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TABLE OF CONTENTS

Inflation and public finances in the 2020s

Editor's introduction to the thematic issue of Public Sector Economics

DUBRAVKO MIHALJEK, Ph.D.*

Editor's introduction
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* The views expressed are those of the author and not necessarily those of the Bank for International Settlements.

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PUBLIC SECTOR ECONOMICS
47 (4) 407-412 (2023)

The last time inflation and public finances were intensely discussed as a joint topic of economic research and policy analysis dates back to half a century ago. After the final collapse of the Bretton Woods system in March 1973 and the first oil shock in October of the same year, many advanced economies started experiencing stagflation – stagnating growth with rising unemployment and inflation. To cushion the rise in unemployment and the fall in real incomes, fiscal and monetary policies turned expansionary. Budget deficits, public debt and money supply increased rapidly, and real interest rates turned negative for much of the 1970s. Many advanced economies found it difficult to finance growing budget and balance of payments deficits. The UK government, for instance, faced a currency crisis with annual inflation approaching 25% and 10-year bond yields exceeding 16% in 1975. Macroeconomic dislocations in less developed economies were an order of magnitude larger: in Brazil, annual inflation increased from 30% in 1975 to over 235% in 1985, and budget deficit ranged from 6-12% of GDP (Garcia et al., 2018); in former Yugoslavia, inflation accelerated from 27% in 1975 to 90% in 1986, and public sector deficit averaged 15% of gross social product in 1983-86 (Lahiri, 1991).

Stagflation ended in the mid-1980s, after advanced economy central banks regained credibility by tightening monetary policy and reining in inflation, and after fiscal authorities managed to consolidate public finances. Countries such as Germany and Switzerland, which maintained prudent fiscal policies after the collapse of Bretton Woods and adopted a new nominal anchor – monetary targeting – largely escaped the Great Inflation and fiscal instability (Mihaljek, 2021). Their success partly paved the way for emphasis on stable public finances along with central bank independence and the anchoring of inflation expectations through inflation targeting.

In the three decades that followed, inflation and public finances were rarely analysed jointly. From 1990 until 2019, inflation in advanced economies averaged 2% per annum, and until the Great Financial Crisis (GFC) public finances were generally not a major source of macroeconomic instability. In the period of "great moderation" before the GFC and deflation after the GFC, some inflation was in fact welcome for public finances. With stable inflation expectations and moderate wage growth, inflation mechanically enlarged the tax base and nominal GDP without boosting government expenditure, so fiscal indicators such as the overall balance, its ratio to GDP, and the ratio of public debt to GDP tended to improve.

With the widespread rise in inflation since mid-2021, a new generation of policymakers rediscovered in practice the powerful interactions between inflation and public finances. A series of shocks, including global supply chain disruptions and labour shortages following the recovery from the Covid pandemic, as well as energy and food supply dislocations due to the war in Ukraine, raised inflation in many advanced and emerging market economies to levels not seen since the 1970s. In addition, large fiscal stimulus packages implemented during the Covid pandemic and following the start of the war in Ukraine raised government

PUBLIC SECTOR ECONOMICS 47 (4) 407–412 (2023)

spending sharply. The resulting rise in public debt, together with geopolitical tensions, has made the overall macroeconomic outlook more uncertain, with the risk of stagflation arising for the first time since the 1970s. In this environment, interactions between inflation and public finances, and monetary and fiscal policies more generally, moved again to the centre stage in policy analysis – though only to a limited extent so far in empirical and theoretical research.

To fill this gap at least partially, in September 2022 the editors of *Public Sector Economics* launched a call for papers on the subject of inflation and public finances in the 2020s. Six papers were selected, analysing different aspects of taxation, public expenditure, and fiscal policy in both advanced and emerging market economies. One paper was published in the preceding issue of this journal, and five are included in this issue. One common message of these contributions is that inflation has significant implications for the design of tax and benefit systems, as well as for fiscal positions and their macroeconomic impact. For example, governments often respond to inflation-induced falls in households' purchasing power with various subsidy schemes, which are typically poorly targeted, costly, and tend to heighten the inflationary risks and undermine fiscal positions in the medium term.

In "Tax distortions from inflation: What are they? How to deal with them?", published in the preceding issue of this journal, Sebastian Beer, Mark Griffiths and Alexander Klemm show that even relatively low rates of inflation create distortions with significant economic consequences, because tax systems are in practice not neutral with respect to inflation. For example, with a real rate of return of 2% on savings and a tax rate of 25% on savings income, the effective tax rate on real savings returns reaches 100% when inflation rises to 6% per year. And in corporate income taxation, inflation raises effective tax rates for equity-financed investments, but lowers them for debt-financed investment, with the impact from interest deductibility dominating the loss in the value of depreciation allowances. The incentive to finance investments with debt thus intensifies as inflation rises.

In the paper "Inflation and public finances: an overview" that opens this issue of the journal, I analyse how inflation affects fiscal outcomes and identify the potential sources and consequences of fiscal instability in a high-inflation environment. The main argument I develop is that high inflation initially boosts government revenue faster than expenditure and may thus create an impression of healthy public finances. Greater sensitivity of tax revenues to inflation is partly structural, as modern tax systems have become much more reliant on VAT, and as digital technology facilitates collection of indirect and direct taxes and strengthens tax compliance. However, government expenditure also catches up quickly when inflation is persistently high, so the initial positive effect of inflation on fiscal positions quickly dissipates. The main risk in this situation is that the impression of abundant tax revenues and the initially slower adjustment of expenditure could lead politicians to advocate new public spending programmes or tax cuts, which could be difficult to reverse and would damage public finances in the longer term.

PUBLIC SECTOR ECONOMICS
47 (4) 407–412 (2023)

Inflation also has major distributional consequences, which Orsetta Causa, Emilia Soldani, Nhung Luu and Chiara Soriolo analyse for OECD countries in their paper "A cost-of-living squeeze? Distributional implications of rising inflation". Drawing on national micro-based household budget surveys, they estimate that the declines in household purchasing power between August 2021 and August 2022 ranged from 3% in Japan to 18% in Czechia. Rural households were hit particularly hard, notably by energy price shocks, often more than low-income ones. This heterogeneity in the effects of inflation suggests the use of targeted support measures, which can limit the burden on government budgets by preserving, for instance, price signals for energy savings while providing a financial lifeline to most vulnerable households. The authors also underscore the need to consider factors such as the area of residence for effective targeting of fiscal support.

The remaining papers of this thematic issue are country case studies.

In "Short- and medium-term fiscal positions in a high-inflation environment: the case of Croatia", Frane Banić, Dominik Ivan Pripužić and Pave Rebić add inflation shocks to standard fiscal reaction functions. They find that an inflation surprise indeed has a favourable effect on the primary balance in the short term, and explain this effect by the high buoyancy of nominal tax bases with respect to inflation on the one hand, and the absence of formal indexation of public expenditure on the other. In the medium-term, however, inflation is likely to have a negative effect on the primary balance by raising government expenditure more than tax revenues. Fiscal policymakers in Croatia thus cannot take too much comfort from the current favourable state of public finances: without consolidation measures, fiscal positions could deteriorate in the medium term as inflation and policy rates are likely to stay elevated for a while.

In her study "A nexus between fiscal policy and inflation: a case study of Indonesia using SVAR model", Julie Ann Basconcillo analyses how public spending affected inflation and personal consumption in Indonesia over the past two decades. Her findings indicate that inflation responses differed across spending categories, with shocks to spending on subsidies more likely to lead to higher inflation than those on the government's own consumption or transfers to households. But even spending on subsides did not always have a statistically significant effect on inflation. Equally surprisingly, government spending shocks did not have statistically significant effect on private consumption. In other words, while the inflationary consequences of fiscal expansions in the case of Indonesia may be smaller than feared, they do not seem to boost private consumption either. The main macroeconomic consequence of fiscal expansions may thus have been a steady rise in government debt.

Finally, in "Unexpected inflation and public pensions: the case of Hungary", András Simonovits analyses the effects of different inflation indexation schemes and evaluates the impact of accelerating inflation on the decision to delay

PUBLIC SECTOR ECONOMICS 47 (4) 407–412 (2023)

retirement. He highlights flaws in the design of pension benefits in an environment of high inflation (which are not unique to Hungary) and argues for, among other remedies, a more frequent intra-year annual adjustment of benefits when inflation is high.

As the Editor of this thematic issue, I would like to thank the authors for their outstanding effort in preparing this set of stimulating and analytically rich papers. I am very grateful to the reviewers for their insightful comments and patient reading of multiple versions of manuscripts. This issue would not have been possible without the great team from the Institute of Public Finance – Mihaela Bronić, Marina Nekić, Katarina Ott and Branko Stanić – to whom I extend heartfelt thanks for their guidance, expertise, and patience. Last but not least, I am grateful to the Editorial Board of *Public Sector Economics* for giving me the opportunity to arrange this special issue.

PUBLIC SECTOR ECONOMICS
47 (4) 407-412 (2023)

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Inflation and public finances: an overview

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Article**
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PUBLIC SECTOR ECONOMICS
47 (4) 413-430 (2023)

Abstract

This paper presents an analytical overview of the effects of inflation on government revenues, expenditure and fiscal positions. Evidence for a range of countries from the current inflation episode and that of the 1980s is compared and contrasted. The key finding is that high inflation initially boosts tax revenues and improves fiscal positions, but expenditure quickly catches up and offsets this improvement. The short-term boost is partly due to structural changes that have made modern tax systems more elastic with respect to inflation. The medium-turn deterioration reflects a shift toward spending items more responsive to inflation. The key risk is that the impression of abundant tax revenues will lead to spending programmes or tax cuts that damage public finances in the long term. As research on inflation and public finances has been dormant since the 1980s, this analysis fills a gap in our understanding of the fiscal consequences of inflation.

Keywords: inflation, tax revenue, government expenditure, fiscal balances, public debt, fiscal-monetary policy interactions, advanced economies, emerging market economies, Great Inflation

1 INTRODUCTION

The purpose of this paper is to analyse systematically the way in which inflation affects fiscal outcomes and identify the potential sources and consequences of fiscal instability in a high-inflation environment. The widespread increase in inflation since 2021 has highlighted the powerful macroeconomic interactions between inflation and public finances that most policymakers in advanced economies have not experienced since the early 1980s. Research on inflation and public finances has also been largely dormant over the past four decades. Since the Great Financial Crisis (GFC) in particular, research has focused mostly on macro-fiscal analysis in an environment of deflation and negative or near-zero interest rates and high public debt. The return of high inflation has exposed a gap in our understanding of the fiscal consequences of inflation that this paper attempts partly to fill.

The main argument developed in the paper is that high inflation initially boosts government revenue faster than expenditure and may thus create an impression of healthy public finances. The greater sensitivity of tax revenues to inflation is partly structural, as modern tax systems have become much more reliant on VAT, and as digital technology facilitates the collection of indirect and direct taxes and strengthens tax compliance. However, government expenditure also catches up quickly when inflation is persistently high, so the initial positive effect of inflation on fiscal positions quickly dissipates. The main risk in this situation is that the impression of abundant tax revenues and initially slower adjustment of expenditure could lead politicians to advocate new public spending programmes or tax cuts, which could be difficult to reverse and would damage public finances in the longer term.

The paper is structured as follows. Sections 2 and 3 analyse the effects of inflation on tax revenues and government expenditures using recent empirical and historical

PUBLIC SECTOR ECONOMICS 47 (4) 413-430 (2023)

examples. Section 4 discusses the impact of inflation on the budget balance and public debt in the short- and medium-term. Section 5 looks at some feedbacks from fiscal to monetary policy under high inflation to highlight the potentially corrosive effects of inflation on public finances in the medium term. Section 6 concludes.

2 INFLATION AND TAX REVENUES

The 1970s and 1980s witnessed a flourishing of the literature on the microeconomic aspects of inflation and taxation, especially on the various accounting procedures used to compensate for the distorting effects of inflation. There has been much less analytical and empirical work on the macroeconomic effects of inflation on taxation, both at the time (Nowotny, 1980) and more recently, for the structure of tax systems has changed considerably.

Inflation automatically enlarges the nominal tax base, especially for broadly-based consumption taxes such as VAT. For example, if the VAT revenue base is equal to €1 billion and the VAT rate of, say, 25% is assessed on all items in the CPI basket, an increase in average annual CPI inflation from 0 to 10% will enlarge the VAT base by €100 million and the VAT revenue by €25 million even if the tax base does not expand in real terms.

For personal income and social security taxes, the effects of inflation on revenue are more complicated because they depend on income growth (which often lags behind inflation), the degree of so-called bracket creep (i.e. the extent to which taxpayers move into a higher tax bracket in a progressive tax system), and how much the nominal values of tax credits, deductions and exemptions are adjusted for inflation (Beer, Griffiths and Klemm, 2023). The less the tax brackets, credits, deductions, and exemptions are adjusted, the greater the extent of bracket creep and, hence, of personal income tax growth. In Europe, for example, only 11 out of 27 OECD member countries automatically adjust personal income tax brackets for inflation every year (Bunn, 2022).

A moderately high inflation can buoy tax revenues for several years. From 1979 to 1983, for example, inflation in the United Kingdom increased by a cumulative 42%, VAT revenue by 86% and personal income tax revenue by 51%, even though real GDP grew by no more than 2.3% over that period, the VAT rate was constant at 15%, and personal income tax schedules were adjusted regularly to offset the bracket creep caused by inflation.[1] However, as monetary policy tightened to rein in inflation and as the economic activity slowed, the revenue bonus due to inflation dissipated: the average annual growth of the VAT revenue decreased from 17% in 1979-83 to 12% in 1984-88 as inflation fell from 11.3% to 4.6% per year. Due to collection lags, inflation persisting at much higher rates tends to lower tax revenue in real terms – the so-called Olivera-Tanzi effect.[2] For example, with a

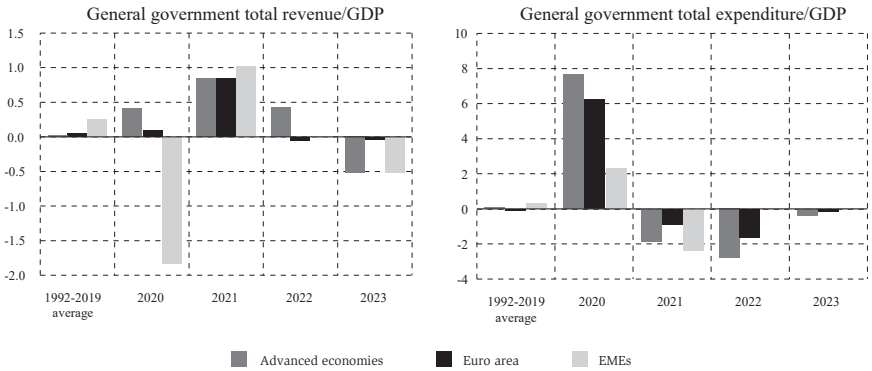
[1] Calculated from UK National Office of Statistics and Institute of Fiscal Studies data.
[2] See Tanzi (1977) and Aghevli and Khan (1978) for original contributions, and Anušić and Švaljek (1996) for a recent country episode, that of Croatia in 1992-94.

10% monthly inflation rate and a collection lag of 60 days for the payment of VAT by companies, the inflation-adjusted value of the VAT paid after 60 days would be 17% lower; with a monthly inflation rate of 20% it would be as much as 31% lower.[3] Real revenue losses for taxes paid once a year can be huge in such circumstances. Without monthly withholding, the real value of personal income taxes paid, e.g. in March for the previous calendar year would be 53% lower at a constant monthly inflation of 10%, and 74% lower at a monthly inflation of 20%.[4]

The bout of inflation that started in mid-2021 has not seen inflation rates as high as in the 1970s and 1980s. The average annual inflation in advanced economies was 3.1% in 2021 and 7.3% in 2022, compared with double-digit rates in the late 1970s and the early 1980s. Nevertheless, inflation well above the long-term average of almost exactly 2% from 1990-2019 has significantly boosted tax revenues. General government revenue as a share of GDP increased in advanced economies by 0.9% of GDP in 2021 and by a further 0.4% of GDP in 2022, after being virtually constant between 1992 and 2019, at about 35½% in advanced economies and 45½% in the euro area (graph 1, left-hand panel).

Graph 1

Changes in annual revenue and expenditure/GDP, 1992-2023 (in percentage points)



Source: IMF (2023a); author's calculations.

Particularly buoyant have been the VAT receipts: in the first half of 2022, Spain collected 12% more VAT than in the first half of 2021, Germany and Italy 14%, and France as much as 18% more (Baert, 2022). What is remarkable is that this occurred despite indirect tax cuts amounting to about 0.4% of GDP at the euro area level (Checheritta-Westphal and Dorrucci, 2023), introduced to offset the much higher energy prices after Russia's invasion of Ukraine.

[3] Calculated as a given nominal amount of VAT divided by $(1.1)^2$ or $(1.2)^2$.

[4] Calculated as $\sum_{i=1}^{12} Y_i(1+\pi)^{(15-i)}$, where Y is an assumed monthly tax payment, p is monthly rate of inflation (for simplicity, both taken to be constant), and i is the month (1=January, etc.).

PUBLIC SECTOR ECONOMICS
47 (4) 413–430 (2023)

High inflation and strong underlying growth do not account on their own for this extraordinary buoyancy of VAT. This suggests that structural factors have played a role as well, especially compared with the 1970s. One is that the VAT base has become much broader over time, expanding from goods to most services. Another is that its collection has become much more efficient, as the use of digital technologies greatly facilitates the enforcement of VAT payments. As a result, the share of VAT in total tax revenues of OECD countries has doubled to 20% on average since the 1970s, while the share of other taxes on goods and services has fallen from over 30% to about 12% (graph 2, left-hand panel). While the personal income tax still accounts on average for the largest share of tax revenues, VAT has become the main revenue source in 15 out of 38 OECD countries, mostly emerging market economies.

Graph 2

Trends in tax structure in OECD countries (in per cent of total tax revenue)[1]

[1]*Simple averages of OECD member countries.*

Source: OECD (2023).

In parallel, the share of personal income taxes has declined to less than a quarter from the peak of nearly a third of total tax revenues in the early 1980s (right-hand panel). A key reason for this decline has been a significant flattening of highly progressive tax schedules since the 1980s, partly initiated by advances in the optimal income tax literature, notably Diamond and Mirrlees (1971a; 1971b), and forcefully pursued by the Thatcher government in the United Kingdom and the Reagan administration in the United States.

As in the case of VAT, the share of social security contributions has risen because digital technologies have further facilitated collection through income withholding (Keen and Slemrod, 2021). Social security contributions now represent over a quarter of total tax revenues compared with around 18% on average in the 1970s. These structural changes in the composition of tax revenues are important for interactions between inflation and fiscal policy because they have made the tax system more elastic with respect to inflation. Even finance ministries around the world seem not to have realised this shift until the latest bout of inflation. The revenue surprises – the difference between taxes collected and those initially

PUBLIC SECTOR ECONOMICS
47 (4) 413-430 (2023)

projected in government budgets – amounted to as much as 3% of GDP on average in advanced economies and 2½% in emerging market economies (EMEs) in 2022 (IMF, 2023b). Not surprisingly, this has created the perception that treasuries had large surpluses at their disposal, and that revenues would remain ample in the coming years.

3 INFLATION AND PUBLIC EXPENDITURE

The main difference between the impact of inflation on tax revenues and on public expenditure is the timing and scale of adjustment. Tax revenues react to inflation more or less immediately and proportionately – especially VAT, but also, via monthly withholding, personal income taxes and social security contributions. Public expenditure items adjust to inflation with varying lags.

More specifically, government purchases of goods and services and public investment costs increase in line with inflation, unless some items are subject to long-term pricing agreements. Goods and services purchases account on average for about 16% of total government expenditure in OECD countries, and public investment for about 9%, so about a quarter of public spending rises more or less one-to-one with inflation.

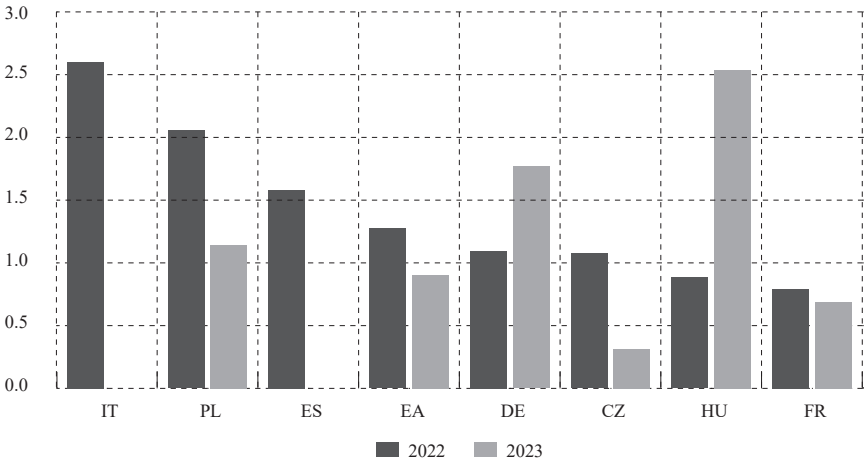
Pensions, social security and other transfers to households, which account on average for close to 40% of government spending, typically adjust within months via cost-of-living clauses. Public sector wages (22% of total spending on average) increase more slowly with inflation, as their dynamics is mostly set in multi-year contracts with public sector unions.

Finally, payments on newly issued government debt rise automatically with market interest rates and sovereign risk premia, while the increase in payments on outstanding debt depends on the maturity structure and the share of variable-rate debt. Total debt payments account for about 5% of spending, with large variation across countries.

This analysis suggests that up to two thirds of total government spending adjusts to inflation fairly quickly. In addition, governments are often compelled to provide special compensation to households and firms when prices of some important consumption items increase sharply. In 2022, for example, natural gas prices in Europe increased by up to seven times following Russia's invasion of Ukraine. In response, governments provided energy and other cost-of-living subsidies to households and firms equivalent to 1-2½% of GDP (graph 3). Clearly, such one-off measures offset the initial dampening effect of inflation on the growth of nominal government expenditure.

Graph 3

Estimated cost of energy measures in the EU (as a percentage of GDP)



Source: European Commission (2022).

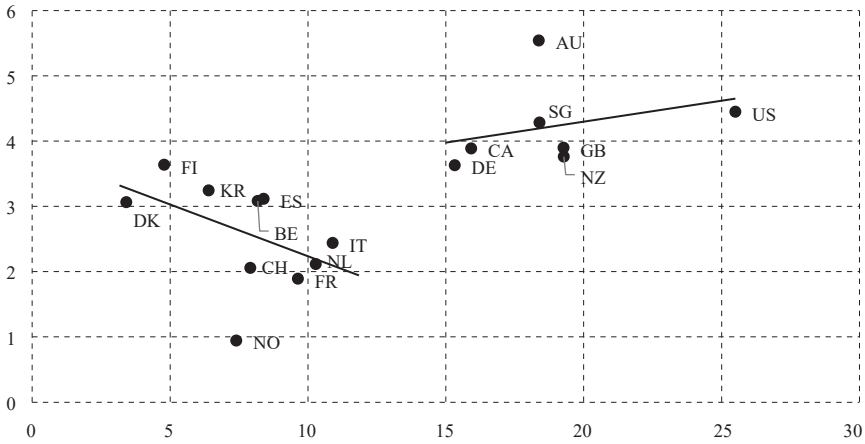
Cost of living subsidies provide an interesting example of interactions between inflation and public expenditure. They clearly raise government spending. But they also affect inflation, and possibly in a non-linear way. Model-based simulations suggest that support measures related to higher energy and other living costs in the euro area lowered inflation by 1 percentage point in 2022 relative to the scenario without subsidies (Bankowski et al., 2023). However, this initial dampening effect is reversed when the subsidies are withdrawn, especially if underlying prices of energy, food or other items remain high.

Moreover, the relationship between fiscal policy support and inflation could differ depending on the level of support (graph 4). Countries providing relatively low levels of extraordinary fiscal support to households and firms during the Covid pandemic (March 2020 – September 2021) tended to experience lower inflation (left-hand cluster around the left-hand regression line in graph 4). Conversely, countries providing high levels of support tended to experience higher inflation (right-hand cluster around the right-hand regression line). This suggests that focused subsidy programmes, like those, for instance, in France, Norway and Switzerland, may have helped lower near-term inflation, as intended by the authorities. However, unfocused and perhaps overly generous fiscal support, as e.g. in the United States, may have been pro-inflationary, as households spent the government transfers and thereby heightened the inflationary risks.

PUBLIC SECTOR ECONOMICS
47 (4) 413–430 (2023)

Graph 4

Fiscal policy support and core inflation, 2020-22



Horizontal axis: additional spending or foregone revenue between March 2020 and September 2021, as a percent of GDP. Based on national authorities and IMF staff estimates. Includes temporary support measures for households and firms and temporary tax reductions (e.g. lower social security contributions and VAT reductions for specific sectors severely hit by the pandemic).

Vertical axis: change in annual average year-on-year core inflation between 2020 and 2022, in percentage points.

Sources: IMF (2021); OECD (2023); author's calculations.

Longer-term changes in the composition of public spending may have heightened the impact of inflation on the expenditure side of the budget. The share of two big-ticket items that adjust quickly to inflation – social security transfers and purchases of goods and services – has risen steadily over the past four decades (table 1). The share of other items that also adjust to inflation quickly – interest payments, public investment, and, with a longer lag, public sector wages – has declined; however, these items together account for a smaller proportion of total spending than transfers and purchases of goods and services.

These trends reflect broader social and political developments over the past four decades and are likely to continue, making expenditure even more responsive to inflation in the future. On the one hand, market-friendly political parties have put pressure on governments to downsize. As a result, the public sector wage bill has remained more or less the same or declined since the 1980s (table 1). On the other hand, the need for elected officials to cater to the interest of the electorate and maintain the level of public services that the public has grown accustomed to has led to more outsourcing, resulting in an increase in spending on goods and services. More importantly, population ageing has led to an expansion of social security transfers, which is likely to continue in the future.

Table 1

Structure of government expenditure, as a percentage of GDP, period averages

	Public sector wages			Purchases of goods and services			Interest payments			Social security transfers			Public investment		
	1980- 95[1]	1996-2008	2009-21	1980- 95[1]	1996-2008	2009-21	1980- 95[1]	1996-2008	2009-21	1980- 95[1]	1996-2008	2009-21	1980- 95[1]	1996-2008	2009-21
EA	–	10.3	10.3	4.6	4.7	5.5	5.3	3.6	2.3	21.1	20.6	22.9	3.3	3.2	3.0
GB	9.2	10.1	9.4	7.8	6.7	8.3	4.0	2.4	2.6	11.8	12.3	14.1	1.7	2.3	2.8
JP	5.8	5.9	5.4	2.9	2.9	3.4	3.3	2.8	2.0	12.2	15.5	21.3	7.5	5.4	4.0
US	10.4	9.9	9.8	5.7	6.3	6.7	6.1	4.4	4.0	10.1	11.3	15.4	4.4	3.7	3.5
SOE[2]	14.2	12.6	13.2	7.4	6.5	6.8	4.6	2.4	0.8	17.8	16.3	16.5	2.6	3.4	3.9
EME[2]	–	8.6	8.8	–	5.1	4.8	–	2.3	1.8	–	4.4	7.1	–	3.1	3.6

Note: EA = euro area; GB = United Kingdom; JP = Japan; US = United States; SOE = small open economies; EME = emerging market economies.

[1]Initial observations vary across countries.

[2]Median values for small open economies (Denmark, Norway, Switzerland and Sweden) and EMEs (Chile, Korea, Poland and South Africa).

Sources: OECD (2023); author's calculations.

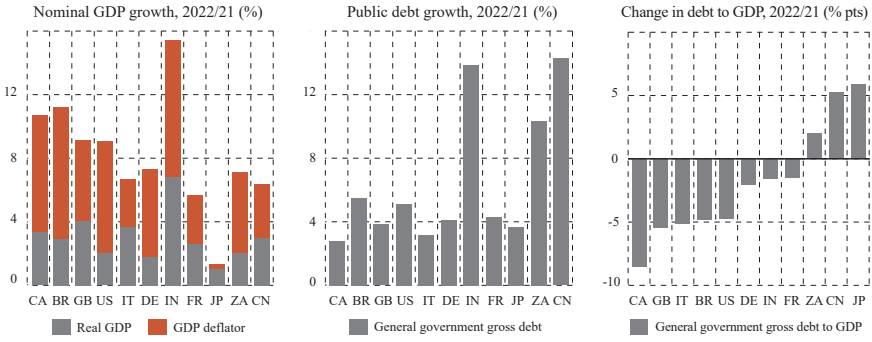
4 BUDGET DEFICIT AND PUBLIC DEBT UNDER HIGH INFLATION

With inflation boosting government revenue faster than expenditure, the overall budget balance tends to improve under high inflation. Empirical studies generally confirm a positive but mild effect of inflation on budget balances. Atinassi and Klemm (2016) and Berti et al. (2016), for example, found that a 1 percentage point increase in the GDP deflator growth was associated with a 0.1-0.2 percentage point improvement in the primary balance ratio in various samples of EU countries from 1970 to 2013. How long this improvement lasts depends on how quickly big-ticket items such as social security transfers and public sector wages catch up with inflation, whether new subsidy scheme are introduced to offset the loss of purchasing power for households, and also on the level of inflation. As noted above, at very high inflation rates real tax revenue may start to decline. Crucially, the extent of improvement depends on the response of monetary policy to inflation (discussed below).

In addition to its impact on revenue and expenditure, inflation typically lowers the ratios of budget deficit and public debt to GDP by inducing a rise in nominal GDP. In 2022, for example, strong real GDP growth and high inflation boosted nominal GDP by 6-15% in major economies (graph 5, left-hand panel). As a result, the ratio of overall general government deficit to GDP in advanced economies fell to 4¼% on average in 2022 from 7½% in 2021 (IMF, 2023c). Public debt to GDP ratios fell by 2-8 percentage points despite the rise in gross nominal debt by 3-14% (graph 5, centre and right-hand panels).

Graph 5

High nominal GDP growth lowers public debt ratios



Source: IMF (2023d).

Even when the government runs a balanced budget on an annual basis, treasuries need to borrow in financial markets to finance their day-to-day operations, as there is always some discrepancy between the time when taxes are collected and the time when various budget units pay their expenditures. Fiscal positions therefore depend importantly on market interest rates and, hence monetary policy, especially when the central bank raises policy rates to contain inflation. The higher the budget deficit and public debt, the more sensitive fiscal positions are in general to

higher interest rates. For example, gross interest payments for the major advanced economies are projected to be around 1% of GDP larger on average in 2024 than in 2021. For Italy the interest rate bill is projected to be 4% larger, and for the United States and the United Kingdom as much as 5% larger (appendix graph A1). In some cases, the mechanical impact of higher policy interest rates may have increased in recent years despite governments issuing at longer maturities. This is because of large-scale central bank purchases of long-term sovereign bonds financed from reserves that commercial banks hold in the central bank. These reserves are remunerated at policy rates, which are typically higher than the interest rates governments paid to issue debt between 2012 and 2021. The relatively high cost of asset purchases implies lower central bank profits and hence lower central bank remittances to the government. For major central banks active in large-scale asset purchases, current figures indicate that some 20-40% of sovereign debt is in effect indexed to overnight interest rates (BIS, 2023).

Interest payments are also projected to rise in many EMEs by 2024, to about 2% of GDP in Croatia and Poland, 3% in Hungary, and more than 5% in India, Mexico and South Africa. Some EMEs also face higher interest payments on their foreign debt, as the tightening of external financing conditions due to high inflation abroad increases their foreign debt servicing costs. Where commercial banks hold large amounts of government bonds, banking and sovereign debt distress might coincide, as was the case in the euro area in 2010-12. Hardy and Zhu (2023), for instance, found evidence of greater co-movement of CDS spreads between banks and sovereigns in a range of countries since the pandemic.

So far, concerns about public debt sustainability have materialised mostly in lower-income economies, which have also seen most downgrades in their credit ratings. For example, Ghana, Lebanon, Sri Lanka, Suriname, Venezuela and Zambia are currently in outright default. But with little potential for deleveraging, weak growth outlook and high inflation, other EMEs may also experience debt strains.

In sum, the boost to tax revenues and deficit and debt to GDP ratios induced by inflation is temporary. Government expenditure generally catches up quickly when inflation is persistently high. Banić, Pripužić and Rebić (2023) present clear evidence of this effect for the case of Croatia. And tight monetary policy in response to inflation eventually slows the economic activity and the tax revenue intake. Deficits start to widen, and – with slower nominal GDP growth – deficit and debt to GDP ratios stop falling and start rising again, posing a threat to debt sustainability where public debt levels are already high.

PUBLIC SECTOR ECONOMICS
47 (4) 413-430 (2023)

5 FEEDBACKS FROM FISCAL TO MONETARY POLICY UNDER HIGH INFLATION

In addition to affecting fiscal positions directly through revenues and expenditures, inflation has second round effects on fiscal policy through interactions of fiscal positions with monetary policy. After the GFC, central banks have for many years called for fiscal expansion as monetary policy had reached limits in sustaining the recovery from the financial crisis (Mihaljek, 2021). During the Covid pandemic and after the start of the war in Ukraine, fiscal policy finally turned highly expansionary – arguably overly so in some advanced economies. But with inflation remaining stubbornly high since mid-2021, central banks have called for more restrictive fiscal policy to assist in the fight against inflation. To shed more light on such appeals, this section briefly analyses recent feedbacks from fiscal to monetary policy.

Fiscal positions have indeed improved since the pandemic but budget deficits remain high. The overall general government deficit in advanced economies fell to 4¼% of GDP on average in 2022 from 7½% in 2021; in EMEs it remained stable at 5¼% of GDP.[5] This compares with overall deficits in 2020 of 10¼% of GDP in advanced economies and 9% in EMEs. Global public debt fell to 92% of GDP over 2021-22, reversing half of the sharp increase in 2020 (IMF, 2023b). Cyclically adjusted fiscal positions in advanced economies also improved, on average by over 2 percent percentage points of potential GDP in 2022, but they deteriorated slightly in EMEs.

The improvement in fiscal positions is projected to be smaller or to come to a halt in 2023. The overall general government deficit and public debt in relation to GDP are forecast to remain more or less unchanged in advanced economies and to increase slightly in EMEs. In most countries, cyclically adjusted primary deficits are projected to shrink further or turn into small surpluses. That said, in many cases cyclically adjusted primary deficits would remain high: 3-4% of potential GDP in France, the United States and the United Kingdom, and 4-5% in China, India and Turkey.

The envisaged fiscal tightening should thus support central banks in the fight against inflation. Monetary policy may need to tighten less to help bring down inflation than would be the case with an expansionary fiscal policy.

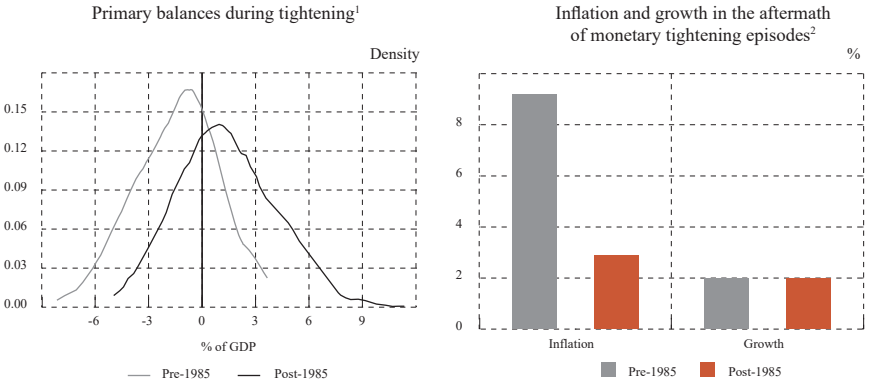
Historical experience provides some support for positive reinforcement of monetary tightening by fiscal prudence. Since 1985, most advanced economies generated primary surpluses during monetary tightening episodes, while before 1985 most incurred primary deficits (graph 6, grey and black lines, left-hand panel). The more prudent fiscal stance was associated with lower inflation and the same growth rates around monetary tightening episodes than the looser stance prevailing before 1985 (right-hand panel).

[5] Before the pandemic, general government overall deficits in advanced economies averaged 3% of GDP, and in EMEs 4½% (2019 averages). All fiscal data in this and next paragraph are from IMF (2023c).

PUBLIC SECTOR ECONOMICS
47 (4) 413–430 (2023)

GRAPH 6

Monetary tightening and primary fiscal surpluses



[1]*Distribution of primary balances during episodes of monetary tightening. Based on data for 20 advanced economies since 1970.*

[2]*Median across countries, during the last year of monetary tightening and the two subsequent years.*

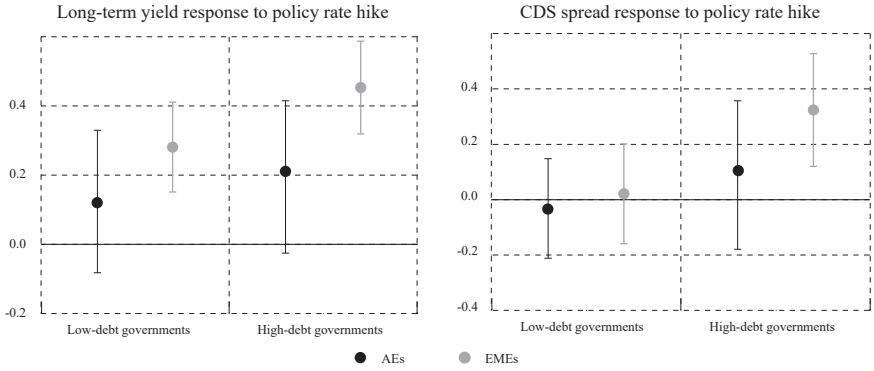
Sources: Boissay et al. (2023); Mauro et al. (2015); IMF (2023a); national data; BIS.

Tighter fiscal policy also helped improve monetary policy transmission in the past. Where fiscal policy consolidated to support monetary tightening, risk premia in long-term interest rates became less volatile and monetary policy lags less uncertain. In EMEs, lower sovereign risk decreased the probability of future currency depreciation, which is often a major hindrance to central banks' disinflation efforts. Long-term bond yields of highly indebted sovereigns thus tended to rise more than those of less indebted ones in past monetary tightening episodes, especially in EMEs (graph 7, left-hand panel). This largely reflected shifts in credit risk premia: sovereign CDS spreads tended to widen much more for high-debt EMEs (right-hand panel).

In advanced economies, yield and credit premia changes were not statistically sensitive to policy rate hikes in the past, partly because of the long period of central bank purchases of government bonds. However, as these purchases are reversed, high-debt advanced sovereigns may face a jump in long-term bond yields and CDS spreads. While central banks could step in to provide support in such a situation, the deployment of balance sheet tools to counter market dysfunction when monetary policy is tightening would send confusing signals to financial market participants and the real economy.

GRAPH 7

High public debt leads to larger yield and CDS increases when policy rates rise (in percentage points) [1]



Note: AEs = advanced economies; EMEs = emerging market economies.

[1]Dots correspond to point estimates and bars to +/- two standard deviations around these estimates.

Sources: Bloomberg; IHS Markit; Refinitiv Datastream; national data; BIS.

The projected fiscal tightening in 2023 should thus help monetary policy pull in the right direction. But many countries continue to run large budget deficits, and high public debt poses broader financial stability concerns with implications for the monetary policy stance. In other words, while helpful, tighter budget plans – even if fully implemented – may not provide *enough* support to disinflation.

6 CONCLUDING REMARKS

This paper analysed the effects of high inflation on government revenue, expenditure, fiscal balances, and public debt by studying recent empirical and historical experiences in a range of advanced and emerging market economies. The main finding is that inflation tends to boost tax revenues and improve fiscal positions in the short term, but expenditure catches up quickly with inflation and offsets much of this improvement in the medium term.

The short-term improvement in fiscal positions is partly due to structural changes that have made modern tax systems much more elastic with respect to inflation – notably the expansion of VAT and the spread of digital technology in tax collection – and partly due to the practice of setting expenditure targets in annual budgets in nominal terms without automatic indexation, so that higher than budgeted inflation generally does not increase spending to the same degree and as quickly as it does revenues. The medium-turn deterioration in fiscal positions mainly reflects the fact that up to two thirds of total government spending adjusts to inflation fairly quickly, and that monetary tightening eventually dampens tax revenue and nominal GDP growth.

The key risk of inflation for fiscal stability is that strong tax revenue growth in the short-term creates the perception that treasuries have large surpluses at their

PUBLIC SECTOR ECONOMICS
47 (4) 413–430 (2023)

disposal, and that tax revenues will remain ample in the future. This perception may tempt governments and parliaments to consider new spending programmes and tax cuts rather than saving the tax windfalls. Fiscal policymakers generally seem to be aware of this risk. But political economy pressures to increase public spending are strong when fiscal positions appear healthy.

The paper discussed one recent example of pressures to spend the tax windfalls – energy subsidies to households and firms in European countries after the Russian invasion of Ukraine. There are indications that countries providing higher subsidies tended to experience higher inflation, as unfocused fiscal support increased consumption and thereby heightened the inflationary risks. With more permanent transfer programmes such risks would increase and could quickly destabilise public finances.

Disclosure statement

No potential conflict of interest was reported by the author.

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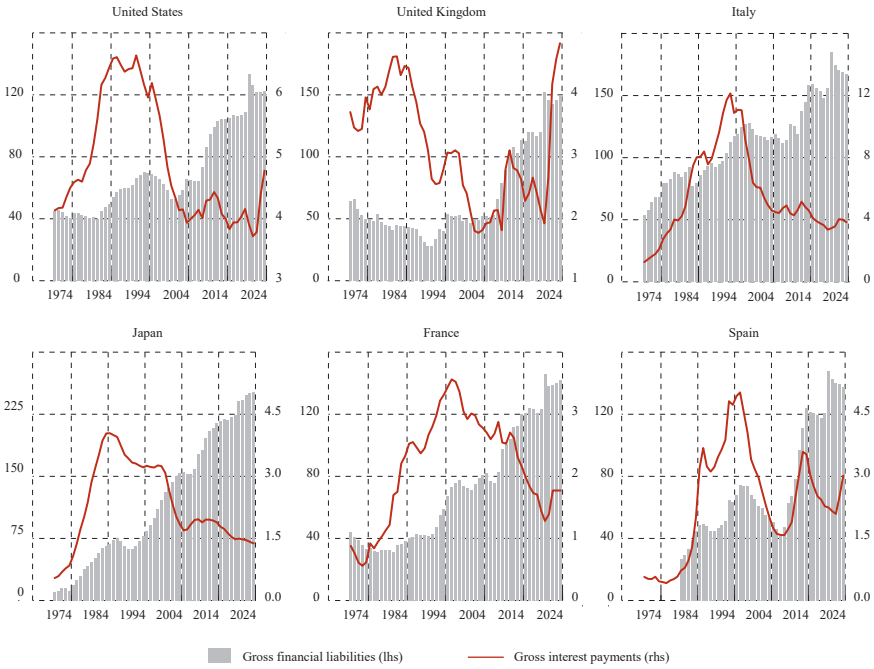
PUBLIC SECTOR ECONOMICS
47 (4) 413-430 (2023)

APPENDIX

Graph A1

Gross public debt and gross interest payments in advanced economies, as a percentage of GDP[1]



[1] *For the general government.*

Sources: OECD, Economic Outlook; BIS.

A cost-of-living squeeze? Distributional implications of rising inflation

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PUBLIC SECTOR ECONOMICS
47 (4) 431–460 (2023)

Abstract

In most OECD countries inflation sharply increased since the end of 2021, mostly driven by energy and food prices. Certain categories of households are particularly vulnerable, as they spend large portions of their consumption on energy and food. Drawing on national micro-based household budget survey data, this paper quantifies the impact of rising prices on households' welfare. Declines in household purchasing power between August 2021 and August 2022 are estimated to range from 3% in Japan to 18% in Czechia. This decline is driven by energy prices in most countries, especially Denmark, Italy, and the United Kingdom. In general, inflation weighs relatively more on lower income households. The effects are stronger for rural households, due to energy price inflation. These findings call for a careful targeting of income and price support measures, notwithstanding their administrative and logistical complexity, taking into account their effects on economic activity, inflation, and environmental goals.

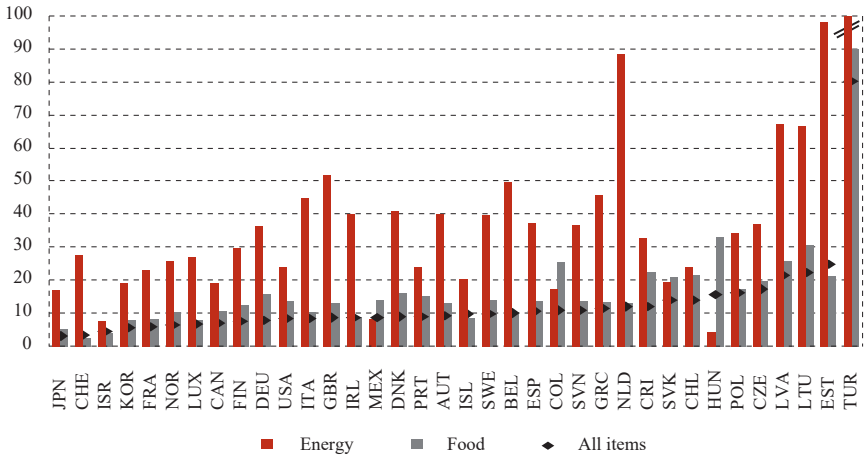
Keywords: inflation, purchasing power, distribution, inequality, energy, policy analysis

1 INTRODUCTION

Inflation in the OECD has been on the rise since the start of 2021, intensifying sharply following Russia's war of aggression against Ukraine. Soaring energy and, to a lesser extent, food prices are a global phenomenon, yet the inflationary picture differs across countries (figure 1).

FIGURE 1

Consumer price inflation across OECD countries, change between August 2021 and August 2022 (%)



Note: Year on year energy price inflation for Turkey: 132.76 per cent.

Source: OECD (2013a).

PUBLIC SECTOR ECONOMICS
47 (4) 431–460 (2023)

This paper looks at the distributional impact of rising inflation[1] over the past year, with a focus on energy and, to a lesser extent, food price inflation, for ten OECD countries selected on the basis of adequate and timely data availability, i.e., the Czech Republic, Denmark, Germany, France, Italy, Japan, Mexico, Spain, the United Kingdom and the United States. The exercise draws on national micro-based household budget surveys (HBS) providing information on the structure of household spending across the distribution of households based on income, age, and area of residence, depending on data availability. This paper associates expenditure shares from national HBS with price changes from national CPIs.

This work informs the policy debate by identifying households more exposed and vulnerable to the recent rise in inflation and in particular to changes in energy prices, which in the future might also fluctuate as we move along the path to a low-carbon economy (IEA, 2021). The main findings can be summarised as follows:

– Rising prices, especially for energy, have been squeezing households' purchasing power, but with large differences across countries, partly reflecting differences in the rate of inflation, its breadth across consumer items and the spending structure of the average household.
– Low-income, rural and senior households are more exposed to rising energy prices than the average household, but the variation in purchasing power losses across these three vulnerable groups is highly heterogeneous across countries.
– The difference in estimated energy prices effects between rural and urban areas are even larger than between lower and higher income households in most countries, and especially in Czechia, Spain, and France.
– Non-energy non-food-price inflation tends to be progressive, thus somewhat mitigating, but not offsetting the effect of rising energy and food prices. This reflects the fact that "other" rising consumer prices correspond to items representing a higher share of spending for more affluent households, i.e., non-energy transport, recreation, restaurants and hotels.
– Improving the timeliness and granularity of the data would help in the designing of well-targeted policy support: for instance, to identify households most exposed to shifts in energy prices, e.g. those with limited financial resources and possibilities to substitute in the short-run. The digital transformation is the opportunity to build agile targeting instruments based on data collection and management.

The rest of this paper is structured as follows. Section 1 provides an overview of the data and empirical approach – additional methodological aspects are provided

[1] Households across the income distribution experience differential inflation effects for several reasons: consumption shares may differ systematically (e.g. for low- and high-income households); the goods and services within each consumption category may differ; the ability to substitute lower-priced alternatives of the same item may differ; and prices paid for the same good may differ systematically due to differences in access. Experimental measures of consumer prices for different household groups have been recently constructed for several countries. See Klick and Stockburger (2021) and Orchard (2022) for recent experimental evidence in the case of the United States.

PUBLIC SECTOR ECONOMICS
47 (4) 431- 460 (2023)

in the annex. Section 2 delivers the core results of the analysis, i.e., it sheds light on the distributional effects of the recent rise in inflation, with a focus on energy and food driven price inflation across a selection of OECD countries. The emphasis is on differences across income groups, but alternative relevant dimensions are also explored. This evidence is followed by a short policy discussion on key policy challenges to achieve effective targeted support for households most vulnerable to energy price swings while pursuing decarbonisation objectives.

2 THE APPROACH

2.1 DATA AND COUNTRY COVERAGE

The analysis draws on household budget surveys, which are national surveys on households' expenditure on goods and services. Countries covered are those for which data are available and are as up to date as possible. Harmonised Eurostat HBS data for European countries would have been well-suited for this exercise but are not up to date, only being updated every five years. The following ten countries can be covered, with HBS data available for the year 2020 (with the exception of France): the Czech Republic, Denmark, France, Germany, Italy, Japan, Mexico, Spain, UK, US.[2]

2.2 METHODOLOGY

Distributional effects of inflation are assessed based on household exposure to the change in the prices of the items that make up households' consumption baskets. This is expressed in terms of change in purchasing power following the conceptual framework of the compensating variation approach (Deaton, 1989). The compensating variation (CV) measures how much expenditure can be decreased (increased) when consumer prices fall (rise) so that the utility level remains the same as before the price decrease (increase). For household i, the CV is measured relative to total household expenditure (C_i). This is a measure of the change in household purchasing power resulting from changes in consumer prices underlying inflation; that is, the price change in item k (indicated as $\frac{dp_k}{p_k}$) weighted by the share of expenditure that is spent on item k (sc_k^i,), defined as $\frac{q_k^i p_k}{c_i}$, where p_k and q_k^i refer, respectively, to consumption item k's price and to the quantity purchased by household i, and c_i refers to the household's total expenditure:

$$\frac{CV_i}{C_i} = \frac{\sum_k q_k^i p_k \times dp_k / p_k}{C_i} = \sum_k sc_k^i \times \frac{dp_k}{p_k} \qquad (1)$$

This approach has been used to assess the distributional effects of consumption taxes (OECD/KIPF, 2014) and of trade-driven price changes (Luu et al., 2020; Porto, 2006). The change in purchasing power can be computed for the average household and by income or other socioeconomic groups defined by, e.g. age,

[2] The annex provides details on countries' data sources.

education and urbanisation of the area of residence, depending on data availability. For the purpose of the current exercise, the analysis relies on semi-aggregated data provided by national sources, that is, expenditure shares by socioeconomic groups.

The CV for household *i* corresponds to the average of the percentage changes in prices across categories of expenditures, weighted by the household's expenditure share on each category. This is close, but not equal, to the inflation rate, i.e., percentage change in CPI, for household *i*, which would be the percent change in the average of prices across categories of expenditures, weighted by the household's expenditure shares. The CV approach is adopted here because it has a conceptually-grounded economic interpretation for the purpose of the current exercise, similar to previous papers on distributional aspects of consumer price changes. In addition, the CPI calculations rely on weights that are adjusted according to consumption estimates from national accounts, with country-specific frequencies and methodologies (OECD, 2023a). Given the focus on distributional effects and for internal consistency, the current exercise uses the original expenditures shares from domestic HBS surveys, including those for the average household.[3]

The analysis uses 2020 household expenditure shares to assess the impact of inflation over the past year,[4] consistent with the standard CPI methodology: national CPIs are constructed as weighted averages of sub-indices covering different products in the consumption basket, using the total household expenditure shares of a base year, as weights. These weights are regularly updated[5] and, in normal times, are very stable.[6]

To introduce the exercise, figure 2 reports expenditure shares on energy and food across the household income distribution for the Czech Republic, Germany, Japan, Mexico, the United Kingdom, and the United States.[7] The main insights are:

– Households devote a significant share of their spending to food and energy, and this share declines with increasing income level. Their combined spending share ranges from more than 30 per cent at the bottom to less than 15 per cent at the top of the income distribution, across the advanced economies

[3] As a result, the purchasing power loss from "all items" inflation for the average household does not necessarily match the official CPI from OECD.stat. The numbers can be reconciled by factoring out methodological differences, for instance applying the CPI weights from OECD.stat instead of the HBS weights for the average household (this technical material is available upon request).

[4] The current exercise is based on changes in CPI between August 2021 and August 2022 except otherwise stated.

[5] See above and OECD (2023a) for details on CPI methodology.

[6] One possible concern is that the COVID-19 crisis induced changes in consumption patterns by lockdowns and restrictions. This poses analytical challenges because the 2020 weights differ from the pre-COVID weights and may differ from the post-COVID weights. The problem raised by spending shifts during the pandemic has been addressed by the OECD Statistic Directorate, by various National Statistical offices and researchers, using different experimental methods. Almost all these studies find small effects on 2020 inflation. As a robustness check on this issue, the annex reports a comparison between 2019 and 2020 expenditure weights across income groups for countries that collect yearly HBS data. This exercise shows that while 2020 weights tend to differ from 2019 weights in some consumption categories, the difference in such weights between income groups is stable over the period.

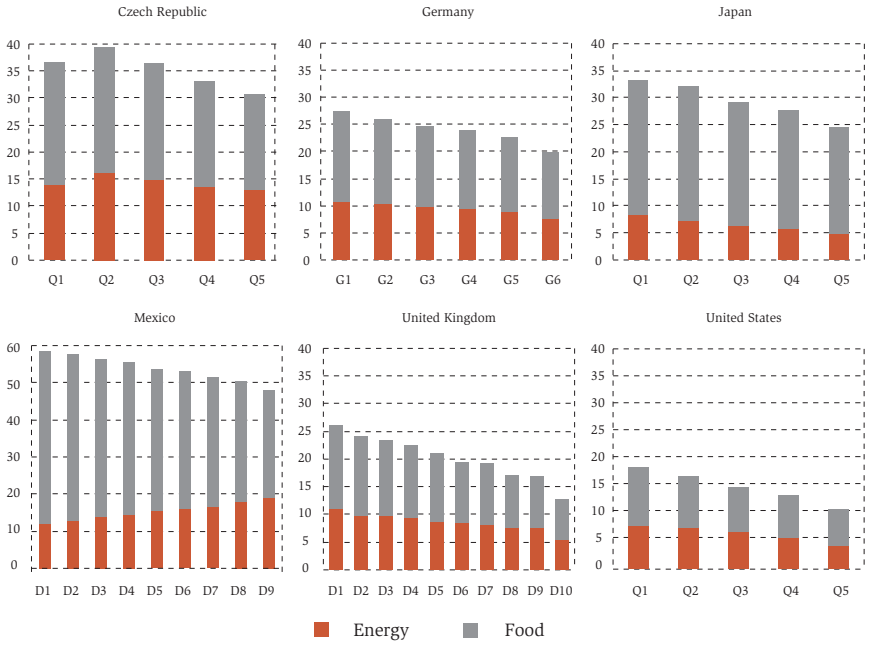
[7] The annex reports more detailed expenditure shares for all countries covered by the study.

covered here, yet with large cross-country differences within that broad spectrum.

– Food is a major component of the consumption basket. Low-income households spend around 20 per cent on food in the advanced economies covered by this paper with the notable exception of the United States, where that share is around 10 per cent. In line with Engels' law, the weight of food is larger in Mexico, where low-income households devote approximately half of their spending on food and high-income ones 30 per cent.
– Energy represents around 10 per cent of household spending in most of the countries covered and this share declines across the income distribution. Mexico stands out as energy represents a much higher share of spending and this share increases across the income distribution. The share of consumption spent on energy is highest in the Czech Republic and lowest in Japan and the United States. Such cross-country differences likely reflect differences both in relative prices and in consumption patterns.

FIGURE 2

Shares of expenditure on energy and food, by income group (%)



Note: Distribution based on household income (see annex for country-specific income measurement). Energy refers to energy from housing and private transportation. Food includes food and non-alcoholic beverages, with the exception of Mexico, where it also includes alcoholic beverages consumed at home. When possible, expenditure shares are shown by income deciles (for Mexico and the United Kingdom) or quintiles (the Czech Republic, Japan, United States). In the case of Germany, the data can only be obtained by the income groups defined by DEStatis (indicated as G1,…G6).

Source: National HBS sources (see annex).

PUBLIC SECTOR ECONOMICS
47 (4) 431–460 (2023)

Differences in energy spending are more pronounced across place of residence than across households' incomes. This is illustrated in panel A of figure 3 with France and the United States. For example in France, people living in rural areas devote around 12 per cent of their budget to energy, more than twice as much as people living in the Paris agglomeration. It is often the case that people living in metropolitan areas have diverse commuting and mobility options, including public transportation, walking, biking, and while people living in rural or non-central areas may have no other option than driving a personal car (for example to go to work or the doctor). Differences in energy spending by age are less systematic across countries than they are by income and place of residence: taking again France and the United States as examples, panel B of figure 3 shows that the share of spending devoted to energy increases almost monotonically with age in France, but not in the United States.[8]

3 THE RESULTS

3.1 THE BIG PICTURE: THE COST-OF-LIVING PRESSURE FOR THE AVERAGE HOUSEHOLD

Rising prices, especially for energy, have been squeezing households' purchasing power, yet with large differences reflecting differences in the rate of inflation, its breadth across consumer items, and the spending structure of the average household.[9] The main findings on the basis of year-on-year August 2021 – August 2022 inflation are (figure 4):

- Declines in households' purchasing power range from around 3% in Japan to 18% in the Czech Republic.[10]
- The effect of rising energy prices is large but differs across countries, being particularly important in Italy, Denmark and the United Kingdom.
- Rising food prices weigh less than rising energy prices on the purchasing power of the average household. Mexico is an exception given the high share of food in the consumption basket and the relatively mild increase in energy prices over the period.
- The effect of "non-food-non-energy" prices on the average household's purchasing power is relatively higher in countries like the Czech Republic and the United States, reflecting the fact that inflation in these countries was more broad-based.
- These differences across countries are in part due to differences in the relative price changes and in part to differences in the consumption share allocated to food, energy and the residual category.

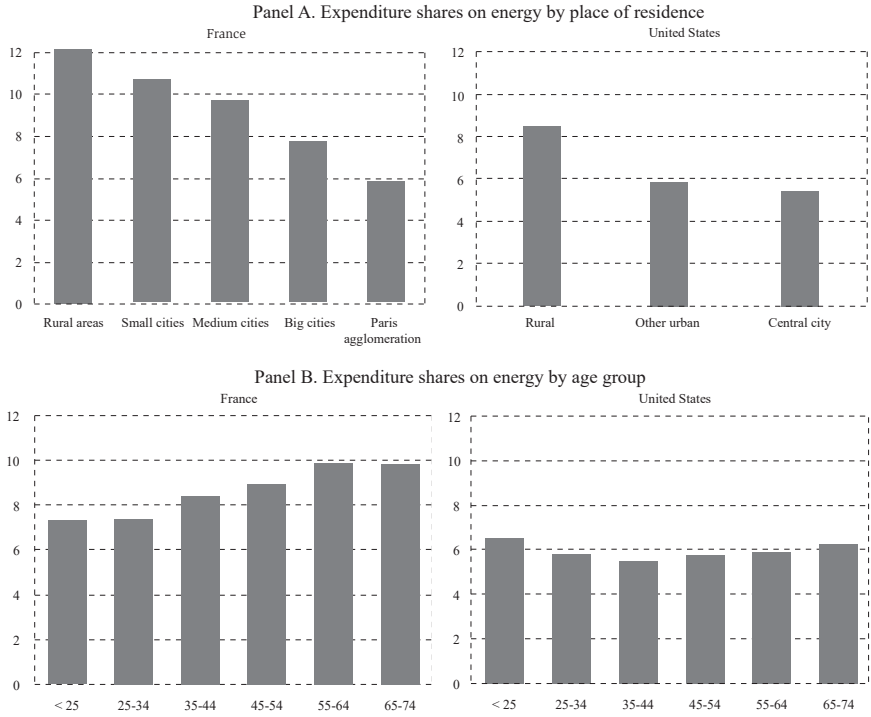
[8] These various vulnerability dimensions are to some extent correlated, e.g., high-income prime-aged households living in metropolitan areas; but, as also suggested by the illustrative charts in this section, such correlation is not necessarily very high and, in any case, differs across countries.

[9] See INSEE (2022a) for a recent assessment of the role of differences in the spending structure of the average household in explaining differences in HIPC inflation between France and three other big Euro area countries (i.e., Germany, Italy, and Spain).

[10] Due to the differences in formulas between CPI and CV discussed above, these numbers are close but not identical to official average inflation figures.

FIGURE 3

Expenditure shares on energy (%)



Note: For France, "small cities" are defined as those below 20,000 inhabitants, "medium cities" range between 20,000 and 100,000 inhabitants, "big cities" have more than 100,000 inhabitants. For the U.S., the classification in rural, urban and central city areas is provided by BLS-CEX.

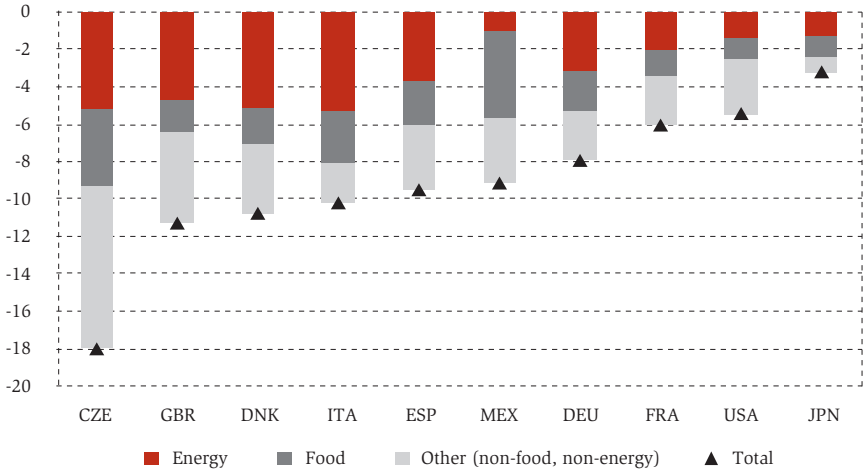
Source: National HBS. See annex.

These results are subject to two main caveats: (1) the computations include the purchasing power effects of price-based policy interventions, e.g., reduced prices or taxes on electricity, gas and gasoline; they do not include the purchasing power effects of non-price-based policy interventions, e.g. income support via cash transfers or reduced income taxes. This might affect the cross-country comparison exercise, in light of differences in the adopted mitigation measures. In general, at least during 2022, price support measures introduced to contrast the cost-of-living crisis following Russia's attack on Ukraine outnumbered and involved higher costs than income support measures (OECD, 2022). Evidence for France and the United States suggests that the combined effect of these measures has been effective in supporting the purchasing power of vulnerable households (Madec, Plane and Sampognaro, 2022; CBO, 2022). The current calculations can therefore be interpreted as measures of potential exposure to purchasing power losses, abstracting from the mitigation achieved through *ad hoc* income support measures. (2) energy effects are to be taken as a lower-bound, given that energy items are key intermediate inputs for the production of non-energy items, and therefore for the pass-through to non-energy

consumer items (see Ari et al. (2022), and OECD (2023b) for a quantification exercise of direct and indirect effects from rising energy prices).[11]

FIGURE 4

Purchasing power changes for the average household (%)



Note: How to read: in Italy, the average household experienced a 10.2% decline in purchasing power following changes in consumer prices between August 2021 and August 2022. This is driven by three effects: the effect of changes in energy prices (a 5.3% decline in purchasing power), the effect of changes in food prices (a 2.8% decline in purchasing power) and the effect of changes in non-energy non-food consumer prices (a 2.1% decline in purchasing power).

Source: National HBS and CPI. See annex.

3.1.1 BEYOND THE AVERAGE HOUSEHOLD: DISTRIBUTIONAL EFFECTS OF THE COST-OF-LIVING PRESSURE

The effects of inflation are highly heterogeneous across households and distributional patterns differ across countries (figure 5). A comparison of low- and high-income households (defined as first and last decile, quintile, or country-specific threshold of the household income distribution, see annex) yields the following insights (figure 5, panel A).

Inflation has a greater impact on low than high-income households, but with marked differences across countries. Nevertheless, such differences do not appear to be strongly correlated with the level of inflation in the country. The gap between low and high-income households is the largest in the United Kingdom while it is almost absent in the Czech Republic and Denmark despite similar or even higher headline inflation over the period covered.

Energy price inflation is strongly regressive in all countries except Mexico, where it has a relatively higher effect on high-income households; this is consistent with

[11] See Blake and Bulman (2022) for the technical background paper associated with the Survey of Greece.

PUBLIC SECTOR ECONOMICS
47 (4) 431–460 (2023)

the fact that in Mexico the share of spending on energy is positively associated with household income (figure 2).[12]

Food price inflation is also regressive but less so than energy price inflation in most countries covered. Mexico stands out, again, since food price inflation is the single major driver of regressivity. The regressivity of the effects of food price inflation is also more marked than that of energy price inflation in the Czech Republic and Spain.

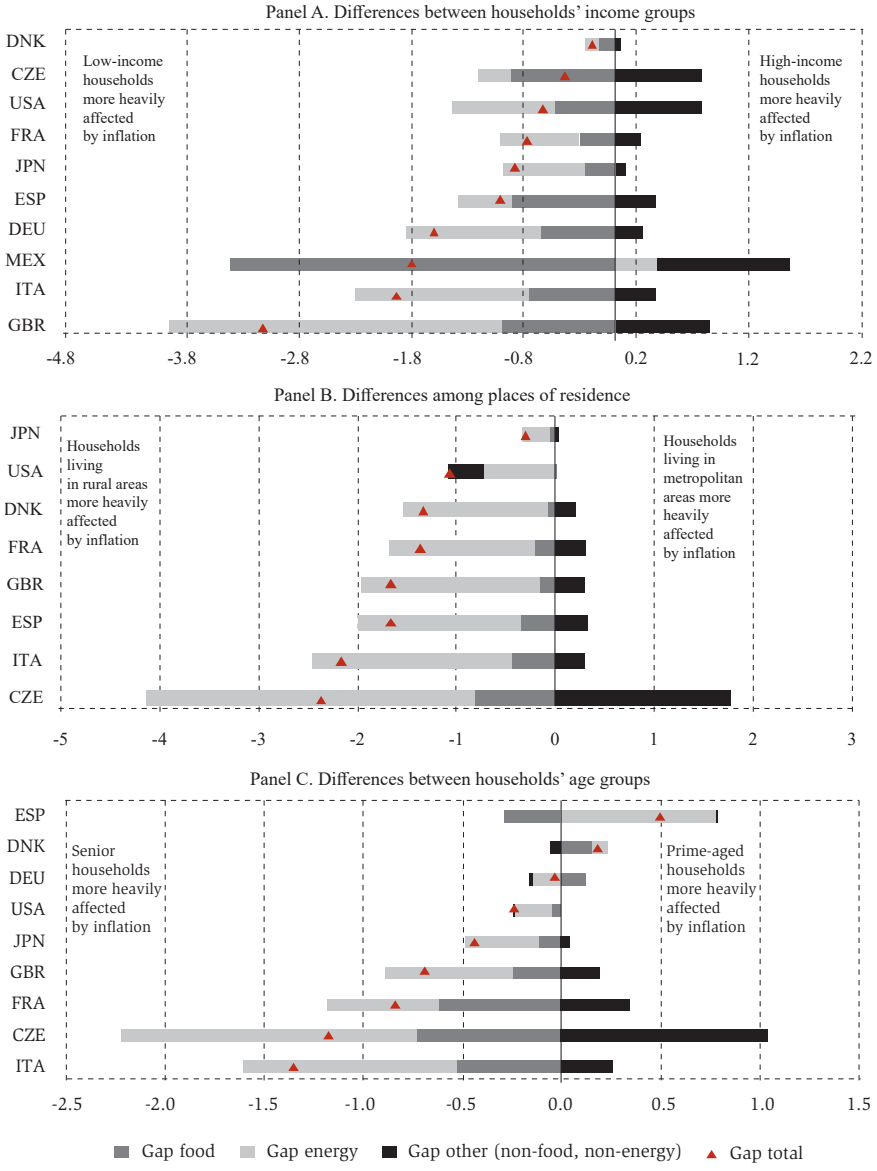
The effect of non-food non-energy price inflation is progressive, i.e., affecting high- more than low-income households, which is why the total gap is lower than the sum of the energy and food gaps.

Living on limited income resources is not the only and often not the first factor of vulnerability to the current inflationary picture. Living in a small, isolated village is a major vulnerability factor. Inflation tends to disproportionately affect rural households and thus to amplify spatial inequalities. In most countries, the purchasing power gap between rural and metropolitan households tends to be larger than that between low and high-income households and this gap is driven by energy (figure 5, panel B). Age is another factor of vulnerability to energy and food price inflation, as indicated by the finding of larger purchasing power losses for senior relative to prime-aged households in all countries except Denmark and Spain (figure 5, panel C). But age-related gaps are generally lower than place of living- and income-related gaps.

[12] These distributional effects can be nuanced to the extent that they may differ by energy carrier, see Flues and Thomas (2015).

FIGURE 5

Differences in purchasing power effects between various types of households (pp)



Note: How to read: in the United Kingdom, the decline in purchasing power following changes in consumer prices between August 2021 and August 2022 was 3.1 percentage points (pp) higher for low- than for high-income households (a negative 3.1 pp gap). This total gap is driven by three effects: the effect of changes in energy prices (a negative 2.9 pp gap), the effect of changes in food prices (a negative 1 pp gap) and the effect of changes in non-energy non-food consumer prices (a positive 0.8 gap). Due to limited data availability, Mexico cannot be covered in panels B and C, and Germany in panel B. See annex for country-specific definitions of high- versus low-income, rural versus metropolitan, and senior versus prime-aged households (age always refers to that of the household reference person).

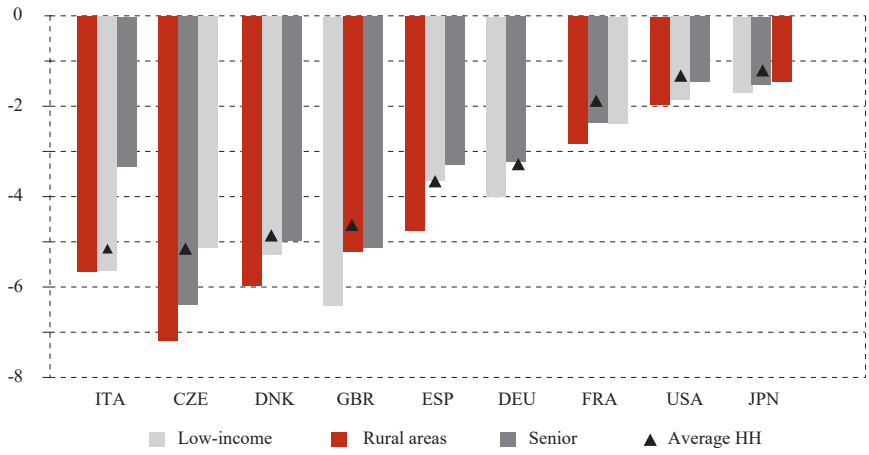
Source: National HBS and CPI. See annex.

In summary, figure 6 reports the purchasing power loss associated with rising energy prices for the three vulnerable groups covered in the analysis, i.e., low-income, rural and senior households. Main insights are:

– Low-income, rural and senior households are more exposed to rising energy prices than the average household but the variation in purchasing power losses across these three vulnerable groups is highly heterogeneous across countries.
– In most countries, rural households are more vulnerable than low-income households to energy price inflation, in particular in the Czech Republic, Spain, and France. This could in part be due to the relatively limited access to public transport and the need to drive higher mileages, but also to differences in energy efficiency of the primary dwellings. Disentangling such drivers is however beyond the scope of the current exercise, and would require access to data at a more granular level.
– Senior households tend to experience milder purchasing power losses than low-income and rural households, in particular in Italy and in the United States.

FIGURE 6

Purchasing power losses from energy price increases: low-income, rural, senior households (%)



Note: The chart shows the change in purchasing power between August 2021 and August 2022. How to read: in Denmark, households living in rural areas experienced a 6% decline in purchasing power, low-income households a 5.3% decline in purchasing power and senior households a 5% decline in purchasing power following changes in energy prices between August 2021 and August 2022.

Source: National HBS and CPI. See annex.

4 GRANULAR ANALYSIS OF NON-ENERGY-NON-FOOD PRICE INFLATION

The evidence in the baseline analysis is that inflation is regressive because energy and food price inflation is strongly regressive, while non-energy non-food price inflation tends to be progressive, thus somewhat mitigating (but not offsetting) the

effect of rising energy and food prices. Such evidence is obtained by computing the average change in prices on food, energy, and "non-food non-energy" items, each weighted by the respective share on household expenditures. Given the importance of non-energy non-food purchasing power effects, an important question is what drives them.

A granular analysis, giving illustrative insights, is possible for France, Germany, Italy and the United Kingdom, because of the collection of more granular data.[13] Detailed HBS and CPI data are combined to compute the compensating variation (CV) for each of the COICOP-99 one-digit expenditure categories, net of food (COICOP-99 category 1) and energy (COICOP-9 categories 4.5 and 7.2.2) expenditures. The sum of the resulting CVs is equal to the average of the change in prices of each one-digit category, weighted by the respective expenditure shares (exact formulas in the annex). The sum corresponds to the CV of the category "Other" in figure 4, up to a small approximation margin. Performing this exercise for each income bracket sheds light on the distributional effects of changes in major non-food non-energy price items. The results are presented in figure 7 and summarised below.

Average household effects (figure 7, panel A)

- Rising prices of recreation and restaurants and of non-energy categories of transport goods and services (e.g., buying a car or an airline ticket) are major drivers of purchasing power losses for the average household across the sample of countries considered.
- Rising prices of non-energy housing (i.e., mostly actual and, in some countries, imputed rentals) have a significant effect in Germany and, to a lesser extent, the United Kingdom. Rising prices of housing furniture add to purchasing power losses for the average household.

Distributional effects (figure 7, panel B)

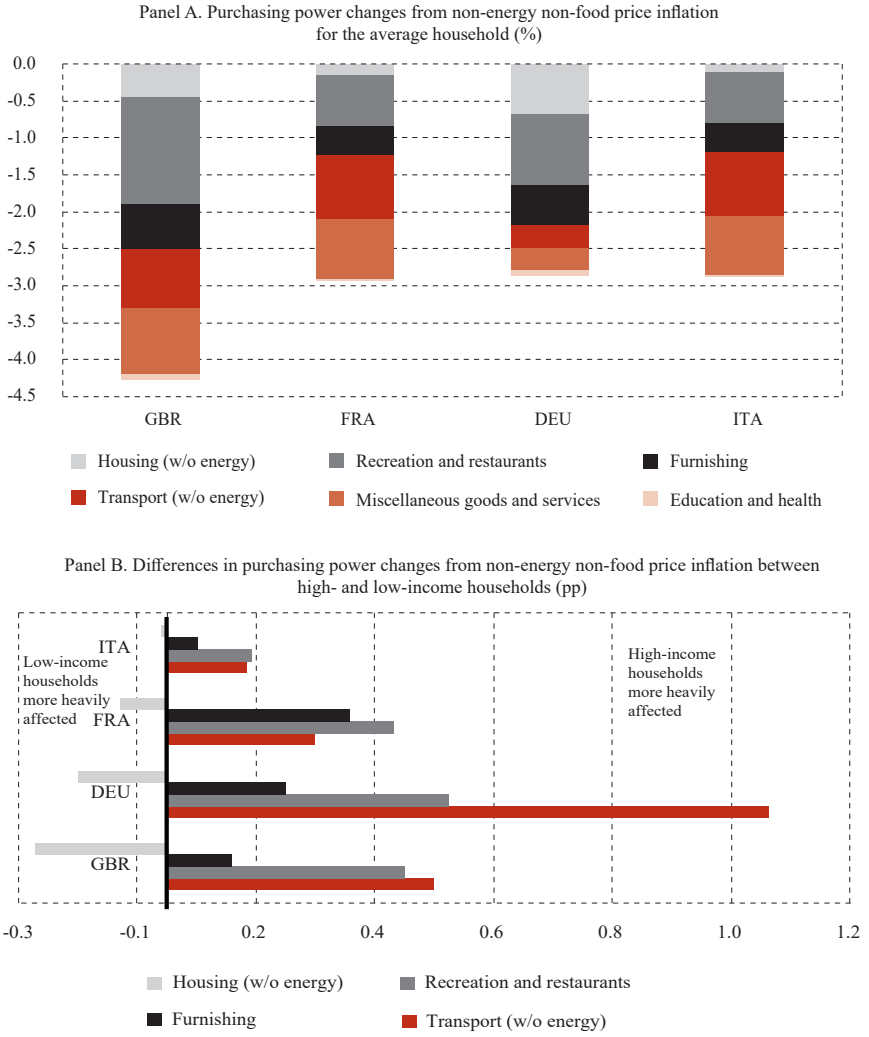
- The effect of rising prices of recreation, restaurants, furnishing and non-energy transport is progressive, i.e., the price increase affects higher income households more than lower income ones.
- The progressivity of non-energy transport price inflation is particularly marked for Germany. This reflects the significantly large share of expenditures on non-energy transport, especially on the purchase of vehicles, among German high-income households (over three times that of low-income households).

[13] Major methodological and data-driven obstacles, which are even more constraining in a cross-country perspective, precluded an examination of these, in particular, cross-country differences in consumer items classification: while most countries rely on the COICOP-99 classification (UN, 2000), Japan and the United States adopt a different classification, raising complex mapping issues. In addition, cross-country and within-country differences in the treatment of housing expenditure and prices: some countries cover only actual rentals in HBS data (e.g. France), while others cover both actual and imputed rentals (e.g. Germany). In addition, a few countries include imputed rentals in HBS but not in CPI data. This is the case for Italy and the United Kingdom.

– Non-energy housing price inflation is regressive i.e., affecting low more than high-income households, but the purchasing power difference between high- and low-income households is minor relative to all other spending categories; and furnishing also has a progressive effect.[14]

FIGURE 7

Non-energy non-food price inflation tends to affect high- more than low-income households



Note: For Germany, "Housing" includes imputed rental costs. See annex for details.

Source: National HBS and CPI. See annex.

[14] Such housing effects should be interpreted with caution, owing to cross-country differences in the coverage and measurement of owner-occupied housing costs (imputed rentals), as already mentioned. For instance, among the countries covered, Germany is the only country for which the data and thus the analysis include imputed rentals.

One key implication of this analysis is the potential importance of improving the consistency, granularity, and timeliness of the data, as a basis for research and all the more for policymaking. Reliable timely information on consumption patterns would allow to quantify the reactions of demand to price shifts and expectations. At the moment, detailed data by consumption category is published with a lag. For example, at the time of the analysis, in 2022, the latest harmonized HBS data released by Eurostat was for 2015.

5 POLICY DISCUSSION

As outlined above, a quantification of the impact on household purchasing power of the price and income based support measures adopted by governments is beyond the scope of this paper. Nonetheless, the results showcase the stark heterogeneity in the exposure of different categories of households to food and energy price shocks. Such heterogeneity in turn suggests the use of targeted support measures. Well-designed income support can limit the burden on government budgets as they preserve price signals for energy savings while providing a financial lifeline to those who need it the most and, in the longer run, improve resilience to price swings while also facilitating a just transition towards a greener economy (OECD, 2022). With respect to effective targeting, our results underscore the need to consider further factors of vulnerability beyond income, notwithstanding the likely correlation among the different factors. One important dimension in this respect may be the area of residence and in particular whether it is rural, as shown in this paper. Yet targeting households living in rural areas is also likely to be crude, as e.g., affluent retirees in the countryside are less vulnerable to rising energy prices than younger people looking for a job in rural areas. Furthermore, other dimensions of vulnerability that could not be covered in the current analysis would also need to be considered, such as housing quality (e.g., energy efficiency) and access to infrastructure (e.g., public transport). The implication is that effective targeting may be logistically and politically complicated and require detailed and timely data on consumption patterns.

Disclosure statement

The authors have no potential conflict of interest to report.

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PUBLIC SECTOR ECONOMICS
47 (4) 431–460 (2023)

ANNEX

INFORMATION ON DATA SOURCES

The two main data sources used in the analysis are the national Household Budget Surveys (HBS) and the Consumer Price Indexes (CPI) databases. While the CPI's are typically computed on the basis of HBS data, often combined with National Accounts data, important differences exist in the underlying concepts, the methodology, and the statistical coverage of HBS and CPI. For example, for most countries, the CPI does not include owner occupied housing costs (i.e. imputed rents), while those can be included in HBS.

Tables A1 and A2 provide further details on the sources and methodology of CPI and HBS data.

TABLE A1
CPI data

Country	Data source for CPI	Treatment of housing
CZE	OECD CPI	Actual rents
DEU	OECD CPI for the baseline. Destatis CPI by COICOP 2-5-digit hierarchy. Table 61111-0004 for the granular extension.	Actual and imputed rents
DNK	OECD CPI	Actual rents
ESP	OECD CPI	Actual rents
FRA	OECD CPI for the baseline. Insee CPI by COICOP 2-5-digit hierarchy for the granular extension.	Actual rents
ITA	OECD CPI for the baseline. ISTAT Harmonized index of consumer prices for the granular extension.	Actual rents
JPN	Statistics Bureau of Japan	Actual rents
MEX	OECD CPI	Actual and imputed rents
GBR	OECD CPI for the baseline. ONS Harmonized index of consumer prices for the granular extension.	Actual rents
USA	Bureau of Labour Statistics	Actual and imputed rents

Source: National Statistical Offices and OECD Database on Consumer Price Indices.

Table A2 shows that for most countries the categories of expenditures used for HBS data follow the COICOP-98 classification (United Nations Department of Economic and Social Affairs 2000). Japan and the USA represent an exception, as they use their own classifications. The energy component of transportation costs is "Fuels and lubricants for personal transport equipment" (COICOP1998 07.2.2) but needs to be proxied with "Operating of personal transport equipment of private transports" (COICOP1998 07.2) for Denmark, Spain, and Mexico.

TABLE A2
HBS data

Country	HBS year	HBS data sources	Energy consumption categories (COICOP codes)	Treatment of housing
CZE	2020	Czech Statistical Office – Household Budget Survey	04.5 + 07.2.2	Actual rents
DEU	2020	Destatis – Laufende Wirtschaftsrechnungen Einkommen Einnamhen und Ausgaben privater Haushalte	Housing energy ("Energie") + 07.2.2	Actual and imputed rents. Housing does not include the category "Water supply, misc. services related to the dwelling"
DNK	2020	Statistics Denmark – Household Budget Survey	04.5 + 07.2 (data for 07.2.2 not available)	Actual rents
ESP	2020	National Institute of Statistics – Household Budget Survey	04.5 + 07.2 (data for 07.2.2 not available)	Actual rents
FRA	2017	National Institute of Statistics and Economic Studies – Enquete Budget de Famille	04.5 + 07.2.2	Actual rents
ITA	2020	National Institute of Statistics – Indagine sulle spese delle famiglie	04.5 + 07.2.2	Actual and imputed rents
JPN	2020	Statistics Bureau of Japan – Family Income and Expenditure Survey	Housing energy ("Fuel, light & water charges" excluding "Water and sewerage charges")	Actual rents
MEX	2020	INEGI – Encuesta Nacional de Ingresos y Gastos de los Hogares	Housing energy ("Electricidad y combustibles") and Transports energy ("Refacciones, partes, accesorios, mantenimiento, combustibles y servicio para vehículos")	Actual and imputed rents
GBR	2020	Office for National Statistics – Living Cost and Food Survey	Housing energy ("Electricity, gas and other fuels") and transport energy ("Petrol, diesel and other motor oil")	Actual rents
USA	2020	Bureau of Labour Statistics – Consumer Expenditure Survey	Housing energy ("Utilities, fuels, and public services" excluding "Telephone services" and "Water and other public services") and Transport energy ("Gasoline, other fuels, and motor oil")	Actual and imputed rents

Note: All countries follow the COICOP classification, except for US and Japan which follow a national classification. Mexico follows the COICOP classification except that Food not consumed at home (COICOP11) and alcoholic beverages (COICOP 2) are included in the category "Food" (COICOP1).

Source: National Statistical Offices.

PUBLIC SECTOR ECONOMICS
47 (4) 431–460 (2023)

ANALYTICAL APPROACH FOR ASSESSING THE IMPACT OF PRICE CHANGES ON CONSUMERS

When assessing the impact of price shocks on consumers, the literature essentially relies on one of two alternative approaches. The first approach is to compute a CPI index of inflation for each household, where a household's expenditure shares are used as CPI weights (INSEE, 2022b; McGranahan and Paulson, 2006; Jaravel, 2019). The second approach, favoured in the present analysis because it is theoretically founded and interpretable from a welfare perspective, relies on the compensated variation (CV) framework:

$$\frac{CV_i}{C_i} = \frac{\sum_k q_k^i p_k \times \frac{dp_k}{p_k}}{C_i} = \frac{\sum_k q_k^i p_k \times \frac{dp_k}{p_k}}{C_i} = \sum_k sc_k^i \times \frac{dp_k}{p_k}$$

where C_i refers to the total expenditure of the household i; p_k and q_k refer to the price and quantity of the consumption item k, respectively; $\frac{dp_k}{p_k}$ refers to the percentage variation in prices of the item k; and sc_k refers to the expenditures spent on category k as a share of the total expenditure. The CV framework was developed by Deaton (1989) to measure the impact of price changes on consumers' welfare. This approach has been widely used in the literature: recently by the IMF to assess the effect of surging energy prices on European households' cost-of-living (Ari et al., 2022) and similarly but on smaller scale by Bruegel (Claeys and Guetta-Jeanrenaud, 2022); by the OECD to assess the effect of trade policy-driven price changes on consumers' purchasing power (Luu et al., 2020).

The main analysis in the paper is based on three consumption categories: food, energy, and other (all goods and services excluding food and energy) and applied to all households and to various household groups, defined and aggregated based on relevant socioeconomic characteristics such as income. The total CV for household group i is hence computed as:

$$\frac{CV_i}{C_i} = sc_{Food}^i \times \frac{dp_{Food}}{p_{Food}} + sc_{Energy}^i \times \frac{dp_{Energy}}{p_{Energy}} + sc_{Other}^i \times \frac{dp_{Other}}{p_{Other}}$$

where sc_k indicates the share of expenditures spent by household group i on category k, and $\frac{dp_k}{p_k}$ the percentage variation in prices for this category.

For France, Germany, Italy, and UK, the paper is extended with a granular analysis at the COICOP-1-digit level. This requires one to properly separate the energy components from COICOP categories 4 (Housing, containing category 4.5 "Electricity, gas and other fuels") and 7 (Transports, containing category 7.2.2 "Fuel and lubricants"). In order to achieve this, the analysis exploits CPI and HBS data at the 3-digit COICOP level and applies the following formula:

$$CV_i = \sum_{k=COICOP1}^{COICOP12} sc_k^i \times \frac{dp_k}{p_k}$$

where the contributions for non-energy COICOP 4 and COICOP 7 are computed as:

$$CV_{i,COICOP4} = sc^i_{COICOP4.1} \times \frac{dp_{COICOP4.1}}{p_{COICOP4.1}} + sc^i_{COICOP4.3} \times \frac{dp_{COICOP4.3}}{p_{COICOP4.3}} + sc^i_{COICOP4.4} \times \frac{dp_{COICOP4.4}}{p_{COICOP4.4}}$$

and

$$\begin{aligned} CV_{i,COICOP7} = {} & sc^i_{COICOP7.1} \times \frac{dp_{COICOP7.1}}{p_{COICOP7.1}} + sc^i_{COICOP7.2.1} \times \frac{dp_{COICOP7.2.1}}{p_{COICOP7.2.1}} \\ & + sc^i_{COICOP7.2.3} \times \frac{dp_{COICOP7.2.3}}{p_{COICOP7.2.3}} + sc^i_{COICOP7.2.4} \times \frac{dp_{COICOP7.2.4}}{p_{COICOP7.2.4}} \\ & + sc^i_{COICOP7.3} \times \frac{dp_{COICOP7.3}}{p_{COICOP7.3}} \end{aligned}$$

For Italy an additional adjustment is necessary, because imputed rents are included among the expenditure categories in HBS data, but not among price categories in CPI data (see tables 1 and 2). To ensure internal consistency, the expenditure shares of all other categories in Italy are therefore first re-scaled so that their total (excluding imputed rents) sums to 100%. The rescaled shares are then multiplied by the corresponding price index, according to the formulas above. A minor adjustment is required for Germany: the category "Water supply, misc. services rel. to the dwelling" has to be excluded, as it is not recorded in HBS data.

DEFINITION OF SOCIO-ECONOMIC GROUPS

Table A3 reports details concerning the country-specific definitions of the income brackets used for the analysis. Whenever possible, the analysis is carried out at the quintile-of-income level. When such categorization is not available, the analysis is carried out according to the original definition of income groups by the statistical department releasing HBS data.

TABLE A3
Income

Country	Income definition	Income categories
CZE	Net money income per person	Quintiles
DEU	Net monthly household income	Up to 1,300 euro, From 1,300 to 1,700 euro, From 1,700 to 2,600 euro, From 2,600 to 3,600 euro, From 3,600 to 5,000 euro, 5,000 euro or more
DNK	Household annual total income	Up to 250,000 DKK, From 250,000 to 449,999 DKK, From 450,000 to 699,999 DKK, From 700,000 to 999,999 DKK, 1,000,000 DKK or more
ESP	Monthly net household income	Up to 499 euro, From 500 to 999 euro, From 1,000 to 1,499 euro, From 1,500 to 1,999 euro, From 2,000 to 2,499 euro, From 2,500 to 2,999 euro, From 3,000 to 4,999 euro, 5,000 euro or more
FRA	Equivalized household disposable income	Deciles
ITA	Income proxied by education	Lower secondary, Upper secondary, Tertiary education
JPN	Annual household income	Quintiles
MEX	Quarterly total household income	Deciles
GBR	Equivalized household disposable income	Deciles
USA	Income before taxes, defined as the combined income of all consumer unit members (14 years of age or over) during the 12 months preceding the interview	Quintiles

Source: National Statistical Offices.

Table A4 reports the country-specific definitions of areas of residence.

TABLE A4
Place of residence

Country	Definition basis for rural and metropolitan areas	Rural	Metropolitan
CZE	Number of inhabitants	Less than 1,999 inhabitants	More than 50,000 inhabitants
DNK	Population density & Eurostat regional classification	Nordjylland	Hovedstaden
ESP	Number of inhabitants	Less than 10,000 inhabitants	100,000 or more inhabitants
FRA	INSEE-HBS classification directly available	Rural	Paris complex
ITA	ISTAT-HBS classification directly available	Other municipalities up to 50,000 inhab. (different from metropolitan area suburbs)	Metropolitan area – centre
JPN	Statistics Bureau of Japan classification directly available	Small cities, towns and villages	Major cities
GBR	Population density and Eurostat regional classification	North-East	London
USA	BLS-CEX classification directly available	Rural	Central city

Source: National Statistical Offices.

Table A5 reports the country-specific definitions of age groups.

Table A5

Age

Country	Age definition	Senior	Prime-age
CZE	Labour market status as a proxy for age	Pensioner	Employed
DEU	Age of the household head or reference person	65 to 69 years old	35 to 44 years old
DNK	Age of the household head	60 to 74 years old	35 to 44 years old
ESP	Age of the household head	65 and over	35 to 44 years old
FRA	Age of the household head	65 to 74 years old	35 to 44 years old
ITA	Labour market status as a proxy for age	Retired	Employed
JPN	Age of the household head	65 and over	30 to 39 years old
GBR	Age of the household head	65 to 74 years old	30 to 49 years old
USA	Age of the household head	65 to 74 years old	35 to 44 years old

Source: National Statistical Office.

SHIFTS IN CONSUMPTION SHARES DURING COVID-19

This section compares 2019 and 2020 consumption shares for 1-digit COICOP categories of high-income and low-income groups by country, for the countries for which data are available to perform this exercise. The definition for high-income and low-income categories can be found in table A3.

Table A6

Czech Republic, income (%)

	2019			2020		
Description	**Low**	**High**	**Delta**	**Low**	**High**	**Delta**
Food and non-alcoholic drinks	20.09	16.58	3.51	22.57	17.53	5.04
Alcoholic drink, tobacco and narcotics	2.72	2.81	-0.09	3.06	3.01	0.05
Clothing and footwear	4.59	5.18	-0.59	4.73	4.89	-0.16
Housing, fuel and power	25.00	22.20	2.80	25.10	22.72	2.38
of which Electricity, gas and other fuels	11.20	9.95	1.25	9.89	9.17	0.72
Household goods and services	5.82	6.57	-0.75	5.70	8.34	-2.65
Health	2.43	2.74	-0.31	2.76	2.81	-0.05
Transport	10.23	11.55	-1.33	9.31	11.49	-2.18
of which Fuels and lubricants for personal transport equipment	4.46	4.76	-0.30	3.99	3.96	0.04
Communication	4.50	4.21	0.29	4.75	4.14	0.61
Recreation and culture	9.97	11.00	-1.03	9.04	9.78	-0.73
Education	1.53	1.25	0.28	1.15	0.69	0.45
Restaurants and hotels	7.00	7.25	-0.25	5.34	6.65	-1.31
Miscellaneous goods and services	6.12	8.65	-2.53	6.50	7.95	-1.45

Source: Czech Statistical Office.

TABLE A7

Denmark, income (%)

	2019			2020		
Description	**Low**	**High**	**Delta**	**Low**	**High**	**Delta**
Food and non-alcoholic drinks	12.18	11.14	1.05	12.37	11.53	0.84
Alcoholic drink, tobacco and narcotics	2.66	1.84	0.82	2.84	1.97	0.87
Clothing and footwear	3.54	4.05	-0.51	4.38	3.42	0.95
Housing, fuel and power	42.14	29.22	12.92	43.23	28.75	14.48
of which Electricity, gas and other fuels	10.64	5.54	5.10	9.61	4.95	4.66
Household goods and services	4.13	5.32	-1.18	4.57	6.06	-1.49
Health	3.04	2.06	0.98	3.08	2.28	0.81
Transport	8.33	16.05	-7.72	7.22	17.57	-10.35
of which Operation of personal transport equipment	3.75	7.80	-4.05	3.43	7.80	-4.37
Communication	2.90	2.07	0.83	3.32	2.10	1.22
Recreation and culture	8.48	10.80	-2.33	7.83	10.48	-2.65
Education	0.57	0.95	-0.38	0.61	0.84	-0.22
Restaurants and hotels	5.32	7.35	-2.03	3.95	5.48	-1.53
Miscellaneous goods and services	6.71	9.15	-2.44	6.61	9.52	-2.92

Source: Statistics Denmark.

TABLE A8

Italy, income (%)

	2019			2020		
Description	**Low**	**High**	**Delta**	**Low**	**High**	**Delta**
Food and non-alcoholic drinks	20.22	13.69	6.53	22.37	15.98	6.39
Alcoholic drink, tobacco and narcotics	2.19	1.37	0.82	2.20	1.56	0.65
Clothing and footwear	4.27	5.04	-0.77	3.72	4.41	-0.69
Housing, fuel and power	34.34	34.65	-0.30	37.19	38.66	-1.46
of which Electricity, gas and other fuels	5.09	3.38	1.71	5.22	3.59	1.63
Household goods and services	4.00	4.81	-0.81	4.11	5.03	-0.92
Health	4.61	4.12	0.49	4.53	4.21	0.32
Transport	11.65	12.00	-0.35	9.63	9.46	0.17
of which Fuels and lubricants for personal transport equipment	5.57	4.35	1.22	4.74	3.40	1.34
Communication	2.54	1.96	0.58	2.55	2.06	0.50
Recreation and culture	4.32	6.20	-1.88	3.54	5.11	-1.57

	2019			2020		
Description	**Low**	**High**	**Delta**	**Low**	**High**	**Delta**
Education	0.45	1.05	-0.59	0.41	1.01	-0.60
Restaurants and hotels	4.24	6.87	-2.63	2.88	4.43	-1.55
Miscellaneous goods and services	7.16	8.26	-1.10	6.87	8.09	-1.22

Note: High-income and low-income categories are proxied by high-education and low-education.

Source: ISTAT.

Table A9

Japan, income (%)

	2019			2020		
Description	**Low**	**High**	**Delta**	**Low**	**High**	**Delta**
Food	28.28	22.85	5.43	28.66	24.94	3.72
Housing	20.30	10.87	9.43	20.94	12.01	8.93
of which Fuel & light	8.23	4.47	3.76	8.21	4.78	3.43
Furniture & household utensils	3.73	3.65	0.08	4.20	4.44	-0.23
Clothing & footwear	2.82	4.45	-1.64	2.42	4.01	-1.59
Medical care	5.74	4.05	1.69	5.80	4.41	1.39
Transportation & communication	10.99	15.57	-4.59	10.69	14.72	-4.03
Education	0.27	6.08	-5.80	0.30	5.83	-5.53
Culture & recreation	9.61	11.15	-1.54	8.82	9.50	-0.68
Other consumption expenditures	18.27	21.33	-3.06	18.16	20.15	-1.98

Note: The category "Fuel & light" originally also comprehended water charges (Fuel, light & water charges), however for comparability reasons with the other countries the contribution of water charges is not considered. Likewise, the category "Fuel, light & water charges" is treated as a subcategory of "Housing" despite being a separate category according to the classification of the Statistics Bureau of Japan.

Source: Statistics Bureau of Japan.

Table A10

Mexico, income (%)

	2019			2020		
Description	**Low**	**High**	**Delta**	**Low**	**High**	**Delta**
Food and non-alcoholic drinks	45.12	15.35	29.76	46.15	22.19	23.96
Alcoholic drink, tobacco and narcotics	0.20	0.17	0.03	0.19	0.18	0.02
Clothing and footwear	3.61	4.90	-1.28	2.22	3.44	-1.22
Housing, fuel and power	10.20	8.58	1.62	12.69	9.79	2.90
of which Electricity, gas and other fuels	5.58	3.14	2.44	5.80	4.06	1.74
Household goods and services	6.58	7.05	-0.47	6.45	7.88	-1.43
Health	2.60	3.09	-0.49	4.17	5.08	-0.91
Transport	9.96	17.58	-7.62	8.20	14.79	-6.59

	2019			2020		
Description	**Low**	**High**	**Delta**	**Low**	**High**	**Delta**
of which Fuels and lubricants for personal transport equipment	2.25	9.56	-7.31	2.65	8.91	-6.26
Communication	2.34	4.70	-2.36	3.58	5.51	-1.93
Recreation and culture	1.47	5.90	-4.42	1.19	2.37	-1.18
Education	4.35	11.07	-6.72	2.43	9.79	-7.36
Restaurants and hotels	4.64	9.88	-5.24	3.86	6.11	-2.25
Miscellaneous goods and services	7.45	7.49	-0.04	7.62	8.23	-0.61
Other expenditure items	1.46	4.24	-2.78	1.23	4.63	-3.40

Note: 2019 not available.

Source: National Institute of Statistics and Geography.

Table A11

Spain, income (%)

	2019			2020		
Description	**Low**	**High**	**Delta**	**Low**	**High**	**Delta**
Food and non-alcoholic drinks	17.17	10.37	6.80	19.95	13.28	6.67
Alcoholic drink, tobacco and narcotics	2.60	1.25	1.35	2.17	1.29	0.88
Clothing and footwear	3.20	5.14	-1.94	2.01	4.16	-2.15
Housing, fuel and power	45.80	27.36	16.13	48.80	32.02	14.49
of which Electricity, gas and other fuels	5.20	2.89	2.31	5.51	3.22	2.29
Household goods and services	2.99	6.41	-3.42	2.83	6.62	-3.79
Health	2.07	3.23	-1.16	2.66	3.15	-0.49
Transport	6.03	13.90	-6.31	5.00	10.81	-4.79
of which Operation of personal transport equipment	4.85	6.41	-1.56	4.27	5.29	-1.02
Communication	3.50	2.28	1.22	4.00	2.69	1.31
Recreation and culture	2.65	6.62	-3.97	1.91	4.51	-2.60
Education	n.a	3.52	n.a	n.a	4.42	n.a
Restaurants and hotels	4.23	12.30	-8.07	1.79	9.06	-7.27
Miscellaneous goods and services	6.42	7.45	-1.03	5.51	7.88	-2.37

Note: Data on education spending share not available for low-income households.

Source: National Institute of Statistics.

TABLE A12

United Kingdom, income (%)

	2019			2020		
Description	**Low**	**High**	**Delta**	**Low**	**High)**	**Delta**
Food and non-alcoholic drinks	13.90	7.20	6.70	15.00	7.40	7.60
Alcoholic drink, tobacco and narcotics	3.40	1.70	1.70	3.20	1.70	1.50
Clothing and footwear	4.20	3.80	0.40	4.20	3.90	0.30
Housing, fuel and power	21.90	9.20	12.70	21.70	10.40	11.30
of which Electricity, gas and other fuels	7.30	2.80	4.50	7.60	2.70	4.90
Household goods and services	6.30	9.00	-2.70	5.40	6.50	-1.10
Health	1.20	1.20	0.00	0.90	1.60	-0.70
Transport	11.20	15.40	-4.20	10.10	14.50	-4.40
of which Operation of personal transport equipment	3.20	3.10	0.10	3.40	2.70	0.70
Communication	4.20	2.50	1.70	4.50	2.60	1.90
Recreation and culture	9.80	13.50	-3.70	10.70	14.00	-3.30
Education	0.40	2.00	-1.60	n.a	1.40	n.a
Restaurants and hotels	6.80	9.90	-3.10	7.40	10.00	-2.60
Miscellaneous goods and services	6.50	7.70	-1.20	6.60	7.90	-1.30
Other expenditure items	10.10	16.90	-6.80	10.20	18.20	-8.00

Note: Data on education spending share not available for low-income households in 2020.

Source: Office for National Statistics.

TABLE A13

United States, income (%)

	2019			2020		
Description	**Low**	**High**	**Delta**	**Low**	**High**	**Delta**
Food at home	9.73	5.86	3.87	10.79	6.81	3.98
Alcoholic beverages and tobacco	1.77	1.20	0.57	1.50	1.19	0.31
Apparel and services	2.85	2.94	-0.08	2.65	2.46	0.20
Housing	36.93	26.36	10.57	39.65	27.59	12.05
of which Utilities and fuels	4.80	2.27	2.53	5.26	2.38	2.88
Household furnishings and equipment	3.29	3.50	-0.21	3.23	4.32	-1.08
Healthcare	9.96	6.92	3.04	9.66	6.91	2.75
Transport	15.98	15.77	0.21	15.19	14.63	0.56
of which Gasoline, other fuels, and motor oil	3.48	2.63	0.85	2.84	1.91	0.93
Personal care products and services	1.27	1.16	0.11	1.05	1.02	0.03

	2019			2020		
Description	**Low**	**High**	**Delta**	**Low**	**High**	**Delta**
Entertainment and Reading	4.08	5.74	-1.66	4.39	5.35	-0.96
Food away from home	5.62	5.64	-0.03	3.48	3.85	-0.37
Education	2.68	3.35	-0.67	2.22	3.09	-0.88
Miscellaneous	1.43	1.38	0.05	1.46	1.37	0.09
Personal insurance and pensions	2.16	16.34	-14.18	2.12	17.37	-15.25
Cash contribution and personal insurance and pensions	2.26	3.83	-1.57	2.61	4.05	-1.43

Note: The category "Utilities and fuels" originally comprehended also Telephone services and Water and other public services (Utilities, fuels, and public services), however for comparability reasons with the other countries the contribution of water charges is not considered. Likewise, the category "Household furnishing and equipment" which would be a subcategory of Housing is treated as a separate category.

Source: Bureau of Labour Statistics.

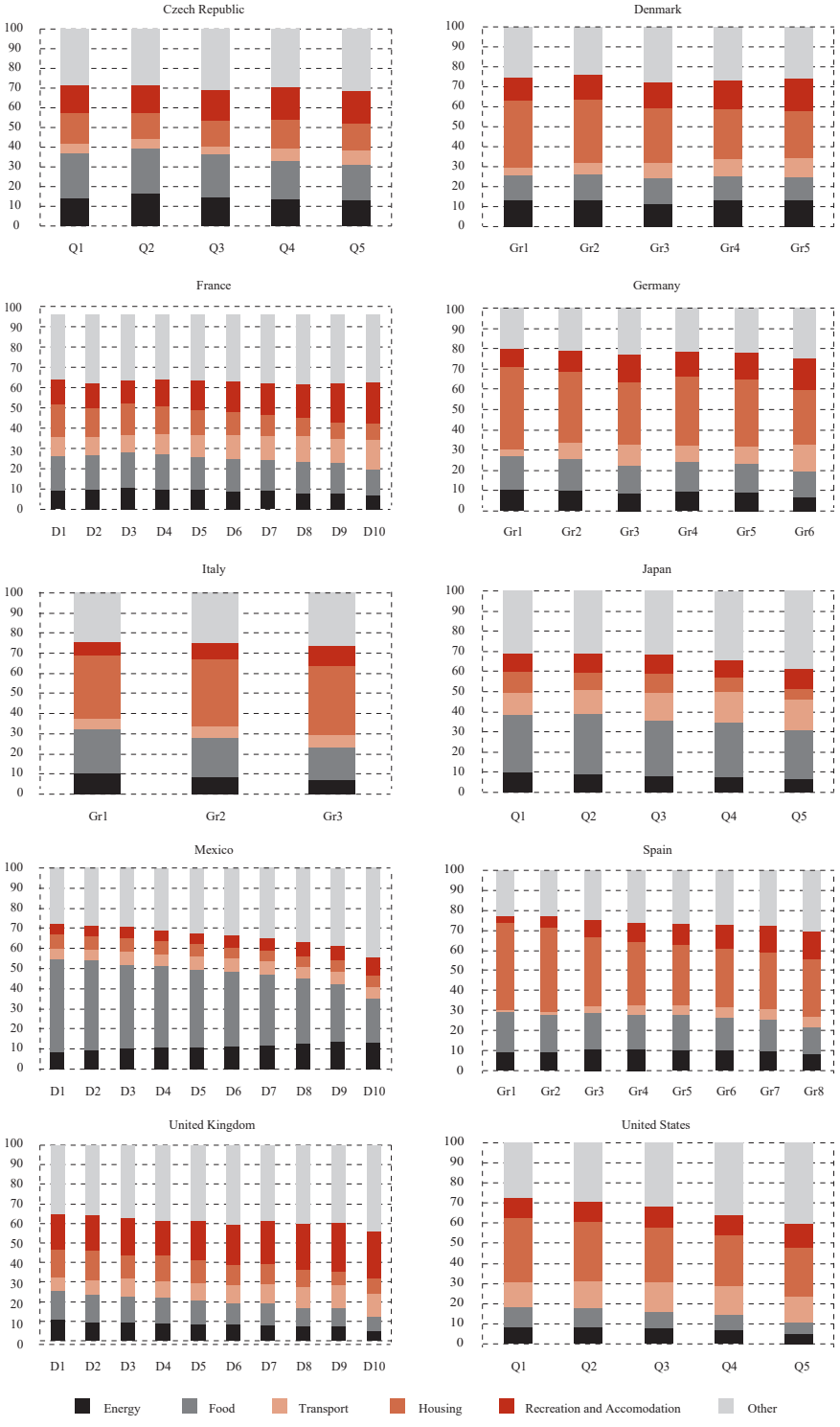
ADDITIONAL COUNTRY-BY-COUNTRY DESCRIPTIVE MATERIAL AND RESULTS

This section contains additional country-by-country results on the expenditure shares and the inflation-driven purchasing power losses across income groups, where the definition of income categories can be found in table A3.[15] Specifically, five expenditure categories are considered in figure A1: Energy, Food, Transport, Housing, Recreation and Accommodation, and Other. In figure A2, showing the changes in purchasing power across income groups, the categories considered are: Food, Energy, Other (non-food, non-energy) and Total.

[15] Detailed materials and results by area of residence and age groups are available upon request.

FIGURE A1

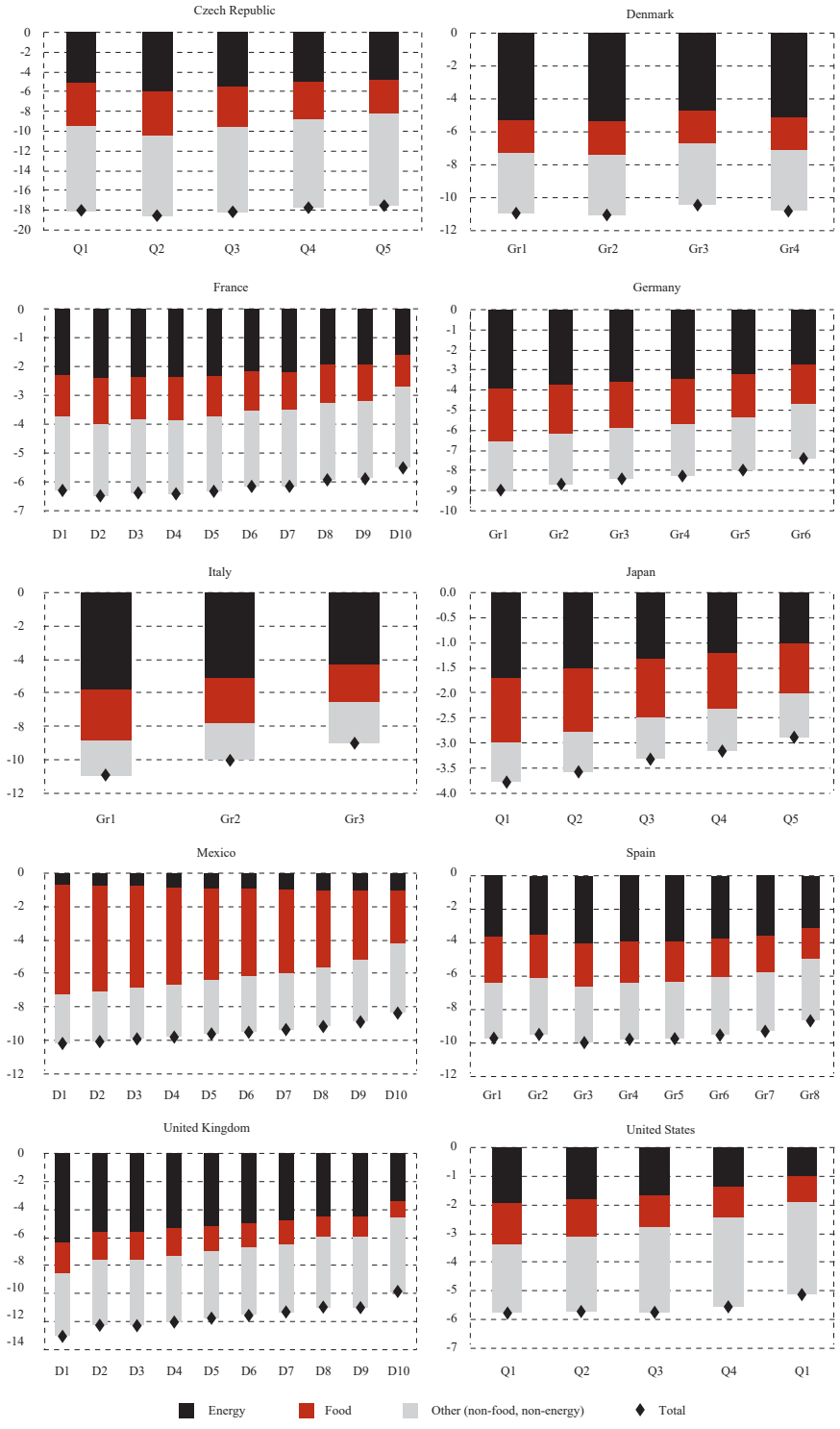
Country-by-country expenditure shares across income groups (%)



Source: National HBS.

FIGURE A2

Country-by-country purchasing power losses across income groups (%)



Source: OECD calculations based on National HBS and CPI.

Short- and medium-term fiscal positions in a high-inflation environment: the case of Croatia

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PUBLIC SECTOR ECONOMICS
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Abstract

This paper analyses the short- and medium-term effects of high inflation on fiscal developments in Croatia. The main analytical novelty is to add inflation shocks to the fiscal reaction function, an approach that was not considered in macro-fiscal research during the long period of moderate inflation. Our results suggest that inflation has a favourable effect on the primary balance in the short term, which can be explained by the positive effect of inflation on nominal tax revenues and an initial lagged adjustment of public expenditure to inflation. In the medium term, however, inflation is likely to have a negative effect on the primary balance by raising government expenditure more than tax revenues.

Keywords: fiscal policy, inflation, tax revenue, public expenditure, debt dynamics, business cycle, breakpoint regression

1 INTRODUCTION

This paper aims to assess the effects of unexpected inflationary shocks on fiscal developments in Croatia. In the short run, one would expect an inflation surprise to have a positive effect on the primary budget balance because of the more or less automatic response of nominal tax revenue bases to higher prices. Over an extended period of elevated inflation, however, the primary balance can be expected to deteriorate, as fiscal policymakers cannot escape adjusting most expenditure items for inflation in order to shield the purchasing power of economic subjects in terms of real wages and pension adjustments. In addition, as monetary policy tightens to contain inflation and economic activity weakens, tax revenue growth is bound to slow down and debt servicing costs to rise, which complicates medium-term fiscal sustainability if public debt is high.

High inflation is only the latest in a series of shocks that fiscal policymakers in Croatia and other European countries have recently had to deal with. Following the unprecedented rise in public spending during the Covid pandemic in 2020-21, Croatia and other EU countries were hit in 2022-23 by a sharp increase in energy prices triggered by Russian aggression in Ukraine. Various income and price measures were implemented at the EU level to mitigate the harmful effects of higher energy prices on business operations and living standards. At the euro area level, these measures added up to almost 2% of GDP in 2022 and could be slightly higher in 2023 (Bankowski et al., 2023). In Croatia, discretionary measures amounted to around 1.5% of GDP in 2022 and were projected to be 1.6% in 2023 (MoF, 2023). If most discretionary measures are unwound as currently planned, they will fall to 0.2% of GDP in 2024.

However, despite an initially planned deficit (2.6% of GDP) for 2022 in late 2021 and the unexpected increase in spending during the year due to energy price measures, Croatia's general government budget recorded a surplus of 0.4% of GDP in 2022. This surprising outturn was due to a combination of buoyant tax revenues, which grew by 13.3% in 2022, and lagging adjustment of expenditure, which

grew by only 6.6% (table 1). In addition, strong nominal GDP growth (14.9%) made the nominal budget balance and general government debt smaller as a ratio of GDP – the latter decreased by around 10 percentage points, to 68.4 % of GDP, from the 2021 level, and by almost 20 points from the 2020 level (graph 1). Compared with averages for the EU, euro area, and Central and Eastern European countries, Croatia recorded larger improvements in overall and primary balances, and in particular, debt to GDP ratios in 2022.

As argued in this paper, inflation played a key role in this positive fiscal outcome. We show that the effect of inflation on the primary balance was positive during the high inflation period from Q3:2021 to Q3:2023, but is projected to turn negative through 2025 as the positive impact of inflation on tax revenues dissipates and public spending catches up with higher prices. In other words, inflation tends to be good for fiscal positions in the short term, but not in the medium term.

Table 1

Croatia: Government revenue and expenditure growth in 2022, in %

Total revenue	**13.3**
Direct tax revenues	37.4
Indirect tax revenues	13.6
Social contributions	12.8
Other current revenue	-14.2
Capital revenue	15.9
Total expenditure	**6.6**
Social benefits	7.1
Subsidies	-1.1
Interest expenditure	3.5
Compensation of employees	5.6
Intermediate consumption	9.4
Total capital expenditure	9.8
Budget balance (% of GDP)	**0.4**

Note: Initial budget planned in 2021 forecast a deficit of - 2.6% of GDP.

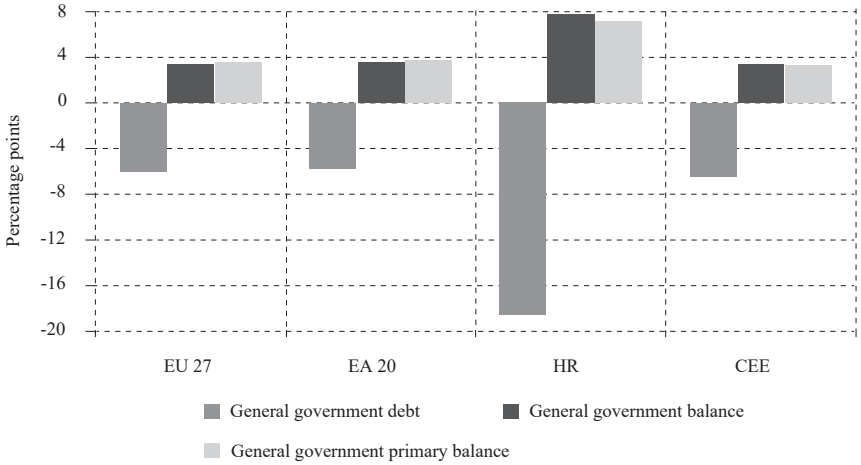
Source: MoF (2021), Eurostat (2023).

The remainder of this paper is structured as follows. The literature review (Section 2) surveys findings of recent empirical research on the fiscal reaction function of the United States, the EU, the euro area and Croatia, highlighting the gap in the analysis of the fiscal effects of inflation. In Section 3 we outline our estimating framework for the fiscal reaction function, adding inflation to the regression as a novelty in this line of work. We estimate the fiscal reaction function with OLS and breakpoints, to focus on the fiscal effects of inflation in different inflation environments. Section 4 describes the empirical results, and Section 5 the robustness check. Section 6 concludes.

PUBLIC SECTOR ECONOMICS
47 (4) 461-475 (2023)

Graph 1

Changes in general government balance, primary balance and public debt, 2020-22



Source: Eurostat (2023), authors' calculations.

2 LITERATURE REVIEW

As the last period of high inflation dates back to the 1970s and 1980s, there is not much recent empirical work on the effects of inflation on fiscal positions. Most macro-fiscal analyses since the Global Financial Crisis (GFC) have estimated fiscal reaction functions, originally developed to assess how expansionary fiscal measures affected economic activity and public debt sustainability in a deflationary environment when policy interest rates were at the zero lower bound and quantitative easing of monetary policy started having consequences for the sustainability of consolidated public finances.

In an early contribution, Bohn (1998) analysed how primary and cyclically adjusted primary balances in the United States reacted to increases in public debt. A positive sign of the public debt coefficient in his framework implied that fiscal policy was sustainable, as primary and cyclically adjusted primary balances improved for a given change in public debt. He found that the US public debt displayed mean reversion if one controlled for wartime spending and for cyclical fluctuations, and that the primary surplus increased with higher public debt. In another early contribution, Golinelli and Momigliano (2008) identified a positive reaction of the cyclically adjusted primary balance to accumulation of public debt, and the countercyclical character of fiscal policies in euro area countries.

More recently, Berti et al. (2016) found that primary balances in EU member states generally responded more strongly to public debt accumulation after the GFC, so that fiscal policies were mostly sustainable at the time. Using non-linear fiscal reaction functions, Medeiros (2012) established "fiscal fatigue" in cases where EU countries' public debt ratios ranged from 90% to 100% of GDP. In a similar exercise for euro area countries, Checherita-Westphal and Žďárek (2017) assessed fiscal

policies as mostly sustainable at the time, but found only weak evidence of fiscal fatigue. Separately, they established a negative and statistically significant effect on the primary balance of a dummy variable for the year when elections were held, which they interpreted as evidence of a fiscal electoral cycle. Similarly, Mačkić and Rusmir (2021) showed that policymakers in 11 new EU member states were undermining the stabilisation function of public finances in electoral periods by allowing the widening of budget deficits – however, only in periods when countries were not under the European Commission's excessive deficit procedure.

For the case of Croatia, Arčabić and Banić (2021) studied how cyclically adjusted primary balances reacted to changes in output gap. They found that in an expansionary regime fiscal policy was countercyclical, while in a recessionary regime the outcomes varied between procyclical and acyclical. Similar results were obtained by Deskar-Škrbić and Grdović Gnip (2020), who estimated both linear and nonlinear fiscal response functions.

The only recent study to our knowledge that directly assessed the impact of inflation shocks on fiscal balances is Staehr et al. (2023). For a panel of 12 euro area countries, they established a positive effect of inflation on both revenue and expenditure, but found no evidence of non-linearities in the impact of inflation on primary balances.

3 ANALYTICAL FRAMEWORK

To assess the effect of inflation on the primary balance, we use the fiscal reaction functions of Bohn (1998) and Arčabić and Banić (2021) and extend them for inflation:

$$pb_t = \alpha + \Omega_1 pb_{t-1} + \beta_1 d_{t-1} + \beta_2 \hat{y}_t + \beta_3 \pi_t + \varepsilon_t \quad (1)$$

where pb_t is the ratio of primary government balance to GDP, d_{t-1} is the ratio of general government debt to GDP, $\hat{y}_t$ is the output gap as a percent of potential GDP, (π_t) is the inflation rate measured by the harmonised consumer price index, and ε_t is the residual. We estimate equation (1) on seasonally-adjusted quarterly data using the OLS with and without breakpoints, testing for autocorrelation and heteroskedasticity.

In the baseline model, we estimate the potential output and output gap from the production function:

$$Y_t = TFP_t \times L_t^a \times K_t^{1-a} \quad (2)$$

where potential output Y_t is determined by labour (L) and capital (K) input and unobservable total factor productivity (TFP). The share of labour is set at 0.65 and of capital at 0.35 as in previous studies on Croatia (Grgurić, Nadoveza Jelić and Pavić, 2021; Jovičić, 2017). The output gap $\hat{y}_t$ is then calculated as a deviation of real from potential GDP in percentage of potential GDP. For robustness check, we

also estimate potential output and output gap with HP filter (see Arčabić and Banić, 2021; Rebić and Arčabić, 2023; Švaljek, Vizek and Mervar, 2009).

All model variables are depicted in appendix graphs A1-A5.

4 EMPIRICAL RESULTS

We first estimate the fiscal reaction function for the period Q2:2002 – Q4:2022. The results in table 2 suggest that in the long run inflation is not a statistically significant determinant of the primary balance. A key reason is probably that, in the long-term, tax revenues are driven more by real growth than by inflation, while public sector wages, pensions and other social transfers, which account for the bulk of government expenditure, are only partly indexed for inflation.

Fiscal policy on the whole appears sustainable in the long term: the fiscal stance has persistent effects as indicated by the positive sign of a lagged primary balance to GDP, which is in line with Arčabić (2018), and increases in public debt are associated with higher primary balances in a statistically significant way, a finding that is consistent with Arčabić and Banić (2021). The primary balance also seems to be statistically significantly sensitive to the business cycle, as indicated by the positive sign of the output gap coefficient. However, given that the dependent variable is the primary balance and not the cyclically adjusted primary balance, we cannot argue confidently that fiscal policy in Croatia had properties normally associated with automatic stabilisers over this period.

Table 2

Baseline and sub-period model results with breakpoints (BP)

	OLS	OLS – BP	OLS – BP	OLS – BP	OLS – BP
	Q3:2002 – Q4:2022	Q3:2002 – Q3:2018	Q4:2018 – Q2:2021	Q3:2021 – Q3:2023	Q4:2023 – Q4:2025
Constant	-3.843***	-2.148**	3.925	4.588	-92.864*
	(0.000)	(0.045)	(0.135)	(0.110)	(0.060)
Inflation rate	-0.901	-0.218*	-1.946***	0.241***	-1.562***
	(0.142)	(0.098)	(0.000)	(0.000)	(0.000)
Output gap (prod. fn.)	0.626***	0.524***	0.985***	1.699***	-2.686
	(0.000)	(0.001)	(0.000)	(0.000)	(0.426)
Lagged primary balance/GDP ratio	0.305**	0.516***	-0.189***	-0.650***	-0.279
	(0.020)	(0.000)	(0.001)	(0.001)	(0.573)
Lagged general gvt. debt/GDP ratio	0.050***	0.032**	-0.034	-0.122**	1.631**
	(0.000)	(0.023)	(0.337)	(0.012)	(0.046)
R^2	0.732	0.818	0.818	0.818	0.818

Note: The results of the Breusch-Godfrey test indicate that there is no autocorrelation in the models. The results of the Breusch-Pagan-Godfrey test indicate that there is no heteroskedasticity in the models with the usual level of significance.

, **, * indicates statistical significance at 10%, 5% and 1%, respectively.*

Source: Authors' calculations.

PUBLIC SECTOR ECONOMICS
47 (4) 461–475 (2023)

To differentiate the impact of inflation on the primary balance in the short- and medium-term, we extended the sample with official projections until 2025 and tested for structural breaks in inflation time series. For the projection horizon we used inflation, real GDP and output gap forecasts of the Croatian National Bank, and primary balance and government debt forecasts of the Ministry of Finance (with quadratic interpolation for quarterly data). The structural breaks tests identified four subperiods in the time series for inflation: Q3:2002 – Q3:2018; Q4:2018 – Q2:2021; Q3:2021 – Q3:2023; and Q4:2023 – Q4:2025. The estimates of equation (2) for these structural breaks are shown in the last four columns of table 2.

The first subperiod from Q3:2002 to Q3:2018 saw both high and low inflation as well as periods of fiscal instability (see e.g. Mihaljek, 2009) and consolidation. The overall results shown in the second column of table 2 are similar to baseline estimates. The negative coefficient for inflation becomes significant at the 10% level, suggesting that over the longer-term inflation tends to have a negative effect on the primary balance. The responsiveness of the primary balance to the output gap and lagged debt to GDP ratio is somewhat smaller than in the full sample; the responsiveness to the lagged primary balance is larger.

The second subperiod from Q4:2018 to Q2:2021 was characterised by low and stable inflation and the pandemic shock in 2020, which had huge macroeconomic and fiscal consequences. The government took large discretionary fiscal measures – tax write-offs, tax deferrals, transfers to compensate households and firms for income and revenue losses due to lockdowns – that led to sharp deterioration in public finances. The low and stable inflation in this period was thus inevitably associated with a large widening of the primary deficit. The primary deficit also increased, almost one-to-one, with the output gap. Fiscal policy was clearly not sustainable, as indicated by negative coefficients on lagged primary balance and debt to GDP ratios. Staehr, Tkacevs and Urke (2023) obtained similar results for 12 euro area countries covering this period.

Most interesting in this paper are estimates for the last two periods. Inflation began to pick up in Q3:2021 and remained elevated through Q3:2023. Our estimates confirm that it had a statistically highly significant positive effect on the primary balance (fourth column in table 2). The primary balance was also highly responsive to the output gap. These results suggest that inflation and strong growth in personal incomes and firms' operating surplus did indeed buoy revenues from direct and indirect taxes and social security contributions, as noted in table 1, while expenditure was slow to catch up with inflation. Regarding fiscal policy sustainability, the negative coefficient on lagged primary balance indicates that fiscal policy did not have persistent effects related to the negative pandemic shock on revenue, expenditure, and nominal GDP. Also, considering the idiosyncratic nature of the shock in 2020, the large financing needs to relieve it, and the sharp drop in nominal GDP, it is not surprising that public debt was not sustainable during that period.

PUBLIC SECTOR ECONOMICS
47 (4) 461-475 (2023)

However, as estimates for the projection period from Q4:2023 to Q4:2025 indicate, the positive effect of inflation on the primary balance can be expected to dissipate over the next two years. With inflation expected to converge slowly to target and growth weakening, expenditure growth is projected to pick up and tax revenue growth to slow. That shift is reflected in the negative and statistically highly significant response of the primary balance to inflation shown in the last column of table 2. Persistent inflation over time inevitably leads to adjustment of spending on public sector wages, pensions, transfers to households and all other current and capital spending categories, while tighter monetary policy takes a toll on economic activity and hence tax revenues. The coefficient of public debt is positive in this projection period, partly reflecting the still positive effect of inflation on nominal GDP, which helps reduce the debt to GDP ratio. In contrast to the preceding high inflation period, the coefficients of the output gap and lagged primary balance are no longer statistically significant.

In sum, the above results for Croatia are indicative of the typical response of fiscal outcomes to high inflation: a favourable impact on the primary balance in the short term, but a likely negative one in the medium term. This result is intriguing, taking into account that inflation did not have a statistically significant impact (although, the sign was negative) on primary balance in the baseline model (Q3:2002 – Q4:2022).

5 ROBUSTNESS CHECK

In order to test the robustness of the results in table 2, we re-estimated the output gap by using the HP filter. In the baseline model we obtained very similar estimates: the primary balance does not respond statistically significantly to inflation, but fiscal policy seems sustainable, as debt accumulation is associated with an improvement in the primary balance (table 3, first column). The primary balance also responds positively to an increase in the output gap measured by the HP filter. The size of the estimated coefficient is very similar to that in table 2, where the output gap was estimated using the production function.

The estimates for subperiods are also broadly similar to those with the output gap estimated from the production function. As in table 2, the estimated coefficients of inflation are negative, with the exception of the high inflation period Q3:2021 – Q3:2023. The main difference in this high inflation period is the coefficient on lagged debt to GDP ratio, which is estimated to be positive and statistically significant, suggesting fiscal policy sustainability, whereas in the model with the production function the output gap was negative and statistically significant. This difference most likely arises from substantial changes in macroeconomic and fiscal conditions as the economy recovered from the Covid pandemic and faced the energy crisis, but also a different output gap indicator. However, the public debt coefficient is positive in both models, suggesting fiscal sustainability.

Table 3

Robustness check: HP filter instead of production function estimate of output gap

	OLS	OLS – BP	OLS – BP	OLS – BP	OLS – BP
	Q3:2002 – Q4:2022	Q3:2002 – Q3:2018	Q4:2018 – Q2:2021	Q3:2021 – Q3:2023	Q4:2023 – Q4:2025
Constant	-4.071***	-1.926*	0.516	-4.493***	-69.026***
	(0.000)	(0.069)	(0.904)	(0.000)	(0.000)
Inflation rate	-0.049	-0.187	-2.062***	0.216***	-1.374***
	(0.384)	(0.172)	(0.000)	(0.000)	(0.000)
Output gap (HP filter)	0.569***	0.411**	0.981***	0.814***	-1.369***
	(0.000)	(0.012)	(0.000)	(0.000)	(0.006)
Lagged primary balance/GDP ratio	0.317*	0.575***	-0.227**	-0.219***	-0.004
	(0.054)	(0.000)	(0.031)	(0.005)	(0.979)
Lagged general gvt. debt/GDP ratio	0.053***	0.028**	0.014	0.031***	1.233**
	(0.000)	(0.046)	(0.822)	(0.001)	(0.000)
R^2		0.806	0.806	0.806	0.806

Note: The results of the Breusch-Godfrey test indicate that there is no autocorrelation in the models. The results of the Breusch-Pagan-Godfrey test indicate that there is no heteroskedasticity in the models with the usual level of significance.

, **, * indicates statistical significance at 10%, 5% and 1%, respectively.*

Source: Authors' calculations.

6 CONCLUSION

In this paper we estimated the effects of high inflation on the primary fiscal balance in Croatia in the short- and medium-term. We extended the standard fiscal reaction function framework with inflation and estimated a model with breakpoints for inflation to distinguish different inflation environments and study how the primary balance responded to inflation in different periods of low and high inflation.

Our main finding is that in the short term a high inflation surprise has a favourable effect on the primary balance. This can be explained by the high buoyancy of nominal tax bases with respect to inflation on the one hand, and the absence of formal indexation of public spending on the other. In particular, VAT and excises, which account for the bulk of tax revenues in Croatia, expand one for one with inflation, while direct tax revenues and social security contributions expand in line with the gross operating surplus of firms and wages, which are highly correlated with inflation. At the same time, in the absence of formal indexation, expenditure categories other than intermediate consumption and debt service costs adjust to inflation with a time lag, so the increase in public spending in the short term tends to be smaller than that in tax revenues – and smaller than the increase in spending in the medium term, when public sector wages, pensions, social transfers and other current and capital spending adjust more or less fully to inflation.

Another finding in the paper is that fiscal policy in Croatia was on the whole sustainable and sensitive to the business cycle between 2002 to 2022, as the primary balance tended to improve when government debt and the output gap increased.

When it comes to the research limitations, which can serve also as the motivation and roadmap for further analysis, it would be interesting to assess the impact of surprise inflation on the revenue and expenditure side with a disaggregated approach. In this way, fiscal policymakers could more efficiently address the budget redistribution in order to shield the living standard of citizens, as well as continuity of business operations. Further, an extension to this research could be directed towards discretionary fiscal policy reaction to sudden inflation, i.e. to analyse the reaction of the cyclically adjusted primary balance to an increase in inflation. Also, assessing the character of fiscal policy in a period of high inflation is important for Croatia in view of the interaction with ECB monetary policy, aiming for price stability. Thus, it would be possible to adequately assess the policy mix in Croatia and determine whether fiscal is working in tandem with monetary policy or not.

In sum, fiscal policymakers cannot take too much comfort from the current favourable state of public finances. With inflation and policy interest rates expected to stay relatively high for a while, fiscal positions are likely to deteriorate in the medium term.

Disclosure statement

The authors have no potential conflict of interest to report.

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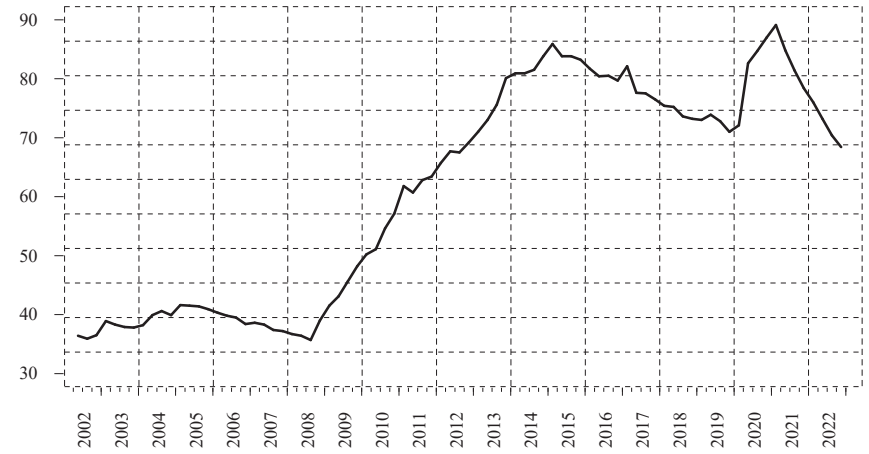
GRAPH A1

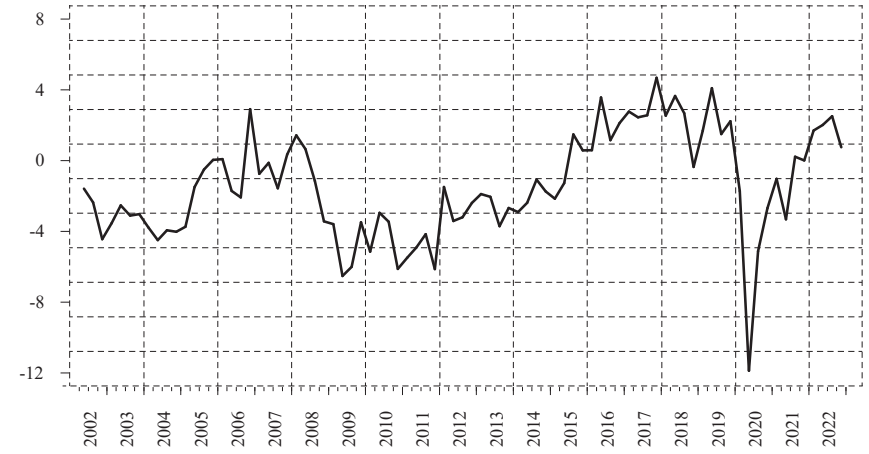
General government debt in Croatia (% of GDP)



Source: Eurostat (2023).

GRAPH A2

General government primary balance in Croatia (% of GDP)

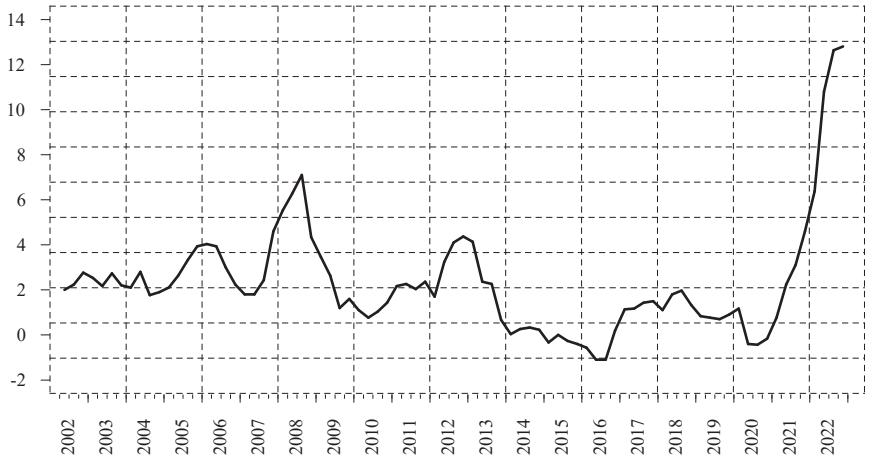


Source: Eurostat (2023).

PUBLIC SECTOR ECONOMICS
47 (4) 461-475 (2023)

Graph A3

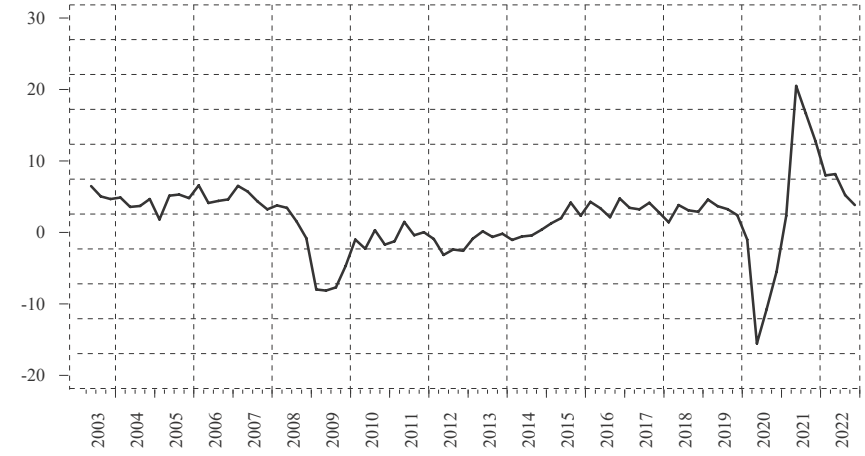
Harmonised index of consumer prices (HICP) in Croatia (YoY %)



Source: Eurostat (2023).

Graph A4

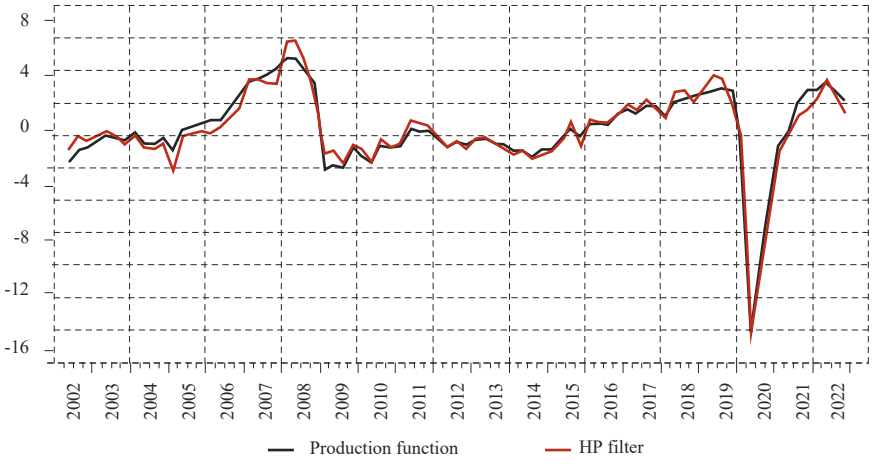
Real GDP in Croatia (YoY %)



Source: Eurostat (2023).

GRAPH A5

Output gap in Croatia: production function and HP filter methods (% of potential GDP)



Source: Eurostat (2023), authors' calculations.

A nexus between fiscal policy and inflation: a case study of Indonesia using SVAR model

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Article**
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PUBLIC SECTOR ECONOMICS
47 (4) 477–503 (2023)

Abstract

This paper investigates the dynamic effects of changes in three different government spending components – public sector wages and purchase of goods and services, energy and other subsidies, and transfers to households – on inflation and private consumption in Indonesia from 2001:Q1 to 2022:Q4, using a non-recursive structural VAR model. The model consists of eight endogenous variables: exchange rate, output gap, tax ratio, government spending, inflation, debt ratio, interest rate, and private consumption. Structural decompositions reveal that inflation responses differ across the three government spending components. Shocks to government subsidies are more likely to lead to higher inflation than shocks to other components. But even spending on subsidies does not always have a statistically significant effect on inflation. Surprisingly, government spending shocks – aggregate or by components – do not seem to have a statistically significant impact on private consumption. The main effect of fiscal expansions may thus be a deterioration in public finances.

Keywords: fiscal policy, government spending, structural VAR, inflation, Indonesia

1 INTRODUCTION

Monetary policy is widely believed to be the most effective tool of macroeconomic management, as it can help achieve both inflation and growth objectives efficiently (Campante, Sturzenegger and Velasco, 2021). For inflation targeting regimes in particular, there is a broad agreement about the effects of monetary policy on the economy through different transmission channels. Whenever monetary authorities perceive the inflation forecast as exceeding or falling below the target, monetary policy can be tightened or eased to steer inflation back towards the target relatively quickly and at relatively small cost in terms of potential output.

By comparison, fiscal policy is believed to be less effective in the fine tuning of "normal" cyclical developments. Arguments for its countercyclical use have been advanced, for instance, in the context of asymmetric shocks in a monetary union (Gootjes and de Haan, 2022; Kirsanova et al., 2007; Landmann, 2018) as individual countries cannot use monetary policy to respond to country-specific shocks. However, the Global Financial Crisis (GFC) in 2008-09 and, more recently, the Covid pandemic made macroeconomists and policymakers realise that monetary policy alone was not sufficient to stabilise the economy after very large shocks to the financial system or the supply side of the economy.

In Indonesia, for example, Bank Indonesia (BI) adopted inflation targeting in July 2005, with maintenance of rupiah stability as an overarching goal. As the GFC broke out in 2008, the rupiah depreciated sharply, the fall being exacerbated by a drastic decline of the Indonesia Stock Exchange index. BI initially responded to the crisis by increasing its policy rate to manage the volatility of the rupiah and defend it against depreciation pressure. However, the effectiveness of higher interest rates remained limited as the rupiah continued to weaken (Basri and Siregar,

PUBLIC SECTOR ECONOMICS
47 (4) 477-503 (2023)

2009). BI consequently cut the policy rate and together with the government took actions to ensure adequate liquidity in the financial system. But despite the measures, the interbank market remained largely frozen. This led to the widening of interest spreads between the policy rate and key market rates, weakening monetary policy transmission (Basri and Rahardja, 2010) and making it difficult for the central bank to calibrate its policy response to inflation, output gap and exchange rate volatility (Basri and Siregar, 2009).

Given these limitations, the government implemented a countercyclical fiscal policy through income tax cuts, tax and import duty waivers, subsidies, and other government expenditure. A large share of the fiscal stimulus was provided through income tax cuts in order to boost spending by the household and corporate sectors. While this approach helped revive growth, it created a challenge for monetary policy in that it had to contain rising inflationary pressures without undermining economic recovery.

The motivation for this paper is to try to shed more light on the effects of fiscal expansion on inflation and private consumption. Since the GFC, the effectiveness of fiscal policy has been assessed mainly in terms of the size of fiscal multipliers. Several studies distinguish between tax and spending multipliers (Campante, Sturzenegger and Velasco, 2021; Fontana, 2009). Among the latter, many compare public consumption and investment multipliers (Ducanes et al., 2006; Hur, Mallick and Park, 2014). However, only a few have analysed multipliers associated with different components of current spending. For example, Jordà et al. (2022) and Li and Lin (2016) found that spending on social benefits may have contributed to a rapid rise in inflation and may even be potentially associated with stagflation. Makin and Layton (2021) questioned whether fiscal responses during the Covid pandemic were too comprehensive, of the right form, and whether generous cash handouts to encourage private consumption were appropriate in the first place.

This paper contributes to the literature by analysing how three different components of current government spending – public sector wages and purchase of goods and services, transfers to households, and energy and other subsidies – affected inflation and private consumption in Indonesia over the past two decades. The rationale for this decomposition is that the Indonesian government reformed the budget in 2015, moving to direct and targeted household subsidies and, recently, introducing unemployment insurance. The Covid pandemic led to additional transfers to vulnerable households.

Simulations using a non-recursive structural VAR model with eight endogenous variables – exchange rate, output gap, tax ratio, government spending components, inflation, debt ratio, interest rate, and private consumption – suggest that shocks to different government spending components generate different inflation paths. In particular, shocks to government spending on subsidies are more likely to lead to higher inflation than shocks to spending on government's own

PUBLIC SECTOR ECONOMICS
47 (4) 477–503 (2023)

consumption (public sector wages and purchases of goods and services) or shocks to transfers to households. Interestingly, the estimated effects are not statistically significant in all periods. On the other hand, government spending shocks – aggregate or by components – do not seem to have any statistically significant impact on private consumption. These results suggest that fiscal and monetary authorities need to look carefully at the composition of changes in public expenditure when adjusting their countercyclical policy settings. While fiscal expansions in Indonesia may not affect inflation as much as often feared, they do not seem to affect private consumption either. The main effect of fiscal expansions may thus be a deterioration of public finances.

The remainder of the paper is structured as follows: Section 2 sets this paper within the broader context of the empirical literature on the effects of fiscal policy on inflation. Section 3 describes the empirical approach. Section 4 discusses the main findings of the analysis. Section 5 concludes.

2 LITERATURE REVIEW

To put the main findings of this paper into perspective, this section reviews some key results in the recent empirical literature on the effects of fiscal policy on growth and inflation in emerging market economies (EMEs) like Indonesia.

One general finding is that Asian EMEs tend to be fiscally conservative in normal times. Where this is not the case, e.g., the pro-cyclical fiscal expansion during the pre-GFC boom in Indonesia (Herrera, Kouame and Mandon, 2019), the outcome is usually lower economic growth, higher output volatility and higher inflation in the medium term (McManus and Ozkan, 2015). By contrast, counter-cyclical fiscal policy such as the boost in public spending and tax cuts to stimulate economic activity during the GFC are generally found to be effective (Abdurohman, 2013; Kraay and Serven, 2013). The relatively healthy fiscal positions of Asian EMEs contributed to the success of fiscal stimulus in boosting aggregate demand (Ducanes et al., 2006; Hur, Mallick and Park, 2014).

Another general finding is that fiscal expansions in EMEs tend to have significant effects on inflation depending on fiscal space and economic conditions (Cevik and Miryugin, 2023; IMF, 2023). For example, Asandului et al. (2021) and Ferrara et al. (2021) found that discretionary government spending could generate strong enough inflationary pressures to destabilise economic activity. Sriyana and Ge (2019) established an asymmetric effect of fiscal policy on inflation in both short and long run in Indonesia. For EMEs in Central and Eastern Europe, Asandului et al. (2021) found insignificant effects of fiscal policy on inflation and growth in the short run, and negative ones in the long run. Several studies highlighted the importance of supply-side effects of government spending: to the extent it boosts productivity growth, public expenditure may lower inflation in the long term (Di Giorgio, Nisticò and Traficante, 2018; Gabriel, Klein and Pessoa, 2023; Jørgensen and Ravn, 2022).

The inflationary effects of the different government spending components, which we focus on in this paper, have received less attention to date. Existing studies typically focus on the fiscal multiplier effects on output or consumption (Abdurohman, 2013; Perotti, 2004; Sahminan et al., 2017). Klein and Linnemann (2023) found that positive shocks to public investment and public consumption both lead to persistent increases in GDP and productivity, but, somewhat counterintuitively, shocks to public consumption are associated with lower and shocks to public investment with higher inflation. In contrast, Bhattarai and Trzeciakiewicz (2017) found that positive expenditure shocks to public consumption and transfers to households both result in persistently higher inflation, but the effect of public investment shocks on inflation was temporary, as they raise total factor productivity fairly quickly.

The recent Covid pandemic renewed the interest in studying the counter-cyclical role of social protection spending, including the disaggregated analysis of the effects of different types of social benefits such as cash transfers, unemployment insurance, and pensions (Faria-e-Castro, 2021; Sanches and Carvalho, 2022), and the distinction between conditional and unconditional transfers (Bayer et al., 2020). Most findings point to an asymmetric response of private consumption to transfers across households. For example, in Germany and the United Kingdom, public transfer shocks led to higher consumption of liquidity-constrained (i.e., non-Ricardian) households, but lower consumption of optimising (i.e., Ricardian) households (Bhattarai and Trzeciakiewicz, 2017; Hinterlang et al., 2023).

Exploring the role of monetary policy for the transmission of fiscal expansion, Bayer et al. (2020) found that the public transfers multiplier was higher when monetary policy was less responsive to inflation. Budiman et al. (2022) found that monetary and fiscal policy coordination facilitated the economic recovery in Indonesia, and that fiscal policy shocks generated less inflation in the long run than monetary policy shocks.

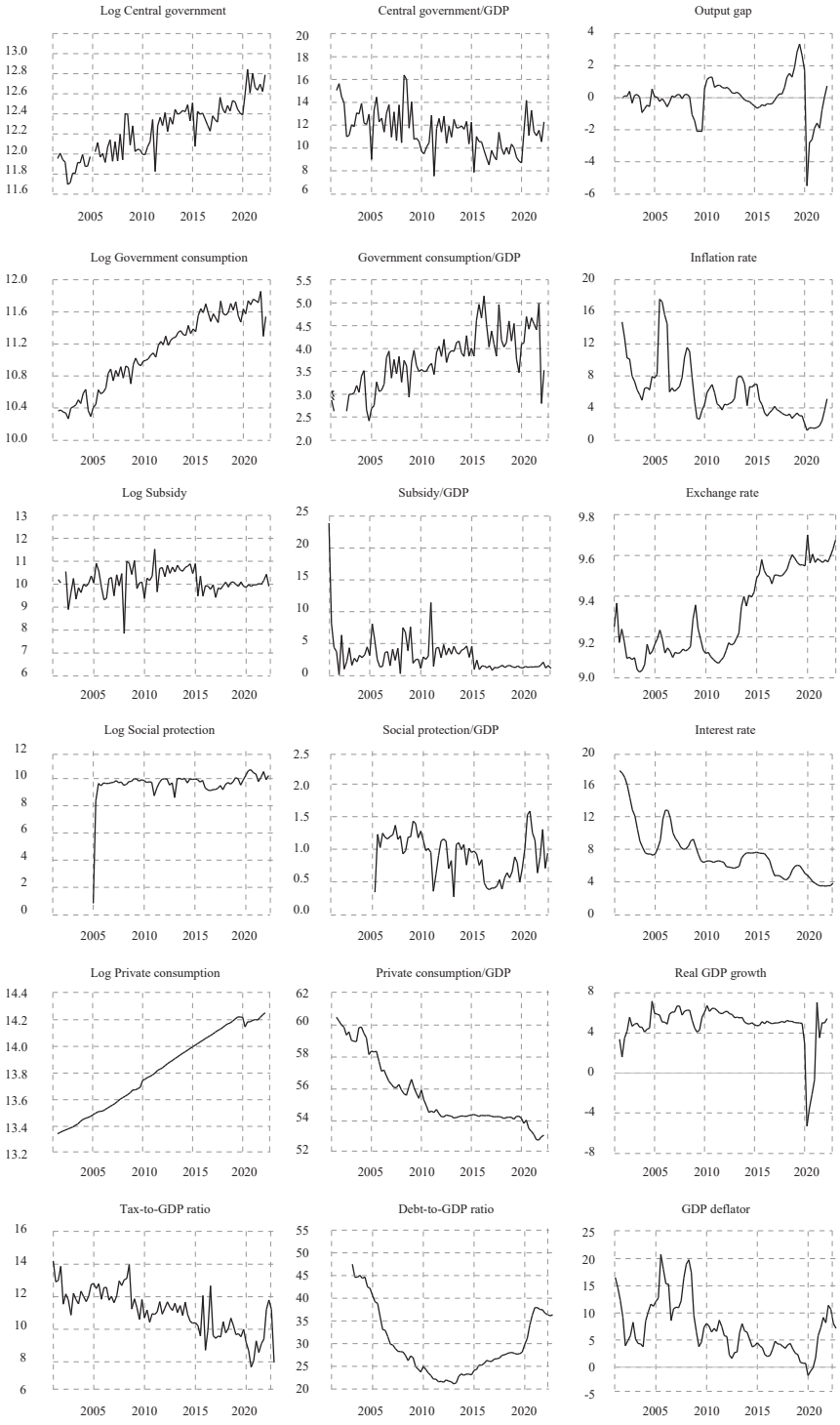
3 METHODOLOGY

3.1 DATA

To analyse the dynamic effects of central government spending on inflation and economic activity in Indonesia with an SVAR model, quarterly data from 2001:Q1 to 2022:Q4 are used. Earlier observations in this period are rebased to constant 2010 billion rupiahs to get a longer time series for national accounts. The variable output gap is derived by extracting the trend component of GDP using the Hodrick-Prescott filter. All series with the exception of output gap, inflation rate, interest rate, debt ratio and tax ratio are expressed in logarithms; nominal values are deflated with the GDP deflator, obtained from the ratio of nominal to real GDP at 2010 prices. Data definitions, sources, and summary statistics are shown in appendix tables A1 and A2. Graph 1 shows the main data series adjusted for seasonality using the US Census X-13 method.

GRAPH 1

Plot of variables



Source: Author's calculation based on data from sources indicated in appendix table A1.

Total central government expenditure in Indonesia amounts on average to 11.6% of GDP over the sample period. Of this, government´s own consumption (public sector wages and purchases of goods and services) accounts for 34% on average, but surges to more than 50% during the Covid pandemic. Transfers to households account for 9%, subsidies for 22% of total expenditure. The government spending reforms of 2014-15 saw the share of subsidies shrinking to 13%, and transfers to households growing. Indonesia has a low revenue base, with total tax revenue accounting for only around 11% of GDP over the sample period. The tax ratio fell sharply after the GFC in 2008 and again in 2016 following the spending reforms. The ratio of public debt-to-GDP was declining through 2012 as the government continued to dispose of assets taken over during the Asian Financial Crisis. The ratio has since steadily risen, although it remains relatively low compared with other EMEs, partly because of the debt limit rule adopted by the government.

Following the GFC, Indonesia experienced a negative output gap for about two years. The quantitative easing program in the United States contributed to a commodity boom, which boosted output growth in Indonesia. Financial sector activity expanded as well, leading to exchange rate appreciation. The recovery stalled after Indonesia and other EMEs were hit by the so-called “taper tantrum” about Fed policies in mid-2013. Private consumption amounted on average to 55.7% of GDP over the past two decades.

The annual inflation rate averaged 6.2% over the entire sample period. It declined from the high of 17.8% in 2005 to 1.2% during the Covid pandemic. The policy interest rate also declined, reflecting the central bank's efforts to keep inflation within the target range of 3-5%. The nominal rupiah/US dollar exchange rate has depreciated since 2011.

3.2 ECONOMETRIC ESTIMATION

The VAR (p) model used for estimation can be written in reduced form as:

$$y_t = \upsilon + A_1 y_{t-1} + \cdots + A_p y_{t-p} + u_t = A Y_{t-1} + u_t \quad (1)$$

where $Y_{t-1}^{'} \equiv \left(1, y_{t-1}^{'}, \cdots, y_{t-p}^{'}\right)$ is (Kp + 1)-dimensional, $A \equiv \left[\upsilon, A_1, \cdots, A_p\right]$ is K × (Kp + 1)-dimensional, and $u_t \sim \left(0, \Sigma_u\right)$ is a K-dimensional white noise residual process. The y_t is a (Kp + 1)-dimensional vector of variables that may be integrated of order 1 and possibly cointegrated, p is the prespecified maximum autoregressive lag order, and the K × 1 vector υ is a fixed, non-stochastic intercept term.

The VAR (p) model in structural form can be generally formulated as:

$$\mathrm{A} y_t = \mathrm{A}\upsilon + A_1^* y_{t-1} + \cdots + A_p^* y_{t-p} + \varepsilon_t = A^* Y_{t-1} + \varepsilon_t \quad (2)$$

where $A_i^* \equiv \mathrm{A} A_i (i = 1, \ldots, p)$, A is an invertible K × K matrix, and $\varepsilon_t \sim (0, \Sigma_\varepsilon)$. Structural shocks or innovations ε_t are assumed to be serially uncorrelated

PUBLIC SECTOR ECONOMICS
47 (4) 477–503 (2023)

("orthogonal") and have a diagonal covariance matrix Σ_ε of full rank, such that the number of shocks coincides with the number of variables (see Kilian and Lütkepohl, 2017). This assumption is required to consider the dynamic impact of an isolated shock (Breitung, Brüggemann and Lütkepohl, 2004). A and A^* represent the matrix of contemporaneous and lagged coefficients, respectively.

This specification implies that each variable can be affected by current and past realisations of the other variables. The identifying restrictions in this model are imposed on both matrix A and matrix B, which represent the instantaneous relations between the variables and the impact or short-run effects of the structural shocks, respectively. The reduced-form disturbances u_t are linked to the underlying structural shocks ε_t expressed in the relationship $u_t = A^{-1}B\varepsilon_t$ where $u_t = \mathrm{A}^{-1}\varepsilon_t \sim (0, \Sigma_\varepsilon)$ is a white noise error term with positive definite covariance matrix $\Sigma_u = \mathrm{A}^{-1}\Sigma_\varepsilon \mathrm{A}^{-1\prime}$. This identification strategy is known as the "AB" model (following Amisano and Giannini, 1997):

$$Au_t = B\varepsilon_t \qquad \varepsilon_t \sim (0, I_K) \tag{3}$$

The structural VAR model used in this paper consists of eight endogenous variables: exchange rate (ER), output gap (GAP), tax revenue to GDP ratio (TAX), government spending components (GOV), inflation rate (INF), debt-to-GDP ratio (DEBT), interest rate (INT), and private consumption (PC). Four models of government spending shocks are estimated: a baseline model of total central government expenditure (CG); government's own consumption (GC), i.e., spending on public sector wages and government purchases of goods and services; social protection spending, i.e., transfers to households for social protection (SP); and spending on energy and other subsidies (SUB). The model for policy shocks is specified as:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & a_{23} & a_{24} & 0 & 0 & 0 & 0 \\ 0 & a_{32} & 1 & a_{34} & 0 & a_{36} & a_{37} & 0 \\ 0 & 0 & 0 & 1 & 0 & a_{46} & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 & 0 & 0 \\ a_{61} & 0 & 0 & a_{64} & a_{65} & 1 & a_{67} & 0 \\ a_{71} & a_{72} & a_{73} & a_{74} & a_{75} & 0 & 1 & 0 \\ a_{81} & a_{82} & a_{83} & a_{84} & a_{85} & a_{86} & a_{87} & 1 \end{bmatrix} \begin{pmatrix} u_t^{ER} \\ u_t^{GAP} \\ u_t^{TAX} \\ u_t^{GOV} \\ u_t^{INF} \\ u_t^{DEBT} \\ u_t^{INT} \\ u_t^{PC} \end{pmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{55} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{66} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & b_{77} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & b_{88} \end{bmatrix} \begin{pmatrix} \varepsilon_t^{ER} \\ \varepsilon_t^{GAP} \\ \varepsilon_t^{TAX} \\ \varepsilon_t^{GOV} \\ \varepsilon_t^{INF} \\ \varepsilon_t^{DEBT} \\ \varepsilon_t^{INT} \\ \varepsilon_t^{PC} \end{pmatrix} \tag{4}$$

The matrix of contemporaneous variables (i.e., matrix A) in equation (4) is identified by non-recursive short-run restrictions. The SVAR model is "just-identified", with 92 restrictions imposed, that is $2K^2 - K(K+1)/2$ restrictions. Restrictions on A and B take the form of assumptions about the structure of contemporaneous feedback of variables in the SVAR and assumptions about the correlation structure of the errors, respectively. These assumptions are drawn from economic theories and institutional knowledge. Both VAR Granger causality / block exogeneity Wald tests, and pairwise Granger causality tests are used to guide the ordering of variables and the

setting of restrictions. For example, a variable that Granger-causes another variable (when the null hypothesis of no Granger-causality is rejected at the 5% level of significance) is considered more exogenous with respect to the latter.

Exchange rate is considered the most exogenous of all variables, driven mainly by external factors such as global shocks, terms of trade changes, and capital flows. It is ordered first in the model because it influences in turn other macroeconomic variables such as output, inflation, and interest rates.

Fiscal shocks are ordered before the other variables given that the paper focuses on their effects. Tax to GDP ratio is ordered in the upper row because it does Granger-cause the succeeding variables across several lag periods, based on pairwise Granger causality tests. Note, however, the $a_{43} = 0$ restriction, as we assume that policymakers set public expenditure before taxes. This assumption reflects decision and implementation lags in fiscal policy, which suggest non-instantaneous or even no discretionary response of fiscal policy to unexpected contemporaneous movements in activity (Blanchard and Perotti, 2002; Kilian and Lutkepohl, 2017). Conversely, tax revenue responds to exogenous government spending shocks, i.e., $a_{34} \neq 0$ whenever such shocks lead to an increase in interest rate, subsequently raising the level of public debt (Juhro, Narayan and Njindan Iyke, 2022).

To contain political pressure to overspend and thereby ensure fiscal responsibility and debt sustainability, the Indonesian government adopted in 2004 budget deficit and debt rules, which cap annual deficits at 3 percent of GDP and gross outstanding public debt at 60 percent of GDP.[1] As debt levels are also affected by factors over which the government has less control, such as the exchange rate and interest rates, this study follows the composite fiscal rule given by equation (5):

$$\tau_t = \tau_{t-1} + \left\{ \Omega \left[\left(g_t - \tau_t y_t + R_t B_{t-1} \right) - \Psi_1 y_t \right] + \phi \left[B_{t-1} - \Psi_2 y_t \right] \right\} \Big/ y_t \qquad (5)$$

where $\tau_t y_t$ is tax revenue; g_t is government spending; R_t is the nominal interest rate; B_{t-1} is the nominal value of outstanding government debt; and $\Psi_1 \geq 0$ and $\Psi_2 > 0$ are the deficit- and debt-to-GDP ratio targets.[2] The first term in brackets refers to the budget balance rule and the second to the debt rule: the fiscal authority is assumed to respond to deviations of the budget deficit and public debt from their target values by adjusting taxes by fractions Ω and ϕ. Before the Covid pandemic, Indonesia's fiscal performance was not constrained by fiscal rules, but after exceeding the budget deficit ceiling of 3% of GDP in 2020 and 2021, the government had to suspend the rules temporarily. Stronger than expected growth in tax revenue has since helped the government consolidate its finances.

[1] These rules draw on the European Union's Stability and Growth Pact.

[2] Nominal values are used for both budget deficit rule and public debt rule. Railavo (2004), from whom this rule is adopted, used real values to assess the effects of monetary policy on fiscal variables through the price level.

PUBLIC SECTOR ECONOMICS
47 (4) 477–503 (2023)

The use of fiscal rules is modelled in the third row of matrix A: some shocks, such as output, government spending, debt ratio, and interest rates, are assumed to have contemporaneous effects on the tax to GDP ratio. By construction, changes in the debt ratio can influence government's fiscal choices, including changes in spending.

Output gap and inflation are ordered prior to the interest rate, as the central bank is assumed to follow the Taylor rule (6):

$$i_t^T = \overline{r} + \pi^* + \alpha_1 \left(\pi_t - \pi^* \right) + \alpha_2 \left(y_t - y_t^* \right) \tag{6}$$

where i_t^T, $\overline{r}$, π_t, π^*, and $y_t - y_t^*$ denote, respectively, the policy interest rate, the equilibrium interest rate, the inflation rate, the inflation target, and output gap. In Indonesia, the central bank adjusts its policy interest rate (a_{71}) whenever there are sharp movements in the rupiah exchange rate, as exchange rate stability is an integral part of its efforts to support low and stable inflation.

Private consumption is modelled so as to capture aggregate demand shocks. Neoclassical models predict a negative effect of government spending on private consumption as they assume Ricardian behaviour of consumers, while Keynesian models predict a positive effect.

4 RESULTS AND DISCUSSION

Appendix table A3 shows the results of the Augmented Dickey-Fuller (ADF) test for the presence of unit roots, and the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) test for trend-stationarity. Government's own consumption, debt-to-GDP ratio, exchange rate and private consumption are found to be I(1) or difference-stationary. The total central government expenditure, tax-to-GDP ratio and interest rate are found to be I(0) but trend-stationary. The public debt ratio remains non-stationary under the KPSS test after first differencing. A structural break was found after performing the breakpoint unit root test (appendix table A4). Where the deterministic trend and the dummy breaks are found to be statistically significant, they were included in the regression equation to generate the fitted line and residual series. The residual series was also checked for stationarity and was then included as an adjusted variable in the SVAR model.[3]

The SVAR model can accommodate both I(0) and I(1) variables. As some variables are I(1), they were tested for cointegration. Neither the Engle-Granger nor the Phillips-Ouliaris tau statistics indicated any cointegration between the I(1) variables (appendix table A5).

In the SVAR estimation different lag lengths were used in sub-models based on the Hannan and Quin (1979) recommended lag order. For stationary variables, the presence of autocorrelation for different lag orders was checked for each model

[3] Another option to adjust for trend-stationarity and structural breaks – include deterministic trend and/or dummy directly in the VAR as an exogenous variable – was not used because of the limited sample size.

PUBLIC SECTOR ECONOMICS 47 (4) 477-503 (2023)

with the Lagrange multiplier statistic in VAR residual serial correlation LM tests (so-called bottom-up sequential testing). The null hypothesis was no correlation in lag order. Normality test of the innovations of VAR sub-models, i.e., normality of the observed variables, is not required for the validity of most of the asymptotic procedures related to VAR modelling (Kilian and Lutkepohl, 2017). The VAR systems of all sub-models are stable, with modulus smaller than 1.

4.1 IMPULSE RESPONSE FUNCTIONS

Graph 2 shows the impulse responses of endogenous variables to shocks ("innovations") to the individual components of government spending.

Panel A shows impulse responses to an increase in total central government spending. The output gap and the tax-to-GDP ratio rise on impact. The inflation rate jumps initially but falls back quickly although the impact is not statistically significant. This result is surprising but is in line with Surjaningsih, Diah Utari and Trisnanto (2012), who found that government spending shocks in Indonesia had a persistent negative effect on inflation beginning with the fourth quarter. A few other studies also found flat or even negative effects of government spending shocks on inflation (Jørgensen and Ravn, 2022; Mountford and Uhlig, 2009; Perotti, 2004). Kühn, Muysken and van Veen (2010) argued that direct and indirect productivity effects of government spending could boost aggregate demand without a major impact on inflation. Relatedly, a recent study of Gabriel, Klein and Pessoa (2023) found that an increase in regional government spending led to a significant fall in inflation in the impact period and one year after the fiscal intervention.

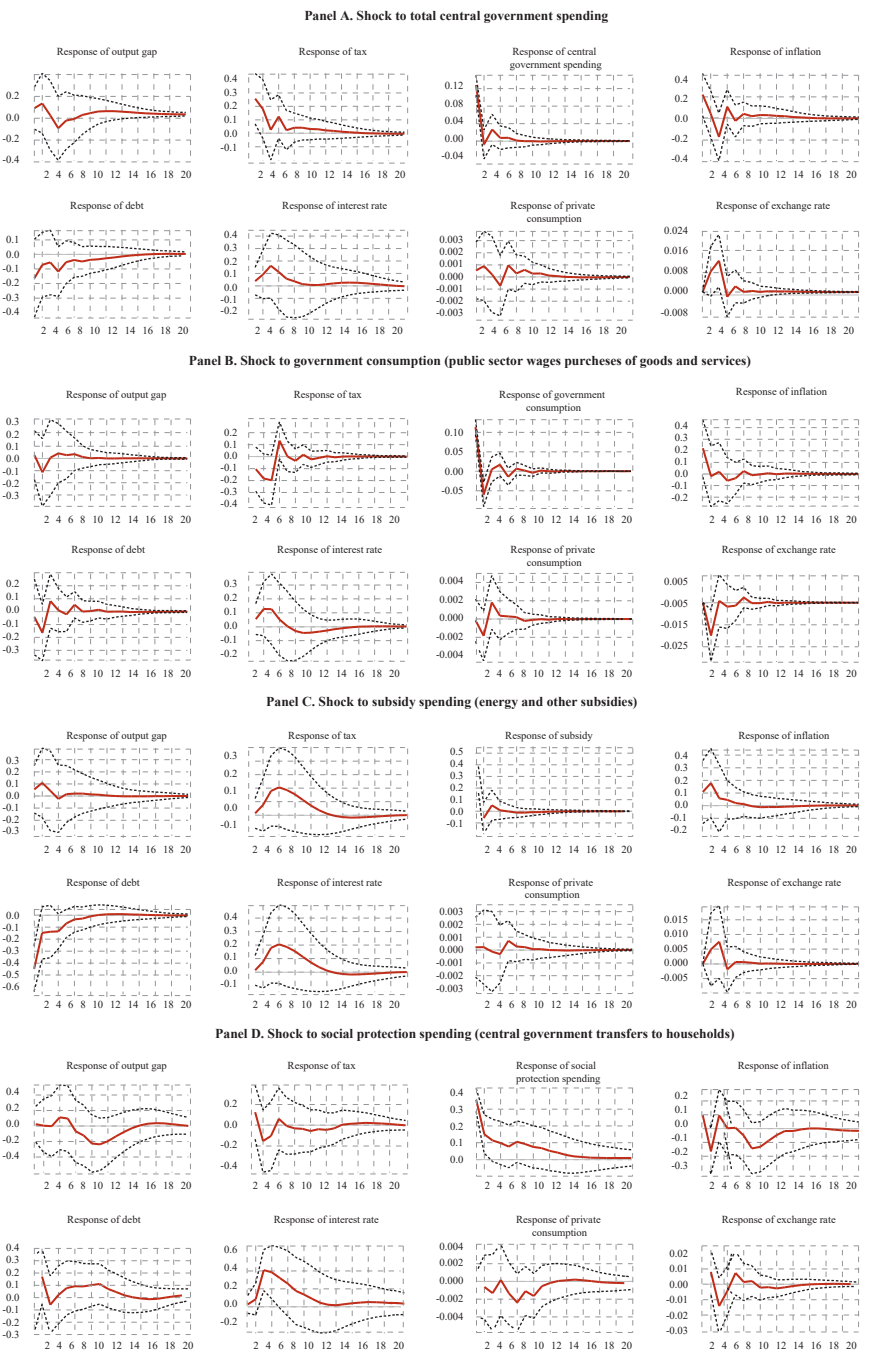
Another surprising result is the initial fall in debt-to-GDP ratio. This could partly reflect the longer-term trend of declining debt-to-GDP ratio through 2012, and partly the subsequent use of fiscal rules, which limited the increases in central government spending to tax revenue growth over the medium term. Auerbach and Gorodnichenko (2017) also found cases of expansionary fiscal policy in downturns that reduced the debt-to-GDP ratio.

Importantly, policy interest rates increase in response to higher government spending, which is consistent with the predictions of most macroeconomic models. Private consumption increases slightly, but is not statistically significant. The nominal exchange rate depreciates, contrary to the standard view that higher interest rates strengthened the exchange rate.[4] Ravn, Schmitt-Grohe and Uribe (2012) suggested that higher domestic demand provided an incentive for firms to lower markups, making the domestic economy more competitive relative to the rest of the world. Di Giorgio, Nisticò and Traficante (2018) argued that productive government spending made the private sector more competitive, lowering marginal costs and inflation, and ultimately improving competitiveness.

[4] Unlike most literature, which uses real exchange rates, this study follows Juhro, Narayan and Njindan (2022) in using nominal exchange rates. In the case of Indonesia, the real and nominal effective exchange rates of the rupiah follow practically the same trend. Higher government spending increases aggregate demand, which leads the central bank to raise interest rates and thereby strengthens the domestic currency.

GRAPH 2

Impulse responses to structural VAR innovations in government spending



Note: The size of the shock is one unit or one percentage point. The solid line refers to the impulse response of the structural decomposition; dashed lines refer to the ± 2 standard error bands. Lag length is 2 across government spending components, except for social protection, where lag length is 3.

Panel B shows impulse responses to an increase in the first subcomponent of government spending studied here, i.e., public sector wages and purchases of goods and services. Output gap is practically negative over the first three quarters, indicating a lagged response to fiscal expansion. Similarly, the tax-to-GDP ratio increases only after three quarters. Inflation rises on impact with the spending shock, but falls after three quarters. Debt-to-GDP ratio initially falls but starts rising from the third quarter. Higher public sector consumption triggers a tightening of the monetary policy rate. The impact on private consumption is positive but negligible. In contrast to the response to an increase in *total* central government spending, nominal exchange rate appreciates for this sub-component.

Panel C shows impulse responses to an increase in the sub-component energy and other subsidies. The effect on output gap is generally positive, suggesting that higher subsidies boost aggregate demand. This is not surprising given that subsidies accounted for about 25% of total central government spending before the 2014-15 energy subsidy reform. The tax-to-GDP ratio rises on impact and tapers off through the eighth quarter. While this suggests that subsidies might be partly self-financed, macroeconomic evidence suggests that in the medium term higher subsidies weaken the fiscal balances (Jazuli, Steenmans and Mulugetta, 2021). As expected, subsidies increase inflation: the effect is quite persistent, lasting six quarters. This finding has not been documented in the literature so far. De Castro and Hernández (2006), for instance, found large positive effects on inflation only for *total* government spending. Monetary policy tightens in response to higher subsidy spending. But the debt-to-GDP ratio falls initially and rises gradually to reach the pre-shock level only after eight quarters. Private consumption increases modestly as a result of higher subsidies. The nominal exchange rate depreciates.

Panel D shows impulse responses to an increase in social protection spending, i.e., transfers to households. The output gap does not respond to an increase in transfers to households until the third quarter, and even then the rise is temporary. The tax-to-GDP ratio increases on impact but subsequently falls below the pre-shock level. The response of inflation is volatile but largely positive over the first six quarters; thereafter inflation turns negative for six quarters. Debt-to-GDP ratio grows over the years. The monetary authorities tighten policy rates in response to higher spending on social protection, as expected. Surprisingly, the impact on private consumption is negative, albeit not statistically significant. Although social protection expenditure in Indonesia accounts for only 1.7 percent of private consumption over the sample period, this counterintuitive result might reflect Ricardian behaviour of consumers. Expectations about duration of social protection schemes and possible future tax increases to finance higher social protection spending might deter households from spending the transfers they receive. This behaviour has also been observed in Germany and United Kingdom (Bhattarai and Trzeciakiewicz, 2017; Hinterlang et al., 2023). The nominal exchange rate is quite volatile in response to higher household transfers over the first six quarters.

PUBLIC SECTOR ECONOMICS
47 (4) 477–503 (2023)

4.2 ROBUSTNESS CHECKS

Three sets of robustness checks against benchmark results for each government spending component were performed. First, government spending and private consumption were redefined in terms of percentages of real GDP. Second, real private consumption was redefined in terms of real per capita consumption. Third, output gap was replaced with industrial production gap, CPI inflation with GDP deflator inflation, and the central bank's seven-day policy rate with Bank Indonesia lending rate.[5]

When government spending and private consumption are expressed in percentages of GDP, the results do not deviate from the benchmark model, with the exception of shocks to social protection and subsidies (appendix graph A1). The negative impact of higher transfers to households on inflation is more pronounced, i.e., more persistent relative to the benchmark model. In response to a positive subsidy shock, inflation still rises, but falls by the third quarter compared with sixth quarter in the benchmark model. The response of debt-to-GDP ratio to shocks across all government spending components remains virtually the same relative to the benchmark model. The response of private consumption as a percentage of GDP to the shocks in individual component shocks is amplified (i.e., higher multiplier). Still, there is no evidence of higher household consumption in response to an increase in social protection spending. Surprisingly, shocks to government spending components lead in some cases to lower policy rates, at the earliest by the fifth quarter in response to higher social protection spending. In the baseline model, policy rates normally increase in response to higher spending.

When private consumption is redefined in per capita terms, the results remain robust; the main difference is that the impact of shocks on private consumption is smaller.

In the third set of robustness checks, the model was estimated using alternative indicators for output gap, interest rate and inflation (appendix graph A2). The benchmark results shown in appendix graph A3 remain robust to replacement of output gap with industrial production gap and CPI inflation with GDP deflator across all sub-models. The main difference is that inflation measured by GDP deflator responds less to government spending shocks than CPI inflation. Full robustness checks could not be performed for model specifications using the central bank lending rate instead of the seven-day policy rate due to the presence of serial correlation in some sub-models. Where serial correlation was not an issue, the results were robust to the change in definition of interest rate.

[5] The alternative variables have also been tested for unit roots, structural breaks, etc.

5 CONCLUSION

This paper attempted to fill the gap in the empirical literature on the effects of government spending on inflation and other macroeconomic variables by estimating a structural VAR model that disaggregated central government expenditure in Indonesia to three components: government consumption (public sector wages and purchases of goods and services), energy and other subsidies, and transfers to households. Overall, the impulse responses show that transfers to household have the most persistent effects.

For total central government spending, the inflation rate jumps initially but falls back quickly. The impact is not statistically significant, however. A few other studies also found flat or even negative effects of a government spending shock on inflation. Shock to public sector wages and purchases of goods and services has in general a small effect on inflation. In contrast, there seems to be evidence of persistent effects of higher energy and other subsidies on inflation. The response of inflation to increases in social protection transfers to households is largely positive over the first six quarters, but weakens thereafter.

Surprisingly, government spending shocks do not seem to have a statistically significant impact on private consumption. What impact can be detected seems to be transitory, with only government subsidies leading to somewhat more persistent increases in consumption. In particular, transfers to households do not seem to stimulate private consumption at all. Perotti (2004) reported similar findings for a sample of five OECD countries: he found no evidence that transfers to households, even if disbursed quickly, were superior in boosting consumption to increases in other government spending components. For Indonesia, Saraswati and Wahyudi (2018) argued that transfers to households failed to stimulate household consumption in both short- and long-run because, in contrast to regular wage increases, they failed to raise labour productivity. Other possible effects of transfers reported in the literature – e.g., an easing of credit constraints allowing households to invest in human capital accumulation (Bayer et al., 2020; Hannan, Honjo and Raissi, 2022; Perotti, 2004) – could not be verified within our empirical framework.

In terms of shocks to total central government spending, a surprising result is the persistent fall in debt-to-GDP ratio. This could partly reflect the declining debt-to-GDP ratio through 2012, and partly the subsequent use of fiscal rules, which limited increases in central government spending to tax revenue growth over the medium term. By components, debt-to-GDP ratio falls initially after a shock to public sector wages and purchases of goods and services, but rises after the third quarter. Central government transfers to households feed a persistent rise in debt-to-GDP ratio until the twelfth quarter. More surprisingly, following a spending shock in terms of energy and other subsidies, debt-to-GDP ratio declines persistently.

These findings suggest that, in adjusting their countercyclical policy settings, fiscal and monetary authorities need to consider carefully the composition of changes

in public spending. While fiscal expansions in Indonesia may not affect inflation as much as often feared, they do not affect private consumption either. The main effect of fiscal expansions since the mid-2010s may thus have been a deterioration in public finances, as indicated by rising central government expenditure and debt-to-GDP ratios on the one hand, and falling tax revenue to GDP ratio on the other, despite the use of fiscal rules.

Separately, Demid (2018) and Juhro, Narayan and Njindan Iyke (2022) argued that monetary and fiscal policies in Indonesia often had not been well coordinated, with monetary authorities occasionally tightening in order to offset the inflationary effect of increases in government spending.[6] Petrevski, Bogoev and Tevdovski (2016) and Haug and Power (2022) identified similar episodes in Bulgaria and New Zealand, respectively. The need for policy coordination increases in periods of high uncertainty such as the current global inflation episode with spillovers from the war in Ukraine. Divergent policy goals and lack of policy coordination could hinder the achievement of macroeconomic policy objectives (Demid, 2018; Juhro and Rummel, 2022), and lead to higher inflation and faster growth of public debt (Leeper and Leith, 2016).

Future research could further analyse the impact of public spending on private consumption by using more sophisticated models allowing for household heterogeneity, e.g., between Ricardian and non-Ricardian households. Public investment could also be added as a component of government spending to examine its impact on inflation via its indirect effect on productivity.

Disclosure statement

There is no conflict of interest.

[6] After the GFC, policy coordination initiatives contributed to a better alignment of policies in Indonesia (Juhro, Narayan and Njindan Iyke, 2022).

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APPENDIX

TABLE A1

Data definitions and sources [a]

Variable	Definition	Source
Central government expenditures (CG)	Central government expenditures	Ministry of Finance's State Revenue and Expenditure Budget (Anggaran Pendapatan dan Belanja Negara or APBN)
Government consumption (GC)	Central government expenditures on employee compensation and use of goods and services	
Social protection (SP)	Central government spending on social benefits in the form of transfers of money, goods or services	
Subsidy (SUB)	Central government spending on energy and non-energy items	
Exchange rate (ER)	Bilateral nominal rupiah per US$ exchange rate	Bank Indonesia's Indonesian Economic Financial Statistics (Statistik Ekonomi dan Keuangan Indonesia or SEKI)
Debt-to-GDP ratio (DEBT)	Ratio of central government debt to nominal GDP	Indonesian Public Sector Debt Statistics (Statistik Utang Sektor Publik Indonesia)
Output gap (GAP)	Difference between log of real GDP and log of potential GDP	Indonesian Bureau of Statistics (Badan Pusat Statistik or BPS)
IPI gap	Difference between log of the real and log of potential total production of large and medium non-oil manufacturing establishments	
Tax (TAX)	Ratio of tax revenue to nominal GDP	Government Finance Statistics
Inflation rate (INF)	First difference of logarithm of the consumer price index: all items[b]	Federal Reserve Bank of St. Louis
GDP deflator	First difference of logarithm of the GDP deflator index: all items[b]	
Interest rate (INT)	Short-term interest rate based on the BI 7-Day Reverse Repo Rate	Bank Indonesia's Indonesian Economic Financial Statistics (SEKI)
Investment lending rate	Investment lending rates of the reporting banks' branches located in Indonesia	
Private consumption (PC)	Household consumption expenditures	Indonesian Bureau of Statistics (BPS)

[a] *All data series cover the period from 2001:Q1 – 2022:Q4 except for debt ratio and social protection which only started in 2003:Q1 and 2005:Q1, respectively. Some fiscal data covering the period 2017:Q1 – 2022:Q4 are collected from the APBN Kita monthly reports of the Ministry of Finance.*

[b] *This definition of inflation rate is the one used for SVAR modeling. The ones shown in the descriptive statistics and graph refer to the published inflation rates.*

Table A2

Descriptive statistics

Statistic	CG[a]	GC[a]	SUB[a]	SP[a]	TAX[a]	DEBT[a]	GAP	INF	INT	ER	PC[a]
Mean	11.6	3.7	3.1	0.9	11.1	32.1	0.0	6.2	7.6	11,307	55.7
Median	11.4	3.8	2.4	1.0	11.2	29.8	0.1	5.4	7.0	10,250	54.4
Max.	18.0	5.2	23.9	2.0	14.2	52.0	3.4	17.8	17.7	16,359	60.5
Min.	7.5	2.4	0.0	0.0	7.7	22.6	-5.5	1.2	3.5	8,310	52.6
Std. dev.	1.97	0.62	3.02	0.36	1.39	7.93	1.22	3.63	3.36	2,367	2.20
Skewness	0.56	0.08	4.19	0.01	-0.25	0.87	-0.93	1.24	1.34	0.40	0.82
Kurtosis	3.42	2.49	27.62	3.32	2.71	2.65	z.41	4.26	4.40	1.59	2.38
Jarque-Bera	5.18	1.04	2,478	0.31	1.25	10.50	83.81	28.26	33.3	9.69	11.35
P-value	0.07	0.59	0.00	0.86	0.54	0.01	0.00	0.00	0.00	0.01	0.00
Obs.	88	88	88	72	88	80	88	88	88	88	88

[a] *Figures are in percent of GDP.*

Table A3

Unit root tests

Variable	ADF t-statistic				KPSS (LM-Stat)				Status
	Ho: series has unit root				Ho: series is stationary				
	Intercept only		Intercept with Trend		Intercept only		Intercept with Trend		
Log Central government	-0.732 (2)		-4.878 (1)	***	1.112	***	0.058		TS
Log Government consumption	-1.551 (1)		-2.725 (1)		1.162	***	0.249	***	
D(Log Government consumption)	-9.709 (1)	***	-9.767 (1)	***	0.185		0.113		I(1)
Log Subsidy	-5.169 (1)	***	-5.270(1)	***	0.186		0.167	**	I(0)
Log Social protection	-20.745 (0)	***	-20.931 (0)	***	0.512	**	0.119		I(0)
As Percent of GDP									
Central government/GDP	-3.850 (1)	***	-4.315 (1)	***	0.830	***	0.117		I(0)
Government consumption/GDP	-2.760 (1)	*	-5.712 (0)	***	1.080	***	0.186	**	
D(Government consumption/GDP)	-14.342	***	-14.316	***	0.095		0.081		I(1)
Subsidy/GDP	-6.788 (1)	***	-12.153 (0)	***	0.862	***	0.069		I(0)
Social protection/ GDP	-4.859 (0)	***	-5.023 (0)	***	0.219		0.147	**	I(0)
Debt ratio	-1.678 (1)		-1.248 (1)		0.356	*	0.301	***	
D(Debt ratio)	-5.817 (0)	***	-7.017 (0)	***	0.825	***	0.071		I(1)
Tax ratio	-1.979 (2)		-6.659 (0)	***	1.179	***	0.063		TS
Log Exchange rate	-0.554 (0)		-2.915 (0)		0.995	***	0.208	**	
D(Log Exchange rate)	-11.315 (0)	***	-11.570	***	0.185		0.056		I(1)
Inflation rate	-6.709 (0)	***	-8.060 (0)	***	0.963	***	0.042		I(0)
Interest rate	-3.967 (2)	***	-5.137 (1)	***	1.029	***	0.124	*	TS
Output gap	-4.051 (0)	***	-4.023 (0)	**	0.038		0.038		I(0)
GDP growth	-3.79 (0)	***	-3.94 (0)	**	0.31		0.15	**	I(0)

Variable	ADF t-statistic				KPSS (LM-Stat)				Status
	Ho: series has unit root				Ho: series is stationary				
	Intercept only		Intercept with Trend		Intercept only		Intercept with Trend		
Log Private consumption	-1.026 (0)		-0.937 (0)		1.202	***	0.184	**	
D(Log Private Consumption)	-9.988 (0)	***	-10.046 (0)	***	0.239		0.149	**	I(1)
Private Consumption/GDP	-1.101 (0)		-1.585 (0)		1.066	***	0.263	***	
D(Private Consumption/GDP	-8.775 (0)	***	-8.782 (0)	***	0.144		0.097		I(1)
IPI gap	-5.603 (0)	***	-5.570 (0)	***	0.039		0.039		I(0)
GDP deflator	-4.023 (1)	***	-7.403 (0)	***	0.659	**	0.103		I(0)
Lending rate	-1.501 (1)		-4.425 (1)	***	1.115	***	0.122	*	TS

****, ** and * denote 1%, 5% and 10% significance levels of null hypothesis rejection, respectively. Values inside parentheses refer to lag lengths based on Schwarz Information Criterion. The KPSS output only provides the asymptotic critical values. TS stands for trend-stationarity.*

Table A4

Test for structural breaks

Variable	Break date		Deterministic component	Status
Log Central government			Constant + Trend	Level
Log Government consumption			Constant	FD
Log Subsidy	2008Q2	*	Constant	Level
	2015Q2	*	Constant	
Log Social protection			Constant	Level
As Percent of GDP				
Central government/GDP	2009Q2	*	Constant	Level
Government consumption/GDP			Constant	FD
Subsidy/GDP	2015Q2	*	Constant	Level
Social protection/GDP			Constant	Level
Exchange rate			Constant	FD
Tax ratio	2008Q3		Constant + Trend	Level
Debt ratio	2011Q4	*	Constant	FD
Output gap	2019Q4		Constant	Level
Inflation rate	2008Q3	*	Constant	Level
Interest rate	2005Q2		Constant + Trend	Level
	2013Q3	*		
Log Private consumption			Constant	FD
Private consumption/GDP			Constant	FD
IPI gap	2019Q4		Constant	Level
GDP deflator	2008Q3	*	Constant	Level
Lending rate	2014Q1	*	Constant + Trend	Level

*Bai-Perron multiple breakpoint tests used F-statistic. * denotes that the statistic is significant at the 5% level. FD stands for first-difference.*

PUBLIC SECTOR ECONOMICS
47 (4) 477-503 (2023)

TABLE A5

Cointegration test

Null hypothesis: Series are not cointegrated

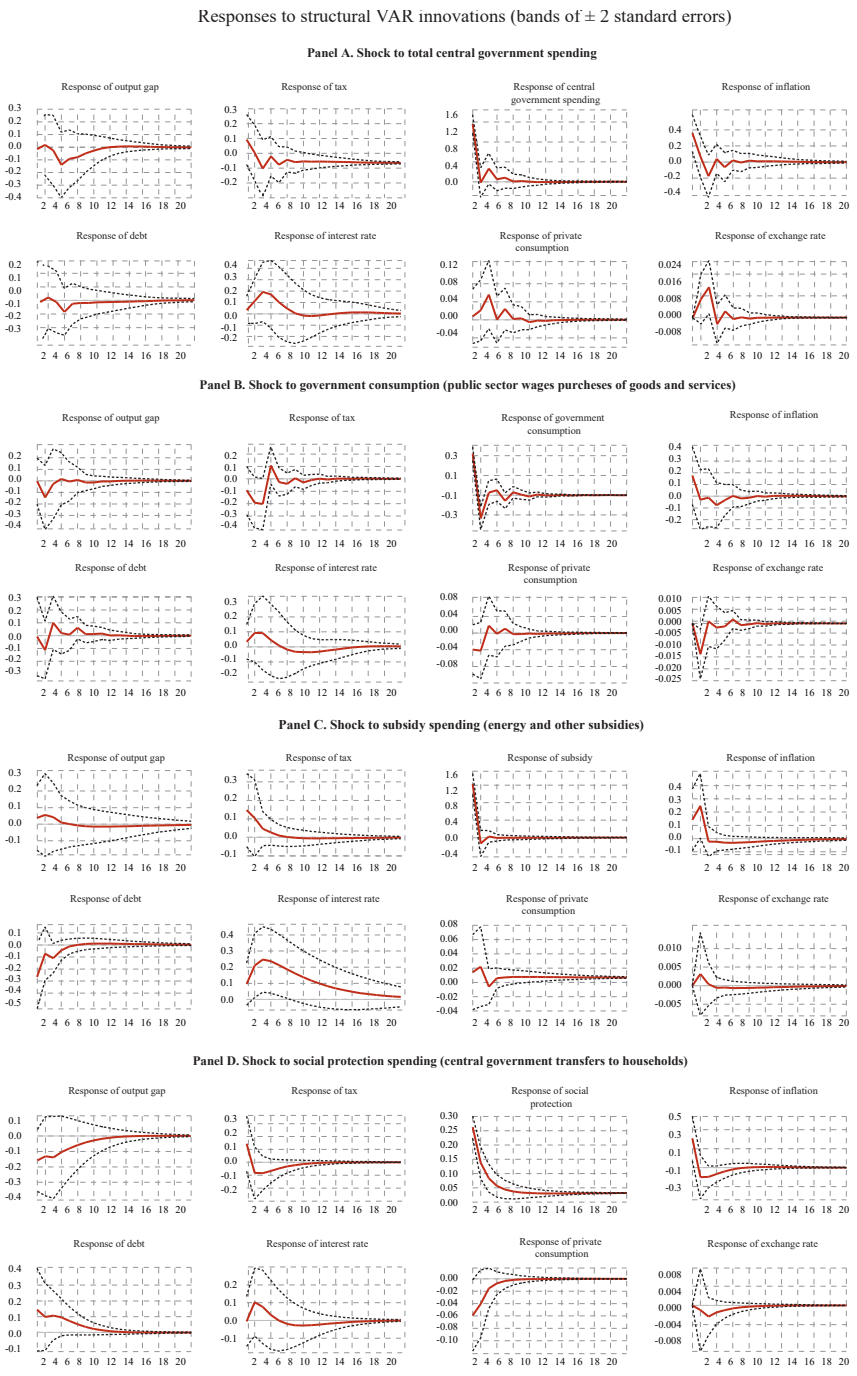
Paired Series	Engle-Granger tau-statistic	Phillips-Ouliaris tau-statistic	Decision
DEBT and LER	-1.555 (1)	-2.342	Do not reject null
DEBT and PCGDP	-0.011 (1)	-0.633	Do not reject null
LER and PCGDP (with trend)	-3.996 (0)**	-4.004**	Reject null
LER and PCGDP (without trend)	-1.801 (0)	-1.769	Do not reject null
LER and LPC	-2.771 (0)	-2.770	Do not reject null

*Series are expressed in logarithmic form (except for PCGDP and DEBT which are in percent) and are seasonally adjusted. Automatic lag specification (in parentheses) is based on the Schwarz information criterion. Unless stated otherwise, the cointegrating equation deterministics used is simply the constant (level). ** denotes rejection of the null hypothesis of no cointegration in the series at 5% level of significance, based on MacKinnon (1996) p-values.*

PUBLIC SECTOR ECONOMICS
47 (4) 477-503 (2023)

Graph A1

Robustness check: Impulse responses to structural VAR innovations in government spending as percentage of GDP

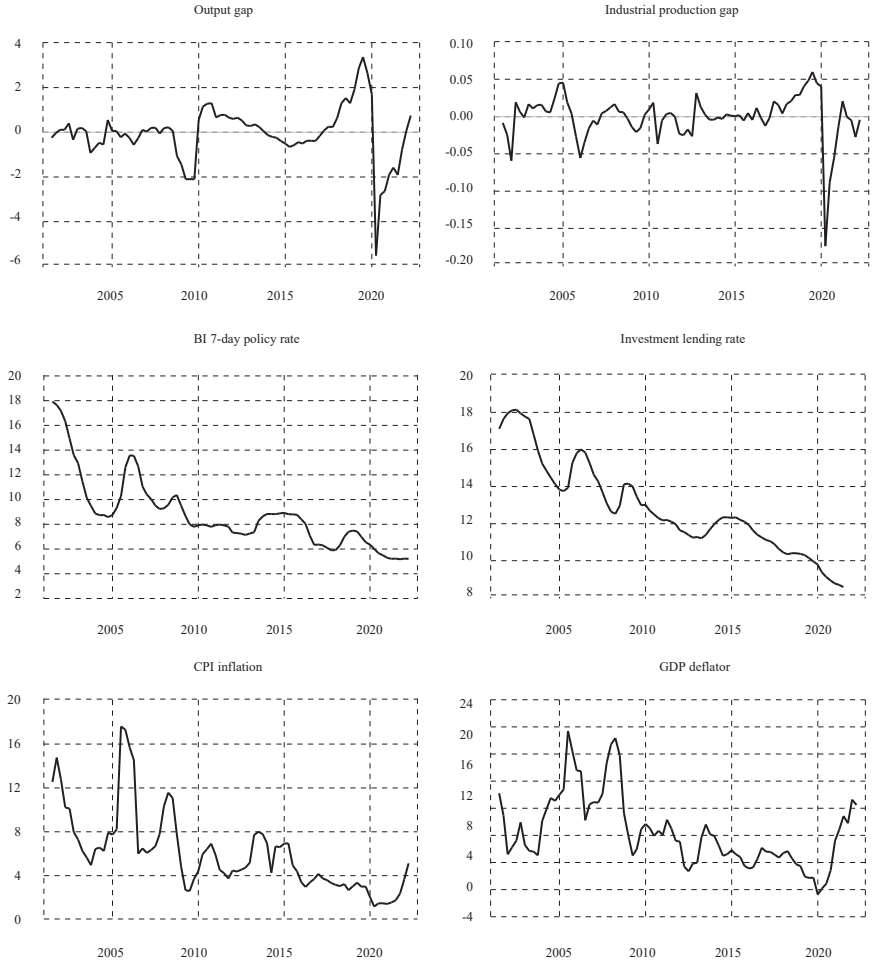


Note: The size of shock is one unit or one percentage point. The solid line refers to the impulse response of the structural decomposition; dashed lines refer to the ± 2 standard error bands. Lag length is 2 for central government spending and government consumption spending, lag length for subsidy and social protection spending is 1.

PUBLIC SECTOR ECONOMICS
47 (4) 477-503 (2023)

GRAPH A2

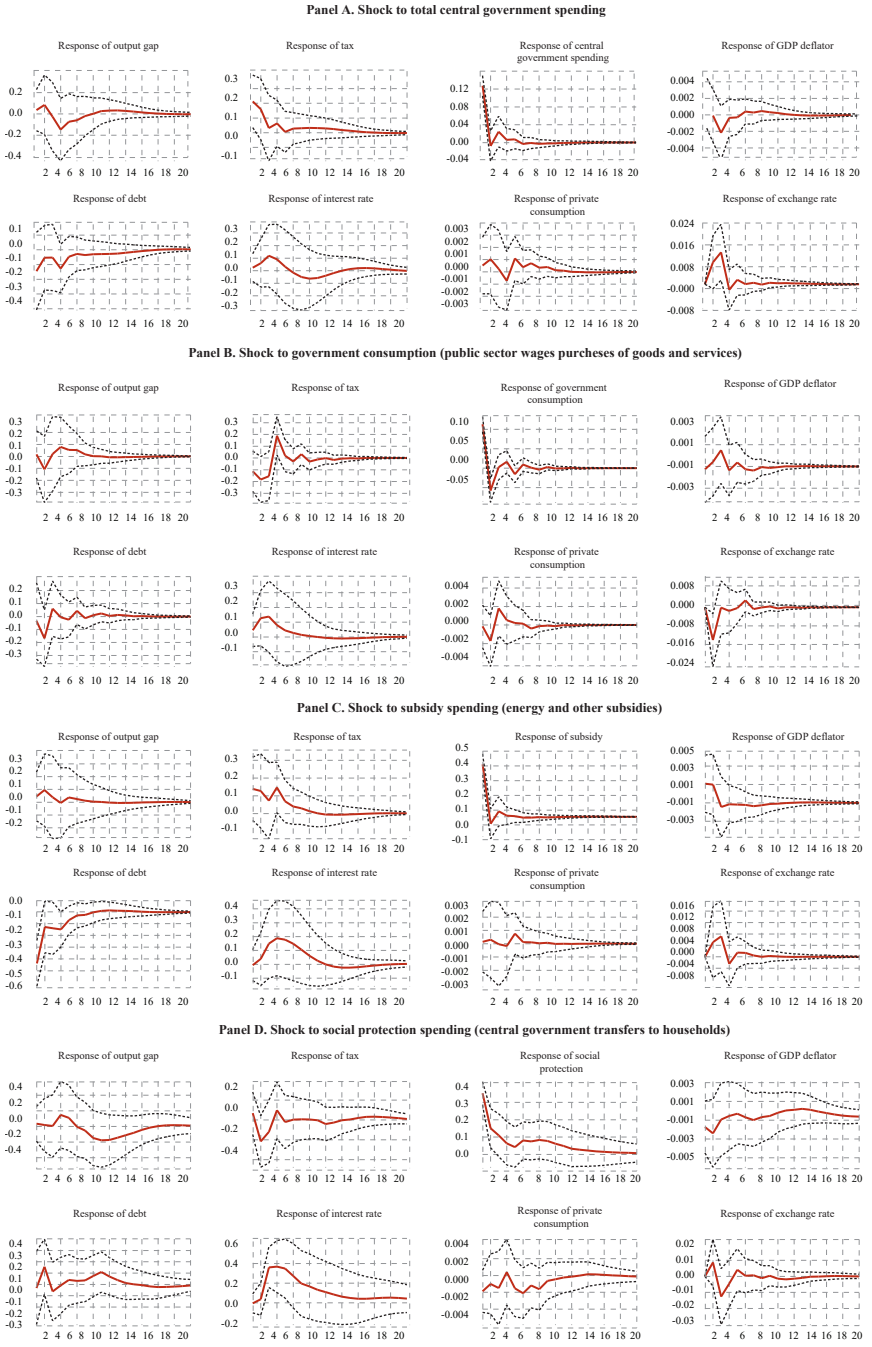
Alternative robustness check indicators for some variables[a]



[a] *Definition and sources are shown in table A1.*

Graph A3

Robustness check: Impulse responses to structural VAR innovations in government spending (with GDP deflator as indicator for inflation)



Note: The size of shock is one unit or one percentage point. The solid line refers to the impulse response of the structural decomposition; dashed lines refer to the ± 2 standard error bands. Lag length is 2 across government spending instruments, except for social protection, where lag length is 3.

Unexpected inflation and public pensions: the case of Hungary

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Article**
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PUBLIC SECTOR ECONOMICS
47 (4) 505–520 (2023)

Abstract

Since increases in public pensions are generally related to prices or wages or combinations of them, the impact of inflation on the real value of benefits can often be neglected, especially in the case of indexation to prices. With high and accelerating/decelerating inflation like that currently prevailing in Hungary, however, this is not the case. (i) With fast inflation of basic necessities, the proportional indexation of benefits in progress devalues the lowest benefits, which have to pay for above-the-average consumption share of these goods. (ii) Annual "lumpy" increases of these benefits entail too high an intra-year drop in the real value of benefits. (iii) With accelerating inflation, the declining real value of delayed initial benefits may incentivise immediate retirement. (iv) With unindexed parameter values (like progressivity bending points), the initial benefits' structure unintentionally changes.

Keywords: inflation, public pensions, indexation, progressivity of initial benefits, delayed retirement

1 INTRODUCTION

For a long time, public pensions in progress have been indexed to prices or wages or a combination of the two (Whitehouse, 2009). At the moderate inflation characteristic of the last two decades, politicians and pensioners have been inclined to neglect the issues of pension indexation, especially in the case of indexation to prices. This complacency has been shattered by the recent worldwide surge in inflation. In December of 2022, the 12-month inflation rate reached 11% in EU27; exceeded 24% in Hungary and 16% in Czechia. The annual inflation was more modest, being 14% in Hungary and 15% in Czechia.

It is worth quoting some key observations of OECD (2022) on how inflation challenges pensions. (a) "[D]ue to falling real wages, price indexation has become a more favourable protection for pensioners than wage indexation, while being more costly than initially anticipated." (b) "[A]lternatives for full price adjustment for all include a combination of: a flat rate payment; full adjustment up to a threshold and partial adjustment, potentially up to a cap beyond which no adjustment would apply."

From now on, we shall confine our attention to Hungary, mostly to recent developments. Just before the national elections in April 2022, the Hungarian government introduced several significant budgetary measures to increase its popularity. One of them was the accelerated introduction of the 13th month pension. The cost of the acceleration and the total impact amounted to about 0.3 and 0.6% of GDP, respectively. The cost of this and other measures approached 3% of GDP, explaining a large part of the extra inflation.

Hungary has a public pension system in which initial benefits are almost proportional to lifetime contributions but 10 and 20% of the pension base, lying in the higher brackets, are progressively deducted. (Another progressive factor is that

the marginal accrual rate is U-shaped, almost halving the impact of the first 20 years of contribution in the second 20 years: 27% < 53%.) Benefits in progress are indexed to prices, meaning that in January of the current year, all benefits are raised by the annual inflation rate forecasted by the government. If the forecast is below the actual inflation rate, then at the end of the year, the difference is made up; if the forecast is above the actual rate, then pensioners retain the surplus.

Between 2013 and 2021 the reported rise of nationwide real wages was very fast, partially fuelled by the forced reduction of contribution rates. On the one hand, through indexation of initial benefits, this raised the real value of these benefits quite substantially. On the other hand, the relative value of older benefits dropped, resulting in a declining ratio of benefits to net earnings from 67 to 50%. Though the genuine real wage rise was much lower (say 30 rather than 50%), the initial benefits rose by this overestimated value and the relative loss of benefits to wages looked much greater than it was in reality. (For a text in Hungarian, see Oblath and Simonovits, 2023.)

Turning to the actual subject of our study, the unexpected acceleration of inflation in 2022 made the initial 5% increase of *benefits in progress* unsatisfactory, and it was completed by 3.9 and 4.5% in July and in November, respectively. Using a multiplicative rule, this has led to a total increase of $1.05 \times 1.039 \times 1.045 = 1.140$, i.e., +14%, slightly lower than the final index.

Though the benefit increases are generally proportional to the last benefits, there are strong arguments for nonproportional raises for pensioners with low benefits when the prices of basics like food and household energy increase much faster than the average, while their shares are higher in such baskets than on average. For example, in December 2022, in Hungary the price levels of certain groups of goods were much higher than they were 12 months previously – food: 45%, energy: 62%, heating gas: 121%. Note that the shares of food and of energy expenditures of the lowest quantile were 33 and 14 rather than the corresponding averages of 26 and 12%, respectively.

The real values of the *initial benefits* have also been affected by the accelerated inflation. On the one hand, the acceleration reduced or even eliminated the gain from delayed retirement. On the other hand, through nominally fixed progressivity bending points, inflation diminished high benefits relative to expectations or past benefits.

These changes justify the discussion of the following pension measures: (i) In addition to introducing special heating subsidies, low benefits deserve temporary special increases. (ii) Smoothing out the path of the real values of pensions in progress within a given year by intra-year rises if necessary. (iii) Dampening the impact of accelerating inflation on delayed retirement with proper indexation. (iv) Making the progressivity of higher benefits inflation-free by indexing the bending

PUBLIC SECTOR ECONOMICS
47 (4) 505–520 (2023)

points of the progressive initial benefit formula. Adding up the impacts of these apparently minor measures may imply important changes.

Considering the literature, we start with the classic paper of Fischer (1982) on the *pros* and *cons* of indexation in general. We single out few earlier discussions of various issues of pension indexation: Simonovits (2003, Chapter 6) emphasized the obvious problem of backward- or forward-looking indexation of benefits in progress and the delayed valorisation of initial benefits during the transition period in Hungary. Barr and Diamond (2008, Chapter 5) clearly differentiated between indexing initial benefits and benefits in progress; and analysed the so-called over-indexation of US Social Security benefits and of the UK state pension. Lovell (2009) very thoroughly examined various pitfalls in the indexation of US Social Security benefits. Though payday lending, i.e., very expensive short-term loans (Stegman, 2007), may seem unrelated to pensions, it can still be an option for pensioners who cannot cope with the fast-decreasing real value of monthly benefits within a year. Domonkos and Simonovits (2017) surveyed pension design problems of post-socialist countries. Simonovits (2020) studied the role of indexation in the relative devaluation of older pensions with respect to newer pensions and current wages. Checherita-Westphal (2022) is the latest analysis of the indexation of public pensions (and of public wages) in the current period of higher inflation.

The structure of the remaining part of the paper is as follows. Section 2 justifies special increases of low benefits. Section 3 compares actual annual and proposed monthly indexation. Section 4 evaluates the impact of accelerating inflation on the yield of delayed retirement. Section 5 studies the impact of wage and price inflation on the progressivity of a nominally framed initial benefit. Section 6 concludes. An appendix supplies the details of the Hungarian pension system skipped in the main text.

2 SPECIAL INCREASES OF LOW BENEFITS

For a long time, inflation rates have been moderate and quite uniform among the various categories. Since 2021, however, not only has the general inflation accelerated but food and energy prices have risen especially fast. Since these categories have a higher share in the consumption of households of lower incomes, these households deserve extra income support. Traditionally, low-income pensioners enjoy greater support than the average low-income population, therefore any pension study must tackle the issue. Table 1 displays the aforementioned tendency among the ten deciles for food and income and five quantiles for household energy in Hungary, in 2020. Note that as we move from the poorest to the richest decile and quantile, the shares of food and energy expenditures decline from 33 to 21% and from 14 to 9%, respectively.

PUBLIC SECTOR ECONOMICS
47 (4) 505–520 (2023)

Table 1

Shares of expenditure on food and household energy, Hungary, 2020 (in %)

Decile	Food	Relative income	Household energy
1	33	41.2	14
2	32	50.9	
3	29	61.4	13
4	29	75.4	
5	28	87.7	11
6	27	99.1	
7	27	109.6	11
8	25	124.6	
9	24	150.0	9
10	21	193.0	
Average	26	100.0	12

Source: Central Office of Statistics (2021) and Eurostat HBS STR T223. The energy shares refer to quantiles rather than deciles.

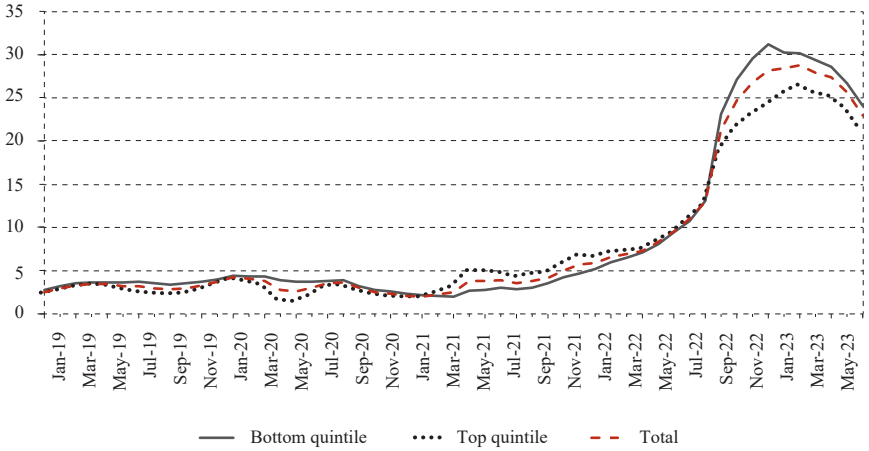
The explosion of food prices is menacing but it appears to be simpler to address than that of household energy prices. The government fixed the latter between 2012 and July 2022, but since last August, only the part of consumption below a cap has been supported, separately for energy and heating gas. Any unit of consumption above the corresponding cap costs twice as much for electricity and 7.6 times as much for heating gas. As a result, in September 2022, the average electricity and heating gas prices grew by 29 and 121%, respectively. As a first approximation, we assume uniform distribution below and above the cap, then the average electricity and heating gas consumption grew by 14 and 16%, respectively. (In fact, $1 + 0.14 \times 2 = 1.28$ and $1 + 0.16 \times 7.6 = 2.16$, respectively.) It is evident that within every decile, a significant share of households is unaffected, while the remaining shares are heavily affected. It is a tricky question how to treat this problem. Perhaps heating should be taken out from the pensioners' price index and an additional heating support should be introduced but this needs a special study.

Claeys et al. (2023) report the impact of income-dependent consumption weights on the inflation of the lowest and the highest quantile's inflation in the EU in general, and Hungary in particular. Earlier the impact was quite small but from September 2022, the gap opened wide.

PUBLIC SECTOR ECONOMICS
47 (4) 505–520 (2023)

FIGURE 1

Inflation rates for top and bottom quintiles, Hungary (in %, year-on-year)



Source: Claeys et al. (2023).

From now on we shall neglect inflation inequality.

3 INDEXATION OF BENEFITS IN PROGRESS

The indexation of benefits in progress is probably the most important single measure of the pension policy. And it becomes an especially hot topic when inflation is as high as it is in Hungary now. To understand the impact of accelerating inflation we must go beyond annual inflation. We shall show that under once-a-year increases of benefits, high inflation causes huge temporary losses (and gains) to pensioners. But we must make it clear that if high inflation is only a transitory phenomenon, and the indexation rules are sensible, then these losses (and gains) are only temporary; and in the long-run, they are netted out.

We shall first describe the various inflationary indices and then discuss the benefit increases. We start from the monthly price index $p_{t,h}$, where t and h stand for the year and the month, respectively. We shall need the *price level* $P_{t,h}$, cumulating the monthly price indices from an arbitrary period, say year 0 and month 12, starting with $P_{0,12} = 1$, it is

$$P_{t,h} = \begin{cases} p_{t,1} P_{t-1,12} & \text{for} \quad h = 1 \\ p_{t,h} P_{t,h-1} & \text{for} \quad h = 2,3,\ldots,12 \end{cases}$$

We shall start from year $t = 2021$ and display the actual Hungarian data of 2021-2022 in table 2 and supplement them by a forecast made by Éva Palócz (Kopint) for year 2023 (personal communication).

Table 2

Annual and monthly price indices (actual and forecast)

Year	Month	Monthly change	Cumulated monthly price level	12-month price index	Annual price index
t	h	$p_{t,h}$	$P_{t,h}$	$I_{t,h}$	$P_{t,}$
2021	1	1.009	1.009	0	
	2	1.008	1.017	0	
	3	1.007	1.024	0	
	4	1.008	1.032	0	
	5	1.005	1.038	0	
	6	1.006	1.044	0	
	7	1.004	1.048	0	
	8	1.002	1.050	0	
	9	1.002	1.052	0	
	10	1.011	1.064	0	
	11	1.007	1.071	0	
	12	1.003	1.074	0	1.051
2022	1	1.015	1.090	1.081	
	2	1.011	1.102	1.084	
	3	1.010	1.114	1.087	
	4	1.016	1.131	1.096	
	5	1.017	1.151	1.109	
	6	1.015	1.168	1.119	
	7	1.023	1.195	1.140	
	8	1.018	1.216	1.158	
	9	1.041	1.266	1.203	
	10	1.019	1.290	1.213	
	11	1.018	1.313	1.226	
	12	1.019	1.338	1.246	1.147
2023	1	1.023	1.369	1.255	
	2	1.015	1.390	1.260	
	3	1.005	1.397	1.254	
	4	1.005	1.404	1.241	
	5	1.015	1.425	1.238	
	6	1.002	1.427	1.222	
	7	0.996	1.422	1.190	
	8	1.003	1.426	1.173	
	9	1.003	1.430	1.130	
	10	1.003	1.435	1.112	
	11	1.005	1.442	1.098	
	12	1.000	1.442	1.077	1.188

Columns 1 and 2 stand for the year and the month, respectively. Column 3 shows the monthly change in the price level. For example, 1.009 in row 2021:1 shows that the price level rose by 0.9% from 2020:12 to 2021:1.

PUBLIC SECTOR ECONOMICS
47 (4) 505–520 (2023)

Column 4 displays the accumulated price level $P_{t,h}$, $P_{2020,12} = 1$. For example, 1.442 in the last row shows that the price level is expected to be 44.2% higher in December 2023 than it was in December 2020.

Next we introduce the year-on-year inflation index of 12 months:

$$I_{t,h} = \frac{P_{t,h}}{P_{t-1,h}}, \qquad h = 1, 2, \ldots, 12$$

Entries of column 5 show these numbers. By the forecast, this indicator will drop from 1.245 (2022:12) to 1.077 (2023:12).

Finally, the arithmetic average of 12 monthly year-on-year indices of a year is called the *inflation index* of year t:

$$P_t = \frac{1}{12}\sum_{h=1}^{12} I_{t,h}$$

This index can be rationalized as follows: if in every month of years $t-1$ and t, the consumer buys quantity y, she spends P_t times more in year t than in year $t-1$. Column 6 displays this index. For example, 1.15 stands for the price index of 2022 to 2021. This plays a prominent role in macroeconomics in general and in pension economics.

Turning from inflation to benefits, we repeat: the main problem with the "lumpy" annual increase is that it only preserves the purchasing power of the benefits spread over the whole year but it tolerates steep declines within the year. Assuming that the annual forecast is perfect and no intra-year compensation is needed, the uniform monthly nominal value of the benefit in year t can be denoted by b_t. By definition,

$$b_t = b_{t-1} P_t \qquad t = 1, 2 \qquad b_0 = P_0$$

The next question is: how to define the *real values* of the monthly payments? One possibility of defining them is to discount the nominal values to the last month of year 0:

$$\mathbf{b}_{t,h} = \frac{b_t}{P_{t,h}}, \quad h = 1, 2, \ldots, 12 \tag{1}$$

We shall need the annual average of these benefits in real terms:

$$\mathbf{b}_t = \frac{1}{12}\sum_{h=1}^{12} \mathbf{b}_{t,h} \tag{2}$$

Inserting (1) into (2) yields

$$\mathbf{b}_t = \frac{1}{12}\sum_{h=1}^{12} \frac{b_t}{P_{t,h}}$$

PUBLIC SECTOR ECONOMICS
47 (4) 505–520 (2023)

Typically the price level rises every month, therefore the real value of the monthly benefits is decreasing except for January:

$$\mathbf{b}_{t,1} > \mathbf{b}_{t,2} > \cdots > \mathbf{b}_{t,11} > \mathbf{b}_{t,12}.$$

We shall argue that in the case of high inflation, to smooth out this drop, it is worth having a more frequent, even monthly increase, also preserving the real value of the monthly benefits from 2023:

$$\hat{\mathrm{b}}_{2023,h} = \hat{\mathrm{b}}_{2023,h-1} p_{2023,h}, \quad \hat{\mathrm{b}}_{2023,h} = \hat{\mathrm{b}}_{2023,1}, \quad h = 2,3,\ldots,12$$

where the real value of the reformed January benefit (bold) is the ratio of the nominal monthly benefit and the corresponding price level:

$$\hat{\mathbf{b}}_{2023,1} = \frac{\hat{b}_{2023,1}}{P_{2023,1}}$$

Of course, the extraordinary increase in January should be determined to preserve the real value of the annual benefits. Having the equality of the past and future annual benefits in real terms, this yields

$$\frac{\hat{b}_{2023,1}}{P_{2023,1}} = \hat{\mathbf{b}}_{2023,1} = \mathbf{b}_{2022}$$

With rearrangement,

$$\hat{\mathrm{b}}_{2023,1} = \mathrm{b}_{2022} P_{2023,1}$$

If this rule implies a nominal drop in benefits, skip it and credit it against future nominal raises. For example, if a 2% nominal drop is implied, then fix the nominal values of the benefits until inflation eats it up.

Like table 2, table 3 also has a double year and month index. Columns 3 and 4 display the traditional sequence of fixed nominal benefits and the resulting decreasing real benefits, respectively. Note the great drop of the benefit's real value in December from January 2022: 0.901 < 1.105. (It was a mixed blessing that due to the rough underestimation of the 2022 inflation, the actual loss was smaller.) Confining our attention to the year 2023, columns 5 and 6 present the proposed monthly rise in nominal benefits and the resulting constant real benefits, respectively.

PUBLIC SECTOR ECONOMICS
47 (4) 505–520 (2023)

TABLE 3

Annual vs. monthly benefit raise, 2021-2023: counterfactual exact forecast

Year	Month	Nominal	Real	Nominal	Real
		Annual raise		Monthly	
t	h	b_t	$\mathbf{b}_{t,h}$	$\hat{\mathbf{b}}_{t,h}$	$\hat{b}_{t,h}$
2021	1	1.044	1.034	–	–
	2	1.044	1.026	–	–
	3	1.044	1.019	–	–
	4	1.044	1.011	–	–
	5	1.044	1.006	–	–
	6	1.044	1.000	–	–
	7	1.044	0.996	–	–
	8	1.044	0.994	–	–
	9	1.044	0.992	–	–
	10	1.044	0.981	–	–
	11	1.044	0.974	–	–
	12	1.044	0.971	–	–
2022	1	1.205	1.105	–	–
	2	1.205	1.093	–	–
	3	1.205	1.082	–	–
	4	1.205	1.065	–	–
	5	1.205	1.048	–	–
	6	1.205	1.032	–	–
	7	1.205	1.009	–	–
	8	1.205	0.991	–	–
	9	1.205	0.952	–	–
	10	1.205	0.934	–	–
	11	1.205	0.918	–	–
	12	1.205	0.901	–	–
2023	1	1.431	1.045	1.383	1.010
	2	1.431	1.030	1.404	1.010
	3	1.431	1.025	1.411	1.010
	4	1.431	1.020	1.418	1.010
	5	1.431	1.005	1.439	1.010
	6	1.431	1.003	1.442	1.010
	7	1.431	1.007	1.437	1.010
	8	1.431	1.004	1.441	1.010
	9	1.431	1.001	1.445	1.010
	10	1.431	0.998	1.450	1.010
	11	1.431	0.993	1.457	1.010
	12	1.431	0.993	1.457	1.010

4 DELAY OF RETIREMENT

When the annual inflation rates were moderate and stable, the initial pension benefits followed the corresponding reported average real wage dynamics with a one-year lag with a good approximation (Simonovits, 2020). Between 2015 and 2020, inflation was moderate and reported average real wages rose by 7-10% per year,

PUBLIC SECTOR ECONOMICS
47 (4) 505–520 (2023)

therefore, the initial benefits grew similarly (see table 5). Though the Hungarian Statistical Office significantly overestimated real wage growth because it used a distorted sample of fulltime-employed workers, the real growth of initial benefits was genuine. Because the individual benefits in progress have stagnated in real terms, the tension between newer and older beneficiaries has become stronger. This changed in 2021/2022, when the real wage dynamics slowed down and the inflation rate accelerated. (It is worth citing Fischer (1982:169): "variability of inflation matters because uncertainty about the inflation rate creates as serious economic difficulties as those caused by high inflation itself".)

To model the problem, we consider an extreme case: a worker considers retiring either on the last day of year t or on the first day of year t+1. Denoting the growth index of the average nominal wage by G_t, and the inflationary index of the next year by P_{t+1} (apart from complications with progressivity, discussed in the next section), the one-day delay multiplies the initial benefit by G_t (extra year of valorisation) and divides it by P_{t+1} (lack of indexation as benefit in progress in the new year). Therefore, the simplest indicator of the delay's yield is

$$d_t = \frac{G_t}{P_{t+1}}$$

If $G_t > P_{t+1}$, then the delay is advantageous; if $G_t < P_{t+1}$, then the delay is disadvantageous; if $G_t = P_{t+1}$, then the delay is neutral. Of course, most workers retire earlier than December 31 or later than January 1, but for our discussion, the analysis of this decision is sufficient. (In Hungary, since 2011/2012, early retirement has been abolished except for females with 40 years of entitlements, and very few employees work beyond the normal retirement age, therefore the actuarial reduction/addition can be safely ignored.)

Note that to forecast the annual inflation index can be difficult not only for the employees but also for the government. For example, as mentioned above, the subsequent expected annual rate has been increasing in 2022 (from 5 to 14%), eliminating the expected advantage of the one-day delay. Table 4 presents the calculation for three distinct months. The actual inflation rate was around 14%, turning the expected gain of 1.087/1.05 − 1 = +0.035 into an actual loss of 1.087/1.14 − 1 = −0.046.

Table 4
Three forecasts

Year: month	Nominal wage index	Inflation forecast	Delay impact
t	G_t	$P^e_{t,h}$	d_t
2021	1.087	1.051*	–
2022:01	–	1.050	1.034
2022:08	–	1.089	0.998
2022:12	–	1.140	0.954

** Actual date, the others are forecasts.*

PUBLIC SECTOR ECONOMICS
47 (4) 505–520 (2023)

Note, however, that in some of my earlier studies (e.g. Simonovits, 2020), I have been using a simpler estimator, naively replacing future inflation with past inflation. If P_{t+1} is estimated by P_t, then the corresponding yield collapses to the annual real wage index:

$$\hat{d}_t = \frac{G_t}{P_t} = \gamma_t$$

Table 5

The estimations of the impact of delaying retirement, 2010-2022

Year	Nominal wage index	Price index	Rationally	Naively	Inflationary acceleration
	Annual change		Estimated impact of delay		
t	G_t	P_t	d_t	γ_t	π_t
2010	1.068	1.049	1.028	1.018	0.990
2011	1.064	1.039	1.007	1.024	1.017
2012	1.021	1.057	1.004	0.966	0.962
2013	1.049	1.017	1.051	1.031	0.981
2014	1.030	0.998	1.031	1.032	1.001
2015	1.043	0.999	1.039	1.044	1.005
2016	1.078	1.004	1.053	1.074	1.020
2017	1.129	1.024	1.092	1.103	1.010
2018	1.113	1.034	1.076	1.076	1.000
2019	1.114	1.034	1.078	1.077	0.999
2020	1.097	1.033	1.044	1.062	1.017
2021	1.087	1.051	0.945	1.034	1.094
2022	–	1.148	–	–	–

Table 5 shows the difference between the "rational" and naive estimations. According to the rational forecast, delay was advantageous even in 2012, when the naive forecast made delay disadvantageous. In 2021, it was the opposite. (In fact, here we neglect that overestimation of inflation in the period 2013-2016, mentioned above.)

5 PROGRESSIVITY OF INITIAL BENEFITS UNDER INFLATION

Fischer (1982: 170) underlined the cost of government's "failure to adjust the tax laws for inflation". This also applies to the real impact of inflation on the progressivity of Hungarian initial benefits. Let t = 2012, 2013, ... stand for the index of year, w_t and w_t^* for the nominal average (reference) wage and bending point in year t, respectively. For a reference wage below or at the bending point, the initial benefit is proportional to the reference wage, $\beta_1 > 0$ being the accrual rate. For a reference wage above the bending point, a second, lower accrual rate enters: $0 < \beta_2 < \beta_1$. (As explained in appendix, there are two, close bending points with two lower accrual rates, but to simplify the exposition, we unify them into one and choose the lower accrual rate.)

With good approximation, the progressive nominal benefits first granted from early January of year t are described by

$$b_t\left(w_{t-1}\right)=\begin{cases}\beta_1 w_{t-1} & \text{for} \quad 0\le w_{t-1}\le w^*\\ \beta_1 w^*+\beta_2\left(w_{t-1}-w^*\right) & \text{for} \quad w_{t-1}>w^*\end{cases}$$

We describe the real values of wages and benefits as functions of the corresponding nominal variables and the annual price level $\mathbf{P}_t$, recursively defined by $\mathbf{P}_t=\mathbf{P}_{t-1}P_t$, with $\mathbf{P}_0=1$:

$$\mathbf{w}_t=\frac{\mathrm{w}_t}{\mathbf{P}_t},\quad \mathbf{w}_t^*=\frac{w^*}{\mathbf{P}_t}\quad \text{and}\quad \mathbf{b}_t=\frac{b_t}{\mathbf{P}_t}$$

The "real" benefit-real earning link is as follows:

$$\mathrm{b}_t\left(\mathbf{w}_{t-1}\right)=\begin{cases}\beta_1\mathbf{w}_{t-1}/P_t & \text{if} \quad 0\le \mathbf{w}_{t-1}\le \mathbf{w}_{t-1}^*\\ (\beta_1-\beta_2)\mathbf{w}_t^*+\beta_2\mathbf{w}_{t-1}/P_t & \text{if} \quad \mathbf{w}_{t-1}>\mathbf{w}_{t-1}^*\end{cases}$$

Table 6

The impact of the declining real value of bending point on high initial pensions, Hungary, 2012-2023

		In terms of average wage, 2012 Benefit for:			
Year	**Cumulated price level**	**average wage**	**bending point**	**average wage**	**triple wage**
t	$\mathbf{P}_t$	$\mathbf{Ew}_t$	$\mathbf{w}_t^*$	$\mathbf{b}_t(1)$	$\mathbf{b}_t(3)$
2012	100.0	100.0	277.8	–	–
2013	101.7	103.1	273.1	78.7	232.5
2014	101.5	106.5	273.7	82.7	242.2
2015	101.4	111.1	274.0	85.2	248.4
2016	101.8	119.3	272.9	88.6	256.2
2017	104.2	131.6	266.5	93.2	266.4
2018	107.8	141.6	257.7	101.8	285.5
2019	111.5	152.6	249.2	109.6	302.9
2020	115.1	162.0	241.3	118.2	322.2
2021	121.0	167.6	229.6	123.3	332.7
2022	139.2	167.6	199.6	116.6	311.7
2023*	164.6	162.9	168.7	113.3	299.0

** Stands for forecast.*

Column 2 of table 6 displays the accumulated inflation index, ending at 1.65 in 2023. Column 3 presents the real average wage, rising from 100 (2012) to 163 (2023). Inflation depressed the relative value of the bending point from 277.8 (2012) to 199.6 (2022) (both in terms of the average wage in 2012). Compare two beneficiaries, one having a reference wage equal to the average wage and the other triple that amount in year t, respectively; the corresponding benefits are denoted by $\mathrm{b}_t(1)$ and $\mathrm{b}_t(3)$, respectively. Those retiring in 2013, receive benefits of 78.7 and 232.5 units, respectively, their ratio being 2.95. Those retiring in 2022, due to the

PUBLIC SECTOR ECONOMICS
47 (4) 505–520 (2023)

real wage explosion, receive benefits of 116.6 and 311.7 units, respectively, their ratio being 2.637, showing stronger progressivity than before. Moreover, the high initial benefit is lower than that awarded a year before: 311.7 < 332.7! In a certain sense, the accidental strengthening progressivity partially makes up for the elimination of the cap from 2013, though the cap concerns earnings in individual years, while progressivity concerns the average earnings of the assessment period.

6 SUMMARY

At the end of the paper, we shortly summarize the conclusions. Accelerating inflation exposes certain errors in pension indexation rules in general and in Hungary in particular. (i) The higher shares of food and of energy expenditures of households with lower rather than higher incomes call for extended government help when the prices of these basic items grow much faster than the average. (ii) With accelerating inflation, the annual increases of benefits generate large intra-year drops in the real value of those benefits. This can be eliminated by a quarterly or monthly raise, simultaneously diminishing the "lumpiness" of the adjustment. (iii) Under the current imperfect rules, accelerating inflation may weaken or even undermine the incentives of delayed retirement. (iv) Though the strengthening of progressivity is welcome, it is illogical to make the real value of initial pensions depend on the accumulated inflation. (v) If Hungary had retained its pure or mixed wage indexation, while adding a sustainability factor and improving its wage statistics, then the inflationary shock on the pension system would have been weaker. It is disappointing that there is no official discussion of these problems and only an EU initiative requiring public discussion of the Hungarian pension system provides grounds for optimism.

To conclude, we note that Hungary may have one of the worst-designed pension systems in the OECD but other countries may also have similar problems with indexation under fast inflation. Since 2021, the ex-socialist countries have been suffering in particular from two-digit inflation, and the annual indexation of pensions in progress may put a temporary burden on their pensioners' shoulders. This burden can be diminished by introducing intra-year indexation if necessary!

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PUBLIC SECTOR ECONOMICS
47 (4) 505–520 (2023)

APPENDIX
DETAILS OF THE HUNGARIAN PENSION SYSTEM

This appendix elaborates certain details of the Hungarian pension system, skipped in the main text.

Starting with the *benefits in progress*, since 2010, in January of the given year, they are raised by the inflation rate forecast. If the forecast was pessimistic, then the gain is retained by the pensioners; if the forecast was optimistic, then the government completes the undervalued benefits in November. It is to be underlined that a more sensible solution would be to withhold the extra raise in next years. For example, when 2013, the initial raise was 5.3% and the actual inflation rate was only 1.5%, the arising extra raise of 3.7% should have been credited for future raises.

Turning to the *initial benefits*, individual net earnings from 1988 (or the start of the carrier if it is later) to the year of retirement are taken into account. First parts of the earnings above the *cap* are deducted, then they are multiplied the nationwide average growth factors of the previous year except the current year. Having the individual valorised annual wages, their arithmetical average is calculated and transformed by the progressive formula presented as a one-part formula in section 5 above and discussed here as the actual two-part progression.

Since 2013, there have been two bending points to be denoted by $w_1^* < w_2^*$ and three aggregated accrual rates to be denoted by $\beta_1 > \beta_2 > \beta_3$, implying a progressive benefit function

$$b_t\left(w_{t-1}\right)=\begin{cases}\beta_1 w_{t-1} & \text{for} \quad 0 \le w_{t-1} \le w_1^* \\ \beta_1 w_1^* + \beta_2\left(w_{t-1}-w_1^*\right) & \text{for} \quad w_1^* < w_{t-1} \le w_2^* \\ \beta_1 w_1^* + \beta_2\left(w_2^*-w_1^*\right)+\beta_3\left(w_{t-1}-w_2^*\right) & \text{for} \quad w_{t-1} > w_2^*\end{cases}$$

Numerically, w_1^*=372,000 HUFs and w_2^*=421,000 HUFs; $\beta_2 = 0.9\beta_1$ and $\beta_3 = 0.8\beta_1$.

Another complication, just mentioned in the main text, is that marginal accrual rates are stepwise linear function of the length of contribution S, rounded-off. Avoiding the details, β_1 is an increasing function of S, having several historically determined bending points $S_1 = 10$, $S_2 = 25$, $S_3 = 36$, $S_4 = 40$ and $S_5 = 50$ years starting at $\beta_1(10) = 0.33$ with annual accrual rates $\gamma_1 = 0.02$, $\gamma_2 = 0.01$, $\gamma_3 = 0.015$, $\gamma_4 = 0.02$ and ending with $\gamma_5 = 0$.

The future of taxation in changing labour markets

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PUBLIC SECTOR ECONOMICS
47 (4) 521–554 (2023)

Abstract

This paper provides a first assessment of the fiscal and distributional consequences of the ongoing structural changes in the labour markets of EU member states, mostly driven by technological progress and ageing. The Cedefop 2020 Skills forecast (including the effects of COVID-19), population projections and the forecast on pension expenditures depict a scenario of an ageing population, an inverted U-shaped unemployment trend and potentially polarising labour markets in the EU till 2030, the latter mostly driven by a surge in high-skill occupations. We make use of the microsimulation model EUROMOD and reweighting techniques to analyse the fiscal and distributional impacts of these trends under a no-policy-change assumption. The results suggest that the macro trends will increase pressure on government budgets, however, we also show that the current tax-benefit systems have the capacity to counterbalance the increases in income inequality and poverty risks triggered by the expected future labour markets developments.

Keywords: income distribution, budget, deficit, job polarisation, population ageing, COVID-19

1 INTRODUCTION

Ongoing changes in labour markets could pose a challenge for tax-benefit systems of EU member states and therefore affect their role with respect to social cohesion. Long-term trends, such as technological progress and ageing, are likely to affect the structure of the labour markets in terms of skills demanded and supplied, earnings distribution and sustainability of welfare systems, including pensions.

During the past decade, various studies have shown that the share of employment in occupations in the middle of the skill distribution have declined rapidly, in both the US and Europe. At the same time, the employment share at the upper and lower ends of the occupational skill distribution has increased substantially (Autor, Katz and Kearneyt, 2006; Goos and Manning, 2007; Goos, Manning and Salomons, 2009; David and Dorn, 2013). As a reason for the trend of increasing skills polarisation, the literature has pointed out that middle-skill jobs often consist of routine tasks that are relatively easy to automatize. There is thus a declining demand for middle-skill jobs (see, among others, Autor, Levy and Murnane, 2003; Michaels, Natraj and Van Reenen, 2014; European Commission, 2018).

Cedefop and Eurofound (2018) describe long-term trends in job polarisation in Europe. These projections suggest that while from a European perspective the hypothesis of increasing job polarisation seems likely, this does not hold for all EU member states. Together with population ageing, these trends can have a substantial influence not only on labour markets, but also on tax revenues, inequality, income distribution and overall on social cohesion. Any emergence of tight labour markets (i.e. labour markets in which there are shortages) in EU member states in the near future, especially for high- and low-skilled workers (Cedefop, 2021), may push their wages up. This may have pronounced effects on tax revenues and

PUBLIC SECTOR ECONOMICS
47 (4) 521-554 (2023)

inequality among workers across different skill levels (including increased wage differences). In addition, ageing and polarisation could pose a challenge to poverty and inequality reduction, as well as to the shock absorption capacity of existing tax-benefit systems (Dolls et al., 2017; 2019).

To summarize, both megatrends – technological progress and population ageing – directly affect economic growth and social and economic inequality. As argued by Acemoglu and Restrepo (2017), rapidly ageing societies in the past have grown faster, mainly because of a more rapid adoption of automation technologies. However, these automation technologies might directly impact income inequality (see Prettner and Stroulik, 2020). Additionally, automation could put numbers of jobs at risk (Frey and Osborne, 2017) and might lead to further job polarization (Goos, Manning and Salomons, 2014), directly affecting social and economic inequality and may raise concerns about social cohesion. This paper provides an assessment of the fiscal and distributional consequences of changing labour markets due mega trends, such as technological progress and population ageing, in EU member states till 2030 under a no policy-change assumption. Additionally, to the best of our knowledge we are the first to try to account for the impact of the COVID-19 pandemic on these megatrends. We make use of reweighting and microsimulation techniques to change the statistical weights of individuals in the EU-SILC survey dataset used in the static microsimulation model EUROMOD. The change of weights is done in such a way that the new data mimic the projected population's age distribution and skill composition in the long-term. The specific scenario we consider derives from available labour market, population and pension expenditure projections. We use data from a dedicated Cedefop Skills forecast scenario that assesses the long-term impact of COVID-19 on the labour market. Additionally, we use EUROSTAT population statistics as well as the pension expenditure forecasts of the 2021 EU Ageing Report[1] to account for the socio-demographic developments for the years 2019, 2025 and 2030. These projections are used to reweigh EUROMOD underlying data, which are based on the 2017 European Statistics on Income and Living Conditions (EU-SILC, with income reference year 2016).

Our work also contributes to the rapidly increasing literature on the economic impact of the COVID-19 pandemic. As argued by Autor and Reynolds (2020) the COVID-19 crisis might incentivize firms to automate tasks more rapidly (automation forcing).[2] Similar in spirit to the approach used in our work, the paper of Aziz, Ball and Creedy (2015) uses demographic projections combined with a reweighting approach to analyse the effect of ageing on the income distribution in New Zealand. The authors find evidence of an increase in market income inequality but stable disposable income inequality due to the balancing effects of the tax-benefit system. Dolls et al. (2019), analyse the effect of population ageing and increasing educational attainment in the EU. Combining a reweighting approach with wage

[1] See Economic Policy Committee (2020).
[2] Note that the projections used do not consider a more rapid adoption of technology because of COVID-19.

PUBLIC SECTOR ECONOMICS
47 (4) 521-554 (2023)

responses, the authors show that while population ageing potentially increases income inequality, its impact on wages will potentially offset this effect. Our work differs from Dolls et al. (2019) in that we explicitly take account of changes in the skill composition[3].

The paper is organised as follows. Section 2 describes the socio-economic data and methodology and also shows the underlying labour market, pension expenditure and population trends expected for the next decade. Section 3 discusses the impact of these trends on the government budgets of the EU-27, as well as on inequality and poverty measures. Section 4 then concludes.

2 DATA AND METHODS

We use EUROMOD, the microsimulation model for the European Union (Sutherland and Figar, 2013). We combine EUROMOD with a reweighting approach to adjust the micro data EUROMOD uses to projections from Cedefop's Skills forecast, EUROSTAT's population projection and the pension expenditure projections from the 2021 Ageing Report (Economic Policy Committee, 2020). Our aim is to evaluate fiscal and distributional consequences of structural changes in the labour markets in the medium-term. The analysis incorporates the consequences of the COVID-19 pandemic on both the labour market and pension expenditure.

2.1 EUROMOD

EUROMOD is a microsimulation model covering all the EU member states[4]. The model analyses in a consistent and cross-country comparable manner the role played by tax-benefit instruments in the formation of household's disposable income. The simulations presented here are based on EUROMOD version I2.0+ using EU-SILC (European Union Statistics on Income and Living Conditions) 2017 data (income reference period is 2016)[5]. EU-SILC data collect information on the demographic and economic circumstances of a representative sample of individuals and households in each EU member state. EUROMOD employs these to simulate direct tax liabilities and (non-contributory) benefit entitlements for a representative sample of households[6]. The simulations run on the tax-benefit rules as of 30 June 2019. It is important to recall first, that EUROMOD covers only the household side of the economy. Second, our simulations do not incorporate second-round and behavioural effects. This means that potential equilibrium effects of changes in the labour markets are not taken into account.

[3] Intuitively, Dolls et al. (2019) estimate a relationship between education, population ageing and wages. Projecting changes in ageing and education, they predict changes in wages. We keep wage skill premiums constant, but we modify the number of people in each age category, the proportion of workers and the skill composition such that we replicate the trends seen in the projections.

[4] EUROMOD is used to simulate the impact certain changes in the tax-benefit system may have on individuals' income. In its standard version, the model does not take into account behavioural changes that may follow these changes, thus it delivers "morning after" effects. However, it can be linked to other models for behavioural analysis and general equilibrium effects.

[5] EU-SILC User Data Base (UDB) data, distributed by ESTAT, have been complemented with information from national SILC data in Austria, Czechia, Estonia, Greece, Italy, Lithuania, Luxembourg, Poland and Slovakia.

[6] Taxes and benefits that cannot be simulated because of lack of relevant information in the data are used as recorded in EU-SILC.

PUBLIC SECTOR ECONOMICS
47 (4) 521-554 (2023)

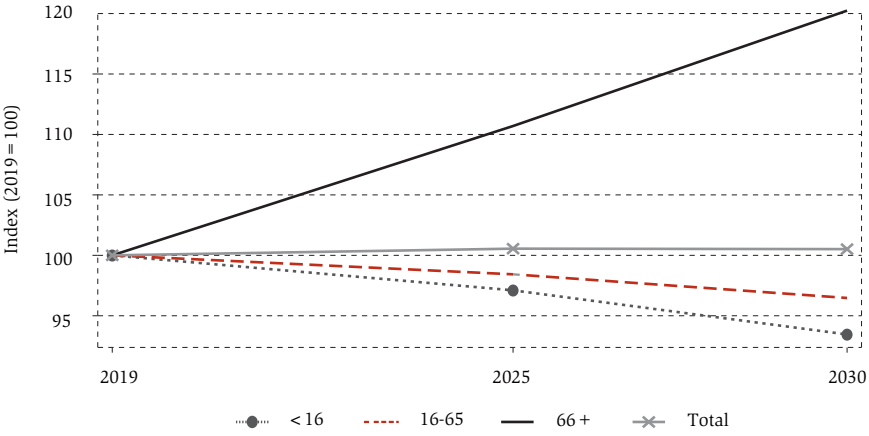
2.2 EUROSTAT POPULATION PROJECTIONS

The population projections by EUROSTAT provide estimates of future changes in the size and structure of the EU member states' populations. To produce the projections, EUROSTAT assumes increasing fertility rates, decreasing mortality rates and positive net migration in most countries in their baseline scenario (EUROPOP2019). For this study, we use the forecast data up to 2030 for a population in the age groups of 0-15 years, 16-40, 41-65 and 65+. No changes were made to the baseline population projections as a result of the COVID-19 pandemic.

Population projections data, summarized in table A1 in the appendix, show that the total EU-27 population will increase by 3 million between 2019 and 2030, when it will reach 449 million. Sixteen member states will experience an increase in the total population between 2019 and 2030, while 11 (Bulgaria, Croatia, Greece, Hungary, Italy, Lithuania, Latvia, Poland, Portugal, Romania and Slovakia) will experience a population reduction. In relative terms, Latvia will experience the largest reduction in the overall population (-11%), and Malta the largest increase (+19%).

Figure 1

Population projections by age groups in the EU-27, 2019-2030



Source: Authors' calculation using EUROSTAT data.

The projections also highlight that EU countries are expected to face population ageing in the coming decade, as highlighted in figure 1 for the EU as a whole. The number of over-65s will increase by 21% at the EU level by 2030, when this population subgroup will account for 22.8% of the total EU population.

However, ageing will affect EU countries differently (see figure A1 in the appendix), with Ireland and Luxembourg experiencing an increase in the number of over-65s close to 40%. Bulgaria will experience the smallest increase in the number of those over 65. In terms of population share, Italy is expected to have the highest share of over-65s by 2030 (25.1%, +3.7 p.p. compared to 2019); Ireland the smallest share (16%).

PUBLIC SECTOR ECONOMICS
47 (4) 521-554 (2023)

2.3 CEDEFOP SKILLS FORECAST

The core element of our approach to study the role of tax-benefit systems in view of future labour markets trends is the Cedefop Skills forecast (Cedefop, 2021).[7] It includes information on EU member states' current structure of occupations on the labour market and provides medium-term projections for skills' demand and supply, following changes in that structure. This analysis makes use of Cedefop Skills forecast data for the years 2019, 2025 to 2030. The scenario employed for the projection builds on data from a dedicated Cedefop Skills forecast scenario that investigates the impact the COVID-19 pandemic may have on medium-term skills' demand and supply. However, the analysis does not focus on the year 2020. This is because the extraordinary use of short-term work schemes and other discretionary policy measures widely used at the onset of the pandemic, cannot be captured appropriately by the reweighting procedure, and therefore results for 2020 would not be robust enough.

Cedefop's Skills forecast uses a modular approach, with specific modules for the demand for skills by sector of economic activity and occupations. The supply of skills (per level of educational attainment) is projected independently from the demand module.[8] The forecast is mainly built on data from EUROSTAT, national accounts and the EU labour force survey (LFS). The COVID-19 scenario built by Cedefop is based on statistical data available at the time of the modelling exercise (in most cases it includes data releases for the second quarter of 2020 from EUROSTAT and other national statistics). It also benefits from comments from country experts composing Cedefop's Skills forecast network. The assumptions reflected two lockdown waves and assumed that a vaccine would be available by mid-2021. The general assumptions are discussed in the appendix in more detail.

The forecasts produce mainly employment estimates, i.e., the number of employed workers in different sectors, occupations and countries. Occupations requiring high skills are considered those in ISCO 1-3. Medium-skilled occupations are considered those in ISCO 4-8, and low-skilled those in ISCO 9.

In Cedefop's projections, unemployment is not a direct product of the macroeconomic model but it is the residual between employment (labour demand) and the labour force (labour supply). Cedefop's Skills forecast network reviews the projections of both employment and the labour force. Following their recommendations, adjustments may be made, possibly affecting the levels of projected unemployment. In that context, it is important to know that Cedefop's estimates of employment refer to jobs rather than persons as it uses National Accounts data which offer a more complete picture of employment activity in a country than the Labour Force Survey. However, as the labour force counts persons, the approach tends to underestimate unemployment. In a second step, Cedefop employs historical data on LFS unemployment to adjust the unemployment estimates.

[7] See also https://www.cedefop.europa.eu/en/events-and-projects/projects/skills-forecast and https://www.cedefop.europa.eu/en/publications-and-resources/publications/4201.

[8] Forecasts are based on harmonized data and a single methodology (see Cedefop, 2012) to obtain comparable results across countries.

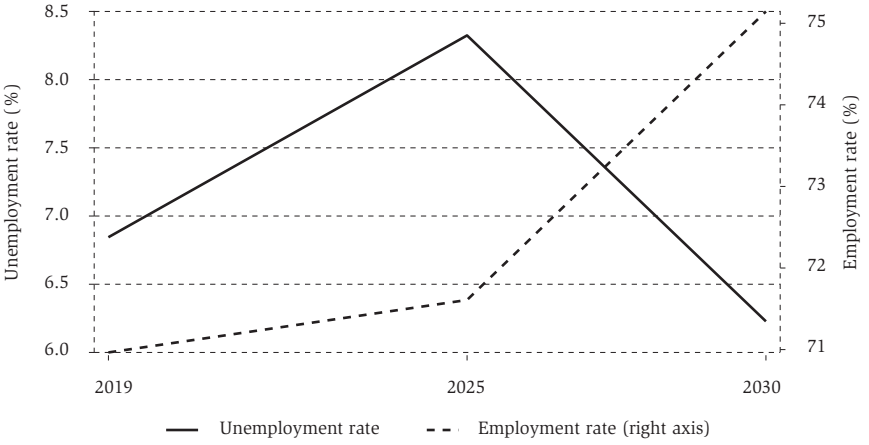
Nevertheless, the process implies that employment and unemployment in the Skills forecast data will not be necessarily equal to the labour force.

Looking at the Covid-19 pandemic, this has caused job opportunities to collapse towards zero during the initial decline of economic activity and employment. In subsequent years, once the immediate crisis subsides as expected, employment growth will recover, to some extent, leading to stronger job opportunities (due to a bounce-back effect) than were originally forecast. Over the whole forecast period (and not just the period of recovery after the initial negative impact), however, job opportunities are expected to remain below the level of the pre-Covid forecast. The Covid-19 pandemic, though presumed to be only of a transitory nature, will have lasting effects on job opportunities and thus employment over the entire forecast period.

As highlighted in figure 2, the Cedefop Skills forecast shows that the EU level unemployment rate is expected to increase in the post COVID-19 years. In 2025, the EU-wide unemployment rate is expected to be about 8.3% of the labour force, thus 1.5 p.p. higher than in 2019. However, after 2025 the unemployment rate is expected to fall to below the pre-COVID-19 level. Employment rates, defined as the number of jobs divided by the number of people of working-age (15-64), show an upward trend from about 71% to 75%, most of the increase happening after 2025. The projections for EU member states can be seen in figure A2 in the appendix.

Figure 2

Employment and unemployment projections in the EU-27, 2019-2030



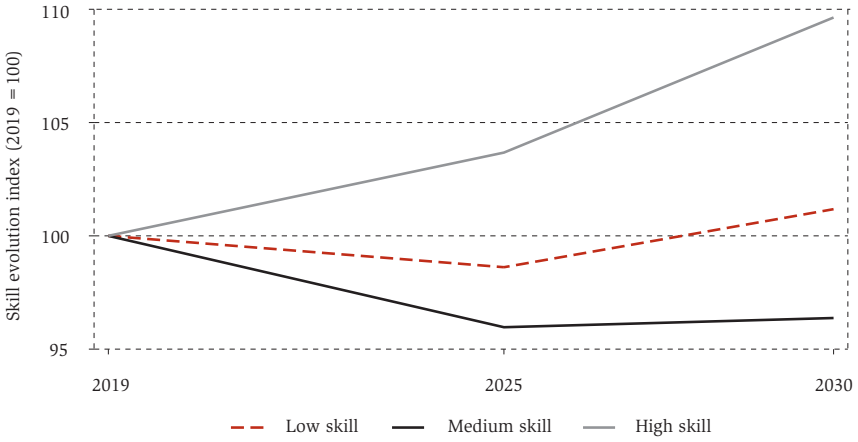
Source: Authors' calculation using Cedefop COVID-19 scenario data.

Both findings are mainly due to the decline of the working-age population, while the total number of jobs in the EU is forecast to stay stable over the 2019-2030 period (table A2 in the appendix). It is worth noting that the Cedefop forecast expects a substantial increase in labour market participation of people above 65.

As highlighted in figure 3, the number of high-skill jobs in the EU will rise by about 10% in the period 2019-2030. At the same time, the number of low-skill jobs is expected to increase by about 2% and the number of medium-skill jobs to fall by almost 4%. In terms of job shares, high-skill jobs will account for 43.4% of the total jobs in 2030, up from 40.5% in 2019. Medium-skill jobs will account for 47% (close to 50% in 2019), while 9.6% of the jobs will be low-skilled (9.7% in 2019) (table A2 in the appendix). The data hence show that despite their increase in number, the share of low-skill jobs in the EU will remain stable.

FIGURE 3

Skills forecast projections in the EU-27, 2019-2030



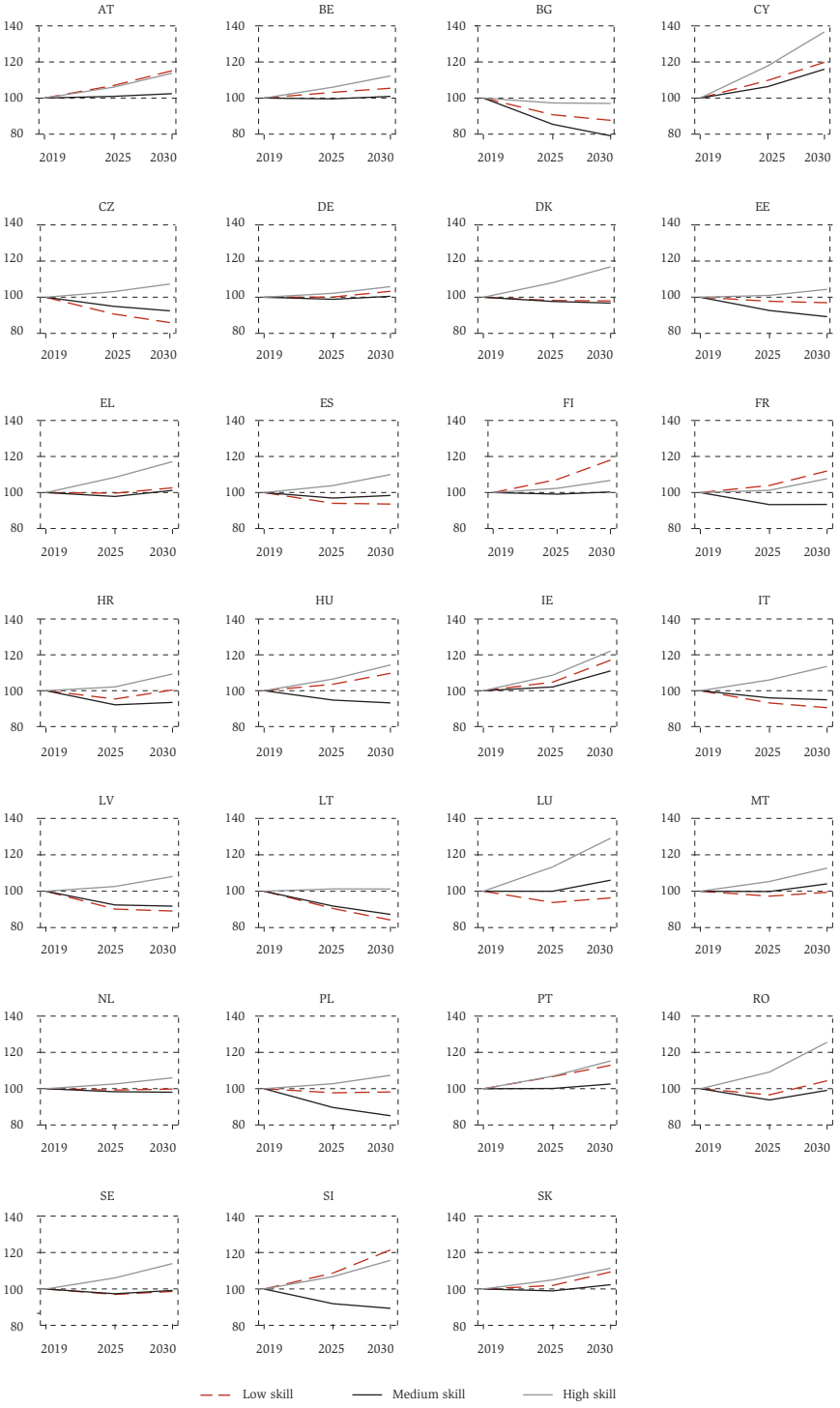
Source: Authors' calculation using Cedefop COVID-19 scenario data.

In terms of skill composition, figure 4 shows that three general patterns can be identified across EU member states. In most countries, high-skill jobs will experience the highest (or least negative) growth rate, followed by low-skill jobs and medium-skill jobs. In Austria, Finland, France and Slovenia low-skill jobs will grow the most, followed by high-skill jobs and medium-skill jobs. In eight countries – Czechia, Spain, Italy, Latvia, Lithuania, Luxembourg Malta and Sweden – high-skill jobs will grow the most, followed by medium-skill and low-skill jobs. It should be noted that the number of high-skill jobs is expected to increase in all member states, with the exception of Bulgaria. The exception can be explained with the fall in the total number of jobs (and employment rates) forecasted for this country. About half of the EU member states will experience a reduction in the absolute number of medium-skill jobs. Seven member states will experience a reduction in the number of low-skill jobs (see table A2 in the appendix for the share of each skill group out of the total jobs)[9].

[9] Please note that jobs in the armed forces are counted in the total number of jobs, but not in the skill classification.

FIGURE 4

Skill evolution index across EU member states, 2019-2030 (2019 = 100)



Source: Authors' calculation using Cedefop COVID-19 scenario data.

PUBLIC SECTOR ECONOMICS
47 (4) 521-554 (2023)

The evidence described suggests the existence of a job polarisation trend in the EU labour market, with larger increases in the number of high- and low-skill jobs compared with medium-skill occupations in all but eight countries. The growth in high-skill occupations tends to be more pronounced than is the case for low-skill occupations in most countries. Recent analysis sees job polarization being driven by rapid job growth at the bottom of the wage distribution (Cedefop and Eurofound, 2018), together with a drop in medium-skill physical or routine tasks (largely replaced by automation and technological changes), while social and intellectual high-skill tasks become more prevalent.

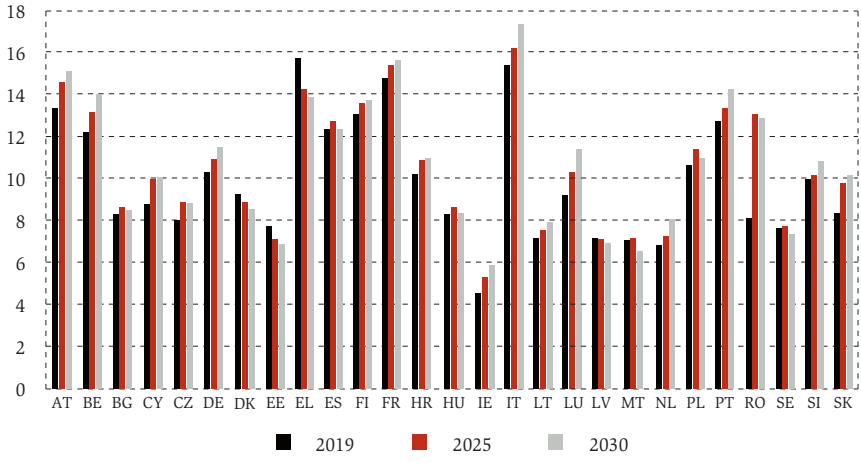
2.4 PENSION EXPENDITURE PROJECTIONS

Data on pension expenditure are based on the 2021 Ageing Report.[10] The data used refer to a scenario that takes into account the impact of the COVID-19 pandemic. Please note that the 2021 Ageing Report assumes the implementation of already legislated reforms (as per 2020), but no future reforms. This enables us to highlight the change in age-related expenditures if current policies remain unchanged.

Pension expenditure is expected to increase in most of the EU-27 member states. Figure 5 highlights the pension expenditure in percent of GDP in 2019, 2025 and 2030. Only a few member states, such as Denmark, Estonia, Greece, Latvia, Malta and Sweden are expected to have stable or decreasing pension expenditure.

FIGURE 5

Pension expenditure projections across EU member states, 2019-2030 (% of GDP)



Source: Economic Policy Committee (2020).

[10] See Economic Policy Committee (2020).

PUBLIC SECTOR ECONOMICS
47 (4) 521-554 (2023)

2.5 THE EMPIRICAL APPROACH

The Cedefop Skills forecasts, together with the EUROSTAT population projections (EUROPOP2019) and the pension expenditure forecast of the 2021 Ageing Report allow some inferences about the challenges that the EU tax-benefit systems will face in the medium term because of changing labour markets.

The empirical approach followed in this paper is based on reweighting, i.e. introducing changes in the population structure in the underlying survey data (in our case the EU-SILC data) such that the micro data mirror the expected macro trends. This methodology is often used to "nowcast" the survey data[11] (see, e.g., Leulescu et al., 2016), but also to estimate potential impacts of future changes in socio-economic characteristics of the population (see, e.g., Dolls et al., 2019). We analyse the impact of future changes in the labour market (understood as changes in the skills composition of labour markets), but also the impact of ageing populations and of the pension expenditure trend.

We focus on the budgetary and distributional effects elicited by these trends, once considered the role played by tax-benefit systems in the formation of household disposable incomes in the future scenarios. In particular, the tax-benefit systems of 2019 are applied to the future scenarios to analyse the budgetary and distributional outcomes (i.e. we assume no fiscal policy change). Note that by tax-benefit systems we mean personal income taxation, social security contributions, social benefits and pensions.

Following Pacifico (2014), the reweighting process can be described as follows: let us consider a survey of N individuals and K individual-level variables, such as income, gender, working status and age: $x_i = (x_{i,1}, x_{i,2},..., x_{i,K})$. The survey weight is defined as a vector $s = (s_1, s_2,..., s_N)$ of all individual weights; the estimated $1 \times K$ vector of survey totals is given by:

$$t = \sum_{i=1}^{N} s_i \times x_i \tag{1}$$

Since we are interested in changing our data so as to describe the future population rather than the actual surveyed population, we use the projected change of the surveyed variables in order to replace current weights by weights that will capture these changes for future years.

It is thus possible to compute a new vector of survey weights $w_i = (w_1, w_2,..., w_N)$ that is as close as possible to the original weights while meeting the following calibrating condition:

$$t_{new} = \sum_{i=1}^{N} w_i \times x_i \tag{2}$$

[11] "Nowcasting" means the forecasting of variables or indicators in current or recent times or in the very near future, as opposed to survey data which are usually available with a time lag.

where t_{new} is the $1 \times K$ vector of projected total values in the future for a given variable x. Let us assume that the distance between the original and the new weight follows a distance function $g(s_i, w_i)$, so that the new weights can be obtained by minimizing a Lagrangian function with respect to the new weights:

$$L = \sum_{i=1}^{N} g\left(s_i, w_i\right) + \sum_{k=1}^{K} \lambda_k \times \left(t_k - \sum_{i=1}^{N} w_i \times x_{i,k} \right) \tag{3}$$

where $\lambda = (\lambda_1, \lambda_2, ..., \lambda_K)'$ are the Lagrange multipliers. Clearly, the solution of the minimization problem depends on the properties of the chosen distance function. We use the chi-squared distance function, not only because it is one of the most popular choices in the applied literature, but also because the above minimization problem has an explicit solution that can be obtained immediately without an iterative procedure. For more information, see Pacifico (2014). Our approach follows the reweighting approach also used by Leulescu et al. (2020) and Leulescu (2016), who perform the reweighting not on an individual but on a household level.

Since we are interested in the future changes on the labour market, we reweight the EU-SILC data in such a way that it resembles the changes in terms of age composition, employment, unemployment, skill composition and pension expenditures.

This approach allows us to mimic a population that is not only similar to the target population in expected employment trends by skills, but also in terms of labour force, as well as in the total age structure and pension expenditure. In order to ensure internal consistency in EUROMOD simulations, the reweighting reflects the projected percent change for the specific groups as described above in sections 2.2 – 2.4 for Cedefop, EUROSTAT and European Commission data. We hence generate datasets that are in line with the projected structure of the population for the years 2019, 2025 and 2030. Please note that contrary to, e.g. Dolls et al. (2019), we do not account for any wage response to the projected change. Wages in the different skill groups are assumed to stay unchanged, even though the labour market composition changes. In addition, it should be mentioned that the analysis also takes account of changes in pension expenditure caused by the longer working lives, in line with the aggregated data from the EU 2021 Ageing Report.

3 RESULTS

The underlying assumptions characterise a future scenario characterised by:

- an ageing population, which increases pension expenditure
- an inverted U-shape trend in unemployment rates due to the impact of the COVID-19 pandemic
- an increase in employment rates and in the participation of older workers
- a potential further polarisation of the labour market.

PUBLIC SECTOR ECONOMICS
47 (4) 521-554 (2023)

The impact of these trends on tax revenues and income distribution cannot be determined a priori.

- on the one hand, the population over 65 would be net fiscal beneficiaries while working age individuals would be net contributors
- a negative impact of the demographic trend on government budgets can be expected
- on the other hand, the increase in high-skill jobs, could have a positive impact on tax revenues, although mitigated by the increase in the prevalence of low-skill jobs in several EU member states.

The consequences for income distribution (before and after direct taxes and social transfers) are equally difficult to predict. The following sub-section will try to shed light on these points.

3.1 FISCAL CONSEQUENCES OF CHANGING LABOUR MARKETS

This subsection examines in detail the fiscal consequences of the new projected labour markets resulting from the population ageing, employment/unemployment and skill composition changes described above. The results are presented for the 27 EU member states and for the EU-27 as a whole. Our micro-approach allows us to disentangle the impacts on three main fiscal aggregates, namely:

- personal income taxes and social insurance contributions (SIC) (please note that indirect taxes are not included in this analysis)
- government spending on pensions
- benefits received by households, including unemployment benefits, social assistance and family benefits.

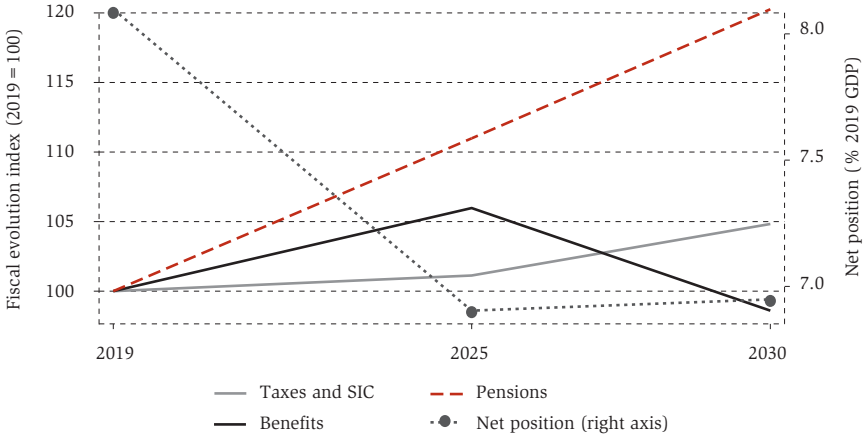
We also analyse changes in the net budgetary positions of governments with respect to households, defined as personal income taxes and SICs minus cash benefits and pensions. Positive values indicate that governments receive from families more in direct taxes and social insurance contributions than their disbursements on cash benefits and pensions. A government's net position with respect to households should not be confused with government deficit, as several revenue and expenditure items are not considered (e.g. revenues from corporate or indirect taxation, expenditure for public in-kind services such as health or education). In addition, the net government budgetary position is measured on a current basis, i.e. without considering possible arrears in taxes or benefits due.

Figure 6 reports the changes in the fiscal aggregates for the EU. The result follows from the aggregation over all 27 countries. Consistent with population ageing described in the previous section, pension expenditure is expected to raise by more than 20%. Revenues from taxes and social insurance contributions (SICs) are also predicted to increase by around 5%. The result is consistent with the favourable labour market developments forecast (increase in the employment rate). Expenditure in social benefits is expected to increase by about 5% in 2025, mainly because of the impact of COVID-19, but then decrease substantially until 2030.

PUBLIC SECTOR ECONOMICS
47 (4) 521-554 (2023)

FIGURE 6

Changes in fiscal aggregates in the EU-27, 2019-2030



Source: Authors' calculation using EUROMOD (version I2.0+).

Figure 6 also reports the development of the net position of EU governments with respect to households as defined above. It is expected to evolve from a value of 8.2% of GDP in 2019 to about 6.9% of 2019 EU GDP in 2030.

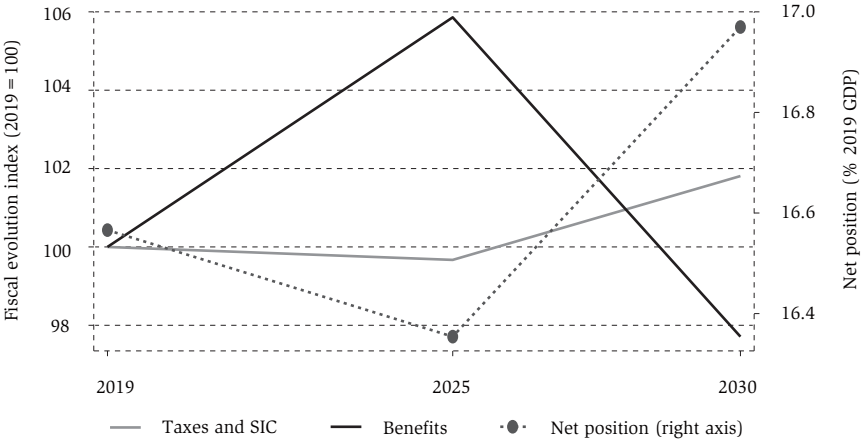
The results show that changes in these fiscal aggregates are strongly driven by population ageing, which is expected to lead to a strong increase in pension expenditures. In order to be able to leave aside the effect of population ageing, figure 7 reports the fiscal aggregates related only to the working age population, defined as individuals aged between 15 and 64 and not receiving pensions. Taxes and SIC are expected to stay stable between 2019 and 2025, but then increase by about 5% till 2030; social benefits are expected to first increase by about 6% in 2025 and then fall to a lower level than observed in 2019. The COVID-19 related increase in unemployment contributes substantially to the pattern observed.

Consequently, the net budgetary position of governments with respect to the working age population is expected to first drop slightly from 16.6% to 16.4% of 2019 EU GDP between 2019 and 2025, but then increase up to 17.0% of 2019 EU GDP by 2030. The finding confirms the importance of population ageing for the future of public finances of EU member states.

PUBLIC SECTOR ECONOMICS
47 (4) 521-554 (2023)

FIGURE 7

Changes in fiscal aggregates in the EU-27, working age individuals, 2019-2030



Source: Authors' calculation using EUROMOD (version I2.0+).

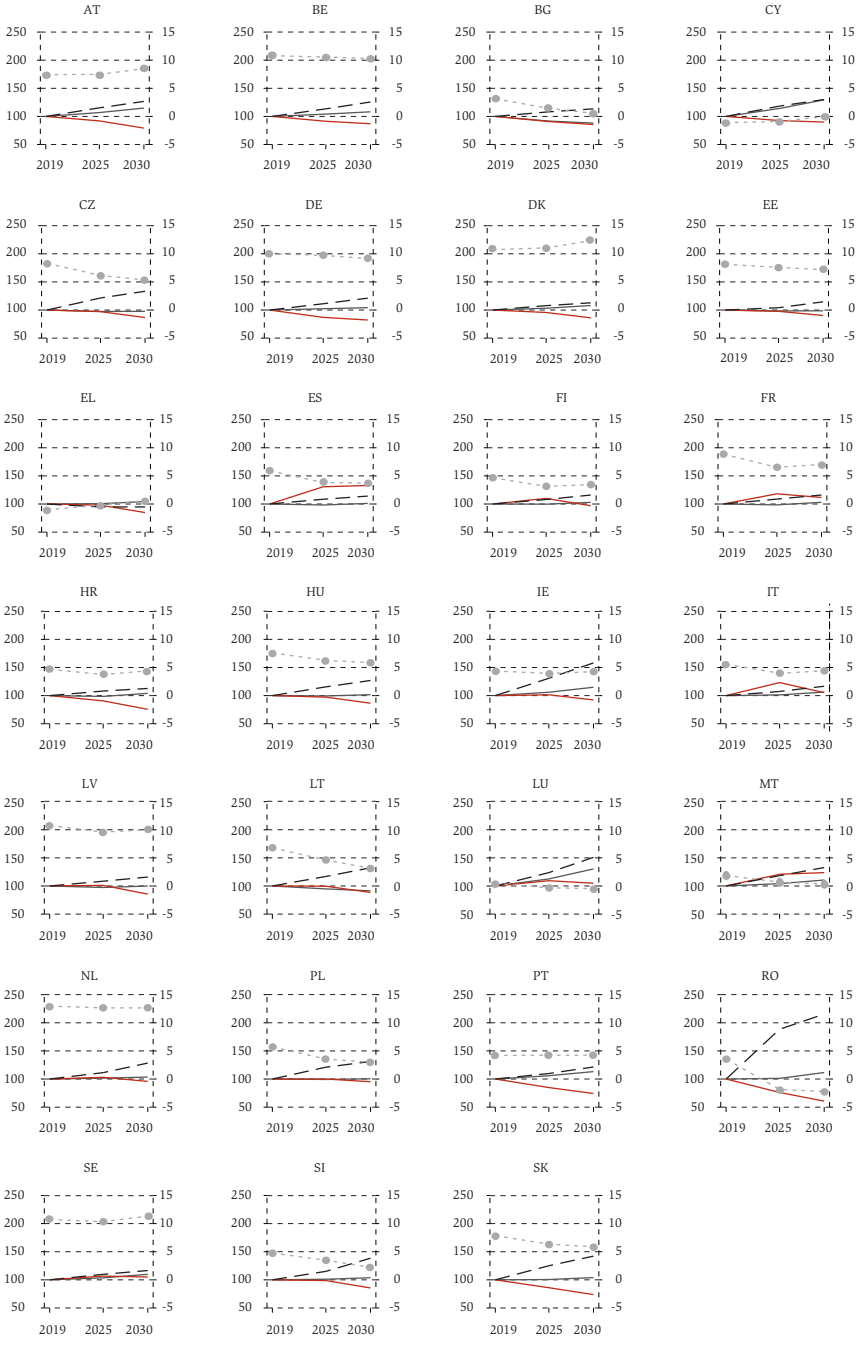
Figure 8 reports the fiscal aggregates for the entire population of each member state. Consistent with the population ageing described, pension expenditure is expected to increase in absolute terms in all EU member states, except for Greece. Several countries show an increase in pension expenditures above 50% in 2030 compared to 2019 values. The increase is especially high in Ireland, Luxembourg, Slovakia and Romania.

Direct taxes and SICs are expected to stay stable in most member states. Bulgaria and Lithuania, which are predicted to be affected by particularly non-favourable socio-demographic developments, and Czechia are expected to experience a reduction in revenues from direct taxes and SIC. Substantial increases in taxes and SICs can be observed in Austria, Cyprus, Luxembourg, Portugal and Romania over the years analysed.

Comparing 2019 and 2030, expenditure on social benefits is expected to decrease in most member states except for Spain, France, Italy, Malta and, to a lesser extent, Sweden. Increases in benefit expenditures are observed in several member states when 2025 is compared to 2019. Results are mostly driven by the unfavourable impact of COVID-19 on unemployment, in combination with potential increases in family benefits due to an increase in young cohorts in Malta and Luxembourg. Figure A2 in the appendix, reports fiscal aggregates for the active population. As expected, the government position for the active population is substantially higher than for the entire population and it shows a stable or improving pattern in most of the countries.

FIGURE 8

*Fiscal evolution index across EU member states, 2019-2030 (2019 = 100)**



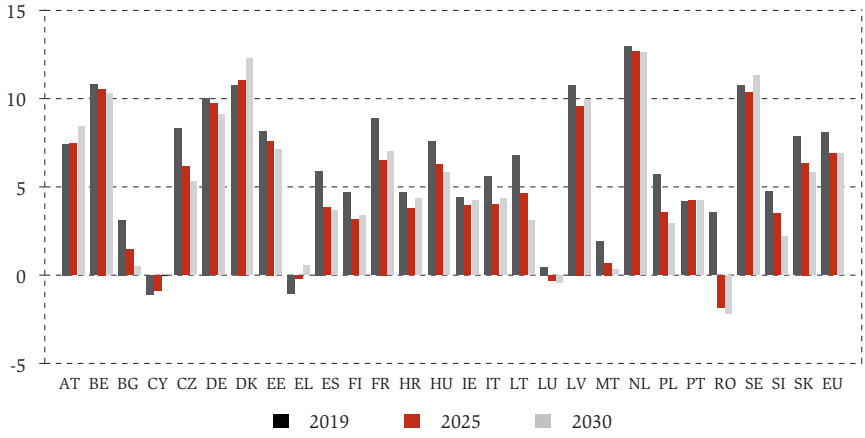
*Net positions for all countries (% 2019 GDP).

Source: Authors' calculation using EUROMOD (version I2.0+).

To facilitate comparison, figure 9 groups the net budgetary positions of the government with respect to households in each member state and in the EU as a whole. The data show that in 2019 all EU member states except Cyprus and Greece present a positive net position of the government with respect to households, meaning that direct taxes and SICs collected exceed government expenditure to households (cash benefits and pensions paid). The governments' net position in 2030 is forecast to be substantially lower than in 2019 in most EU member states (with exceptions, such as Greece, Austria, Denmark and Sweden), indicating that the expected population and labour market developments described in this report pose a significant threat to the government budgets. Our results show that governments' net positions are expected to deteriorate, and this trend is particularly significant in Eastern European countries, such as Romania, Czechia, Poland, Bulgaria, Slovenia, Slovakia and Hungary as well as in Lithuania, Spain and France.

FIGURE 9

Net positions of governments with respect to households, 2019-2030 (% 2019 GDP)



Source: Authors' calculation using EUROMOD (version I2.0+).

3.2 DISTRIBUTIONAL CONSEQUENCES OF CHANGING LABOUR MARKETS

This subsection examines in detail the distributional impact of the future changing labour markets and population ageing in EU member states and in the EU-27 as a whole. We use the results of the simulations to estimate the impact of the described macro trends on the At-risk-of-poverty (AROP) rate and income inequality indicators measured by the Gini coefficient. We also compute the redistribution index (Reynold-Smolensky Index) and the poverty reduction index to measure the redistributive power of tax-benefit systems. All these indicators on EU-level are based on population weights.

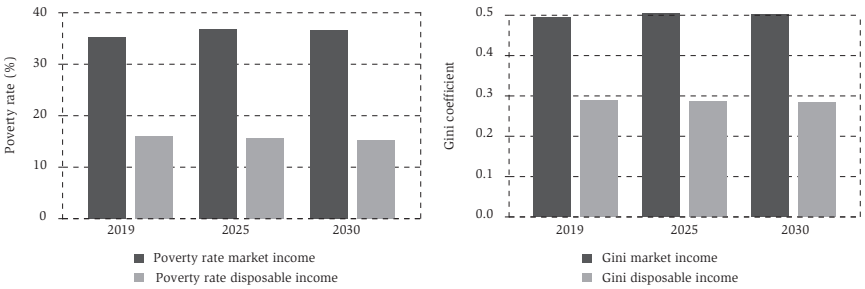
Figure 10 reports the EU average poverty rate and the Gini coefficient. The indicators are computed per country before applying population weights for each country. The EU-level poverty rate, if calculated on the basis of market income, increases from 35.2% to 36.6% between 2019 and 2030. The poverty rate on disposable income (thus including the effect of taxes and transfers) shows however a declining

trend, from 16.1% to 15.2%. Similarly, the Gini coefficient, if based on market income, increases in the EU-27, from a value close to 0.494 in 2019 to 0.502 in 2030; while based on disposable income, Gini shows a decline from 0.289 to 0.284.

These results indicate that while market incomes expected from the new future labour market situation would be slightly more unequally distributed and prone to poverty risks than the current one, EU member states' tax-benefit systems (as of 2019) seem to temper this trend.

Figure 10

At-risk-of-poverty (AROP) rates and Gini coefficients in the EU-27, 2019-2030



Source: Authors' calculation using EUROMOD (version I2.0+).

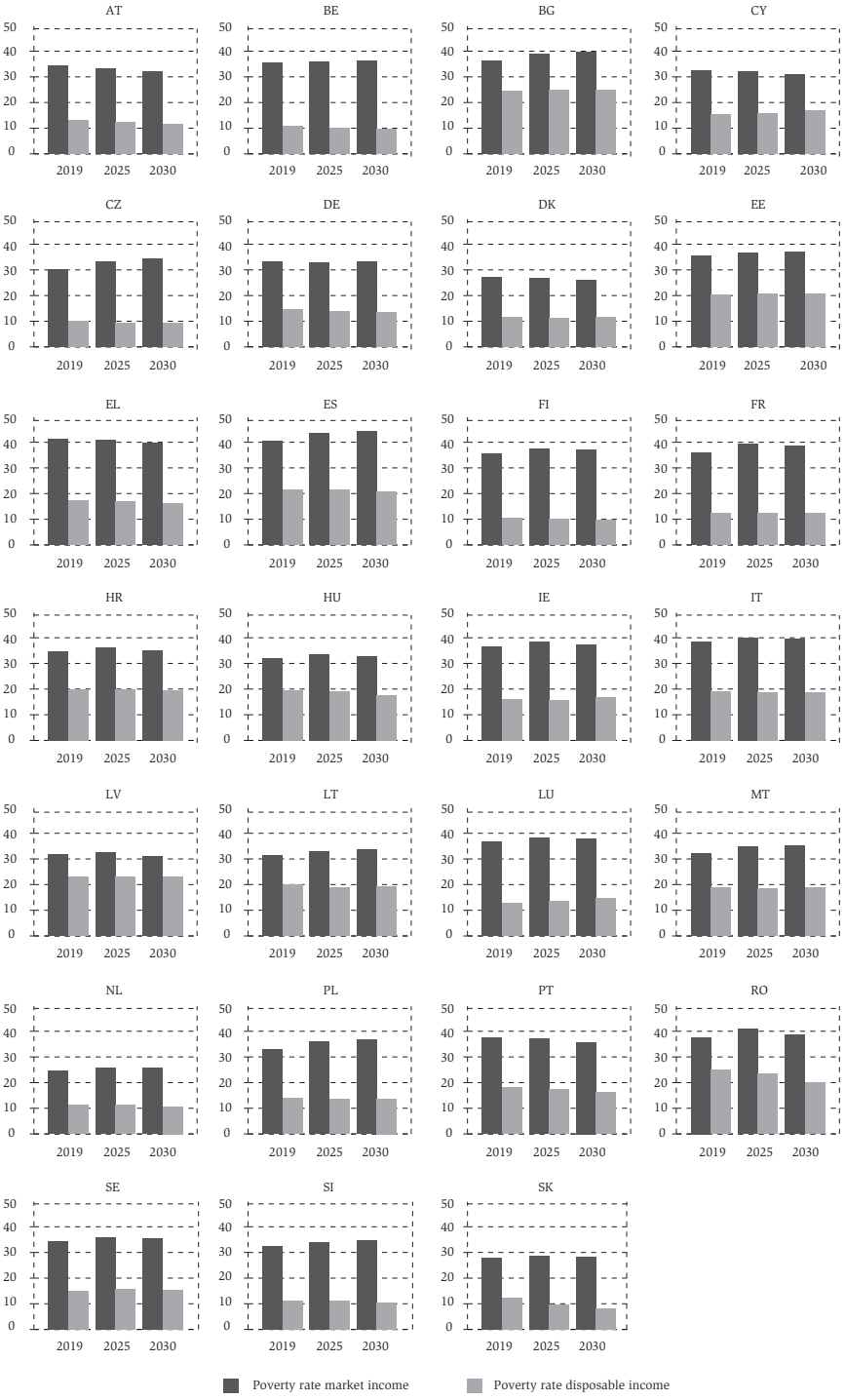
The Gini coefficient, reported in figure 12 for each member state, show consistent results: the change in the distribution of market income is heterogeneous. While the Gini coefficients on disposable income usually indicate either a stable or a more equal income distribution in 2030 than in 2019. In particular, Slovakia and Romania are expected to experience a reduction in Gini coefficients on disposable income above 1 percentage point. On the other hand, in Luxembourg, Malta and Cyprus we observe an increase in the Gini-coefficient of more than 0.5 percentage point.

Figure 11 reports poverty rates for EU member states. The consequences of the socio-demographic changes on market income based poverty rates are heterogeneous, with declining trends in some countries (e.g. Austria, Cyprus, Greece and Portugal), stable patterns in others (e.g. Latvia and Germany) and increasing trends in the rest of the member states (e.g. Belgium, France and Spain). Poverty rates based on disposable income, in contrast, show typically a stable or declining trend in most countries. Significant increases, above 1 p.p., can be only observed in Cyprus and Luxembourg.

The Gini coefficients, reported in figure 12 for each member state, show consistent results: the change in the distribution of market income is heterogeneous. While the Gini coefficient on disposable income usually indicates either a stable or a more equal income distribution in 2030 than in 2019. In particular, Slovakia and Romania are expected to experience a reduction in Gini coefficients on disposable income above 1 percentage point. On the other hand, in Luxembourg, Malta and Cyprus we observe an increase in the Gini coefficient of more than 0.5 percentage point.

FIGURE 11

At-risk-of-poverty (AROP) rate across member states, 2019-2030 (%)

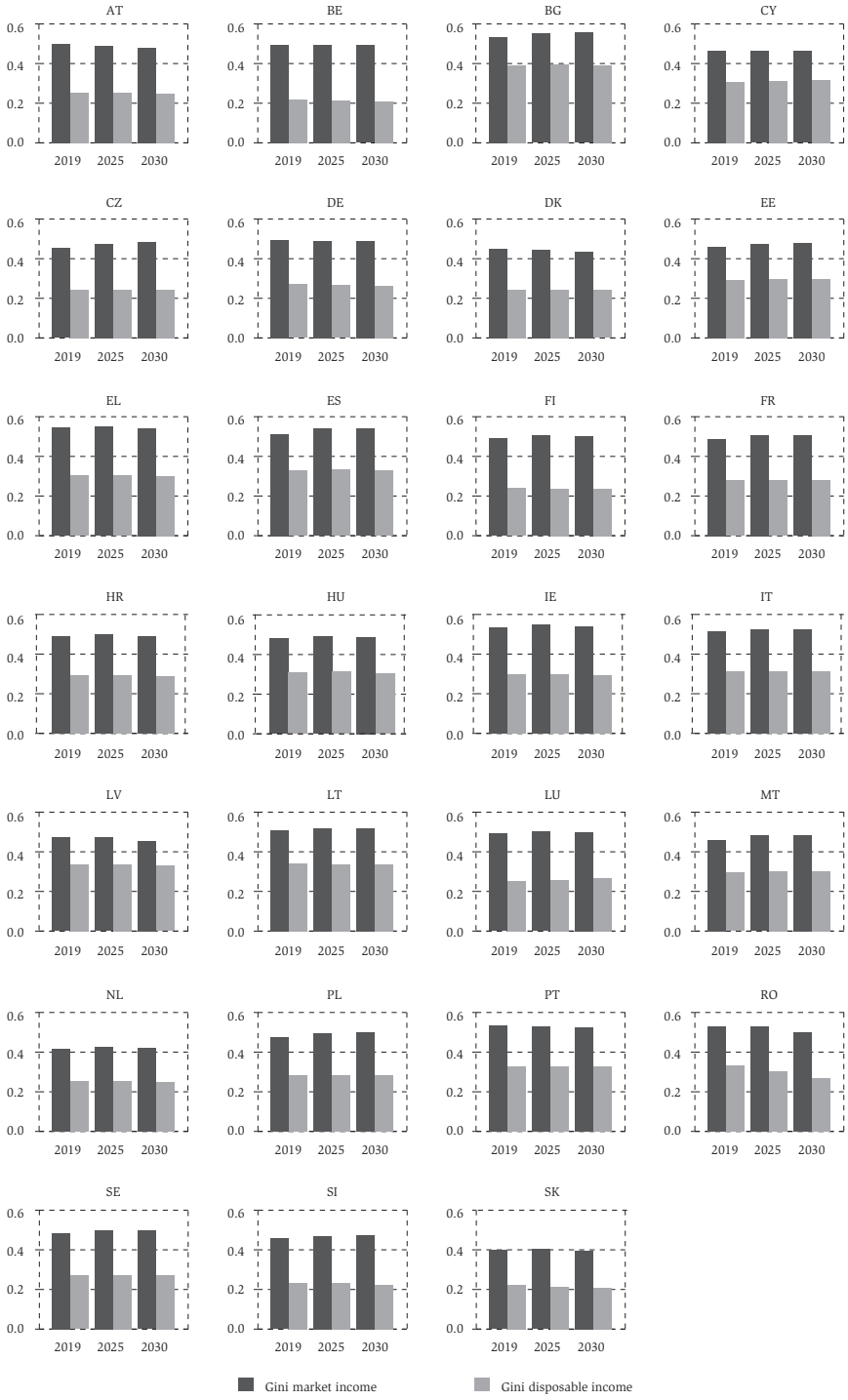


Source: Authors' calculation using EUROMOD (version I2.0+).

PUBLIC SECTOR ECONOMICS
47 (4) 521-554 (2023)

FIGURE 12

Gini coefficients across EU member states, 2019-2030



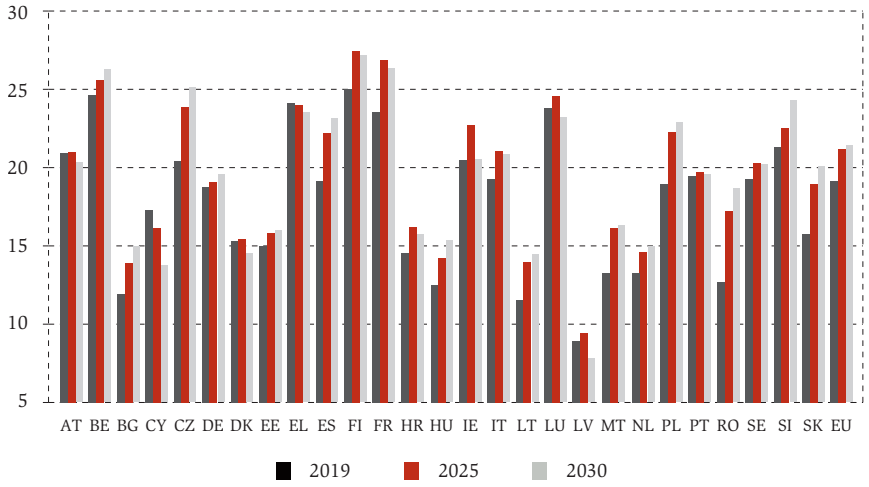
Source: Authors' calculation using EUROMOD (version I2.0+).

PUBLIC SECTOR ECONOMICS
47 (4) 521-554 (2023)

To assess the impact of the tax-benefit system on poverty risk and inequality, we look at the changes in standard indicators before and after government intervention (market income vs. disposable income). Figure 13 highlights the capacity of the tax-benefit systems of each EU member state to reduce poverty risks. The poverty reduction index is computed as the difference between the at-risk-of poverty rates related to market income and the at-risk-of poverty rates related to disposable income. We find that the tax-benefit systems (as of 2019, assuming no fiscal policy changes) absorb a substantial (and in most countries growing) part of the expected increase in poverty risk during the next years. This is due to the features of the tax-benefit systems, such as progressivity of taxes, means-tested benefits, complex interaction of the different elements of the systems, etc. Only Austria, Cyprus, Denmark, Greece and Latvia are expected to have a decrease in the poverty reducing property of their tax-benefit systems.

Figure 13

Poverty reduction index across EU member states, 2019-2030 (p.p.)



Source: Authors' calculation using EUROMOD (version I2.0+).

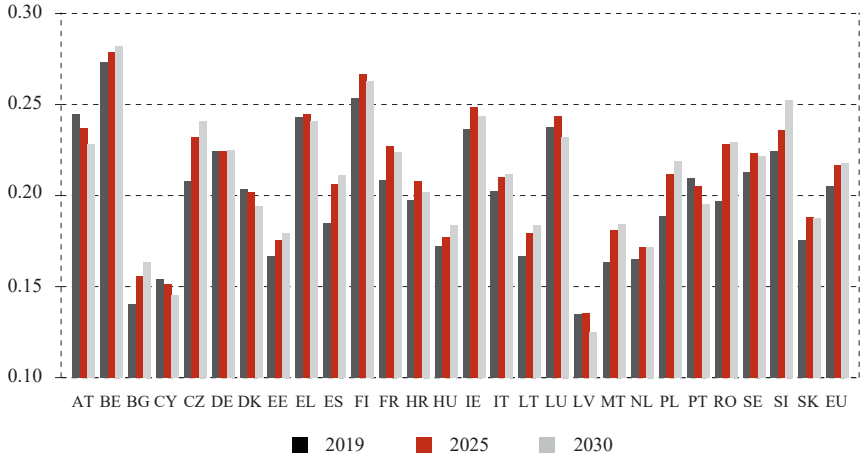
Figure 14 shows the capacity of tax benefit systems to reduce income inequality in the EU and in each member state. The Redistribution Index (a.k.a. Reynold-Smolensky Index) is defined as the difference between Gini coefficient on market income and Gini coefficient on disposable income. Like the poverty reduction index, the redistribution index highlights the strong and important impact of member states' tax-benefit systems in cushioning the inequality-increasing nature of future labour market and population developments. Except with respect to Austria, Cyprus, Denmark, Latvia and Portugal, our results suggest an increasing redistribution by the tax-benefit systems up to 2030.

While the country-specific results show a high degree of heterogeneity across member states, as a consequence of the different characteristics of the EU

tax-benefit systems, on average EU tax-benefit systems are expected to absorb more poverty and inequality in 2030 than they managed to absorb in 2019. These findings can be explained by the features of the tax-benefit systems, such as personal income tax progressivity and the presence of means-tested benefits. Overall, they show that the tax-benefit systems in the EU are generally more redistributive when market income is more unequally distributed.

Figure 14

Redistribution index across EU member states, 2019-2030



Source: Authors' calculation using EUROMOD (version I2.0+).

4 CONCLUSIONS

Future developments, such as job creation, population ageing, and changes in the skill composition of the labour force could in the next decade pose new challenges to the tax-benefit systems of the EU member states, which will need to guarantee their sustainability from a budgetary perspective and to ensure their effectiveness in fighting poverty and redistributing income. In this paper, we have used the microsimulation model EUROMOD to assess the fiscal and distributional consequences of socio-demographic projections by Cedefop, EUROSTAT and the Economic Policy Committee (2020). The use of a microsimulation model has several advantages over the macroeconomic approach which is traditionally used for this type of analysis. Microsimulation models account for the structure of the tax systems and the multiple interactions between tax and social benefits they embed. They also allow the impact of long-term trends to be assessed, both from a budgetary and from a redistributary perspective.

Overall, the data depict a scenario of an ageing population requiring increased expenditure on pensions, declining unemployment in the medium term, following a COVID-19 related peak, increasing employment rates (due to an increasing participation of older workers) and potentially polarising labour markets. The latter trend is dominated by a surge in the number of high-skill occupations. The

PUBLIC SECTOR ECONOMICS 47 (4) 521-554 (2023)

projections used in this study were published during 2020. However, the projected trends are in line with the available data in 2023. In particular, the EU population was around 448 million in January 2023, consistent with the projected value of 449 million in 2025, and the overall upward trend in employment rate for the period 2019-2022 is also in line with the projections used in the current study.[12]

Our microsimulation analysis indicates that macro-trends are expected to deteriorate the government net positions with respect to households in many EU member states. An increase in pension expenditures is expected to largely drive this finding, which holds valid despite government revenues from direct taxes and social insurance contributions are expected to increase in most countries. The finding is less clear cut when focusing on working age population only. In this case, the government net position with respect to households remains stable or improves in most EU member states.

The inverted U-shape trend in unemployment rates drives the changes in the expenditures in social benefits in most member states. In general, the labour market developments are expected to produce a more unequal distribution of market incomes and higher poverty risks (measured by the Gini index and at-risk-of-poverty rates on market incomes, respectively). However, the tax-benefit systems of most EU member states are expected to deliver more redistribution and better absorb the poverty risks (as suggested by the measurement of the same indicators on disposable incomes).

The results depicted in this paper provide novel evidence on the likely fiscal and distributional impact of long-term demographic and technological changes using microsimulation techniques. As the results are heavily dependent on the outcome of the reweighting algorithm, future work could involve the implementation of a bootstrap analysis to compute standard errors and evaluating the statistical significance of the findings. In addition, an assessment of the extent to which the COVID-19 pandemic has affected the longer term sustainability of the tax-benefit systems could be analysed by comparing pre-COVID-19 scenarios with the results of this paper.

When interpreting our results, one has to keep some caveats in mind. First, we are using a weighting approach, which means we cannot account for potential wage effects due to changing labour demand and supply. Wages in the different skill groups are assumed to stay unchanged, even though the labour market composition changes. In addition, we assume a no-policy change scenario, which means that we do not account for potential (and likely) policy interventions in the tax-benefit system of EU member states.

Disclosure statement

The authors have no potential conflict of interest to report.

[12] Data on population in 2023 and employment in 2022 were both retrieved in October 2023 from EUROSTAT database, online data codes tps00001 and lfsi_emp_a__custom_7829993.

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APPENDIX

CEDEFOP SKILLS FORECAST

To forecast the development in skills composition in the medium run, several assumption have been made. Especially the insecurity related to the COVID-19 crisis highlights the importance of carefully discuss this assumptions. The main scenario assumptions can be grouped as follows:

– **Assumptions about the lockdown,** including the nature of the lockdown restrictions, duration and any travel restrictions.

– **Assumptions on labour market participation:** The EU-LFS data for the latest quarter (2020Q2) of labour market participation rates was used to assess labour market participation rates by age group and gender for 2020, and the forecast for future years also considered these changes. As well as the assumptions on the impact of decreased demand on member state economies, the modelling includes some supply constraints. Short-time work schemes, absences, and temporary lay-offs are expected to lead to constraints in the sectors' capacity to produce output, even if there is demand for the goods produced. To inform these assumptions, we have adjusted the 2020 average hours worked per week by the change observed in the first two quarters of 2020.

– **Assumptions regarding changes in aggregate demand, including impacts on consumer expenditure, investment and trade:** The latest statistical information for 2020 was used to inform the assumptions on changes in consumer expenditure, investment and trade. The data was used to estimate the size of the overall shock in 2020 for these indicators, as well as which economic sectors, consumer and trade goods and services were the most affected. These estimates were supplemented by qualitative information gathered regarding lockdown rules and other restrictions. For consumption expenditure, the goods most affected were expenditure on services and durable goods, with small changes assumed in the expenditure on some medical goods, rent and utilities. Regarding investment, most sectors were impacted in the first half of 2020, and in the modelling the shock to investment covered all sectors with the exception of public sectors (e.g. Health). A similar approach has been implemented for the trade assumptions. For 2021, it was assumed that the changes in demand (i.e. consumer expenditure, trade and investment) would be roughly half of those in 2020, with some of the government support measures still continuing. By the end of 2021, most short-term impacts of COVID-19 are expected to fade, although some longer-term consequences, such as degradation of skills, loss of investment capital, permanent closure of businesses, are expected to linger up to 2030 and perhaps beyond.

– **Government response measures, including working arrangements, fiscal support measures and any additional final expenditure measures:** Furthermore, information on government support measures such as different working arrangements and furlough schemes were used to assess the impact

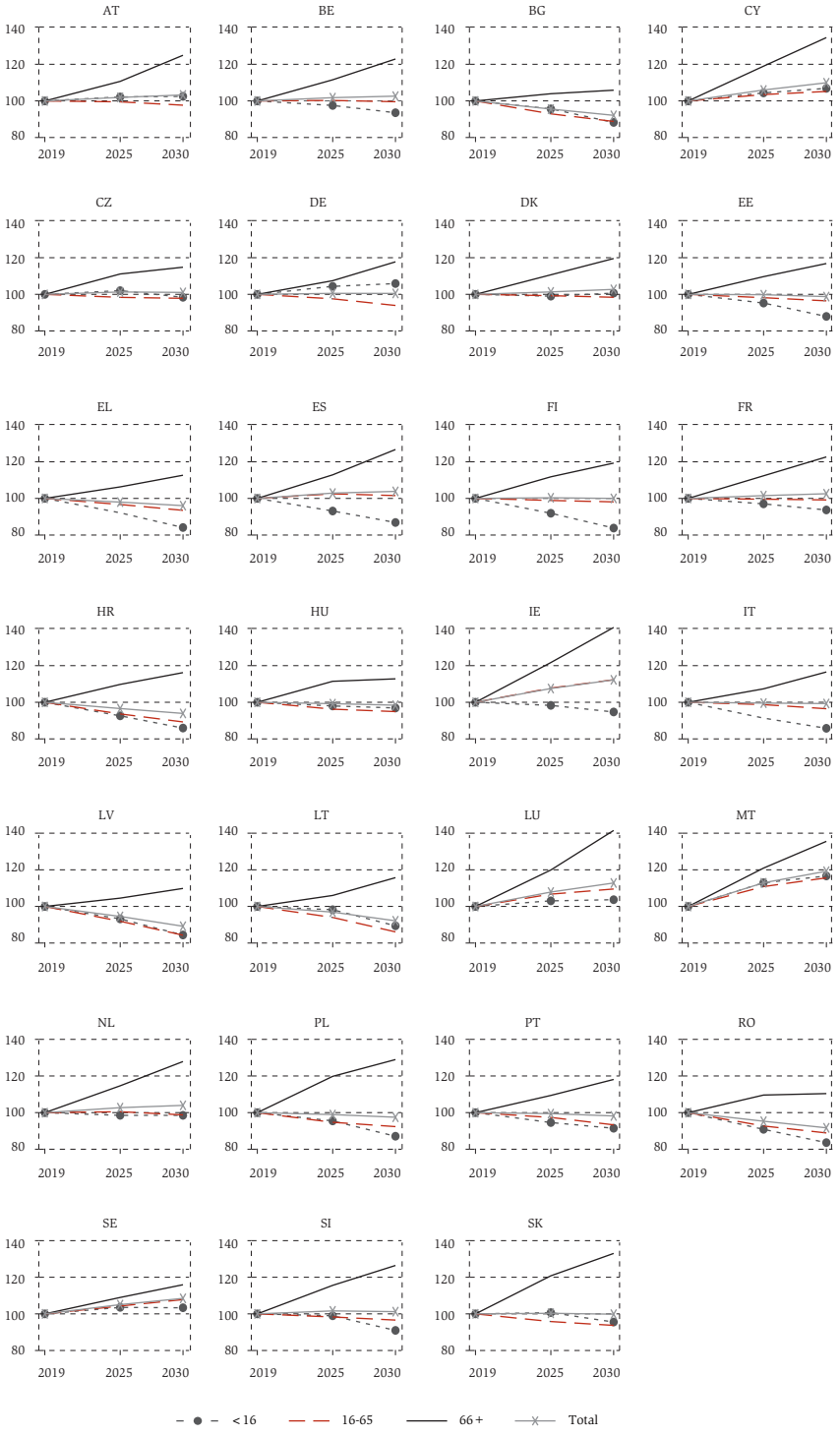
PUBLIC SECTOR ECONOMICS
47 (4) 521-554 (2023)

on wages and employment. Because of the implementation of furlough schemes across some member states, any decrease in average wages was restricted in the modelling exercise to a maximum amount below baseline levels. Information on other working arrangements was used to assess whether the employment impacts resulting from the loss of economic activity are of reasonable scale. Further adjustments were made to the initial changes in employment (e.g. to limit the loss of employment resulting from the loss of production) where different working arrangements were in place. Additional government final expenditure was also included in the assumptions, reflecting support schemes that have been implemented or announced.

It is also important to note that the preliminary results based on the above assumptions have been reviewed by country experts and this process has led to specific regional and sectoral adjustment of assumptions to reflect those comments.

FIGURE A1

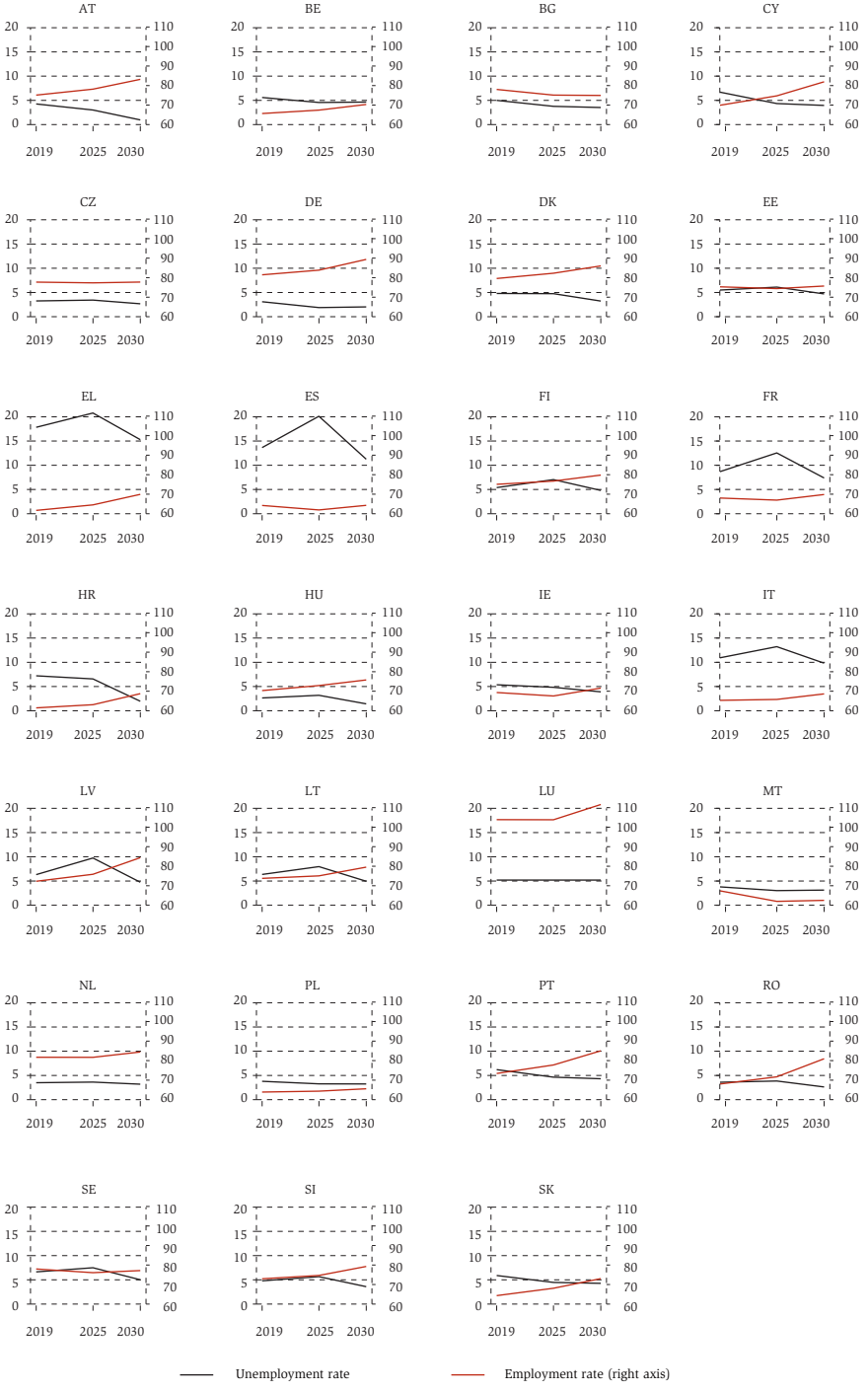
Demographic projections across EU member states, 2019-2030 (2019 = 100)



Source: Authors' calculation using ESTAT data.

FIGURE A2

Employment rate (right hand scale) and unamployment rate (left hand scale) projections (in %) accross EU member states, 2019-2030

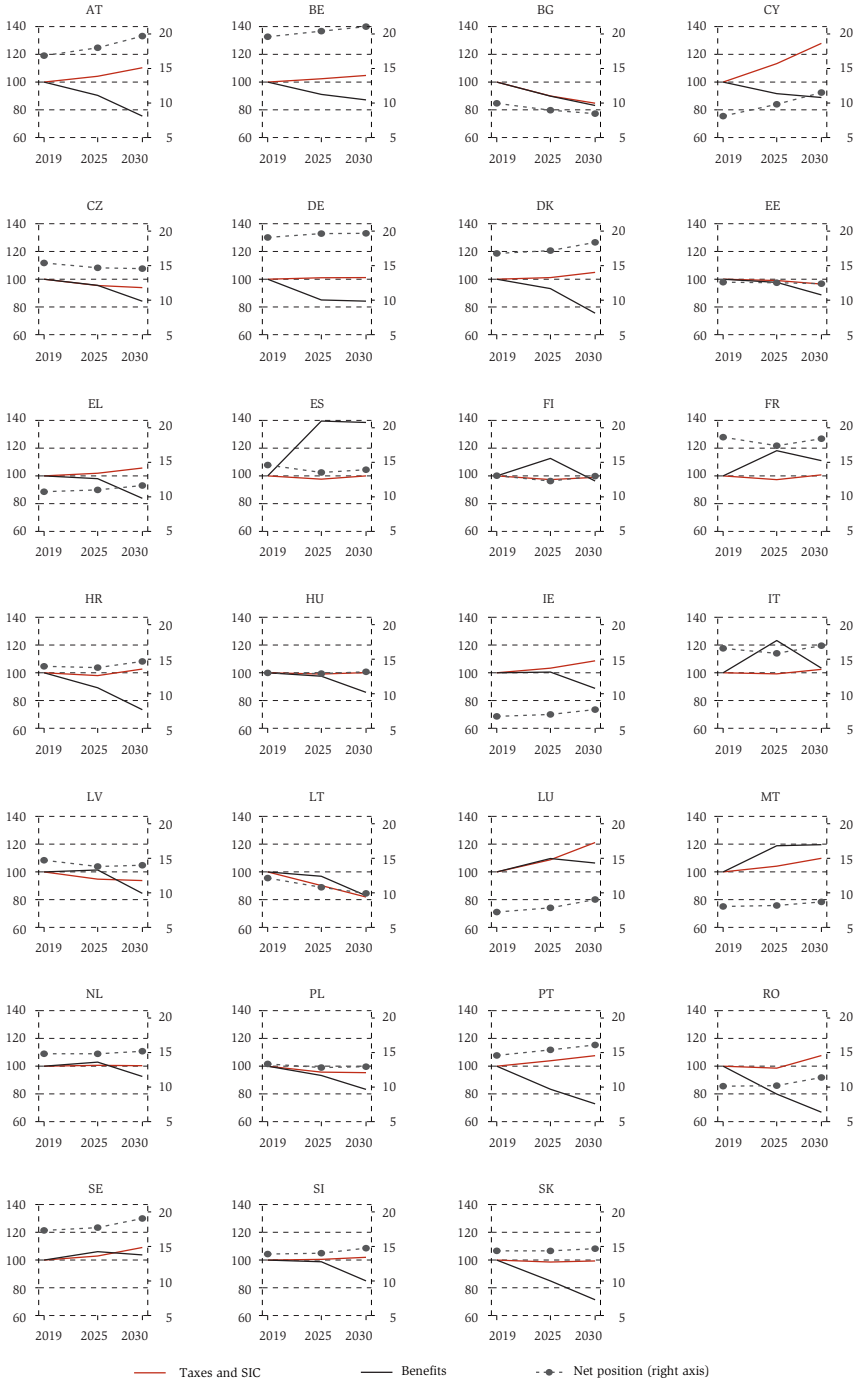


Source: Authors' calculation using Cedefop data.

PUBLIC SECTOR ECONOMICS
47 (4) 521-554 (2023)

FIGURE A3

*Fiscal evolution index and net position across EU member states, working age individuals, 2019-2030**



** Fiscal evolution index (left hand scale, 2019 = 100), net position (right hand scale, % 2019 GDP).*

Source: Authors' calculation using EUROMOD (version I2.0+).

Table A1

Population projections, years 2019-2030 (in %)

	Age group	Year 2019	Year 2025	Year 2030		Age group	Year 2019	Year 2025	Year 2030
AT	<16	15.4	15.4	15.3	IE	<16	21.9	20.0	18.4
	16-65	66.8	65.3	63.2		16-65	65.0	65.1	65.0
	66+	17.8	19.3	21.5		66+	13.2	14.9	16.5
	Pop (mil)	8.86	9.03	9.15		Pop (mil)	4.90	5.27	5.50
BE	<16	18.0	17.3	16.4	IT	<16	14.1	13.0	12.2
	16-65	64.2	63.3	62.3		16-65	64.2	63.7	62.4
	66+	17.8	19.5	21.3		66+	21.7	23.4	25.4
	Pop (mil)	11.46	11.66	11.76		Pop (mil)	60.36	60.09	59.94
BG	<16	15.2	15.3	14.6	LT	<16	16.0	16.2	15.5
	16-65	64.8	63.0	62.4		16-65	65.3	63.4	61.0
	66+	20.0	21.7	23.0		66+	18.7	20.4	23.4
	Pop (mil)	7.00	6.69	6.45		Pop (mil)	2.79	2.71	2.58
CY	<16	17.2	16.9	16.7	LU	<16	17.1	16.3	15.7
	16-65	67.8	66.2	64.9		16-65	69.5	68.7	67.4
	66+	15.1	16.9	18.5		66+	13.4	14.9	16.8
	Pop (mil)	0.88	0.93	0.96		Pop (mil)	0.61	0.66	0.69
CZ	<16	16.8	16.9	16.3	LV	<16	16.9	16.6	16.0
	16-65	64.9	63.0	62.9		16-65	64.0	62.3	60.5
	66+	18.3	20.1	20.8		66+	19.1	21.1	23.5
	Pop (mil)	10.65	10.79	10.76		Pop (mil)	1.92	1.82	1.71
DE	<16	14.5	15.1	15.3	MT	<16	14.5	14.6	14.2
	16-65	65.1	63.2	60.9		16-65	67.9	66.7	65.8
	66+	20.3	21.7	23.8		66+	17.5	18.8	19.9
	Pop (mil)	83.02	83.48	83.45		Pop (mil)	0.49	0.56	0.59
DK	<16	17.7	17.2	17.3	NL	<16	17.0	16.3	16.1
	16-65	63.9	62.6	61.2		16-65	65.0	63.6	61.7
	66+	18.4	20.1	21.5		66+	18.0	20.1	22.1
	Pop (mil)	5.81	5.88	5.96		Pop (mil)	17.28	17.75	17.97
EE	<16	17.4	16.6	15.5	PL	<16	16.3	15.7	14.5
	16-65	64.1	63.0	62.6		16-65	67.4	64.6	63.9
	66+	18.6	20.4	22.0		66+	16.3	19.7	21.6
	Pop (mil)	1.32	1.32	1.31		Pop (mil)	37.97	37.57	37.02
EL	<16	15.3	14.4	13.4	PT	<16	14.7	14.0	13.7
	16-65	63.8	62.9	62.1		16-65	64.6	63.3	61.5
	66+	20.9	22.7	24.5		66+	20.6	22.7	24.8
	Pop (mil)	10.72	10.51	10.30		Pop (mil)	10.28	10.22	10.09
ES	<16	15.8	14.3	13.2	RO	<16	16.7	16.0	15.3
	16-65	65.9	65.6	64.4		16-65	66.0	64.2	64.0
	66+	18.3	20.1	22.4		66+	17.3	19.9	20.8
	Pop (mil)	46.94	48.31	48.75		Pop (mil)	19.41	18.51	17.81
FI	<16	17.1	15.6	14.3	SE	<16	18.9	18.6	18.0
	16-65	62.4	61.5	61.2		16-65	62.3	61.8	61.9
	66+	20.5	22.9	24.5		66+	18.8	19.5	20.1
	Pop (mil)	5.52	5.54	5.52		Pop (mil)	10.23	10.75	11.10

	Age group	Year 2019	2025	2030		Age group	Year 2019	2025	2030
FR	<16	19.2	18.4	17.6	SI	<16	15.9	15.5	14.3
	16-65	61.9	60.7	59.8		16-65	65.6	63.5	62.6
	66+	18.9	20.9	22.6		66+	18.5	21.0	23.1
	Pop (mil)	67.01	68.04	68.75		Pop (mil)	2.08	2.11	2.11
HR	<16	15.4	14.7	14.1	SK	<16	16.7	16.8	16.0
	16-65	65.4	63.5	62.2		16-65	68.5	65.5	64.3
	66+	19.2	21.8	23.7		66+	14.8	17.8	19.7
	Pop (mil)	4.08	3.94	3.83		Pop (mil)	5.45	5.47	5.44
HU	<16	15.5	15.3	15.3	EU	<16	16.2	15.6	15.1
	16-65	66.6	64.5	64.2		16-65	64.7	63.4	62.1
	66+	17.9	20.1	20.5		66+	19.1	21.0	22.8
	Pop (mil)	9.77	9.70	9.62		Pop (mil)	446.82	449.30	449.12

Source: Authors' calculation using EUROSTAT data.

Table A2
Skill and total jobs projections, years 2019-2030 (in %)

	Skill group	Year 2019	2025	2030		Skill group	Year 2019	2025	2030
AT	High	41.2	42.2	43.4	IE	High	41.6	43.0	43.7
	Medium	50.5	49.2	47.8		Medium	50.0	48.6	47.8
	Low	8.3	8.5	8.8		Low	8.4	8.4	8.5
	Total jobs (mil)	4.45	4.61	4.81		Total jobs (mil)	2.21	2.32	2.56
BE	High	47.3	48.7	49.7	IT	High	36.6	39.0	41.0
	Medium	42.1	40.7	39.8		Medium	51.9	50.2	48.7
	Low	10.6	10.6	10.5		Low	11.5	10.8	10.2
	Total jobs (mil)	4.83	4.97	5.15		Total jobs (mil)	25.32	25.17	25.66
BG	High	28.9	31.4	32.8	LT	High	41.8	44.3	45.6
	Medium	58.7	56.0	54.4		Medium	49.0	47.1	46.1
	Low	12.4	12.6	12.8		Low	9.1	8.6	8.3
	Total jobs (mil)	3.54	3.17	3.02		Total jobs (mil)	1.35	1.29	1.25
CY	High	35.0	37.2	38.7	LU	High	54.6	58.0	59.9
	Medium	49.1	47.1	46.0		Medium	35.5	33.3	32.0
	Low	15.8	15.7	15.3		Low	9.9	8.7	8.1
	Total jobs (mil)	0.42	0.46	0.51		Total jobs (mil)	0.44	0.47	0.52
CZ	High	38.2	40.3	42.0	LV	High	42.2	44.9	46.4
	Medium	56.6	54.9	53.5		Medium	44.8	42.9	41.8
	Low	5.1	4.8	4.5		Low	13.0	12.1	11.8
	Total jobs (mil)	5.37	5.26	5.26		Total jobs (mil)	0.89	0.86	0.87
DE	High	44.7	45.5	45.9	MT	High	44.2	45.6	46.3
	Medium	47.2	46.5	46.0		Medium	46.7	45.6	45.2
	Low	8.1	8.1	8.1		Low	9.2	8.7	8.5
	Total jobs (mil)	44.07	44.25	45.41		Total jobs (mil)	0.23	0.23	0.24
DK	High	47.7	50.2	52.4	NL	High	47.9	49.0	49.8
	Medium	41.7	39.7	37.9		Medium	43.0	42.1	41.4
	Low	10.6	10.1	9.7		Low	9.0	8.9	8.8
	Total jobs (mil)	2.95	3.03	3.14		Total jobs (mil)	9.18	9.22	9.37
EE	High	46.3	48.3	49.9	PL	High	39.4	42.5	44.6
	Medium	44.6	42.6	41.1		Medium	52.8	49.6	47.4
	Low	9.0	9.1	9.0		Low	7.7	7.9	8.0
	Total jobs (mil)	0.64	0.62	0.62		Total jobs (mil)	16.37	15.61	15.51
EL	High	29.5	31.6	32.6	PT	High	34.8	36.0	37.1
	Medium	62.6	60.6	59.8		Medium	54.2	52.6	51.4
	Low	7.9	7.8	7.6		Low	11.1	11.4	11.5
	Total jobs (mil)	4.22	4.27	4.47		Total jobs (mil)	4.88	5.03	5.27

	Skill group	Year 2019	2025	2030		Skill group	Year 2019	2025	2030
ES	High	34.3	36.0	37.1	RO	High	23.9	26.7	28.4
	Medium	52.1	51.1	50.4		Medium	66.6	64.0	62.3
	Low	13.6	12.9	12.5		Low	9.4	9.3	9.3
	Total jobs (mil)	19.87	19.65	20.20		Total jobs (mil)	8.72	8.52	9.22
FI	High	46.0	46.6	47.1	SE	High	51.5	53.7	55.0
	Medium	47.4	46.5	45.6		Medium	43.6	41.7	40.5
	Low	6.5	6.9	7.4		Low	4.9	4.6	4.5
	Total jobs (mil)	2.59	2.61	2.70		Total jobs (mil)	4.97	5.06	5.30
FR	High	45.8	47.2	48.3	SI	High	46.5	49.4	51.3
	Medium	43.5	41.4	39.8		Medium	43.6	39.9	37.2
	Low	10.8	11.4	11.8		Low	9.9	10.7	11.4
	Total jobs (mil)	28.21	27.65	28.72		Total jobs (mil)	1.00	1.00	1.05
HR	High	38.0	40.4	41.6	SK	High	33.2	34.4	34.9
	Medium	54.5	52.2	50.9		Medium	58.1	56.8	56.1
	Low	7.5	7.4	7.5		Low	8.8	8.8	9.0
	Total jobs (mil)	1.64	1.58	1.64		Total jobs (mil)	2.40	2.44	2.56
HU	High	36.1	38.5	40.2	EU	High	40.5	42.2	43.4
	Medium	53.2	50.4	48.3		Medium	49.9	48.2	47.0
	Low	10.7	11.1	11.5		Low	9.7	9.6	9.6
	Total jobs (mil)	4.58	4.57	4.68		Total jobs (mil)	205.31	203.92	209.73

Source: Authors' calculation using Cedefop data.

Emerging European economies after the pandemic: stuck in the middle income trap?

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PUBLIC SECTOR ECONOMICS
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Written by an international team of authors, this book about economies before, during and after the Covid pandemic in emerging European economies (EEEs), based on detailed data analysis, gives us a comprehensive picture of global pandemic impacts. It provides an overview of macroeconomic, social, and fiscal policy responses in the economies observed from the Global Financial Crisis (GFC) to Covid and post-pandemic challenges. Numerous chapters cover the pre-transitional and the transitional period, which, although expanding the analysis, also pushes the focus away from what is important – the Covid crisis impacts.

The phrase middle income trap (MIT), coined by the World Bank, signifies the inability of EEEs to raise their incomes, mostly after the transition period in the 1990s. Countries observed in this book, the former transitional economies of Bulgaria, Croatia, Czechia, Hungary, Poland, Romania, Slovakia, and Slovenia, can be characterized as EEEs. They have been part of the European Union (EU), but can still be seen to be lagging behind the most developed EU countries. They are often given as examples of countries positioned in the MIT due to the economic transition; however, according to economic growth and income levels, there is no evidence for this hypothesis. Although the title suggests that the backbone of the book will be MIT, it is not emphasized in some of the chapters in which the topic is discussed but slightly.

The book is the result of international cooperation, with twelve chapters, written by different authors, which gives it sufficient strength and importance. The topic is very useful for macroeconomists, but also for political scientists and historians. To single out shortcomings, the writing style is uneven as the result of several authors. For some, the focus is on the transition, while some are mostly concerned with the crisis of 2008 and sporadically mention the pandemic.

Chapter 1 written by Péter Benczúr and István Kónya on *Convergence to the Centre* focuses on the main macroeconomic developments in the observed countries. The analyzed period includes a wider perspective than that of the pandemic, and can be divided into three periods: the first, post-transition, until 2008; the second, from the global economic crisis of 2008 to 2019, and the third since 2019 and the onset of the pandemic. In addition to giving standard indicators of economic progress such as GDP, unemployment, and employment rates, the authors provide a broader picture and use more comprehensive indicators that indirectly affect economic progress. According to average years of schooling, the EEEs are relatively well educated, but still lagging behind Austria in life expectancy, with the gap larger than it was in the 1990s. During the period 2009-2012, household consumption growth declined (but less than investment) causing EEEs to be more export-oriented. Although its purpose and effectiveness are often questioned, EU financial support did contribute to GDP growth. By the mid-2010s EU funds amounted to 2-4% of EEEs GDP. The Covid pandemic led to a huge decline in economic activity, especially in Croatia and Hungary. The impact on GDP growth during the Covid crisis was similar to the 2008-2012 crisis in all countries except Poland

PUBLIC SECTOR ECONOMICS
47 (4) 555-560 (2023)

where GDP fell significantly during the pandemic. Both crises caused short-run disruptions in international trade, unlike the different causes. The global recession caused demand to decrease, while international trade was partially suspended during the pandemic to stop the spread of the virus.

Chapter 2 written by Katalin Mérő and András Bethlendi entitled *Financial Markets: Banks and Capital Markets* analyzes the EEEs' financial markets, claiming that although these countries are highly integrated into the EU financial system, they are still lagging behind the more developed EU countries. There are huge differences between the GFC and Covid-induced shock – in the former, the financial system was mostly blamed for the crisis, and in the latter regulations established in the previous crisis provided financial stability. Covid changed the EEEs' financial systems mostly in terms of regulations and introduced different kinds of public (legislative) and private (non-legislative) moratoria.

Chapter 3, whose authors are István János Tóth and Éva Palócz, on *Firm Size, Productivity, EU Funds, and Corruption*, emphases the increased risk of corruption caused by the Covid pandemic and examines the tricky relation between EU funds and corruption. In EEEs, small and medium firms correlate with lower labor productivity. These firms were affected by the Covid crisis but in different ways – the smaller firms have fewer financial reserves and weaker market positions. Employment in medium-sized companies in all EEEs decreased, but the cause is not clear. Also, there is a shift in firm size structure. There are some interpretations that medium-sized companies became large-sized, but there is no explanation for the lack of the labor flowfrom small- to medium-sized companies. This is generally one of the weaker chapters, not appropriately connected with the others.

The fourth chapter *Labor Markets: Structural Characteristics and the Impact of Two Crises* written by Martin Guzi and Michael Landesmann discusses the consequences of both crises. The rate of unemployment reached its peak around 2012 but EEEs overcame the financial crisis relatively well except Croatia, Hungary, and Slovenia where it was lengthier. Labor markets in EEEs are characterized by high levels of workforce shortages due to emigration after EU enlargements in 2004 and 2007 and strong wage disparities between EEEs and older EU members. The authors emphasize the strong need for well-designed migration policies. Furthermore, sectoral employment structure was modified during the crises, especially employment in manufacturing during the financial crisis and the same pattern repeated during the Covid crisis. Although the overall increase in unemployment rates during the GFC and pandemic crises was similar, unemployment rates grew faster for women than for men in Bulgaria, Czechia, Romania, and Slovenia during the first phase of the Covid crisis, unlike the period after the financial crisis when there was a much stronger increase in unemployment rate of males. One of the characteristics of the EEE labor market is that life-long learning is less common than in developed countries.

PUBLIC SECTOR ECONOMICS
47 (4) 555-560 (2023)

Transport and Mobility is the title of the fifth chapter, written by Melinda Matyas, Daniel Hörcher, and Jacek Pawlak. The topic is presented throughout the period before as well as after the transition, and during the crises that followed. The chapter discusses infrastructure developments before and after the economic transition, and especially in the 2000s encouraged by EU funding. The changes that followed in the matter of working and means of transportation (such as the emergence of electric vehicles) are also mentioned. The chapter contains a lot of unnecessary information that shifts the focus away from what is most important – how the Covid crisis affected this sector.

Chapter 6 *Monetary, Macroprudential, and Fiscal Policy* by Júlia Király, Balázs Csontó, László Jankovics, and Katalin Mérő shows the importance of policymakers in overcoming crises and the effects of monetary, macroprudential and fiscal policy measures during the GFC and the oubreak of Covid. The chapter detected the main post-pandemic challenges like inflation and interest rate growth. Although in 2008 new regulations on capital requirements were implemented, the impact did not quickly materialize in the form of concrete regulatory developments and the region was hit by the crisis. Like many developed countries, EEEs applied unconventional monetary practices and new approaches to banking regulations after the GFC. The Covid crisis had a strong impact on inflation, and the monetary policy response was aggressive, characterized by policy rate cuts, foreign exchange interventions, liquidity operations, lending programs and asset purchases. In the area of fiscal policy, the post-GFC period was marked by changes in the fiscal governance framework, fiscal tightening in the first half of the 2010s and divergent policies and macroprudential tightening in the second half. The Covid crisis brought to light the differences in the capacity of governments to respond to health situations as well as differences in fiscal policy measures in general. The authors state that there were differences among the various reports/data compilations about fiscal policy measures, but the EEE pandemic period was characterized by additional government spending like other parts of the EU.

Michael Carnegie LaBelle and Tekla Szép in the seventh chapter on *Green Economy: Energy, Environment, and Sustainability*, concluded that the Covid crisis negatively impacted United Nation Sustainable Development Goal for Affordable and Clean Energy (SDG7) and that the impact on Climate Action (SDG13) is not quite clear. The authors also highlighted the importance of sustainable economic growth, stating that a key problem is the large gaps between leaders in green transition (Germany and Scandinavia) and some EEEs (Poland and Hungary), summing up the strong need for a new policy agenda to meet the SDG targets.

Anikó Bíró, Zsófia Kollányi, Piotr Romaniuk, and Šime Smolić in Chapter 8 on *Health and Social Security*, analyze the healthcare systems in EEEs, which lagged behind the EU average before the pandemic while several of them collapsed during it. The health impacts during the pandemic are reflected mostly through caring for sick patients and their treatment, restrictions to reduce the number of patients

PUBLIC SECTOR ECONOMICS
47 (4) 555–560 (2023)

and vaccination, but the authors also emphasise the weak spots of the healthcare system like labor shortages, lack of hospital capacities, and a pressing health problem in the EEEs – limited access to healthcare and rise in health inequalities. This is the most comprehensive chapter of the book, focusing on EEEs and the impact of the pandemic. While the other chapters analyzed a broader time view, here the effects of the Covid pandemic on the EEEs are clearly indicated.

Chapter 9, *Ageing and Pension System*, by András Simonovits and Ádám Reiff compared the ageing and pension systems in EU27 and EEEs and concluded that the pandemic had no major and lasting demographic impact on pension systems. They considered the pre-Covid forecasts about pension systems and stated that they were very optimistic, frequently reflecting the governments' influence. The main impacts of pandemics are reflected in entitlements accruing to future retirees and increase of public debt ratios which may cause sustainability problems. The changes in labor market structure had a negative impact on its development.

Judith Lannert and Júlia Varga in Chapter 10 *Public Education* present the difference between the EU15 and EEEs. Although the public-school system is more accessible in EEEs, the level of basic skills of their young people is below that of the EU15. The pandemic significantly affected the public education system in EEEs primarily due to the lower availability of modern technology that would enable distance education. A lot of students in EEEs faced learning losses as well as the lifetime cost of earning losses. New digital devices are a huge financial cost for these countries but also a great opportunity for the development of the schooling system.

László Mátyás, György Bőgel, Mark Knell, Ludovit Odor, and Marzenna A. Weresa wrote Chapter 11 *Research & Development and Higher Education*. This chapter, more precisely the topic of R&D in higher education is perhaps the most relevant for analyzing the MIT in which EEEs seem to be stuck. The mostly public EEEs higher education systems are lagging behind those of more advanced countries in terms of equipment and development due to a lack of innovation. The authors provided policy recommendations, emphasizing the opportunity for economic growth and structural changes through investment in R&D.

The last chapter *Inequality and Welfare* written by Márton Medgyesi and István György Tóth, presents the logical conclusion of statements in previous chapters and includes the presentation of income distribution in the observed countries before 2009, the changes after the GFC, especially the growth of the Gini coefficients, as well as poverty in EEEs. The disposable income inequalities mostly increased in Bulgaria and Hungary after the GFC crisis. The impact of the Covid crisis in terms of the growth of inequality and poverty was more strongly felt in the EEEs compared to the EU average.

In summary, even though the last data used are from 2021, the book gives an overview of the post-transition state of the observed countries, and more or less

PUBLIC SECTOR ECONOMICS
47 (4) 555–560 (2023)

analyzes the consequences of the economic crisis in 2008, the recovery after that and the renewed crisis caused by the pandemic. The book might serve as a basis for further analysis and its importance and relevance are unquestionable, however it also has some weaker points. As the last wave of the pandemic is not included, it needs to be updated. The middle-income trap is not even mentioned in most chapters. The conclusion of the book as well as the main message is somehow missing, lacking a summary of all previous chapters to get a clearer and more meaningful picture. The huge amount of information leads to saturation, and in this way, the book is diluted and there is an absence of any focus on the essentials. It would have been better to focus only on the last, Covid-induced crisis, without merging it with the GFC. In addition, there are differences in the writing between the authors, but this has its positive and negative sides. On the positive side, one could notice the breadth of the approach, and on the negative side, one could state the lack of uniformity regarding the time frame and the focus on the main topic.

The authors made a huge effort to clarify the Covid crisis and its impact on the observed EEEs, contributing to the understanding of the macroeconomic aspects, and the book might help policy decision-makers to clarify their doubts and help them in making informed and useful political decisions based on relevant research.

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