaving aside the extraordinary policy initiatives undertaken in response to high inflation would miss an important element that has recently been present in numerous euro area countries.** In order to assess the relevance of the ad hoc policy initiatives, one version of the simulations only considers standard institutional arrangements. This simulation scenario paints a considerably more benign picture for the euro area than the main version previously discussed. The euro area inflation surprise is associated with around ½% of GDP budgetary cost in 2024 **(Chart 8, Panel a))**, compared with 1% of GDP in the main simulations. While the debt-to-GDP decrease in this scenario is slightly more pronounced than before, the picture remains broadly the same given the dominant role of the denominator effect **(Chart 8, Panel b))**.

[15] While one would expect a significant decrease in the debt-to-GDP ratio in the case of Greece – the country with the highest starting position – its figures cannot be shown in the paper due to the publication policies of the Bank of Greece.

[16] For euro area simulations on the debt-to-GDP ratio in a general equilibrium approach and a related discussion, see also Bankowski et al. (2023).

## Chart 8

Direct effect of the inflation surprise on public finances considering only standard indexation arrangements




Sources: ECB staff calculations based on the December 2021 and December 2022 Eurosystem staff macroeconomic projections.
Notes: Panel a): the grey budget balance line and the bars (its components) reflect the simulation results of the direct (partial) impact (automatic indexation and other adjustments) of the inflation surprise. These abstract from the indirect effects, such as the impact of monetary policy reaction on interest payments, output and tax bases. For example, the "interest payments*" category in this chart captures only the direct impact of the inflation revisions on interest payments related to inflation-indexed bonds. All effects of indirect channels, including the full interest payment impact and discretionary fiscal policy reaction – together with other factors – are captured in the dotted line, which denotes total revisions in the budget balance-to-GDP ratio between the December 2022 and December 2021 projection vintages. The "Direct taxes" and "Social contributions" categories denote the impact on these items, which are paid by both households and firms. The calculations reflect existing indexations of income tax brackets in Belgium and Austria.
Panel b): The snowball effects in both charts refer to the change in the debt-to-GDP ratio due to the differential between the effective interest rate paid on the stock of debt and the nominal GDP growth (further decomposed in the chart into real GDP growth and GDP deflator growth). The figure illustrates the effect of the revisions to price variables on the debt-to-GDP ratio only, consistent with the methodology followed in the previous subsection. In this context, the "Snowball effect (implicit interest rate)" category reflects only the direct impact of the inflation revisions on interest payments related to inflation-indexed bonds. The dotted line denotes revisions in the debt-to-GDP ratio between the December 2022 and December 2021 projection vintages, excluding the base effects of revisions of the debt ratio in the period analysed. Budget balance charts for individual euro area countries are presented in **Figure F** in the Appendix.

# 5 Conclusion

**This paper highlights that the conventional wisdom on the positive effects of inflation on fiscal accounts may not apply to the current situation in the euro area.** The analysis points to adverse effects from the recent inflation surge on the projected 2022-24 euro area budget balance. The conclusion is even reached using a partial equilibrium framework that abstracts from the endogenous reaction of macroeconomic and financial variables to inflation, which would come with additional adverse effects. The negative assessment can be explained by the nature of the inflation surge of 2022, which largely originated outside the euro area. The composition of the inflation, which left domestic prices less affected than overall prices containing import content, was unfavourable from the point of view of public finances. In this context, it is essential for any analysis designed to assess inflation effects on public finances to consider this important aspect. Furthermore, this paper's simulations underscore the importance of the denominator effect. This phenomenon may noticeably lower the debt-to-GDP ratio, especially in high-debt countries, even in the absence of benefits for the budget balance. A potential decline, however, might be less pronounced when accounting for the endogenous reaction to inflation mentioned earlier. Furthermore, the favourable effect on debt ratios would diminish further if we fully account for the costs of all discretionary measures adopted by euro area governments between 2022 and 2023 in response to energy shocks and the surge in inflation.

**The examination also makes it clear that recent ad hoc spending adjustments to high inflation are of first-order importance when gauging inflation effects.** Given the degree to which the high inflation eroded the purchasing power of government outlays, multiple governments went beyond existing standard arrangements in adjusting spending to prices. Documenting these extraordinary initiatives was only possible thanks to the coordinated effort within the Working Group on Public Finance. The analysis shows that leaving aside this information would result in an incomplete picture, skewing the assessment of the effects of inflation on public finances in the euro area in a positive direction.

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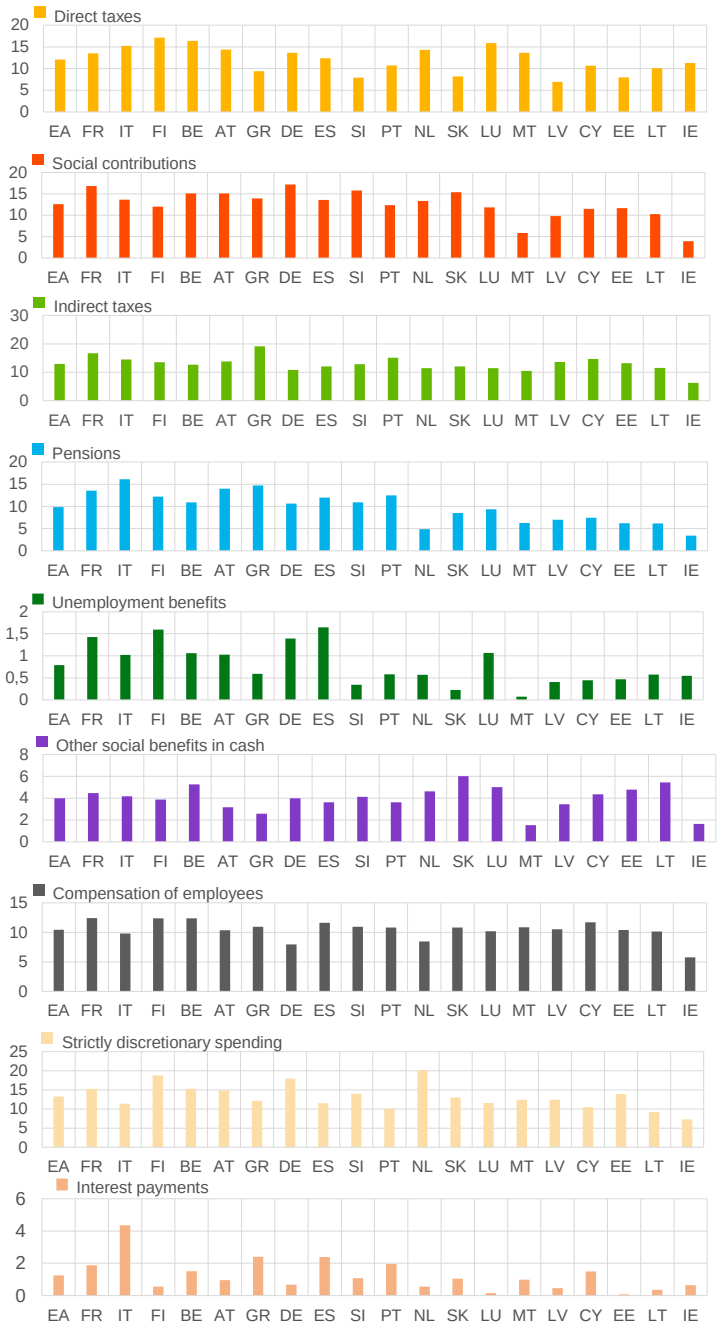
# Appendix

## A Supplementary panel charts

**Figure A**

The share of budget balance items across the euro area

(percentage of GDP, 2022)




Sources: Government Finance Statistics and Eurosystem estimates (in the case of pensions, unemployment benefits and other social transfers in cash).
Notes: Countries are arranged in order based on their government expenditure-to-GDP ratio, from highest to lowest.

**Figure B**

Direct effects from a stylised (1% in 2022 only) broad-based inflation shock on the budget balance

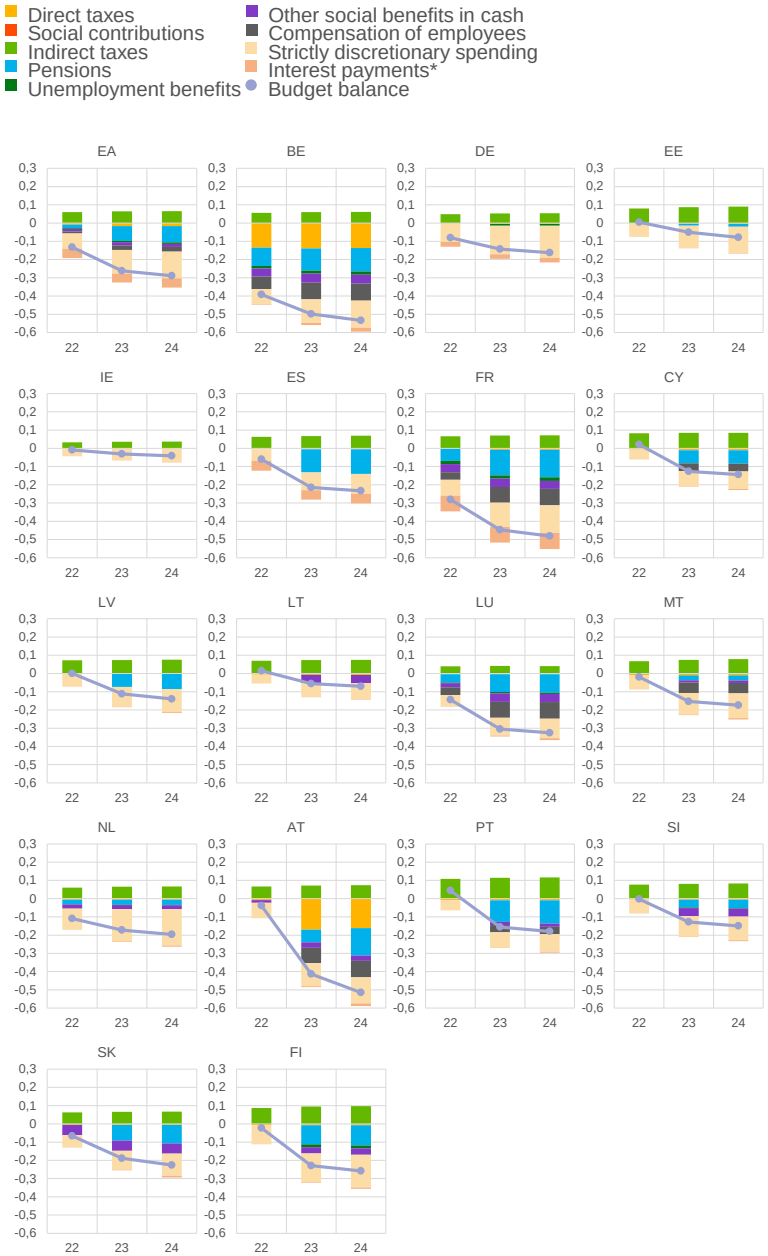
(percentage of GDP)

Source: ECB staff calculations.
Notes: The results reflect both standard and ad hoc indexation initiatives. The "Direct taxes" and "Social contributions" categories denote the impact on these items, which are paid by both households and firms. The "Interest payments*" category in this chart captures only the direct impact of the inflation revisions on interest payments related to inflation-indexed bonds. The calculations reflect existing indexations of income tax brackets in Belgium and Austria. The results for Greece (GR) and Italy (IT) could not be presented due to the existing publication policies of their respective national central banks (NCBs).

**Figure C**

Direct effects from a stylised (1% in 2022 only) HICP-concentrated inflation shock on the budget balance

(percentage of GDP)

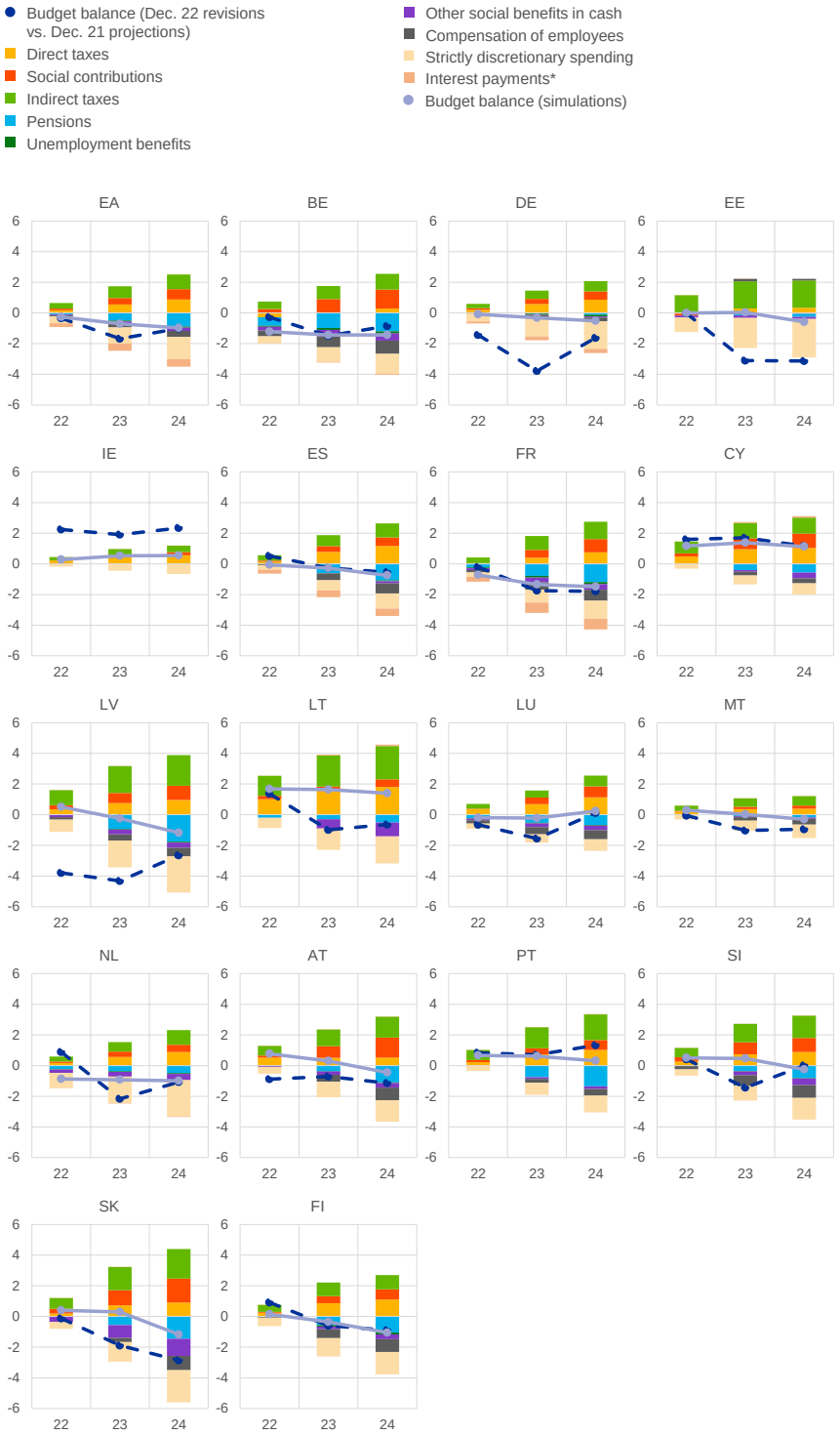



Source: ECB staff calculations.
Notes: The results reflect both standard and ad hoc indexation initiatives. The "Direct taxes" and "Social contributions" categories denote the impact on these items, which are paid by both households and firms. The "interest payments*" category in this chart captures only the direct impact of the inflation revisions on interest payments related to inflation-indexed bonds. The calculations reflect existing indexations of income tax brackets in Belgium and Austria. The results for Greece (GR) and Italy (IT) could not be presented due to the existing publication policies of their respective NCBs.

## Figure D

Direct effects from the observed inflation shock on the budget balance, considering standard and ad hoc indexation arrangements

(percentage of GDP)

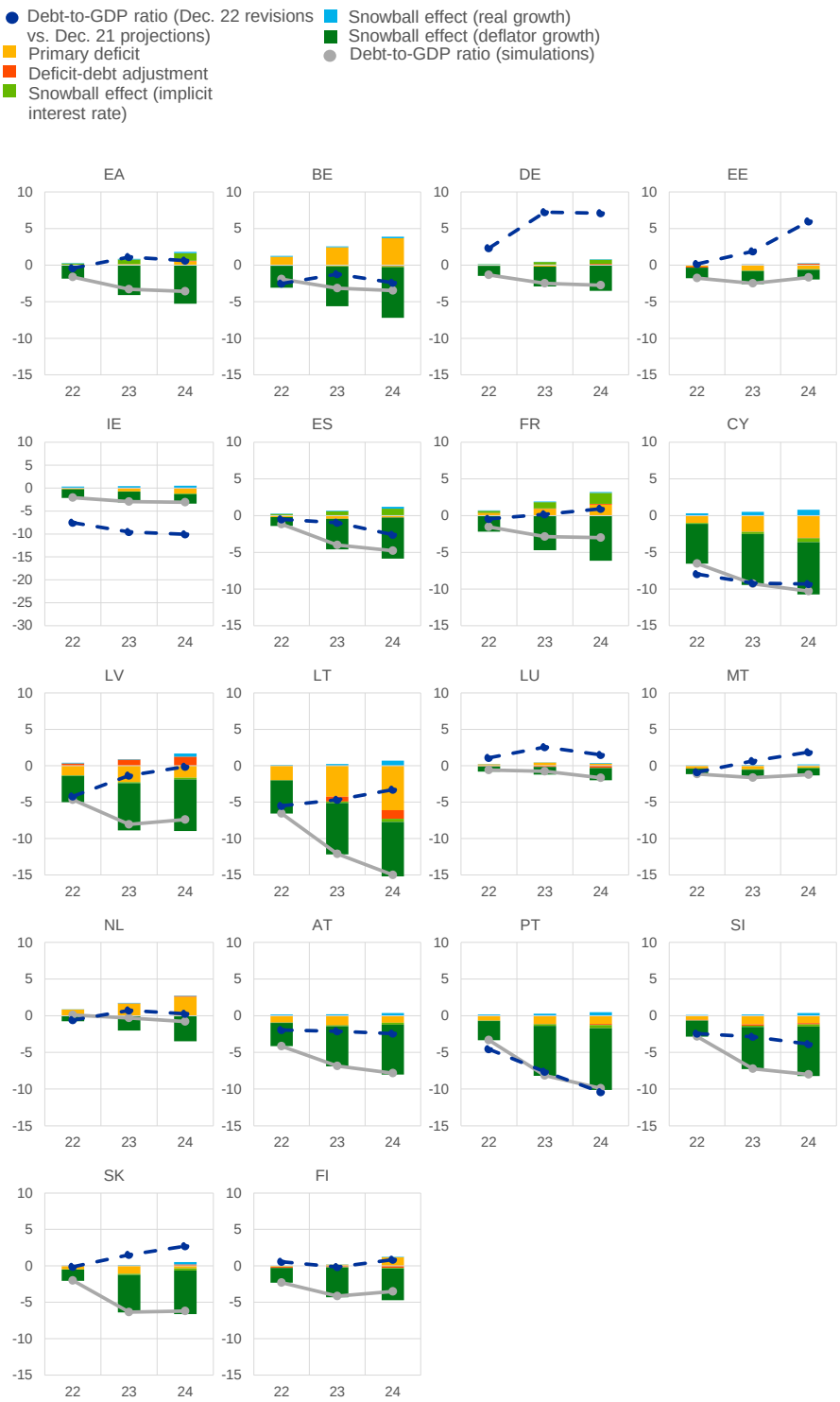



Sources: ECB staff calculations based on the December 2021 and December 2022 Eurosystem staff macroeconomic projections.
Notes: The "Direct taxes" and "Social contributions" categories denote the impact on these items, which are paid by both households and firms. The "interest payments*" category in this chart captures only the direct impact of the inflation revisions on interest payments related to inflation-indexed bonds. The calculations reflect existing indexations of income tax brackets in Belgium and Austria. The results for Greece (GR) and Italy (IT) could not be presented due to the existing publication policies of their respective NCBs.

## Figure E

Direct effects from the observed inflation shock on the debt-to-GDP ratio, considering standard and ad hoc indexation arrangements

(percentage points)

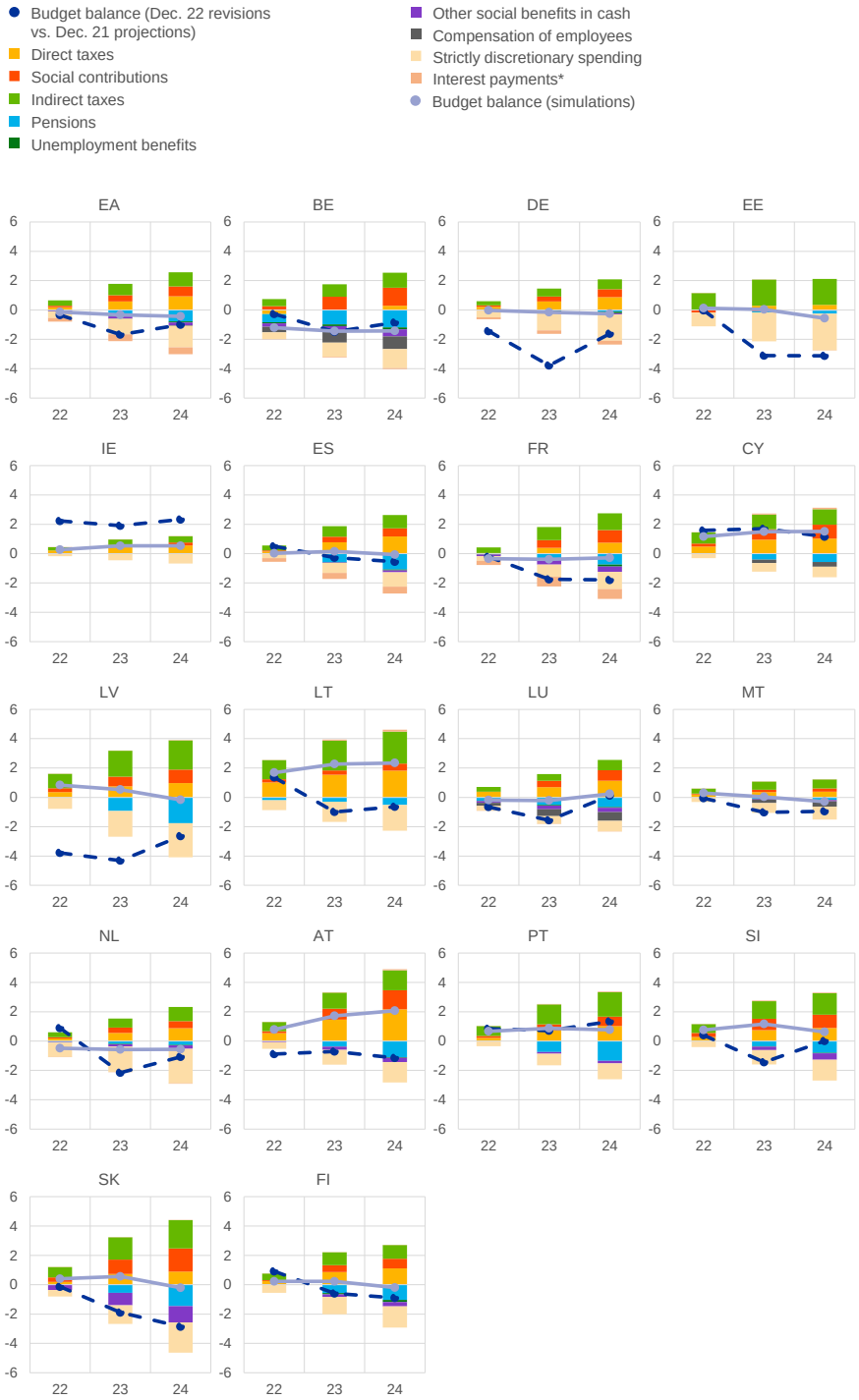



Source: ECB staff calculations based on the December 2021 and December 2022 Eurosystem staff macroeconomic projections.
Note: The results for Greece (GR) and Italy (IT) could not be presented due to the existing publication policies of their respective NCBs.

## Figure F

Direct effects from the observed inflation shock on the budget balance, considering only standard indexation arrangements

(percentage of GDP)




Source: ECB staff calculations based on the December 2021 and December 2022 Eurosystem staff macroeconomic projections.
Notes: The "Direct taxes" and "Social contributions" categories denote the impact on these items, which are paid by both households and firms. The "interest payments*" category in this chart captures only the direct impact of the inflation revisions on interest payments related to inflation-indexed bonds. The calculations reflect existing indexations of income tax brackets in Belgium and Austria. The results for Greece (GR) and Italy (IT) could not be presented due to the existing publication policies of their respective NCBs.

# B Country-specific indexation arrangements

This part of the Appendix summarises the indexation schemes in the euro area based on the WGPF questionnaire responses. The questionnaires contained the following details:

- The structure of public spending subject to standard indexation in 2022 (understood as determined by law)
- Other ad hoc adjustments to prices and other nominal variables of the budget balance components

Based on the information collected, the equations from the fiscal projection platform were amended to reflect the heterogenous indexation arrangement across euro area countries. The description of the variables is presented in the table below (**Table 3**).

**Table 3**

Definition of relevant variables used in the ECB's fiscal projection platform

| Variable name | Definition |
|---|---|
| **HEX_G_LAG** | HICP excl. energy growth lagged by n years |
| **HIC_G** | HICP growth |
| **HIC_G_LAG** | HICP growth (t-1) |
| **HIC_G_LAG2** | HICP growth (t-2) |
| **PCD_G** | Household consumption deflator growth |
| **WAN_G** | Average national wage growth |
| **WAN_G_LAG** | Average national wage growth (t-1) |
| **WAP_G** | Average wage growth in the private sector |
| **WAP_G_LAG** | Average wage growth in the private sector (t-1) |
| **SCT_G_LAG** | Social tax receipts growth (t-1) |
| **SCT_G_LAG2** | Social tax receipts growth (t-2) |
| **YED_G** | GDP deflator growth |
| **YED_G_LAG** | GDP deflator growth (t-1) |
| **Memo items:** | |
| **WAGES_GROWTH** | Wage growth induced by government policy independent of price dynamics |
| **PENS_CHANGE** | Pension growth induced by government policy independent of price dynamics |
| **UNBG** | Macro bases for unemployment benefits primarily reflecting a number of unemployed |
| **UNB_FQ_FC** | Fiscal measures affecting unemployment benefits and independent of price dynamics |
| **OSP_FQ_FC** | Fiscal measures affecting other social benefits in cash and independent of price dynamics |

Source: ECB staff

## B.1 Belgium

**Prepared with the support of Nationale Bank van België/Banque Nationale de Belgique**

| | Standard arrangements | Standard arrangements + ad hoc initiatives |
|---|---|---|
| **Public wages** | WGS = WGS{-1} * (1 + WAGES_GROWTH) * (1 + (5/6) * HIC_G + (1/6) * HIC_G_LAG) | - |
| **Public pensions** | PEN = PEN{-1} * (1 + PENS_CHANGE) * (1 + (11/12) * HIC_G + (1/12) * HIC_G_LAG) | - |
| **Unemployment benefits** | UNB = UNB{-1} * (1 + UNBG ) * (1 + (5/6) * HIC_G + (1/6) * HIC_G_LAG) + UNB_FQ_FC | - |
| **Other social benefits in cash** | OSR = OSR{-1 } * (1 + (11/12) * HIC_G + (1/12) * HIC_G_LAG) + OSP_FQ_FC | - |
| **Comments:** | Public wages are adjusted two months after the four-month moving average of health index crosses a 2% threshold, whereas, for pensions and other social benefits in cash, the same pivot index threshold applies, but the indexation takes place one month prior. The assumption is made that the health index is close to HICP developments. Considering the complexity of the prevailing indexation strategies, specifically in relation to the application of a threshold, the above equations can only offer a rudimentary approximation of the actual situation. | |

## B.2 Germany

**Prepared with the support of Deutsche Bundesbank**

| | Standard arrangements | Standard arrangements + ad hoc initiatives |
|---|---|---|
| **Public wages** | WGS = WGS{-1} * (1 + WAGES_GROWTH) | WGS = WGS{-1} * (1 + WAGES_GROWTH) * (1+WAP_G) |
| **Public pensions** | PEN = PEN{-1} * (1 + PENS_CHANGE) * (1 + 0.5 * WAN_G_LAG) | - |
| **Unemployment benefits** | UNB = UNB{-1} * (1 + UNBG) * (1+0.7 * HIC_G_LAG + 0.3 * WAN_G_LAG) + UNB_FQ_FC | - |
| **Other social benefits in cash** | OSR = OSR{-1} * (1 + 0.85 * WAN_G_LAG) + OSP_FQ_FC | - |
| **Comments:** | The formulas simplify institutional relationships or create basic relationships for the purposes of this paper. | |

## B.3 Estonia

**Prepared with the support of Eesti Pank**

| | Standard arrangements | Standard arrangements + ad hoc initiatives |
|---|---|---|
| **Public wages** | WGS = WGS{-1} * (1 + WAGES_GROWTH) | WGS = WGS{-1} * (1 + WAGES_GROWTH) * (1+WAP_G_LAG) |
| **Public pensions** | PEN = PEN{-1} * (1 + PENS_CHANGE) * (1 +0.75* (0.2 * HIC_G_LAG+ 0.8* SCT_G_LAG)+ 0.25* (0.2 * HIC_G_LAG2+ 0.8 * SCT_G_LAG2)) | - |
| **Unemployment benefits** | UNB = UNB{-1} * (1 + UNBG) + UNB_FQ_FC | - |
| **Other social benefits in cash** | OSR = OSR{-1} + OSP_FQ_FC | OSR = OSR{-1} * (1+ 0.29 * YED_G + 0.17 * WAN_G + 0.06 * ( 0.2 * HIC_G_LAG + 0.8 * WAN_G_LAG ))+ OSP_FQ_FC |
| **Comments:** | The government sector wage growth for T+1 is anchored to the total economy wage growth at time T. Pensions evolve according to the formula above. Unemployment benefits are not indexed in any way. Other social benefits in cash growth are linked to the formula: 48% is adjusted for potential GDP trend growth, 29% is adjusted for nominal GDP trend growth, 17% is linked to growth in social tax receipts and 6% is linked to changes in the pension index. The price variable for nominal GDP is the GDP deflator; wage growth is taken as a price component of social tax receipts; the pensions component grows with the same indicator as pensions. | |

## B.4 Ireland

**Prepared with the support of the Central Bank of Ireland**

| | Standard arrangements | Standard arrangements + ad hoc initiatives |
|---|---|---|
| **Public wages** | WGS = WGS{-1} * (1 + WAGES_GROWTH) | - |
| **Public pensions** | PEN = PEN{-1} * (1 + PENS_CHANGE) | - |
| **Unemployment benefits** | UNB = UNB{-1} * (1 + UNBG) + UNB_FQ_FC | - |
| **Other social benefits in cash** | OSR = OSR{-1} + OSP_FQ_FC | - |
| **Comments:** | No indexation. | |

## B.5 Greece

**Prepared with the support of the Bank of Greece**

| | Standard arrangements | Standard arrangements + ad hoc initiatives |
|---|---|---|
| **Public wages** | WGS = WGS{-1} * (1 + WAGES_GROWTH) | - |
| **Public pensions** | PEN = PEN{-1} * (1 + PENS_CHANGE) * (1+0.5 * HIC_G_LAG) | - |
| **Unemployment benefits** | UNB = UNB{-1} * (1 + UNBG) + UNB_FQ_FC | - |
| **Other social benefits in cash** | OSR = OSR{-1} * (1 + YED_G_LAG) + OSP_FQ_FC | - |
| **Comments:** | Public wages in Greece are not automatically indexed and are set at the discretion of the government through legislation. Currently, they are frozen until end-2023. While main pensions were also frozen until end-2022, they are subject to an automatic indexation formula from 2023 onwards. The formula stipulates the growth based on the smaller of the two figures: either the average of the previous year's growth and inflation, or the previous year's inflation alone. Growth in other social benefits in cash effectively mirrors nominal potential GDP growth. | |

## B.6 Spain

**Prepared with the support of Banco de España**

| | Standard arrangements | Standard arrangements + ad hoc initiatives |
|---|---|---|
| **Public wages** | WGS = WGS{-1} * (1 + WAGES_GROWTH) | WGS = WGS{-1} * (1 + WAGES_GROWTH) * (1+WAP_G) |
| **Public pensions** | PEN = PEN{-1} * (1 + PENS_CHANGE) * (1 + HIC_G_LAG) | - |
| **Unemployment benefits** | UNB = UNB{-1} * (1 + UNBG) * (1 + WAN_G_LAG) + UNB_FQ_FC | - |
| **Other social benefits in cash** | OSR = OSR{-1} * (1+WAN_G_LAG) + OSP_FQ_FC | - |
| **Comments:** | Typically, most social benefits (apart from pensions) are linked to past contributions and contributions are linked to wages with a cap. Public pensions growth follows the average CPI annual growth from December of T-2 to November of T-1. | |

## B.7 France

**Prepared with the support of Banque de France**

| | Standard arrangements | Standard arrangements + ad hoc initiatives |
|---|---|---|
| **Public wages** | WGS = WGS{-1} * (1 + WAGES_GROWTH) | WGS = WGS{-1} * (1 + WAGES_GROWTH) * (1 + 0.5 * HIC_G+0.5 * HIC_G_LAG) |
| **Public pensions** | PEN = PEN{-1} * (1 + PENS_CHANGE) | PEN = PEN{-1} * (1 + PENS_CHANGE) * (1 + 0.5 * HIC_G + 0.5 * HIC_G_LAG) |
| **Unemployment benefits** | UNB = UNB{-1} * (1 + UNBG) * (1 + PCD_G) + UNB_FQ_FC | - |
| **Other social benefits in cash** | OSR = OSR{-1} * (1 + PCD_G) + OSP_FQ_FC | - |
| **Comments:** | Public wages and pensions revalued on the CPI (T-1). Unemployment benefits and other benefits in cash are linked to the household contemporaneous consumption deflator. | |

## B.8 Italy

**Prepared with the support of Banca d'Italia**

| | Standard arrangements | Standard arrangements + ad hoc initiatives |
|---|---|---|
| **Public wages** | WGS = WGS{-1} * (1 + WAGES_GROWTH) * (1 + HEX_G_LAG3) | - |
| **Public pensions** | PEN = PEN{-1} * (1 + PENS_CHANGE) * (1 + HIC_G_LAG) | - |
| **Unemployment benefits** | UNB = UNB{-1} * (1 + UNBG) + UNB_FQ_FC | - |
| **Other social benefits in cash** | OSR = OSR{-1} ) * (1 + 0.2 * HIC_G_LAG) + OSP_FQ_FC | - |
| **Comments:** | Public wages are determined through collective agreements on the basis of the expected CPI net of energy for three-year periods. In the last two contractual rounds (2016-18 and 2019-21), renewals took place with a significant lag, after the end of the reference period. Pensions growth is linked to CPI excluding tobacco (t-1), which for simplification is approximated as HICP. The 2023 budget law changes the pension indexation mechanism for the period 2023-2024, limiting the revaluation of the benefits exceeding certain thresholds. Unemployment benefits parameters (in particular, the maximum value attainable) are indexed (to CPI at t-1), but the effect of such indexation on overall expenditure on this item is negligible as the threshold is virtually never binding. The part of other social benefits in cash, indexed to CPI excluding tobacco at t-1, is only the "Assegno Unico e Universale", a universal children's allowance worth about €12 billion in 2022 (which represents 20% of cash social benefits). | |

## B.9 Cyprus

**Prepared with the support of the Central Bank of Cyprus**

| | Standard arrangements | Standard arrangements + ad hoc initiatives |
|---|---|---|
| **Public wages** | WGS = WGS{-1} * (1 + WAGES_GROWTH) * (1 + 0.5 * HIC_G_LAG) | - |
| **Public pensions** | PEN = PEN{-1} * (1 + PENS_CHANGE) * (1+HIC_G_LAG) | - |
| **Unemployment benefits** | UNB = UNB{-1} * (1 + UNBG) + UNB_FQ_FC | - |
| **Other social benefits in cash** | OSR = OSR{-1} + OSP_FQ_FC | OSR = OSR{-1} * (1 + WAN_G_LAG) + OSP_FQ_FC |
| **Comments:** | The adjustment for public wages equals a payment of 50% of the increase in the Cost-of-Living Allowance (CoLA) index, provided that there was positive growth in the second and third quarters of the previous year. Although this study relates to data up to the December 2022 BMPE, it should be noted that a new transitional agreement was reached in May 2023 that increases the adjustment of public wages to 66.7% of the CoLA index, for the period from June 2023 to June 2025. Pensions are linked to the lagged CPI (t-1), adjusted to exclude excise duties proxied for simplicity by HICP. Unemployment benefits are not subject to indexation. As only a small part of other social benefits is automatically indexed (4-5%), no indexation features in the relevant equation. In practice, the evolution of benefits effectively takes into account the lagged growth in nominal wages. | |

## B.10 Latvia

**Prepared with the support of Latvijas Banka**

| | Standard arrangements | Standard arrangements + ad hoc initiatives |
|---|---|---|
| **Public wages** | WGS = WGS{-1} * (1 + WAGES_GROWTH) | WGS = WGS{-1} * (1 + WAGES_GROWTH) * (1 + 0.4 * WAP_G) |
| **Public pensions** | PEN = PEN{-1} * (1 + PENS_CHANGE) * (1 + HIC_G_LAG + 0.5 * WAN_G_LAG) | - |
| **Unemployment benefits** | UNB = UNB{-1} * (1 + UNBG) + UNB_FQ_FC | UNB = UNB{-1} * (1 + UNBG) * (1 + WAN_G) + UNB_FQ_FC |
| **Other social benefits in cash** | OSR = OSR{-1} + OSP_FQ_FC | OSR = OSR{-1} * (1 + WAN_G_LAG) + OSP_FQ_FC |
| **Comments:** | For public wages, for the central government there is no indexation, only when decisions are taken by local government and in the amount approved, which accounts for 41% of the total public wage bill. Public pensions are linked to CPI for mid-term T-1 and T (from 1.08.T-1 to 31.07.T) and 50% of the actual wage increase of the previous calendar year. Unemployment benefits and other social benefits in cash growth follow the nominal average wage growth in the economy. | |

## B.11 Lithuania

**Prepared with the support of Lietuvos Bankas**

| | Standard arrangements | Standard arrangements + ad hoc initiatives |
|---|---|---|
| **Public wages** | WGS = WGS{-1} * (1 + WAGES_GROWTH) | - |
| **Public pensions** | PEN = PEN{-1} * (1 + PENS_CHANGE) * (1 + WAN_G) | - |
| **Unemployment benefits** | UNB = UNB{-1} * (1 + UNBG) + UNB_FQ_FC | - |
| **Other social benefits in cash** | OSR = OSR{-1} + OSP_FQ_FC | OSR = OSR{-1} *(1+ HIC_G_LAG)+ OSP_FQ_FC |
| **Comments:** | Public wages and unemployment benefits are not subject to any indexation. Pensions growth is anchored to average wage growth. The evolution of other social benefits in cash is treated as a government decision taking account of HICP T-1. | |

## B.12 Luxembourg

**Prepared with the support of Banque centrale du Luxembourg**

| | Standard arrangements | Standard arrangements + ad hoc initiatives |
|---|---|---|
| **Public wages** | WGS = WGS{-1} * (1 + WAGES_GROWTH) * (1 +0.5 * HIC_LAG + 0.5 * HIC_G_LAG) | - |
| **Public pensions** | PEN = PEN{-1} * (1 + PENS_CHANGE) * (1 +0.5 * HIC_LAG + 0.5 * HIC_G_LAG) | - |
| **Unemployment benefits** | UNB = UNB{-1} * (1 + UNBG) * (1 +0.5 * HIC_LAG + 0.5 * HIC_G_LAG) + UNB_FQ_FC | - |
| **Other social benefits in cash** | OSR = OSR{-1} * (1 +0.5 * HIC_LAG + 0.5 * HIC_G_LAG) + OSP_FQ_FC | OSR = OSR{-1} * (1+ HIC_G_LAG)+ OSP_FQ_FC |
| **Comments:** | Public wages and social benefits reflect the evolution of the NICP, which is a national version of the HICP, used for wage indexation. Nominal public spending increases when the average NICP level of the past six months has increased by 2.5% since the latest wage indexation. For simplicity, the HICP is used as a proxy. | |

# B.13 Malta

**Prepared with the support of the Central Bank of Malta**

| | Standard arrangements | Standard arrangements + ad hoc initiatives |
|---|---|---|
| **Public wages** | WGS = WGS{-1} * (1 + WAGES_GROWTH) * (1 + 0.56 * HIC_G_LAG) | - |
| **Public pensions** | PEN = PEN{-1} * (1 + PENS_CHANGE) * (1 + 0.4 * HIC_G_LAG) | - |
| **Unemployment benefits** | UNB = UNB{-1} * (1 + UNBG) * (1 + HIC_G_LAG) + UNB_FQ_FC | - |
| **Other social benefits in cash** | OSR = OSR{-1} * (1 + HIC_G_LAG) + OSP_FQ_FC | - |
| **Comments:** | Public spending is adjusted for past consumer inflation. The rate of inflation is determined by the Retail Price Index (RPI), which is Malta's measure of inflation and is based on the prices of the largest set of goods and services monitored by the National Statistics Office. Only the fractions of wages are automatically adjusted (56%). The pass-through from inflation to public pensions is estimated at 40%. | |

## B.14 The Netherlands

**Prepared with the support of De Nederlandsche Bank**

| | Standard arrangements | Standard arrangements + ad hoc initiatives |
|---|---|---|
| **Public wages** | WGS = WGS{-1} * (1 + WAGES_GROWTH) | WGS = WGS{-1} * (1 + WAGES_GROWTH) |
| **Public pensions** | PEN = PEN{-1} * (1 + PENS_CHANGE) * (1+WAN_G) | PEN = PEN{-1} * (1 + PENS_CHANGE) * (1+0.5 * HIC_G + 0.5 * WAN_G) |
| **Unemployment benefits** | UNB = UNB{-1} * (1 + UNBG) * (1 + WAN_G) + UNB_FQ_FC | UNB = UNB{-1} * (1 + UNBG) * (1+0.5 * HIC_G + 0.5 * WAN_G)+ UNB_FQ_FC |
| **Other social benefits in cash** | OSR = OSR{-1} * (1 + WAN_G) + OSP_FQ_FC | OSR = OSR{-1} * (1+0.5* HIC_G + 0.5 * WAN_G) + OSP_FQ_FC |
| **Comments:** | Although there is no indexation by law for public wages as they are negotiated at a sectoral level, the allocated budget for government salaries is, in practice, indexed on the basis of private wage developments. Social benefits are mainly anchored to the minimum wage, which increases in line with private wages growth. However, as of 2023 there has been a one-off adjustment to the minimum wage that was partly announced in the coalition agreement (before inflation rose) but was accelerated and increased last year during high inflation. The above equations can only offer a rudimentary approximation of the actual situation and they primarily serve the purpose of macroeconomic simulations. | |

## B.15 Austria

**Prepared with the support of Oesterreichische Nationalbank**

| | Standard arrangements | Standard arrangements + ad hoc initiatives |
|---|---|---|
| **Public wages** | WGS = WGS{-1} * (1 + WAGES_GROWTH) | WGS = WGS{-1} * (1 + WAGES_GROWTH) * (1+HIC_G_LAG) |
| **Public pensions** | PEN = PEN{-1} * (1 + PENS_CHANGE) * (1+ 0.5 * HIC_G_LAG+ 0.5 * HIC_G_LAG2) | - |
| **Unemployment benefits** | UNB = UNB{-1} * (1 + UNBG) * (1 + WAN_G_LAG) + UNB_FQ_FC | - |
| **Other social benefits in cash** | OSR = OSR{-1} * (1+ 0.5 * HIC_G+ 0.5 * HIC_G_LAG) + OSP_FQ_FC | - |
| **Comments:** | There is no automatic indexation of public wages. Discretionary measures apply, linking wages to the evolution of past inflation development. Pensions are anchored to the average annual CPI inflation growth rate from August (t-2) to July (t-1). Typically, unemployment benefits are linked to past contributions and contributions are linked to wages (the wage sum) with a cap. | |

## B.16 Portugal

**Prepared with the support of Banco de Portugal**

| | Standard arrangements | Standard arrangements + ad hoc initiatives |
|---|---|---|
| **Public wages** | WGS = WGS{-1} * (1 + WAGES_GROWTH) | WGS = WGS{-1} (1 + WAGES_GROWTH) * (1 + 0.5 * HIC_G_LAG) |
| **Public pensions** | PEN = PEN{-1} * (1 + PENS_CHANGE) * (1 + HIC_G_LAG) | - |
| **Unemployment benefits** | UNB = UNB{-1} * (1 + UNBG) + UNB_FQ_FC | - |
| **Other social benefits in cash** | OSR = OSR{-1} * (1 + 0.5 * HIC_G_LAG) + OSP_FQ_FC | - |
| **Comments:** | There is no automatic indexation of public wages, although high inflation was taken into account for the 2023 wage set-up. Pension indexation is tied to the lagged CPI excluding housing. Despite several extraordinary measures in 2022 and 2023, pensions have remained linked to lagged inflation rates. While unemployment benefits are non-indexed, certain cash-based benefits are tied to the Social Support Index, which in turn is linked to lagged growth in the CPI excluding housing. | |

## B.17 Slovenia

**Prepared with the support of Banka Slovenije**

| | Standard arrangements | Standard arrangements + ad hoc initiatives |
|---|---|---|
| **Public wages** | WGS = WGS{-1} * (1 + WAGES_GROWTH) | WGS = WGS{-1} * (1 + WAGES_GROWTH) * (1 + WAP_G) |
| **Public pensions** | PEN = PEN{-1} * (1 + PENS_CHANGE) * (1 + 0.4 * HIC_G_LAG+ 0.6 * WAN_G_LAG) | - |
| **Unemployment benefits** | UNB = UNB{-1} * (1 + UNBG) * (1 + HIC_G_LAG) + UNB_FQ_FC | - |
| **Other social benefits in cash** | OSR = OSR{-1} * (1 + HIC_G_LAG) + OSP_FQ_FC | - |
| **Comments:** | There is no automatic indexation of public wages. However, for projection purposes, public wages follow, in principle, current year private-sector wage growth in case of no agreement between public sector unions and the government. Pensions are indexed to average inflation in the previous year and the average gross wage in the previous year. Unemployment benefits and other social benefits in cash are indexed each March to the CPI inflation observed in the previous December. | |

## B.18 Slovakia

**Prepared with the support of Národná Banka Slovenska**

| | Standard arrangements | Standard arrangements + ad hoc initiatives |
|---|---|---|
| **Public wages** | WGS = WGS{-1} * (1 + WAGES_GROWTH) | WGS = WGS{-1} * (1 + WAGES_GROWTH) * (1+WAP_G_LAG) |
| **Public pensions** | PEN = PEN{-1} * (1 + PENS_CHANGE) * (1 + HIC_G_LAG) | PEN = PEN{-1} * (1 + PENS_CHANGE) * (1 + 0.5 * HIC_G_LAG) |
| **Unemployment benefits** | UNB = UNB{-1} * (1 + UNBG) + UNB_FQ_FC | - |
| **Other social benefits in cash** | OSR = OSR{-1} * (1 + HIC_G) + OSP_FQ_FC | - |
| **Comments:** | Public wages follow average wage growth (T-1). Pensions reflect changes in the inflation of households of pensioners (T-1). Unemployment benefits are not subject to any indexation, whereas other social benefits in cash are anchored to HICP growth. | |

# B.19 Finland

**Prepared with the support of Suomen Pankki – Finlands Bank**

| | Standard arrangements | Standard arrangements + ad hoc initiatives |
|---|---|---|
| **Public wages** | WGS = WGS{-1} * (1 + WAGES_GROWTH) | WGS = WGS{-1} * (1 + WAGES_GROWTH) * (1 + WAP_G) |
| **Public pensions** | PEN = PEN{-1} * (1 + PENS_CHANGE) * (1 + 0.8 * HIC_G_LAG + 0.2 * WAN_G_LAG) | - |
| **Unemployment benefits** | UNB = UNB{-1} * (1 + UNBG) * (1 + HIC_G_LAG) + UNB_FQ_FC | - |
| **Other social benefits in cash** | OSR = OSR{-1} * (1 + HIC_G_LAG) + OSP_FQ_FC | - |
| **Comments:** | While public wages are not automatically indexed, their growth effectively follows the average wage and salary earnings. Earnings-based pension adjustments are calculated using an index in which 80% weight is given to growth in the CPI and 20% weight to wage growth in the previous year. Unemployment benefits and other social benefits in cash reflect past consumer inflation development. | |

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