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Inflation and fiscal policy: is there a threshold effect in the fiscal reaction function?

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Abstract

This paper estimates a fiscal reaction function (FRF) framework for euro area countries to test for the impact of changes in inflation on fiscal policy. We find evidence of non-linear short-term effects of HICP inflation on the primary balance after controlling for other relevant factors. Over the period 1999-2022, we unveil an inverse U-turn relationship and an inflation turning point - beyond which its short-term (contemporaneous) impact on the primary balance starts being negative - at somewhat above 4% for the sample of mature euro area economies (EA-12, first twelve EA members) and around 6% for the whole sample of euro area countries in 2022 (EA-19). Using an alternative measure of "inflation surprise" (available for the period 2003-2022) yields robust results in the larger EA-19 sample and lowers the threshold to just below 5%. In terms of channels, the non-linear effects are found to propagate through both the primary expenditure and the revenue ratio (more robustly through the former) in the EA-12 sample, while only the combined effect on the primary balance seems to prevail for EA-19. These results reflect primarily the most recent high inflation episode and indicate that in such conditions inflation can be costly for public finance flows even in the shorter run.

JEL: H60, E62, E31, C33

Keywords: fiscal reaction function, inflation, euro area, panel models

Non-technical summary

In this paper, we analyse empirically the impact of inflation on public finances in the euro area, focusing on the question of whether at high levels – like in the most recent episode - inflation could have a different impact on the primary budget balance.

The euro area, like other advanced economies, has recently faced challenges posed by a rapid and strong increase in inflation. Notwithstanding the decline, especially in energy prices, inflation has proven more persistent than initially expected. The relationship between inflation and public finances runs in both directions and depends on several factors. Conventionally, a higher inflation rate is expected to improve public finances, at least in the shorter-term. At a high level, however, inflation could trigger a stronger reaction than when running at moderate levels. This may be especially the case on the spending side, through both discretionary fiscal policy measures to support households' purchasing power or firms' costs, as well as through higher nominal spending adjustments even in cases where automatic indexation schemes are not in place. It is particularly this "high level" hypothesis that the current paper seeks to test empirically and thus contribute to the literature on the effects of inflation on public finances.

To this end, we estimate a fiscal reaction function for euro area countries (EA-19 and EA-12) over the period 1999-2022 and - using various dynamic panel techniques and a battery of robustness checks - we find evidence of non-linear short-term effects of inflation on public finances. The results indicate a turning point in the contemporaneous impact of HICP inflation on the primary balance, at somewhat above 4% for the EA-12 and 6% for the EA-19. After such a turning point is reached, the impact is estimated to be negative. The findings for the full EA-19 sample are broadly confirmed when we use the "inflation surprise", an alternative variable that may better capture an ex-ante inflationary shock and be less affected by endogeneity. In this case, the turning point is considerably lower (around 5% for EA-19) indicating that, in case of an unexpected inflation shock, public finances may start to be negatively affected at a lower inflation level.

Our conclusions remain unchanged when we control for variables that could capture the nature of the inflation shock, namely terms of trade, effective exchange rate and total factor productivity growth. Moreover, the results become even stronger statistically when we add the global commodity prices (oil or natural gas) to our set of instruments. Yet, our finding of a non-linear impact of inflation on the primary balance may still reflect the *nature* in addition to the *level* of the inflation shock. As shown in a related paper for euro area countries (Bankowski et al., 2023b), an external, supply side inflationary shock can be less favourable (even detrimental) for public finances in the shorter run compared with an internal, demand shock. In terms of channels, the non-linear effects are found to propagate through both the primary expenditure and the revenue ratio (more robustly through the former) in the EA-12 sample, while only the combined effect on the primary balance seems to prevail for EA-19.

We also find that the FRF estimates are robust across various specifications and exclusion of individual countries. However, the results differ according to the time period. When we restrict it to end in 2019 or earlier, we find evidence of non-linear effects of inflation on the primary balance (in specifications instrumented with the global commodity prices) only for the EA-19 sample, which contains more episodes of high inflation. These robustness tests suggest that the periods with particularly high inflation drive the results, with no such consequences on the budget when inflation remains moderate.

As regards other determinants of fiscal positions (higher primary surpluses), we find evidence for persistence in fiscal policy, the co-movement of headline fiscal positions with the economic cycle, and for the twin deficit hypothesis (improved external positions and more openness associated with higher primary surpluses). We also find evidence that euro area governments abide, on average, by the (weak) fiscal sustainability constraint, albeit this evidence is more robust in the full EA sample than in the (higher debt) EA-12 group.

Overall, the results in this paper – along with other recent analyses on the topic (e.g., Bankowski et al, 2023a,b) – sound a cautionary tone on the impact of high inflation on fiscal positions in the euro area. They underscore the need for preserving sound fiscal policies and not relying on high inflation to reduce the large deficit and debt levels accumulated over the recent crises.

1. Introduction

The euro area, like other advanced economies, has faced challenges posed by a rapid and strong increase in inflation. After having been below the ECB's 2% target for almost a decade, inflation in the euro area increased in 2022 at a pace last seen in the 1970s and early 1980s, mainly reflecting the energy shock triggered by Russia's invasion of Ukraine in February 2022. Headline year-on-year inflation, as measured by the Harmonised Index of Consumer Prices (HICP), rose from 1.9% in June 2021 to 10.6% in October 2022, before starting to drop. According to the June 2023 Eurosystem's macroeconomic projections, while projected to decline gradually over the medium-term towards the ECB target (Chart 1), inflation was proving to be more persistent than previously expected, despite falling energy prices and easing supply bottlenecks. Core inflation, as measured by the headline HICP excluding energy and food, peaked only in March 2023 at 5.7%. At the time of finalising this paper, the (estimated) HICP inflation rate had dropped to 2.9% in October 2023 and core inflation to 4.2%.

The relationship between inflation and public finances runs in both directions and depends on several factors. Conventionally, a higher inflation rate is expected to improve public finances, at least in the shorter-term. This is because a higher inflation rate raises government revenues, while public expenditure tends to increase only with a lag. However, the actual fiscal implication of an inflationary shock depends on several factors, such as: (i) the nature of the shock (externally generated supply side vs. an internal demand side shock); (ii) the structure and institutional arrangements governing the budget revenue and expenditure, for instance the coverage of indexation rules; and (iii) the size of the inflation shock hitting public finances. With the first two factors analysed in depth in other papers,[3] we hereby focus on the last one. At a high level, inflation can trigger a stronger reaction of government expenditure than in times of moderate inflation, through both discretionary fiscal policy measures to support households' purchasing power or firms' costs (see Chart 2 for the reaction in the euro area), as well as possibly higher demands of nominal spending adjustment even in cases where automatic indexation schemes are not in place.

Chart 1: Euro area HICP inflation – level and decomposition into the main components
(annual percentage changes)

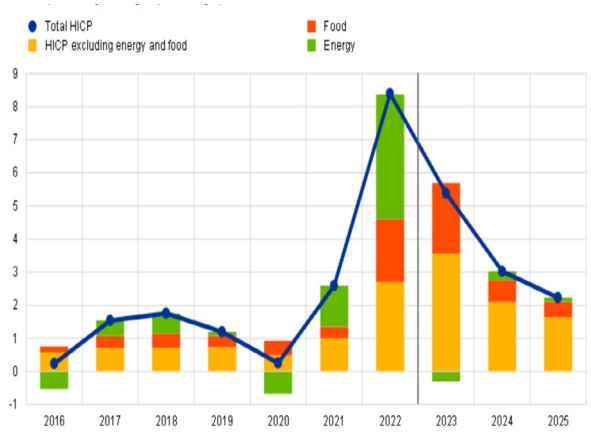
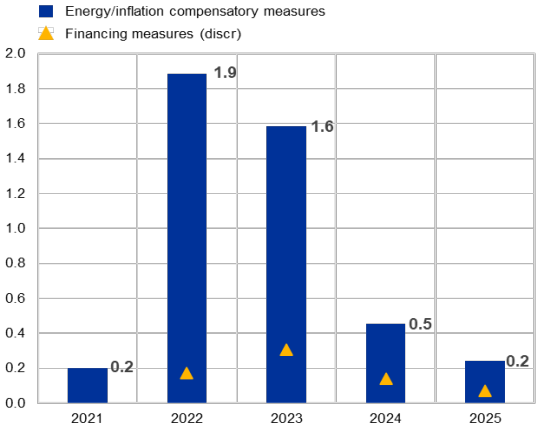


Chart 2: Euro area discretionary fiscal policy support in response to the energy crisis and high inflation
(percentages of GDP)



Source: June 2023 Eurosystem's macroeconomic staff projections.
Notes: In chart 2, the bars represent estimated fiscal policy support (stimulus in levels per year), implying a deterioration in the budget balance. See Bankowski et al. (2023a) and Checherita-Westphal and Dorrucci (2023) for more details.

In order to test this "high inflation level" hypothesis empirically for euro area countries, we estimate the impact of inflation on the primary balance in a non-linear fiscal reaction function (FRF) framework. In the empirical literature, the FRF concept, coined in the seminal paper of Bohn (1998), aims primarily at testing the (weak) sustainability condition, that is, whether primary balances respond positively to

[3] See Bankowski et al. (2023a,b) for an in-depth analysis of the implications of the inflation shock on euro area public finances. These papers provide *model-based* estimates of the impact of the 2022 inflation surprise on euro area primary and budget balance going beyond the discretionary fiscal policy measures and find a slightly negative contemporaneous impact (2022) and a higher negative impact over 2023-24.

higher debt ratio. This analysis can also shed light into other determinants of fiscal policy reaction, that is, what other factors tend to influence the primary balance ratio and to which extent. In particular, such an empirical investigation can be used to study the channel of inflation, which is little investigated in the literature. To our best knowledge, this is the first paper to analyse empirically possible non-linearities in the fiscal policy response to inflation in an FRF framework.

The paper is structured as follows. Section 2 reviews the literature and the methodology. Section 3 presents the data and our model. Section 4 discusses the empirical results, including extensive robustness checks, while section 5 concludes. The Appendix includes a description of data sources and regression results underpinning the various robustness checks.

2. Review of literature and methodology

Grounded in the work of Bohn for the US, the FRF literature is rich, with studies usually investigating sustainability conditions for large panels of advanced and/or developing countries. Complementing the theoretical approach of Blanchard *et al.* (1990) and other more complex sustainability frameworks, Bohn (1998) proposes a simple empirical test of sustainable fiscal policy. This relates the primary balance to the level of debt, with or without conditioning on further controls. It can be written as follows:

$$pb_t = \kappa \cdot d_t + \xi_t, \qquad \text{(eq. 1)}$$

where pb_t is the primary balance in terms of GDP, d_t is the government debt-to-GDP ratio, κ is the responsiveness of the primary balance to the debt ratio and ξ_t contains effects of various other determinants of primary balance (such as economic, institutional, etc.) and the error term.

Bohn (2008) shows formally that for an economy to satisfy its intertemporal budget constraint and the so-called no-Ponzi condition, the coefficient $\kappa > 0$ is sufficient. However, as shown in some studies (see, inter alia, Ghosh *et al.* (2013) or Daniel and Shiamptanis (2012)), a positive coefficient κ cannot be viewed as sufficient to achieve fiscal sustainability. Some *non-linearities* can be involved also in this case, for instance, if there is a limit for positive values of primary balances at very high debt levels or depending on financial market reaction[4]. In this respect, Ghosh et al. (2013) call Bohn's condition a "weak sustainability condition".

While many FRF studies focus on the response of the primary balance to debt[5], very few focus on the response to inflation. This channel can be investigated with this empirical approach, by rewriting Bohn's relation as follows:

$$pb_t = \kappa \cdot d_t + \lambda \cdot infl_t + \xi_t, \qquad \text{(eq. 2)}$$

where $infl_t$ is the inflation rate and λ is the responsiveness of the primary balance to inflation.

Attinasi et al. (2014) investigate the impact of (low) inflation environment for public finances (deficit and debt) in the euro area using various methods. Part of this (co-authored) paper uses an empirical analysis in the FRF framework - which we extend in the current paper - and test specifically for the impact of inflation, proxied by the GDP deflator growth, on the primary balance and its components. For samples of euro area and EU countries over the period 1970-2013, the paper found that a 1 percentage point increase in the GDP deflator growth was associated with a 0.1 to 0.2 percentage point increase in the primary balance ratio. At the time, a possible non-linear impact of inflation on the primary balance was not investigated. In order to gain more insights on the channels through which the GDP deflator interacts with the primary balance, an analogous analysis was followed for primary expenditure and revenue ratios. The impact through the expenditure ratio (capturing expenditure rigidities) was found to be significant, from both an economic and statistical perspective. By contrast, the impact of the revenue ratio was not found to be robust across various specifications.

[4] An upper limit on the amount of debt that can be repaid creates additional restriction for government policy. An extension of Bohn's approach for a country restricted by fiscal limits using a non-linear fiscal rule is in Shiamptanis (2015). Ghosh *et al.* (2013) considers the reaction of financial markets in conjunction with fiscal limits.
[5] For a review, see Checherita-Westphal and Žďarek (2017).

Berti et al. (2016) conduct a FRF analysis on a panel of European countries and test for a change in fiscal behaviour since the beginning of the economic and financial crisis. They estimate country-specific FRFs for 13 EU countries and a panel FRF for 12 Central and Eastern European countries, and find that most EU countries adjust positively their primary balance to rising levels of public debt, albeit with variability as regards the speed of adjustment across countries. As they also included the 3-year moving average of the inflation rate as a control variable in their specification, the inflation channel could be investigated. The estimation results of country-specific FRFs showed that inflation was statistically significant in a relatively high number of cases, but with mixed results: a positive sign was found for the Netherlands, Finland and Portugal, and a negative sign for Belgium, Sweden, Ireland and Spain. For a panel FRF for Central and Eastern European countries over the period mid-1990s-2013, they found that the primary balance responded positively to the average inflation rate of the previous three years, other things being equal, with a coefficient of 0.08 in their base model (Arellano-Bond GMM).

More recently, IMF (2022) reports on the fiscal implications of inflation, with a focus on the effect of inflation surprises on fiscal outcome. They define inflation surprises as the difference between actual and projected inflation rates and run a regression for three fiscal outcomes within the same year (nominal revenue growth, expenditure growth and overall balance-to-GDP ratio) and two measures of inflation (headline consumer price index (CPI) and GDP deflator growth). The dataset uses different IMF World Economic Outlook (WEO) vintages from 1992 to 2020 (i.e., before the current high inflation episode), with data availability differing by country. The paper reports that an inflation surprise of 1 percent corresponds to an increase of 0.3 percent in nominal revenues in advanced economies and 0.8 percent in emerging markets. Results differ rather markedly across the regressions using CPI and GDP deflator growth: for the sample of advanced economies, they find that the CPI inflation surprise has a statistically-significant effect only on the budget balance, but not on the growth rate of its components, while the reverse is found for the GDP deflator. The paper concludes that inflation surprises are associated with lower fiscal deficits in the short term (same year impact), though spending pressures are likely to rise over time. By the time of finalising our paper, two related works had been published in parallel. Staehr et al. (2023) investigate the impact of inflation and inflation surprises in a FRF framework for the EA-12 sample over the period 1999-2021. They find a positive linear impact on the primary balance, feeding through both the revenue and expenditure side. In robustness checks, they do not find "noticeable" non-linearities in inflation (defined as interaction terms) in their sample.[6] The European Commission (2023) conducts a linear analysis similar to IMF (2022), but applied to the sample of EU countries over the period 2000-2020. This analysis finds that surprise inflation tends to increase public revenue and expenditure, although the budget balance appears not to be significantly affected in the short term. Yet, as acknowledged in both papers, their estimates are based on the past two decades of moderate inflation data (particularly for the EA-12 sample in the first paper), while in higher inflation times, such as seen in 2022, the impact could be different and possibly non-linear.

To our best knowledge, no previous FRF study was dedicated to investigating a possible non-linear effect of inflation on public finances, including by taking into account the current high inflation episode. This is the main aim of our paper with application to the euro area countries.

[6] Some caveats are recognised by the authors, for instance, when including the interaction term, the statistical significance of the primary expenditure channel is lost. The "high" inflation regime is defined as upward deviations from country-specific medians and thus do not really capture noticeable high inflation episodes in the EA-12 group. Moreover, the regressions do not include both the HICP inflation level and the dummy variable together with the interaction term. Otherwise, for the same sample, the results in this paper are broadly in line with ours for the EA-12 sub-sample.

3. Model and data

3.1. Panel model specification

Our empirical model is an extension of the relationship given by equation 1:

$$pb_{i,t} = \alpha + \varphi pb_{i,t-1} + \lambda \cdot infl_{i,t} + \sum_{j=1}^{k} \beta_j X_{j,i,t} + \delta_i + \epsilon_{i,t}, \qquad \text{(eq. 3)}$$

where $pb_{i,t}$ is the primary balance as a share to GDP and $pb_{i,t-1}$ is its one year-lagged value, $infl_{i,t}$ is the HICP inflation rate, $X_{j,i,t}$ is a set of various (macro)economic, institutional and political determinants of the primary balance, δ_i are country fixed effects; measurement errors and random shocks are captured by the error term $\epsilon_{i,t}$. The coefficient λ of interest measures the response of the primary balance to changes in the inflation rate.

As it will be shown later, since we do not find a robust statistically significant *linear* effect of inflation on the primary balance for our sample, we move to investigate the existence of a non-linear relationship. To this end, we extend the specification in eq. (3) to a second degree polynomial form in inflation:

$$pb_{i,t} = \varphi pb_{i,t-1} + \beta_0 infl_{i,t} + \beta_0' infl_{i,t}^2 + \sum_{j=1}^{k} \beta_j X_{i,j,t} + \delta_i + \omega_{i,t}, \qquad \text{(eq.4)}$$

where the variable definitions are as per equation 3 (measurement errors and random shocks are captured by the error term $\omega_{i,t}$).

The basic model is estimated for a panel of 19 euro area countries[7] and, respectively, the first 12 euro area member countries,[8] over the period 1999–2022 (with various robustness checks for country and time period sub-samples).

3.2. Choice of variables

The primary balance (PB) has been traditionally employed in the FRF literature as the dependent variable. Some studies also used the cyclically-adjusted primary balance (CAPB). Such a choice obviously highlights the primary focus of a study: models with CAPB estimate the discretionary fiscal policy response or the "fiscal effort" directly, while models with PB control for the output gap, but capture a broader fiscal policy response (part of the "fiscal impulse").[9] Given that the primary balance is the "observable" fiscal policy variable (main budgetary target), less prone to ex-post revisions (due to output gap and elasticities' uncertainty), and following most studies including the initial Bohn's specification, we prefer using it as our main dependent variable. Moreover, we are interested in the overall impact of inflation on the primary fiscal position, including the (semi-)automatic, persistent response, which can occur both on the expenditure and the revenue side. Finally, inflation has an impact on the overall budget balance through the additional channel of interest payments. The latter depends directly on the monetary policy reaction and, due to the longer maturity of government debt, is feeding more gradually into public finances. We also investigate the impact of inflation on the overall headline budget balance in robustness checks.

Regarding the choice for the determinants of the fiscal position, this paper follows Checherita-Westphal and Ždarek (2017). Our core ("*Base*") FRF model includes the lagged primary balance-to-GDP ratio (to account for persistency in fiscal policy), inflation, the lagged public debt-to-GDP ratio (to test the existence of the "weak" fiscal sustainability condition), output gap (a proxy for cyclical conditions), the lagged current account balance net of the government budget balance (or the private sector component

[7] All members of the Euro Area as of 2022, i.e. Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Spain, Slovakia, and Slovenia. The current 20th member, Croatia, is not included because of its later entry (in 2023).
[8] Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain.
[9] See van Riet, ed. (2010) for an exposition of the various concepts related to fiscal balance decomposition.

of the current account balance to control for cross-country spillovers and the hypothesis of twin deficits) and a political risk variable (dummy for election year).[10]

We test two measures for price developments: HICP inflation and the GDP deflator. The only robust (statistically significant) measure across the various specifications employed turns out to be the HICP, which is subsequently used in our analysis. Country fixed effects are included to capture all remaining time-invariant country-specific factors that are not explicitly controlled for. Finally, a time trend to capture common cross-country factors varying over time is also added to the basic model. For a description of the variables used in the extended specifications, see the appendix. The main data source for our analysis is the AMECO database.[11]

3.3. Estimation techniques

Several estimators have been employed in the FRF literature. In this paper, our focus is to tackle estimation issues such as endogeneity and cross-sectional correlation, following the approach in Checherita-Westphal and Ždarek (2017).

Even though our panel is dynamic, in our base model, we use the fixed-effect estimator allowing for the presence of potentially endogenous variables (instrumental variable, IV estimation). Being aware of criticisms of its use (the Nickell's bias), we argue that in our panel the potential bias should be limited ('rule of thumb' based on Bond (2002) states that for cases when T is larger than 20, the potential bias of the FE estimator should be negligible[12]). Moreover, it has been shown that GMM estimators would not alleviate the problem (see Judson and Owen, 1999).[13] Their asymptotic properties are negatively affected by the dimensions of our panel and they are left for robustness checks.

Another problem is the presence of cross-sectional or 'spatial' dependence that may severally affect estimation efficiency and even render some estimators inconsistent (standard difference and system GMM estimators for dynamic panels) unless the unobserved factors are not correlated with the explanatory variables (see Phillips and Sul, 2003). Similarly, standard errors should be treated accordingly to adjust for overoptimistic t-statistics and confidence intervals (see Petersen, 2008).[14]

Overall, in the main regressions, we prefer using a FE-IV estimator to avoid endogeneity problems and robust standard errors to deal with heteroscedasticity, serial correlation and cross-sectional dependence. In the robustness section, further estimators are included.

4. Empirical results

4.1. Baseline specification and extended models

In the first step we apply the Base *linear* specification (eq. 3) to the whole EA-19 group and the current euro area period (1999–2022). As the relationship can be affected by endogeneity, including reverse causation, various suggestions have been used in the literature as to which instruments ought to be employed (primarily for the output gap, both determined by fiscal policy and affecting directly fiscal positions). Some studies simply work with lagged values, others rely on additional variables or the GMM approach. We first decide to use IV (and as a robustness check GMM estimators) and instrument the output gap, lagged dependent variable (primary balance), the HICP inflation and lagged current account net of the budget balance. We try several instrument sets, but in all estimations, neither the

[10] Evidence of political cycles in a panel of EU countries is also shown in Golinelli and Momigliano (2006).
[11] We use AMECO data from Autumn 2022 Economic forecast.
[12] This condition is met for our sample (1999–2022). Nevertheless, it is conditional on the actual panel setting and therefore various estimators are used in the robustness section to show stability and (unbiasedness) of our results.
[13] Celasun and Kang (2006) propose in this context a simple rule based on the main interest of the study. GMM estimators are recommended for testing cyclical sensitivity of fiscal policy variables, FE estimators (LSDV) when tests of intertemporal solvency are performed.
[14] One further possibility would be an estimator with AR(1) correction for serial correlation (applied for example by Ghosh *et al.*, 2013) such as FGLS, which also allows for spatial dependence. Such an estimator works fine for small (balanced) panels. However, Beck and Katz (1995) show that standard errors computed by this method are rather small (overoptimistic estimates). Another possibility is an OLS/Prais-Winstein estimator with the panel-corrected standard errors (PCSEs); however, it assumes strictly exogenous independent variables and for small ratios of T/N produces rather imprecise estimates (for our panel this ratio is around 1.2). In addition, its superiority with respect to the FGLS estimator on the basis of efficiency has been questioned mainly for the $T > N$ case; see Reed and Webb (2010). Therefore, we prefer using an IV, FE estimator and robust standard errors.

HICP inflation nor the GDP deflator growth is found statistically significant. We also test several estimators and several time periods as a robustness check,[15] but this does not change the significance of the coefficient. Therefore, we conclude that there is no robust evidence for a linear impact of inflation on the primary balance in our sample.

Next, we proceed to investigate the existence of a *non-linear* link between inflation and the primary balance. We apply the *Base* specification (eq. 4) to both the whole EA-19 and EA-12 samples, over the time span 1999–2022. As before with the linear specification, we use IV for the output gap, lagged dependent variable, the HICP and lagged current account. Our instrument set includes second lag of the dependent variable, first to third lag of inflation rate and squared inflation rate, lagged output gap and second lag of the current account. This *Base* model performs well in the Kleibergen-Paap test (a test for weak instruments) or Sargan/Hansen test (overidentifying restrictions).

In this *Base* model (see Table 1, column 1 for EA-19 and column 5 for EA-12), we find a significant positive linear term for the HICP inflation growth rate, while the quadratic term is negative. This result implies an inverse U-turn (concave) relationship and a turning point in the impact of inflation on the primary balance, at 4.4% for the EA-12 (95% confidence interval at 3.3 to 5.4%) and 6.1% for the EA-19 (95% confidence interval at 4.5 to 7.7%). After such a turning point is reached, the impact of inflation on the primary balance is estimated to be negative.

Table 1: Basic model and extended specifications, 1999–2022

	EA-19				EA-12		
	Base	m1	m2	m3	**Base**	m1	m2
Lagged primary balance	0.784***	0.780***	0.766***	0.787***	0.817***	0.782***	0.809***
	(0.146)	(0.147)	(0.141)	(0.156)	(0.135)	(0.137)	(0.135)
HICP inflation	**1.689****	**1.768****	**1.488***	**1.816****	**2.625*****	**2.856*****	**2.517*****
	(0.810)	(0.816)	(0.810)	(0.877)	(0.885)	(0.912)	(0.862)
HICP inflation^2	**-0.138****	**-0.141****	**-0.121****	**-0.148****	**-0.301*****	**-0.312*****	**-0.295*****
	(0.061)	(0.062)	(0.062)	(0.066)	(0.104)	(0.107)	(0.102)
Output gap	0.156*	0.172*	0.147	0.148	0.010	0.047	-0.013
	(0.094)	(0.090)	(0.090)	(0.098)	(0.131)	(0.121)	(0.130)
Lagged current account	0.318**	0.337***	0.290**	0.307**	0.362**	0.374**	0.356**
	(0.123)	(0.127)	(0.115)	(0.127)	(0.154)	(0.159)	(0.150)
Lagged debt	0.049***	0.058***	0.049***	0.052***	0.034	0.059**	0.033
	(0.014)	(0.015)	(0.013)	(0.014)	(0.026)	(0.025)	(0.025)
Election dummy	0.095	0.097	0.090	0.133	0.297	0.308	0.311
	(0.303)	(0.305)	(0.285)	(0.329)	(0.370)	(0.379)	(0.361)
Time trend	-0.086**	-0.125**	-0.150***	-0.086*	-0.009	-0.118*	-0.108**
	(0.038)	(0.060)	(0.047)	(0.044)	(0.062)	(0.070)	(0.054)
Interest payments		-0.359				-0.862**	
		(0.347)				(0.363)	
Openness			0.026**				0.050***
			(0.012)				(0.016)
Lagged IMF fiscal rules				0.333			
				(0.997)			
Constant	-5.648**	-5.017*	-7.575***	-6.306***	-6.330**	-4.506	-8.125***
	(2.407)	(2.685)	(2.102)	(2.382)	(2.657)	(2.827)	(2.535)
Turning Point	**6.1**	**6.3**	**6.1**	**6.2**	**4.4**	**4.6**	**4.3**
No. observations	413	413	413	396	263	263	263
Centered R-squared	0.326	0.316	0.419	0.287	0.512	0.518	0.544
Kleibergen-Paap LM statistic	8.897	8.897	9.070	10.16	7.597	7.084	7.476
Kleibergen-Paap LM p-val	0.0307	0.0307	0.0284	0.0173	0.0551	0.0693	0.0582
Hansen test	1.349	1.654	1.264	0.964	1.912	1.045	0.278
Hansen p-val	0.509	0.437	0.531	0.618	0.384	0.593	0.870

*Notes: Dependent variable (DV) primary balance-to-GDP ratio. Robust standard errors (shown in parentheses), country FE used in all specifications. Hansen test's null hypothesis is that instruments (orthogonality conditions) are valid. The null of Kleinbergen-Paap LM test is that instruments are weak. P-value: *** p<0.01, ** p<0.05, * p<0.1: variable is statistically significant at the 99%, 95% and 90% confidence level, respectively. Model m3 cannot be estimated for the EA-12 sample given little variability in the IMF fiscal rule variable.*

Turning to the other variables included in our basic specification, for EA-19 the responses of the primary balance are, overall, highly statistically significant and have the expected sign. Rather high and positive values of the lagged dependent variables indicate persistence in fiscal policy. The response to debt ratio is positive and highly significant, showing the existence of (weak) fiscal sustainability, on average,

[15] We estimate these linear specifications with the FE, IV FE, two-steps GMM and AB GMM estimators. We test for the periods 1999-2019, 1999-2020, 1999-2021, 1999-2022. Results are available upon request.

across the 19 euro area countries, with a coefficient of 0.05 (for an increase in the past debt-to-GDP ratio by 10 percentage points (pp), the primary balance ratio tends to improve by 0.5 pp), confirming for our more updated sample the main findings in Checherita-Westphal and Zdarek (2017). The output gap coefficient is positive and statistically significant, though only at 10%. Replacing the output gap with the real GDP growth rate yields strongly statistically significant results[16] – while not affecting the significance of the non-linear inflation relationship (see Table A2.1 in the Appendix). Overall, these results point to some evidence of co-movement of fiscal position with the economic cycle through the working of automatic stabilisers (an improvement in the cyclical conditions is associated with better fiscal position). The positive coefficient of the current account balance underpins the twin-deficit hypothesis. Somewhat surprising, while the election dummy coefficient is generally found to be negative in the literature, including in the previous study for the euro area (Checherita-Westphal and Zdarek, 2017), it is not found statistically significant in our sample. The time trend variable is negative, which shows that the primary balance declined on average over the period of analysis, after controlling for all the other variables. In contrast to the FRF estimations for the EA-19, when looking at EA-12, we do not find robust evidence in our sample for the (weak) fiscal sustainability condition or for continuously pro- or counter-cyclical fiscal policy, as the coefficients of the lagged debt ratio and the output gap are not statistically significant. Yet, in regressions where the output gap is replaced by the GDP growth rate (though not our preferred specification), the lagged debt ratios and the real growth regain statistical significance, pointing to possible robustness issues of these variables in smaller samples (see Table A.2.1 in the Appendix).

The remaining columns of Table 1 present a first set of robustness checks of our basic specification by adding one variable at a time, as often used in the literature. Such a variable set includes interest payments (as percentage of GDP), a proxy for openness (sum of exports and imports) and fiscal rules (additional institutional factors). In all specifications, the linear and quadratic terms of HICP inflation remain statistically significant, with a turning point ranging between 6.1% and 6.3% for EA-19 and between 4.3% and 4.6% for EA-12 over the period 1999-2022. There are no substantial changes in sign or significance level for the estimated effects of the other baseline determinants either. As regards the added explanatory variables, higher interest payments seem to have a negative impact on the capacity of governments to maintain higher primary surpluses for the EA-12 group, with a rather large coefficient (a 1 percentage point of GDP increase in interest payments is associated with a decline of close to 0.9 percentage point in the primary balance). Yet, the effect is not found to be statistically significant (and its size is reduced to half) in the EA-19 group, where interest payments tend to be lower on average, suggesting the possible presence of non-linear effects also in this variable. Further, more open economies tend to run higher primary surpluses (lower deficits). Finally, the existence of a fiscal rule, as measured by a dummy based on the IMF fiscal rule database, is not found to be significant at standard levels in our sample (adding its four subcomponents - expenditure rule, revenue rule, budget balance rule and debt rule – to the specification does not the change the results either).

Other issues important for the narrative, as explained in the introduction, are the nature of the inflation shock and the channels through which inflation affects the fiscal position (revenue vs. expenditure).[17]

Regarding the former, as shown in Bankowski et al. (2023), an external supply (terms of trade) shock, akin to the one hitting the euro area after Russia's invasion of Ukraine in early 2022, is more likely to be detrimental for public finances compared to, for instance, a demand internal driven inflation shock. We address this issue in two ways. First, we control for it by adding to the Base model one-by-one three variables that could capture the nature of the inflation shock, namely terms of trade, effective exchange rate and total factor productivity growth rates. Controlling for these variables does not change the conclusions with respect to our variable of interest, the level of inflation (see Table 2 below, last three columns for each EA sample size). Yet, our empirical specification in the context of a dynamic panel model (as opposed, for example, a VAR model where different shocks can be directly accounted for) does not fully disentangle the nature from the level of the inflation shock. Therefore, our results should

[16] However, the IV-FE specifications with the real GDP growth rate do not pass the Hansen test overidentifying restrictions; this is why we prefer to maintain the output gap as a control variable in our base specification and further robustness checks.
[17] We thank the reviewers of our paper for pointing these issues to us.

be interpreted as finding a non-linear impact of inflation on the primary balance, which could also reflect or be triggered by the nature of the inflation shock. Second, we instrument inflation by the world-wide developments in oil or natural gas prices. In addition to better accounting for the nature of the inflation shock, this step allows us to further reduce the potential for endogeneity, including reverse causation, as fiscal policy is likely to respond directly to the national inflation rate and not the global commodity prices. In these regressions (Table 2, columns 2 and 3 for each EA sample size), our results with respect to the impact of inflation on primary balance continue to hold. They are even stronger statistically and more robust to various specifications, e.g., when including other control variables[18] or, most importantly, when we reduce the EA-19 sample size to periods before the Covid crisis (see more details under robustness checks below). The turning point is slightly reduced: for the EA-19 from 6.1% to 5.9% (95% confidence interval between 4.2 and 7.5%) and for the EA-12 from 4.4% to 4.3% (95% confidence interval between 3.1 and 5.6%) in the model with natural gas used as instrument.

Table 2: Regression results controlling for external and supply side factors, 1999–2022

	EA-19						EA-12					
	Base	**Base + IV OIL**	**Base + IV GAS**	Base m1	Base m2	Base m3	**Base**	**Base + IV OIL**	**Base + IV GAS**	Base m1	Base m2	Base m3
Lagged primary balance	0.784***	0.768***	0.761***	0.789***	0.779***	0.778***	0.817***	0.811***	0.808***	0.835***	0.822***	0.815***
	(0.146)	(0.123)	(0.120)	(0.149)	(0.139)	(0.147)	(0.135)	(0.125)	(0.121)	(0.134)	(0.131)	(0.134)
HICP inflation	**1.689****	**1.380*****	**1.157*****	**1.823****	**1.646****	**1.806****	**2.625*****	**2.321*****	**2.076*****	**2.836*****	**2.635*****	**2.559****
	(0.810)	(0.404)	(0.419)	(0.855)	(0.805)	(0.896)	(0.885)	(0.578)	(0.555)	(0.808)	(0.880)	(1.007)
HICP inflation^2	**-0.138****	**-0.115*****	**-0.098*****	**-0.149****	**-0.135****	**-0.146****	**-0.301*****	**-0.268*****	**-0.239*****	**-0.314*****	**-0.303*****	**-0.296*****
	(0.061)	(0.038)	(0.037)	(0.073)	(0.061)	(0.067)	(0.104)	(0.079)	(0.072)	(0.097)	(0.104)	(0.109)
Output gap	0.156*	0.149*	0.141*	0.164	0.154*	0.137	0.010	-0.003	-0.009	0.007	0.003	-0.008
	(0.094)	(0.087)	(0.082)	(0.106)	(0.093)	(0.098)	(0.131)	(0.130)	(0.125)	(0.119)	(0.132)	(0.136)
Lagged current account	0.318**	0.291***	0.273***	0.328**	0.315**	0.307**	0.362**	0.327**	0.300**	0.342**	0.355**	0.357**
	(0.123)	(0.084)	(0.076)	(0.160)	(0.126)	(0.137)	(0.154)	(0.142)	(0.125)	(0.158)	(0.154)	(0.143)
Lagged debt	0.049***	0.047***	0.045***	0.051***	0.049***	0.056***	0.034	0.034	0.035	0.031	0.034	0.032
	(0.014)	(0.013)	(0.012)	(0.014)	(0.014)	(0.014)	(0.026)	(0.024)	(0.023)	(0.027)	(0.026)	(0.024)
Election dummy	0.095	0.100	0.106	0.089	0.093	0.195	0.297	0.302	0.308	0.202	0.293	0.310
	(0.303)	(0.287)	(0.277)	(0.312)	(0.299)	(0.310)	(0.370)	(0.360)	(0.352)	(0.376)	(0.373)	(0.374)
Time trend	-0.086**	-0.092***	-0.097***	-0.082**	-0.087**	-0.102**	-0.009	-0.021	-0.032	0.004	-0.008	-0.010
	(0.038)	(0.032)	(0.031)	(0.037)	(0.037)	(0.040)	(0.062)	(0.058)	(0.055)	(0.065)	(0.063)	(0.059)
Total factor productivity				0.004						0.252***		
				(0.147)						(0.075)		
Effective exchange rate					0.021						-0.038	
					(0.081)						(0.082)	
Terms of trade						0.051						0.039
						(0.108)						(0.095)
Constant	-5.648**	-4.754***	-4.109***	-6.047***	-5.506**	-5.898**	-6.330**	-5.840***	-5.446**	-6.658***	-6.368**	-6.062**
	(2.407)	(1.216)	(1.287)	(2.328)	(2.346)	(2.607)	(2.657)	(2.104)	(2.131)	(2.551)	(2.653)	(2.785)
Turning Point	**6.1**	**6.0**	**5.9**	**6.1**	**6.1**	**6.2**	**4.4**	**4.3**	**4.3**	**4.5**	**4.4**	**4.3**
No. observations	413	413	413	413	413	406	263	263	263	263	263	263
Centered R-squared	0.326	0.420	0.474	0.276	0.340	0.308	0.512	0.542	0.511	0.542	0.511	0.513
Kleibergen-Paap LM stat.	8.897	14.60	14.20	7.568	9.979	8.255	7.597	8.162	7.317	8.162	7.317	5.772
Kleibergen-Paap LM p-val	0.0307	0.005	0.006	0.055	0.018	0.041	0.0551	0.042	0.062	0.043	0.062	0.123
Hansen test	1.349	1.790	2.743	1.416	1.440	0.762	1.912	0.109	1.661	0.109	1.661	2.272
Hansen p-val	0.509	0.617	0.433	0.493	0.487	0.683	0.384	0.947	0.436	0.947	0.436	0.321

*Notes: DV is primary balance-to-GDP ratio. In columns 2 and 3 for each EA sample, the instrument set of the Base model also includes the growth rates of the global APSP crude oil price index, and respectively, of the Natural gas price index (see Table A.1.1. "Description of main variables and their sources"). The last three columns for each EA sample show results with the Base model, augmented with controls for the supply side (total factor productivity) and external factors (the effective exchange rate and terms of trade), all three variables in growth rates. Robust standard errors, country FE used in all specifications. Hansen test's null hypothesis is that instruments (orthogonality conditions) are valid. The null of Kleinbergen-Paap LM test is that instruments are weak. P-value: *** p<0.01, ** p<0.05, * p<0.1.*

Regarding the second aspect – the channels through which inflation may affect the fiscal position (revenue vs. expenditure) – we find some evidence for both channels in the EA-12 group, but not in the EA-19. Estimation results are presented in Table A.2.2 (primary expenditure-to-GDP ratio) and Table A.2.3 (revenue-to-GDP ratio) of the Appendix. Linear specifications in HICP inflation are not found to be statistically significant in our sample. The quadratic relationship continues to hold, being as expected convex (U-shaped) for the expenditure ratio and concave (inversed U-shaped) for the revenue ratio. This means that up to a certain level of inflation, primary expenditure (total expenditure less interest payments, as a ratio to GDP) declines in the short-term, but as inflation gets higher this effect vanishes and the expenditure ratio tends to increase, possibly because of additional spending pressures. The converse holds for the revenue ratio: as inflation gets above the threshold, the revenue ratio tends to

[18] Including all the other control variables from Tables 1 and 2 does not change the conclusions (results available upon request).

decline, possibly because of higher uncertainty, negative macroeconomic consequences, and discretionary stimulus measures on the tax side. The evidence for the non-linear effects on the revenue side in the EA-12 group holds statistically only when inflation is additionally instrumented with the global gas (or oil) prices, while for the expenditure side, it holds even in the base model. The stronger reaction of the primary expenditure ratio in the EA-12 (vs. EA-19) could be explained by the larger government size and more activism in fiscal policies in this sample, which includes the largest euro area economies. For the EA-19 sample, there is no robust evidence for the impact of inflation through either channel separately, which leads us to conclude that the net effect on the primary balance is the one that counts most.

Going beyond the primary expenditure, we do not find evidence for a non-linear impact of inflation on interest payments as a share of GDP. In this case, only a statistically significant linear impact is found, with inflation being associated with an increase in interest expenditure. Finally, we test the impact of inflation on the overall budget balance. In this case, the non-linear relation continues to hold, with the turning point for both samples being marginally smaller than in the case of the primary balance. See Table A.2.4 in the Appendix.

4.2. Further robustness tests

4.2.1. Period effects

In the robustness checks, we first focus on period effects since studies in the literature have shown a varying impact of some variables over time. To test for a change in fiscal policy responses we break the sample into several sub-periods, reducing it by one year each time (until 2021, 2020 and 2019). We also test our hypothesis over the entire time span 1995-2022 and not only for the euro period (in this case our results remain almost unchanged). Estimation results are presented in Table A.2.5 of the Appendix.

For the EA-19 group, when we exclude the years 2022 and/or 2021 from the *Base* model, the non-linear relationship between inflation and the primary balance remains statistically significant, albeit somewhat weaker. For periods before 2020, we lose the statistical significance with the Base model, but not when inflation is instrumented with the global oil or natural gas prices. The turning point declines somewhat when the Covid period and the current high inflation episode are completely removed from the sample (from 5.9% for the period 1999-2022 when inflation is instrumented through the natural gas prices to 5.1% for 1999-2019). In case of the EA-12 (generally, the lower inflation group), when the year 2022 is excluded from the sample, the quadratic term for HICP inflation loses statistical significance and we no longer find evidence of a non-linear impact of inflation on the primary balance. Instrumenting the inflation does not help with restoring the statistical significance of the quadratic term. Only the linear term turns again significant, which implies a positive impact of inflation – when at moderate levels – on public finances for the EA-12 group. In this reduced sample, the model is overall less well fit and specified.

Next, we proceed to including dummy variables to our basic specification to control for the effects of crises that occurred over our time span: the financial crisis (2008-2009), the sovereign debt crisis (2010-2012), the Covid-19 crisis (2020-2021) and a dummy for the effects of the Covid-19 crisis plus the war in Ukraine (from 2020 onwards). Estimation results are presented in Table A.2.6 of the Appendix. Adding these dummy variables one by one does not change the robustness of the results. We still find evidence of non-linear effects of HICP inflation on the primary balance, without any major change in the turning point.[19] When we add the three dummies together in a combined Base model, the linear and quadratic terms of the HICP lose significance for both the EA-19 and EA-12 groups, but the significance is restored when the Base model is run with the oil or gas prices as IV for inflation.

[19] Except for the Covid-19 crisis dummy, which turns the *linear* term of HICP insignificant for the EA-19 and decreases the turning point. Yet, the significance is restored and the turning point barely changes when the same model is run with the oil or gas prices as IV.

4.2.2. Country effects

Apart from investigating potentially different fiscal responses in the subgroup of more matured, bigger government euro area economies (EA-12), we examine further the issue of panel heterogeneity. To this end, we control for outliers in the dependent variable (primary balance) and/or the explanatory variable of interest (inflation) by running the basic specification while omitting one country at a time. Countries excluded are Ireland, Greece, Slovenia, Slovakia, Estonia, Lithuania and Latvia. Estimation results are presented in Table A.2.7 of the Appendix. Albeit there is some variability in the FRF coefficients, the differences are rather small and the results remain robust. The turning point is somewhat smaller when each of the Baltic countries is excluded from the sample and higher when Greece is excluded. When Latvia is removed from the sample, the linear HICP coefficient loses significance, while the squared term remains statistically significant at 10% level. However, when the Base model with the additional gas (or oil) price instrument is used, the high statistical significance is regained for both terms.[20]

4.2.3. Choice of estimators

As already introduced in section 3.3., we also test the robustness of our results by employing a battery of estimators to gauge any potential biases in our estimates compared to the base estimator (FE-IV). See Table A.2.8 in the Appendix. For the EA-19 group, we still find evidence of non-linear effects of inflation on public finances with the two-step GMM estimator: both the linear and quadratic terms of HICP remain statistically significant and we find a similar turning point as in the *Base* model (6.0%). With the simple fixed effects estimator and the Arellano-Bond (difference) GMM estimator, one of the inflation terms loses statistical significance. Regarding the other explanatory variables, they keep their levels of significance and signs, except the lagged current account and time trend which turn not significant with AB GMM. For the EA-12 group, our results are rather robust across estimators. The linear and quadratic inflation coefficients remain statistically significant with each of the four estimators. Compared with our base specification, the turning point changes very little with the two-step GMM estimator (at 4.5%), while it is somewhat higher (at 5.3%) in the AB GMM and FE estimators. Regarding the other explanatory variables, the lagged debt and output gap are not significant in our IV FE *Base* model and with the two-step GMM estimator; leaving aside these two results, the coefficients signs of the other explanatory variables are in line with the literature.

4.2.4. Other robustness: the impact of inflation "surprises"

A variable that may better capture an ex-ante inflation shock and be less affected by endogeneity and reverse causation is the inflation "surprise", defined as the difference between actual and forecast inflation. We construct such a variable using the Eurosystem staff projections in year T-1 (December projection rounds) for the HICP inflation forecast in year T and compare it with the actual HICP inflation in year T. In this case, due to data availability, the sample period is more restricted, i.e. to 2003-2022. The results of several regression models using this alternative variable (Base model, Base model with the additional natural gas price instrument (IV) and with other - most relevant - controls) are presented in Table 3 below. They confirm our findings for the full EA-19 sample.

The turning point is considerably lower (4.9% in the Base model compared to 6.1% before), pointing to the fact that in case of an unexpected inflation shock, public finances may start to be negatively affected at a lower inflation level. The inflation surprise variables are not found to be statistically significant in the EA-12 sample using the IV-FE estimator, but are statistically significant if alternative estimators (FE, Arelano-Bond GMM) are used. Given the restricted sample size (both in T and N), the results with the IV estimator for the EA-12 sample could simply reflect efficiency considerations.

[20] Similar improvement in the statistical significance of results holds for the sample excluding Lithuania.

Table 3: The impact of inflation surprises, 2003-2022

	EA-19			
	Base	**Base + IV GAS**	**Base + IV GAS (m1)**	**Base + IV GAS (m2)**
Lagged primary balance	0.941***	0.955***	0.953***	0.957***
	(0.214)	(0.175)	(0.189)	(0.178)
HICP inflation surprise	**1.488****	**1.563*****	**1.439*****	**1.605*****
	(0.752)	(0.517)	(0.546)	(0.607)
HICP inflation surprise^2	**-0.151****	**-0.158*****	**-0.153*****	**-0.161*****
	(0.073)	(0.055)	(0.057)	(0.061)
Output gap	-0.120	-0.121	-0.116	-0.124
	(0.165)	(0.165)	(0.165)	(0.167)
Lagged current account	0.127	0.138	0.169	0.147
	(0.235)	(0.170)	(0.186)	(0.165)
Lagged debt	0.061*	0.060**	0.051	0.058**
	(0.034)	(0.029)	(0.032)	(0.027)
Election dummy	0.582	0.588	0.595	0.604
	(0.388)	(0.402)	(0.389)	(0.421)
Time trend	-0.218***	-0.219***	-0.278***	-0.219***
	(0.055)	(0.057)	(0.055)	(0.058)
Openness			0.040***	
			(0.015)	
Terms of trade				0.034
				(0.087)
Constant	-0.532	-0.488	-4.835**	-0.474
	(1.334)	(1.220)	(1.944)	(1.233)
Turning Point	**4.9**	**4.9**	**4.7**	**5.0**
No. observations	275	275	275	275
Centered R-squared	0.464	0.459	0.478	0.458
Kleibergen-Paap LM statistic	9.793	9.411	9.476	9.793
Kleibergen-Paap LM p-val	0.0204	0.0243	0.0236	0.0204
Hansen test	1.739	2.053	1.653	1.739
Hansen p-val	0.419	0.358	0.437	0.419

*Notes: DV is primary balance-to-GDP ratio. Robust standard errors (shown in parentheses), country FE used in all specifications. Hansen test's null hypothesis is that instruments (orthogonality conditions) are valid. The null of Kleinbergen-Paap LM test is that instruments are weak. P-value: *** p<0.01, ** p<0.05, * p<0.1.*

Conclusions

In this paper, we analyse empirically the impact of inflation on public finances in the euro area, focusing on the question of whether at high levels – like in the most recent episode - inflation could have a different impact on the budget balance.

To this end, we estimate a fiscal reaction function for euro area countries (EA-19 and EA-12) over the period 1999-2022 and, using various dynamic panel techniques and a battery of robustness checks, we find evidence of non-linear effects of inflation on public finances. The results indicate a concave relationship and a turning point in the contemporaneous annual impact of HICP inflation on the primary balance, at somewhat above 4% for the EA-12 (95% confidence interval in the *Base* model at 3.3 to 5.4%) and around 6% for the EA-19 (95% confidence interval in the *Base* model at 4.5 to 7.7%). After such a turning point is reached, the impact is estimated to be negative. The findings for the full EA-19 sample are broadly confirmed when we use the inflation "surprise", an alternative variable that may better capture an ex-ante inflation shock and be less affected by endogeneity. In this case, the turning point is considerably lower (4.9% in the *Base* model for EA-19), indicating that, in case of an unexpected inflation shock, public finances may start to be negatively affected at a lower inflation level.

Our conclusions remain unchanged when we control for variables that could capture the nature of the inflation shock, namely terms of trade, effective exchange rate and total factor productivity. Moreover, the results become even stronger statistically when we add the global commodity prices (oil or natural gas) to our set of instruments. Yet, our empirical specification in the context of a dynamic panel model may not fully disentangle the *nature* from the *level* of the inflation shock.

In terms of channels, the non-linear effects are found to propagate through both the primary expenditure and the revenue ratio (more robustly through the former) in the EA-12 sample. The quadratic relationship continues to hold, being as expected convex (U-shaped) for expenditures and concave (inversed U-shaped) for revenues. This means that up to a certain level of inflation, primary expenditure (total expenditure less interest payments, as a ratio to GDP) declines in the short-term, but as inflation gets higher this effect vanishes and the expenditure ratio tends to increase above the threshold, possibly because of additional spending pressures. The converse holds for the revenue ratio: as inflation gets above the threshold, the revenue ratio tends to decline, possibly because of higher uncertainty, negative macro developments and discretionary stimulus measures on taxes. The stronger reaction of the primary expenditure ratio in the EA-12 (vs. EA-19) could be explained by the larger government size and more activism in fiscal policies in this sample, which includes the largest euro area economies. For the EA-19 sample, there is no robust evidence for the impact of inflation through either channel separately, which leads us to conclude that the net effect on the primary balance is the one that counts most.

Further, we find that the FRF estimates are robust across various specifications and exclusion of individual countries. However, the results differ according to time periods. When we restrict the period to end in 2019 or earlier, we find evidence of non-linear effects of inflation on the primary balance (in specifications instrumented with the global commodity prices) only for the EA-19 sample, which includes more episodes of high inflation. These robustness tests suggest that the periods with particularly high inflation, especially the recent episode in the euro area, largely drive the results, with no such consequences on the budget when inflation remains moderate.

As regards other determinants of fiscal positions (higher primary surpluses), we find evidence for persistence in fiscal policy, the co-movement of headline fiscal positions with the economic cycle, and the importance of external factors (improved external positions and more openness associated with higher primary surpluses). We also find evidence that euro area governments abide, on average, by the (weak) fiscal sustainability constraint, with the evidence being more robust in the full EA sample than in the EA-12 group.

Overall, the results in this paper – along with other recent analyses on the topic (e.g., Bankowski et al, 2023a, b) – underscore the need for governments to preserve sound fiscal policies and not rely on high inflation to reduce the large deficit and debt levels accumulated over the recent crises.

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Appendix

Appendix 1: Data sources and summary statistics

Table A.1.1. Description of main variables and their sources

Variable	Definition	Transformation(s)	Main source
Primary balance	General government primary balance (general government balance net of interest payments) (ESA 2010, EDP)	Percent of nominal GDP	AMECO
Inflation	Harmonised Index of Consumer Prices (HICP)	Annual growth rate (%)	AMECO
Inflation (GDP deflator)	GDP deflator (ESA 2010)	Annual growth rate (%)	AMECO
Debt ratio	General government debt (EDP, ESA 2010)	Percent of nominal GDP	AMECO
Output gap	GDP minus potential GDP over potential GDP	-	AMECO
Current account	Current account balance of the private sector	Current account net of budget balance, as % of nominal GDP	AMECO
Election dummy	Binary variable (1 = election)	Own calculation – Is equal to 1 in years of elections (parliamentary or presidential)	International Institute for Democracy and Electoral Assistance (idea.int)
Interest payments	Interest expenditure, general government (EDP, ESA 2010)	Percent of nominal GDP	AMECO
IMF fiscal rules index	Binary variable (1 = any fiscal rule is applicable)	Own calculation from IMF database – If any fiscal rule is applied then dummy variable is equal to 1	IMF's Fiscal Rules database
Trade openness	Ratio of exports and imports to nominal GDP	Own calculation – As percent of nominal GDP	AMECO
GDP real	GDP at constant prices	Annual growth rate (%)	AMECO
Factor productivity	Total factor productivity, total economy	Annual growth rate (%)	AMECO
Nominal effective exchange rates	Nominal effective exchange rates, relative to the rest of 35 industrial countries, double export weights	Annual growth rate (%)	AMECO
Terms of trade	Ratio between extra exports deflator and extra imports deflator	Own calculation - Annual growth rate (%)	ESCB macroeconomic projection database
APSP crude oil	Simple average of three spot prices (Dated Brent, West Texas Intermediate, and the Dubai Fateh) – index (2016=100)	Annual growth rate (%)	IMF Primary Commodity Price System database
Natural gas price	Includes European, Japanese, and American Natural Gas Price Indices) – index (2016=100)	Annual growth rate (%)	IMF Primary Commodity Price System database
Primary expenditure	Primary expenditure, general government (EDP, ESA 2010)	Total expenditure net of interest payments, as % of nominal GDP	AMECO
Total revenue	Total revenue, general government (ESA 2010, EDP)	Percent of nominal GDP	AMECO
Budget balance	General government balance (ESA 2010, EDP)	Percent of nominal GDP	AMECO
Inflation surprise	Inflation value in year t from ESCB December projections in year t minus inflation forecast for year t from ESCB December projections in year t-1	Own calculation – Annual growth rate (%)	ESCB macroeconomic projection database

Notes: AMECO – Macroeconomic Database of the European Commission

Table A.1.2. Summary statistics

	Primary balance (% of GDP)				HICP inflation (%)			
	min	mean	max	st.dev.	min	mean	max	st.dev.
AT	-6.7	0.1	2.9	2.3	0.4	2.1	8.7	1.6
BE	-7.0	1.4	6.8	3.5	0.0	2.3	10.4	2.0
CY	-5.5	0.0	6.0	3.0	-1.5	1.9	8.0	2.2
DE	-3.7	0.7	2.9	2.0	0.2	1.8	8.8	1.7
EE	-5.4	-0.1	3.1	2.0	-0.6	4.0	19.3	4.1
ES	-9.6	-1.7	3.7	4.2	-0.6	2.3	8.5	2.0
FI	-4.8	1.8	9.6	3.8	-0.2	1.8	7.2	1.5
FR	-7.7	-1.6	1.6	2.2	0.1	1.7	5.8	1.2
GR	-10.2	-1.8	4.3	4.0	-1.4	2.2	10.0	2.5
IE	-29.3	-1.3	6.8	7.4	-1.7	1.9	8.3	2.3
IT	-6.0	1.1	4.6	2.3	-0.1	2.0	8.7	1.8
LT	-7.9	-1.3	1.6	2.7	-1.1	3.1	18.9	4.2
LU	-3.2	1.8	5.9	2.1	0.0	2.4	8.4	1.8
LV	-8.0	-1.9	1.1	2.7	-1.2	4.0	16.9	4.5
MT	-8.1	-0.6	5.1	3.2	0.7	2.1	6.1	1.3
NL	-3.6	0.3	4.5	2.4	0.1	2.3	11.6	2.3
PT	-8.5	-1.3	3.1	2.7	-0.9	2.0	8.0	1.9
SI	-12.0	-1.5	2.8	3.2	-0.8	3.3	9.2	3.0
SK	-8.6	-2.5	0.5	2.4	-0.5	4.0	12.2	3.7

Source: own calculations.

Appendix 2: Robustness checks

Table A.2.1: Regression results controlling for real GDP growth

	EA-19				EA-12		
	Base	**m1**	**m2**	**m3**	**Base**	**m1**	**m2**
Lagged primary balance	0.834***	0.821***	0.823***	0.826***	0.812***	0.823***	0.824***
	(0.113)	(0.109)	(0.109)	(0.116)	(0.096)	(0.091)	(0.107)
HICP inflation	**1.863****	**1.687****	**1.694****	**1.894****	**1.610*****	**1.602*****	**1.462****
	(0.798)	(0.743)	(0.803)	(0.790)	(0.613)	(0.608)	(0.619)
HICP inflation^2	**-0.136****	**-0.123****	**-0.123****	**-0.138****	**-0.140****	**-0.140****	**-0.131****
	(0.061)	(0.057)	(0.061)	(0.061)	(0.065)	(0.064)	(0.065)
Real GDP growth rate	*0.223****	*0.249****	*0.202***	*0.233****	*0.243***	*0.221*	*0.148*
	(0.083)	*(0.089)*	*(0.081)*	*(0.086)*	*(0.118)*	*(0.135)*	*(0.136)*
Lagged current account	0.214*	0.171	0.203*	0.212*	0.184**	0.195**	0.205**
	(0.116)	(0.115)	(0.109)	(0.118)	(0.088)	(0.096)	(0.092)
Lagged debt	0.054***	0.044***	0.053***	0.056***	0.046***	0.045**	0.045***
	(0.013)	(0.016)	(0.013)	(0.013)	(0.017)	(0.021)	(0.017)
Election dummy	0.074	0.058	0.078	0.069	0.236	0.248	0.292
	(0.293)	(0.281)	(0.283)	(0.296)	(0.342)	(0.347)	(0.346)
Time trend	-0.071*	-0.020	-0.101*	-0.077*	-0.077*	-0.073	-0.133***
	(0.037)	(0.066)	(0.052)	(0.040)	(0.041)	(0.072)	(0.048)
Interest payments		0.492				0.024	
		(0.433)				(0.420)	
Openness			0.011				0.026**
			(0.012)				(0.012)
Lagged IMF fiscal rules				0.712			
				(0.885)			
Constant	-6.834***	-7.699***	-7.354***	-7.525***	-5.861***	-5.807**	-6.399***
	(2.432)	(2.588)	(2.043)	(2.192)	(2.008)	(2.418)	(2.015)
Turning Point	6.8	6.8	6.8	6.8	5.7	5.7	5.5
No observations	413	413	413	413	263	263	263
Centered R-squared	0.390	0.448	0.448	0.379	0.703	0.702	0.706
Kleibergen-Paap LM statistic	9.085	9.814	8.733	10.50	8.242	8.357	8.439
Kleibergen-Paap LM p-val	0.0590	0.0437	0.0681	0.0327	0.0831	0.0793	0.0768
Hansen test	7.238	6.707	7.545	6.790	9.315	9.976	9.367
Hansen p-val	[0.0647]	[0.0819]	[0.0564]	[0.0789]	[0.0254]	[0.0188]	[0.0248]

*Notes: The dependent variable is the primary balance-to-GDP ratio. In line with the Base specification with the output gap, the variable Real GDP growth rate is hereby instrumented through its own lags (L1 to L3). Robust standard errors (in parentheses), country FE used in all specifications. Hansen test's null hypothesis is that instruments (orthogonality conditions) are valid. In regressions with real GDP growth (instead of output gap), the Hansen test is always rejected, hence the preference to keep the output gap in the main specifications. The null of Kleinbergen-Paap LM test is that instruments are weak. P-value: *** p<0.01, ** p<0.05, * p<0.1.*

Table A.2.2: Channels: The impact of inflation on the primary expenditure ratio, 1999-2022

	EA-19							EA-12						
	Base	**Base IV GAS**	**Base IV GAS (m1)**	**Base IV GAS (m2)**	**Base IV GAS (m3)**	**Base IV GAS (m4)**	**Base IV GAS (m5)**	**Base**	**Base IV GAS**	**Base IV GAS (m1)**	**Base IV GAS (m2)**	**Base IV GAS (m3)**	**Base IV GAS (m4)**	**Base IV GAS (m5)**
Lagged primary expenditure	0.706***	0.728***	0.743***	0.703***	0.795***	0.728***	0.735***	0.825***	0.849***	0.869***	0.791***	0.864***	0.850***	0.844***
	(0.167)	(0.151)	(0.153)	(0.140)	(0.110)	(0.150)	(0.147)	(0.166)	(0.143)	(0.142)	(0.144)	(0.104)	(0.139)	(0.141)
HICP inflation	**-1.491**	**-0.704**	**-0.519**	**-0.482**	**0.044**	**-0.711**	**-0.764**	**-1.792***	**-1.304****	**-1.193****	**-1.180****	**-0.580**	**-1.380****	**-1.369***
	(1.079)	(0.482)	(0.424)	(0.443)	(0.387)	(0.472)	(0.539)	(1.069)	(0.638)	(0.570)	(0.594)	(0.431)	(0.625)	(0.745)
HICP inflation^2	**0.129**	**0.070***	**0.051**	**0.049**	**-0.011**	**0.070***	**0.074***	**0.205***	**0.150****	**0.132****	**0.142****	**0.051**	**0.160****	**0.160****
	(0.080)	(0.042)	(0.036)	(0.036)	(0.039)	(0.041)	(0.044)	(0.118)	(0.073)	(0.064)	(0.066)	(0.051)	(0.073)	(0.077)
Output gap	-0.293**	-0.249**	-0.247**	-0.237***	-0.166*	-0.250**	-0.238**	-0.129	-0.100	-0.095	-0.100	-0.125	-0.093	-0.099
	(0.127)	(0.103)	(0.099)	(0.090)	(0.085)	(0.104)	(0.105)	(0.155)	(0.152)	(0.147)	(0.141)	(0.095)	(0.151)	(0.156)
Lagged current account	-0.346***	-0.296***	-0.306***	-0.258***	-0.153***	-0.291***	-0.290***	-0.333***	-0.296***	-0.305***	-0.262***	-0.162*	-0.281***	-0.304***
	(0.121)	(0.064)	(0.060)	(0.056)	(0.056)	(0.066)	(0.069)	(0.118)	(0.100)	(0.101)	(0.091)	(0.087)	(0.102)	(0.098)
Lagged debt	-0.030*	-0.023	-0.033*	-0.022*	-0.016	-0.024*	-0.028**	-0.023	-0.023	-0.035	-0.022	-0.022	-0.024	-0.022
	(0.017)	(0.014)	(0.018)	(0.013)	(0.013)	(0.014)	(0.014)	(0.026)	(0.024)	(0.026)	(0.024)	(0.023)	(0.024)	(0.024)
Election dummy	-0.173	-0.202	-0.218	-0.192	-0.159	-0.206	-0.274	-0.377	-0.391	-0.411	-0.403	-0.230	-0.378	-0.391
	(0.314)	(0.274)	(0.269)	(0.253)	(0.253)	(0.274)	(0.279)	(0.344)	(0.337)	(0.342)	(0.324)	(0.320)	(0.344)	(0.348)
Time trend	0.087*	0.103**	0.162***	0.216***	0.101***	0.102**	0.113***	0.026	0.043	0.112**	0.160***	0.063	0.040	0.038
	(0.049)	(0.041)	(0.048)	(0.038)	(0.027)	(0.041)	(0.043)	(0.054)	(0.051)	(0.056)	(0.041)	(0.039)	(0.050)	(0.051)
Interest payments			0.491							0.521*				
			(0.312)							(0.285)				
Openness				-0.046***							-0.056***			
				(0.010)							(0.018)			
Total factor productivity					-0.387***							-0.404***		
					(0.104)							(0.094)		
Effective exchange rate						0.037							0.083	
						(0.067)							(0.085)	
Term of trade							0.005							-0.015
							(0.068)							(0.082)
Constant	17.525**	14.271***	11.884*	19.172***	9.950**	14.312***	14.126***	11.499*	9.619**	7.013	14.113***	7.963**	9.834**	9.840**
	(6.916)	(5.394)	(6.205)	(5.431)	(4.482)	(5.426)	(5.152)	(6.759)	(4.672)	(5.093)	(4.738)	(3.304)	(4.634)	(4.616)
Turning Point	-	**5.1**	-	-	-	**5.1**	**5.2**	**4.4**	**4.3**	**4.5**	**4.2**	-	**4.3**	**4.3**
No. observations	413	413	413	413	413	413	406	263	263	263	263	263	263	263
Centered R-squared	0.794	0.852	0.864	0.876	0.898	0.852	0.851	0.860	0.870	0.874	0.884	0.905	0.869	0.867
Kleibergen-Paap LM stat.	6.618	14.89	15.05	15.30	11.43	14.72	12.77	5.402	14.55	16.02	15	15.35	14.40	14.02
Kleibergen-Paap LM p-val	0.0851	0.005	0.004	0.004	0.022	0.005	0.012	0.145	0.005	0.003	0.005	0.004	0.006	0.007
Hansen test	0.442	1.376	2.427	1.034	10.13	1.269	1.203	4.018	5.780	6.065	2.852	6.695	4.567	5.698
Hansen p-val	0.802	0.711	0.489	0.793	[0.017]	0.737	0.752	0.134	0.123	0.109	0.415	[0.082]	0.206	0.127

*Note: The dependent variable is the government primary expenditure-to-GDP ratio. Robust standard errors, country FE used in all specifications. Hansen test's null hypothesis is that instruments (orthogonality conditions) are valid. Where the test is rejected, the p-values are shown in brackets. The null of Kleinbergen-Paap LM test is that instruments are weak. P-value: *** p<0.01, ** p<0.05, * p<0.1. In this table, turning points shown only for the regression models in which the quadratic term is statistically significant at least at * p<0.1.*

Table A.2.3: Channels: The impact of inflation on the revenue ratio, 1999-2022

	EA-19							EA-12						
	Base	**Base IV GAS**	**Base IV GAS (m1)**	**Base IV GAS (m2)**	**Base IV GAS (m3)**	**Base IV GAS (m4)**	**Base IV GAS (m5)**	**Base**	**Base IV GAS**	**Base IV GAS (m1)**	**Base IV GAS (m2)**	**Base IV GAS (m3)**	**Base IV GAS (m4)**	**Base IV GAS (m5)**
Lagged revenue	0.777***	0.814***	0.838***	0.809***	0.864***	0.809***	0.816***	0.969***	0.971***	0.980***	0.958***	0.984***	0.967***	0.964***
	(0.084)	(0.074)	(0.077)	(0.067)	(0.058)	(0.073)	(0.075)	(0.080)	(0.072)	(0.073)	(0.080)	(0.056)	(0.072)	(0.067)
HICP inflation	**0.039**	**0.275***	**0.340***	**0.329****	**0.693*****	**0.266***	**0.331****	**0.664***	**0.678****	**0.679****	**0.657****	**0.835*****	**0.658****	**0.627*****
	(0.381)	(0.164)	(0.177)	(0.153)	(0.220)	(0.160)	(0.154)	(0.380)	(0.287)	(0.286)	(0.277)	(0.247)	(0.278)	(0.237)
HICP inflation^2	**0.004**	**-0.013**	**-0.020**	**-0.019**	**-0.056****	**-0.013**	**-0.018**	**-0.072**	**-0.074***	**-0.074***	**-0.070***	**-0.095*****	**-0.072***	**-0.067****
	(0.031)	(0.016)	(0.017)	(0.015)	(0.022)	(0.016)	(0.015)	(0.047)	(0.040)	(0.040)	(0.039)	(0.035)	(0.039)	(0.033)
Output gap	-0.093**	-0.081**	-0.081**	-0.074**	-0.052	-0.083**	-0.092**	-0.101**	-0.101**	-0.099**	-0.100**	-0.105**	-0.100**	-0.100**
	(0.042)	(0.039)	(0.039)	(0.036)	(0.041)	(0.039)	(0.038)	(0.043)	(0.045)	(0.046)	(0.045)	(0.041)	(0.045)	(0.044)
Lagged current account	-0.053	-0.037	-0.040	-0.028	0.041	-0.036	-0.046	0.030	0.032	0.032	0.027	0.066*	0.036	0.025
	(0.048)	(0.037)	(0.038)	(0.034)	(0.042)	(0.037)	(0.036)	(0.044)	(0.036)	(0.035)	(0.037)	(0.034)	(0.036)	(0.032)
Lagged debt	0.017**	0.018**	0.014	0.018**	0.020**	0.018**	0.020**	0.002	0.001	-0.000	0.003	0.001	0.001	0.002
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.011)	(0.011)	(0.011)	(0.011)	(0.009)	(0.011)	(0.010)
Election dummy	-0.090	-0.093	-0.095	-0.092	-0.064	-0.095	-0.079	-0.045	-0.045	-0.045	-0.047	-0.003	-0.042	-0.048
	(0.114)	(0.110)	(0.111)	(0.107)	(0.116)	(0.110)	(0.112)	(0.139)	(0.139)	(0.140)	(0.140)	(0.141)	(0.140)	(0.136)
Time trend	-0.006	-0.002	0.018	0.031*	-0.002	-0.002	-0.004	0.016	0.017	0.023	0.020	0.022	0.016	0.014
	(0.020)	(0.016)	(0.024)	(0.016)	(0.013)	(0.016)	(0.017)	(0.028)	(0.026)	(0.031)	(0.019)	(0.023)	(0.025)	(0.023)
Interest payments			0.165							0.050				
			(0.142)							(0.111)				
Openness				-0.014***							-0.003			
				(0.005)							(0.007)			
Total factor productivity					-0.184***							-0.096**		
					(0.050)							(0.042)		
Effective exchange rate						0.019							0.025	
						(0.035)							(0.047)	
Term of trade							-0.003							-0.013
							(0.022)							(0.030)
Constant	9.220**	6.991**	5.355	8.369***	3.973	7.223**	6.763**	0.262	0.150	-0.317	0.748	-0.554	0.369	0.455
	(4.117)	(3.167)	(3.608)	(2.958)	(2.746)	(3.121)	(3.222)	(3.208)	(2.754)	(2.908)	(3.217)	(2.245)	(2.728)	(2.541)
Turning Point	**-**	**-**	**-**	**-**	**6.2**	**-**	**-**	**-**	**4.3**	**4.5**	**4.2**	**5.6**	**4.3**	**4.3**
No. observations	413	413	413	413	413	413	406	263	263	263	263	263	263	263
Centered R-squared	0.969	0.971	0.970	0.972	0.966	0.971	0.970	0.977	0.977	0.977	0.977	0.976	0.977	0.977
Kleibergen-Paap LM stat.	10.09	14.23	14.36	14.66	11.59	14.10	11.90	8.812	15.76	16.09	16.96	16.87	15.74	15.74
Kleibergen-Paap LM p-val	0.017	0.006	0.006	0.005	0.020	0.006	0.018	0.031	0.003	0.002	0.001	0.002	0.003	0.003
Hansen test	3.142	3.173	3.212	3.966	6.504	3.228	2.305	1.279	1.297	1.179	1.150	1.269	1.150	1.605
Hansen p-val	0.208	0.366	0.360	0.265	[0.089]	0.358	0.512	0.527	0.730	0.758	0.765	0.737	0.765	0.658

*Note: The dependent variable is the government revenue-to-GDP ratio. Robust standard errors, country FE used in all specifications. Hansen test's null hypothesis is that instruments (orthogonality conditions) are valid. Where the test is rejected, the p-values are shown in brackets. The null of Kleinbergen-Paap LM test is that instruments are weak. P-value: *** p<0.01, ** p<0.05, * p<0.1. In this table, turning points shown only for the regression models in which the quadratic term is statistically significant at least at * p<0.1, plus Base model for EA-12.*

Table A.2.4: The impact of inflation on the headline budget balance, 1999-2022

	EA-19					EA-12			
	Base	**Base IV GAS**	**Base IV GAS (m1)**	**Base IV GAS (m2)**	**Base IV GAS (m3)**	**Base**	**Base IV GAS**	**Base IV GAS (m1)**	**Base IV GAS (m3)**
Lagged budget balance	0.816***	0.807***	0.812***	0.805***	0.806***	0.876***	0.872***	0.903***	0.873***
	(0.140)	(0.124)	(0.119)	(0.125)	(0.126)	(0.127)	(0.121)	(0.126)	(0.127)
HICP inflation	**1.527***	**1.271*****	**1.155*****	**1.281*****	**1.378*****	**2.318****	**2.124*****	**2.091*****	**2.180*****
	(0.821)	(0.402)	(0.398)	(0.395)	(0.469)	(0.939)	(0.556)	(0.541)	(0.662)
HICP inflation^2	**-0.130****	**-0.111*****	**-0.099*****	**-0.112*****	**-0.118*****	**-0.271****	**-0.250*****	**-0.254*****	**-0.259*****
	(0.062)	(0.038)	(0.036)	(0.037)	(0.041)	(0.107)	(0.074)	(0.074)	(0.076)
Output gap	0.151	0.144*	0.126	0.143	0.127	-0.022	-0.029	-0.062	-0.031
	(0.095)	(0.087)	(0.087)	(0.088)	(0.089)	(0.125)	(0.128)	(0.130)	(0.131)
Lagged current account	0.309**	0.288***	0.271***	0.288***	0.274***	0.358**	0.337**	0.365**	0.346***
	(0.124)	(0.088)	(0.084)	(0.088)	(0.095)	(0.150)	(0.138)	(0.144)	(0.128)
Lagged debt	0.046***	0.044***	0.044***	0.044***	0.051***	0.031	0.031	0.026	0.029
	(0.014)	(0.013)	(0.013)	(0.013)	(0.013)	(0.025)	(0.025)	(0.025)	(0.024)
Election dummy	0.132	0.137	0.135	0.137	0.220	0.359	0.362	0.387	0.359
	(0.302)	(0.290)	(0.279)	(0.291)	(0.298)	(0.363)	(0.359)	(0.358)	(0.372)
Time trend	-0.069*	-0.073**	-0.145***	-0.076**	-0.087***	-0.002	-0.010	-0.109**	-0.004
	(0.035)	(0.033)	(0.036)	(0.034)	(0.033)	(0.056)	(0.054)	(0.049)	(0.051)
Openness			0.030***					0.053***	
			(0.010)					(0.015)	
Lagged IMF fiscal rules				0.299					
				(0.802)					
Terms of trade					0.001				0.006
					(0.074)				(0.089)
Constant	-5.670**	-4.949***	-7.483***	-5.219***	-5.216***	-6.062**	-5.753**	-7.428***	-5.742**
	(2.296)	(1.115)	(1.386)	(1.105)	(1.292)	(2.753)	(2.256)	(2.259)	(2.457)
Turning Point	**5.9**	**5.7**	**5.8**	**5.7**	**5.8**	**4.3**	**4.3**	**4.1**	**4.2**
No. observations	413	413	413	413	406	263	263	263	263
Centered R-squared	0.431	0.492	0.541	0.488	0.478	0.595	0.610	0.619	0.599
Kleibergen-Paap LM stat.	8.794	14.15	14.41	15.83	12.06	7.518	12.91	13.08	12.96
Kleibergen-Paap LM p-val	0.032	0.007	0.006	0.003	0.017	0.057	0.012	0.011	0.012
Hansen test	1.182	1.418	0.960	1.193	0.660	2.305	2.542	0.383	2.294
Hansen p-val	0.554	0.701	0.811	0.755	0.883	0.316	0.468	0.944	0.514

*Notes: DV is the headline budget balance-to-GDP ratio. The results are robust when other variables from Table 1 and Table 2 from the main text are included as additional controls. Robust standard errors, country FE used in all specifications. Hansen test's null hypothesis is that instruments (orthogonality conditions) are valid. The null of Kleinbergen-Paap LM test is that instruments are weak. P-value: *** p<0.01, ** p<0.05, * p<0.1.*

Table A.2.5: Main specification for various periods

	EA-19				EA-12			
	Base 1999-2022	**Base 1999-2019**	**Base IV Gas prices 1999-2019**	**Base IV Gas prices 1995-2019**	**Base 1999-2022**	**Base 1999-2019**	**Base IV Gas prices 1999-2019**	**Base IV Gas prices 1995-2019**
Lagged primary balance	0.784***	0.714***	0.724***	0.716***	0.817***	0.795***	0.785***	0.770***
	(0.146)	(0.094)	(0.086)	(0.085)	(0.135)	(0.202)	(0.107)	(0.101)
HICP inflation	**1.689****	**0.497**	**0.626****	**0.649****	**2.625*****	**1.380**	**1.442***	**1.453****
	(0.810)	(0.450)	(0.297)	(0.293)	(0.885)	(1.062)	(0.745)	(0.717)
HICP inflation^2	**-0.138****	**-0.056**	**-0.062***	**-0.066***	**-0.301*****	**-0.217**	**-0.257**	**-0.263**
	(0.061)	(0.035)	(0.035)	(0.035)	(0.104)	(0.637)	(0.272)	(0.234)
Output gap	0.156*	0.241***	0.236***	0.235***	0.010	0.188	0.196***	0.200***
	(0.094)	(0.058)	(0.059)	(0.059)	(0.131)	(0.142)	(0.075)	(0.073)
Lagged current account	0.318**	0.197***	0.209***	0.199***	0.362**	0.252***	0.249***	0.235***
	(0.123)	(0.072)	(0.063)	(0.061)	(0.154)	(0.072)	(0.079)	(0.076)
Lagged debt	0.049***	0.047***	0.049***	0.050***	0.034	0.040	0.038	0.040*
	(0.014)	(0.017)	(0.015)	(0.015)	(0.026)	(0.040)	(0.024)	(0.022)
Election dummy	0.095	-0.130	-0.120	-0.106	0.297	-0.024	-0.045	-0.022
	(0.303)	(0.270)	(0.259)	(0.257)	(0.370)	(0.560)	(0.348)	(0.323)
Time trend	-0.086**	-0.070***	-0.067***	-0.066***	-0.009	-0.023	-0.024	-0.028
	(0.038)	(0.025)	(0.024)	(0.023)	(0.062)	(0.039)	(0.030)	(0.029)
Constant	-5.648**	-2.456	-2.952***	-3.006***	-6.330**	-4.488	-4.206	-4.417*
	(2.407)	(1.841)	(1.083)	(1.056)	(2.657)	(5.725)	(2.707)	(2.367)
Turning Point	**6.1**	**-**	**5.1**	**4.9**	**4.4**	**-**	**-**	**-**
No. observations	413	356	356	361	263	227	227	232
Centered R-squared	0.326	0.648	0.649	0.653	0.512	0.718	0.718	0.722
Kleibergen-Paap LM statistic	8.897	13.81	14.23	13.82	7.597	9.631	13.65	15.47
Kleibergen-Paap LM p-val	0.031	0.003	0.007	0.008	0.055	0.022	0.009	0.004
Hansen test	1.349	0.0152	0.352	0.380	1.912	6.617	6.987	7.473
Hansen p-val	0.509	0.992	0.950	0.944	0.384	[0.037]	[0.072]	[0.058]

*Notes: The results of the last two columns for each EA sample remain broadly unchanged when the global oil price growth is used as instrument instead of natural gas price growth. Robust standard errors, country FE used in all specifications. Hansen test's null hypothesis is that instruments (orthogonality conditions) are valid. The test is rejected in the last three specifications with EA-12 (p-values shown in brackets). The null of Kleinbergen-Paap LM test is that instruments are weak. P-value: *** p<0.01, ** p<0.05, * p<0.1.*

Table A.2.6: Main specification with dummy variables for crises, 1999-2022

	EA-19						EA-12					
	Base	**m1**	**m2**	**m3**	**m4**	**Base IV Gas (m5)**	**Base**	**m1**	**m2**	**m3**	**m4**	**Base IV Gas (m5)**
Lagged primary balance	0.784***	0.778***	0.682***	0.753***	0.763***	0.644***	0.817***	0.810***	0.610***	0.792***	0.809***	0.654***
	(0.146)	(0.136)	(0.147)	(0.117)	(0.133)	(0.111)	(0.135)	(0.117)	(0.176)	(0.124)	(0.130)	(0.103)
HICP inflation	**1.689****	**1.525***	**2.219***	**0.818**	**1.431****	**1.590*****	**2.625*****	**2.172****	**4.189*****	**1.324***	**2.254****	**2.292*****
	(0.810)	(0.894)	(1.161)	(0.591)	(0.725)	(0.364)	(0.885)	(0.868)	(1.417)	(0.759)	(0.966)	(0.441)
HICP inflation^2	**-0.138****	**-0.123***	**-0.181****	**-0.080***	**-0.115****	**-0.122*****	**-0.301*****	**-0.241****	**-0.492*****	**-0.163****	**-0.256****	**-0.244*****
	(0.061)	(0.070)	(0.088)	(0.045)	(0.057)	(0.034)	(0.104)	(0.101)	(0.170)	(0.079)	(0.129)	(0.050)
Output gap	0.156*	0.149*	0.137	0.133	0.152*	0.117	0.010	0.018	-0.076	0.035	0.019	-0.022
	(0.094)	(0.087)	(0.115)	(0.081)	(0.087)	(0.092)	(0.131)	(0.118)	(0.189)	(0.112)	(0.125)	(0.122)
Lagged current account	0.318**	0.279**	0.378**	0.232***	0.295***	0.280***	0.362**	0.293**	0.463**	0.239**	0.332**	0.267**
	(0.123)	(0.139)	(0.174)	(0.086)	(0.104)	(0.079)	(0.154)	(0.136)	(0.226)	(0.117)	(0.157)	(0.106)
Lagged debt	0.049***	0.048***	0.048***	0.037***	0.044***	0.037***	0.034	0.034	0.037	0.029	0.031	0.033
	(0.014)	(0.013)	(0.016)	(0.013)	(0.013)	(0.013)	(0.026)	(0.023)	(0.034)	(0.021)	(0.024)	(0.021)
Election dummy	0.095	0.102	0.121	-0.057	0.020	0.014	0.297	0.287	0.292	0.125	0.236	0.171
	(0.303)	(0.285)	(0.344)	(0.275)	(0.283)	(0.270)	(0.370)	(0.343)	(0.461)	(0.342)	(0.338)	(0.304)
Time trend	-0.086**	-0.091**	-0.087*	-0.022	-0.029	-0.004	-0.009	-0.032	0.008	0.022	0.019	0.018
	(0.038)	(0.037)	(0.046)	(0.036)	(0.035)	(0.031)	(0.062)	(0.056)	(0.081)	(0.051)	(0.052)	(0.034)
Financial crisis dummy		-0.814				-1.372***		-1.342***				-1.867***
		(0.719)				(0.411)		(0.512)				(0.441)
Sovereign crisis dummy			-2.422**			-2.382***			-4.547***			-3.092***
			(1.222)			(0.547)			(1.519)			(0.612)
Covid crisis dummy				-3.111***						-3.107***		
				(0.543)						(0.764)		
Covid + war in Ukraine Dummy					-1.941***	-2.994***					-1.203	-2.587***
					(0.609)	(0.612)					(1.208)	(0.899)
Constant	-5.648**	-5.040*	-6.604**	-3.676**	-5.602***	-5.636***	-6.330**	-5.351**	-8.363**	-4.497*	-5.941**	-5.754***
	(2.407)	(2.702)	(3.215)	(1.831)	(2.145)	(1.141)	(2.657)	(2.527)	(3.472)	(2.545)	(2.521)	(2.138)
Turning Point	**6.1**	**6.2**	**6.1**	**5.1**	**6.2**	**6.5**	**4.4**	**4.5**	**4.3**	**4.1**	**4.4**	**4.7**
No. observations	413	413	413	413	413	413	263	263	263	263	263	263
Centered R-squared	0.326	0.413	0.092	0.545	0.456	0.484	0.512	0.600	0.190	0.656	0.573	0.662
Kleibergen-Paap LM stat.	8.897	6.384	7.959	9.121	8.703	15.85	7.597	6.698	6.223	7.995	6.144	9.830
Kleibergen-Paap LM p-val	0.031	0.094	0.047	0.028	0.033	0.003	0.0551	0.0822	0.101	0.0461	0.105	0.043
Hansen test	1.349	1.866	1.309	0.458	0.495	0.916	1.912	0.850	0.139	7.183	3.864	0.628
Hansen p-val	0.509	0.393	0.520	0.795	0.781	0.822	0.384	0.654	0.933	[0.027]	0.145	0.890

Notes: The crises are defined as time dummies taking the value 1 for the respective periods: the financial crisis (2008-09), the sovereign debt crisis (2010-12), the Covid-19 crisis (2020-21) and Covid-19 crisis plus the war in Ukraine (2020-22). Robust standard errors, country FE used in all specifications. In m3, if the Base model with IV-gas (oil) prices is used, both inflation terms are significant at least at 95% level and the turning point remains broadly unchanged. See also notes in the tables above for tests and significance levels.

Table A.2.7: Main specification excluding country outliers, 1999-2022

	Base EA19	EA19 excl. IE	EA19 excl. GR	EA19 excl. SI	EA19 excl. SK	EA19 excl. EE	EA19 excl. LT	EA19 excl. LV	Base IV Gas EA19 excl. LV
Lagged primary balance	0.784***	0.627***	0.733***	0.822***	0.791***	0.857***	0.701***	0.803***	0.782***
	(0.146)	(0.135)	(0.143)	(0.153)	(0.154)	(0.185)	(0.113)	(0.169)	(0.138)
HICP inflation	**1.689****	**1.612***	**1.490***	**1.737****	**1.814****	**1.988****	**0.842***	**1.611**	**1.226****
	(0.810)	(0.860)	(0.780)	(0.781)	(0.919)	(0.917)	(0.497)	(1.006)	(0.488)
HICP inflation^2	**-0.138****	**-0.131****	**-0.117****	**-0.139****	**-0.147****	**-0.173****	**-0.075***	**-0.141***	**-0.110****
	(0.061)	(0.064)	(0.057)	(0.060)	(0.070)	(0.076)	(0.041)	(0.083)	(0.046)
Output gap	0.156*	0.256**	0.232**	0.129	0.148	0.104	0.149*	0.150	0.137
	(0.094)	(0.104)	(0.106)	(0.100)	(0.097)	(0.117)	(0.082)	(0.097)	(0.085)
Lagged current account	0.318**	0.305***	0.298***	0.320***	0.308**	0.359*	0.228***	0.383**	0.336***
	(0.123)	(0.116)	(0.104)	(0.119)	(0.129)	(0.188)	(0.063)	(0.161)	(0.091)
Lagged debt	0.049***	0.061***	0.043***	0.049***	0.052***	0.047**	0.044***	0.041***	0.039***
	(0.014)	(0.016)	(0.015)	(0.014)	(0.014)	(0.018)	(0.012)	(0.015)	(0.014)
Election dummy	0.095	-0.104	0.137	0.052	0.134	0.139	0.140	0.094	0.112
	(0.303)	(0.269)	(0.287)	(0.322)	(0.327)	(0.366)	(0.267)	(0.263)	(0.254)
Time trend	-0.086**	-0.116***	-0.087**	-0.082**	-0.082**	-0.079*	-0.103***	-0.081*	-0.090**
	(0.038)	(0.040)	(0.036)	(0.038)	(0.041)	(0.041)	(0.030)	(0.045)	(0.035)
Constant	-5.648**	-5.643**	-5.098**	-3.788**	-6.034**	-6.050**	-3.251**	-5.261*	-4.204***
	(2.407)	(2.584)	(2.365)	(1.858)	(2.726)	(2.450)	(1.528)	(2.793)	(1.401)
Turning Point	**6.1**	**6.1**	**6.4**	**6.2**	**6.2**	**5.8**	**5.6**	**5.7**	**5.6**
No. observations	413	394	394	389	396	389	389	392	392
Centered R-squared	0.326	0.273	0.430	0.332	0.289	0.270	0.562	0.325	0.439
Kleibergen-Paap LM stat.	8.897	8.580	8.176	9.416	8.196	6.610	17.33	6.576	12.42
Kleibergen-Paap LM p-val	0.031	0.035	0.042	0.024	0.042	0.085	0.001	0.086	0.014
Hansen test	1.349	2.921	0.561	1.268	1.176	0.368	2.523	1.787	2.838
Hansen p-val	0.509	0.232	0.756	0.530	0.555	0.832	0.283	0.409	0.417

*Notes: The results are shown for the EA19 sample for the period 1999-2022 excluding one country at a time: Ireland (IE), Greece (GR), Slovenia (SI), Slovakia (SK), Estonia (EE), Lithuania (LT) and Latvia (LV). Robust standard errors, country FE used in all specifications. Hansen test's null hypothesis is that instruments (orthogonality conditions) are valid. The null of Kleinbergen-Paap LM test is that instruments are weak. P-value: *** p<0.01, ** p<0.05, * p<0.1.*

Table A.2.8: Main specification: robustness check with various estimators, 1999–2022

	EA-19				EA-12			
	Base IV FE	FE	GMM 2STEP	AB GMM	Base IV FE	FE	GMM 2STEP	AB GMM
Lagged primary balance	0.784***	0.635***	0.765***	0.638***	0.817***	0.708***	0.777***	0.955***
	(0.146)	(0.085)	(0.145)	(0.142)	(0.135)	(0.072)	(0.128)	(0.154)
HICP inflation	**1.689****	**0.353**	**1.530***	**1.317***	**2.625*****	**1.118****	**2.380*****	**2.079****
	(0.810)	(0.214)	(0.796)	(0.632)	(0.885)	(0.482)	(0.861)	(0.820)
HICP inflation^2	**-0.138****	**-0.024***	**-0.127****	**-0.103**	**-0.301*****	**-0.106***	**-0.264*****	**-0.196***
	(0.061)	(0.013)	(0.061)	(0.067)	(0.104)	(0.050)	(0.100)	(0.102)
Output gap	0.156*	0.324***	0.156*	0.203*	0.010	0.285**	0.033	0.039
	(0.094)	(0.063)	(0.092)	(0.107)	(0.131)	(0.114)	(0.129)	(0.171)
Lagged current account	0.318**	0.158***	0.274**	0.105	0.362**	0.145***	0.319**	0.361***
	(0.123)	(0.021)	(0.116)	(0.120)	(0.154)	(0.036)	(0.134)	(0.109)
Lagged debt	0.049***	0.060***	0.051***	0.140**	0.034	0.064***	0.035	0.057*
	(0.014)	(0.009)	(0.013)	(0.053)	(0.026)	(0.008)	(0.023)	(0.031)
Election dummy	0.095	0.070	0.137	3.214	0.297	0.200	0.146	4.357*
	(0.303)	(0.223)	(0.298)	(2.314)	(0.370)	(0.328)	(0.337)	(2.068)
Time trend	-0.086**	-0.137***	-0.093**	-0.121	-0.009	-0.098*	-0.028	-0.009
	(0.038)	(0.032)	(0.037)	(0.124)	(0.062)	(0.045)	(0.060)	(0.107)
Constant	-5.648**	-2.465***	-5.192**		-6.330**	-5.254***	-5.842**	
	(2.407)	(0.663)	(2.355)		(2.657)	(1.202)	(2.323)	
Turning Point	**6.1**	**7.5**	**6.0**	**-**	**4.4**	**5.3**	**4.5**	**5.3**
No. observations	413	422	413	414	263	268	263	263
(Centered/Within) R-squared	0.326	0.566			0.512	0.631		
Kleibergen-Paap LM statistic	8.897		8.897		7.597		7.597	
Kleibergen-Paap LM p-val	0.0307		0.0307		0.0551		0.0551	
Hansen test	1.349		1.349	7.138	1.912		1.912	3.630
Hansen p-val	0.509		0.509	0.712	0.384		0.384	0.962
AR(1) p-val				0.0532				0.0303
AR(2) p-val				0.395				0.739

*Notes: Robust standard errors, country FE used in all specifications. AB GMM (xtabond2), collapsed. Hansen test's null hypothesis is that instruments (orthogonality conditions) are valid. The null of Kleinbergen-Paap LM test is that instruments are weak. x – exactly identified model. Specification of instruments between estimators may change. For estimators without explicit IV option, we estimated the first stage for both endogenous variables on the same set of instruments as for models with IV option, including lagged dependent variable. P-value: *** p<0.01, ** p<0.05, * p<0.1.*

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