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The Effects of Inflation on Public Finances

Daniel Garcia-Macia

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WORKING PAPER

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The Effects of Inflation on Public Finances
Prepared by Daniel Garcia-Macia*

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ABSTRACT: Does inflation help improve public finances? This paper documents the dynamic responses of fiscal variables to an inflation shock, using both quarterly and annual panel data for a broad set of economies. Inflation shocks are estimated to improve fiscal balances temporarily, as nominal revenues track inflation closely, while nominal primary expenditures take longer to catch up. Inflation spikes also lead to a persistent reduction in debt to GDP ratios, both due to the primary balance improvement and the nominal GDP denominator channel. However, debt only falls with inflation surprises—rises in inflation expectations do not improve debt dynamics, suggesting limits to debt debasement strategies. The results are robust to using various inflation measures and instrumental variables.

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WORKING PAPERS

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I. Introduction

The sharp inflation upsurge affecting most countries since 2021 brought to the fore questions about the impacts of inflation throughout the economy. A key dimension is how inflation affects fiscal sustainability and redistributes resources between the public and private sectors, as reflected in the dynamics of government deficits and debt.

In theory, inflation can affect public finances through multiple channels (Dynan, 2022, CBO, 2022a). It tends to expand tax bases in nominal terms, boosting nominal tax revenue, but can also raise the cost of government expenditure, most directly for budget items that are automatically indexed to inflation. Moreover, the associated increase in nominal GDP tends to reduce deficit and debt ratios. Over time, policies may also react to inflation, including through discretionary fiscal measures (e.g., subsidies and tax cuts to alleviate cost-of-living impacts), or monetary policy tightening, pushing up government borrowing costs. Thus, inflation can impact taxpayers, civil servants, pensioners, beneficiaries of government programs, government suppliers, and bondholders in various forms.

This paper estimates the net effects of inflation on fiscal variables over time, using panel data for a broad set of economies and time period. It finds that inflation shocks improve fiscal balances temporarily, as nominal revenues rise with inflation faster than nominal expenditures. They also lead to a persistent reduction in debt to GDP ratios, both due to primary balance improvements and nominal GDP denominator increases. However, debt only falls with inflation surges that come as a surprise—rises in inflation expectations do not improve debt dynamics.

The estimation is based on local projections of fiscal variables after inflation shocks, with inflation measured as either CPI or GDP deflator changes. To isolate the direct contribution of inflation from concurrent real shocks, the regressions either use instrumental variables for inflation or control for GDP growth (among other variables) in samples where instruments are not strong. The preferred instrument are shocks to commodity import prices, further interacted with the exchange rate regime. The estimation uses quarterly data (1999:Q1–2019:Q4) from International Financial Statistics and annual data (1962–2019) from FAD’s Public Finances in Modern History database, in both cases excluding the pandemic period. The quarterly data, which has been less explored in the literature, allows to capture the automatic effects of inflation on fiscal variables before policies have time to react, as well as look into budget sub-items. Conversely, the annual data permit to study medium-term responses and extend the analysis to advanced economies before the Great Moderation period—when inflation was higher, more volatile, and more persistent—as well as to emerging market economies.

The analysis with quarterly data and instrumental variables suggests that for a 1 percentage point initial increase in CPI inflation, budget balances go up by about 0.5 percent of GDP, with the response peaking in the first two quarters after the shock. Revenue broadly rises in line with nominal GDP as the nominal tax base expands, whereas expenditures tend to react less in nominal terms, especially in initial quarters, including because budgets impose annual caps. Interest expense climbs gradually over time, as in the sample debt tends to feature fixed rates and long maturities, leading to a slow pick-up in effective nominal rates.

The quarterly data also allow to analyze budget sub-items individually. Within tax revenue categories, some items such as profit and income taxes rise more than one-to-one with inflation. This could owe to both tax bracket creep (i.e., taxpayers moving into higher tax brackets as their nominal incomes swell) and other tax design features, such as capital returns being taxed in nominal terms (see Beer, Griffiths, and Klemm, 2023, for

a comprehensive coverage of the channels). On the expenditure side, some categories are sticky, especially compensation of employees and social benefits. Over time, though, automatic or de facto indexation bring those expenditures back to their initial levels in real terms.

The annual data permit to estimate longer-horizon dynamics of fiscal balances and debt. Spikes in inflation measured as GDP deflator growth tend to improve the overall balance by about 0.2 percent on average in initial years and lower the debt-to-GDP ratio persistently. As expected, the debt drop is larger in countries with higher initial debt, with an initial rise of 1 percentage point in the GDP deflator growth associated with a cumulative fall in the debt ratio of 0.6 percentage points of GDP. The estimated responses are similar between advanced and emerging market economies.

Importantly, only unanticipated inflation spikes reduce the debt ratio; oscillations in inflation expectations do not. This difference owes to a few main channels. Unlike inflation surprises, rises in expected inflation do not lead to a decline in expenditure to GDP, probably as political pressures for accommodation of inflation with primary expenditure emerge faster, and markets demand higher interest rates ex-ante for lending to the government. Moreover, rises in expected inflation tend to be associated with declining *realized* inflation (i.e., inflation expectations appear to be adaptive or backward looking), nullifying or reversing the contribution from the GDP denominator. All in all, attempts to keep surprising bondholders and, more generally, the public seem bound to prove futile if not harmful.

A careful interpretation of the results requires noting the type of inflation shock considered in each regression specification. The main qualitative results hold using either CPI or GDP deflator inflation shocks, although the latter are associated with larger fiscal gains, especially for debt ratios, since they are more strongly correlated with the nominal GDP denominator. This is particularly true when instrumenting CPI inflation with commodity import prices, which only have second-round effects on the deflator. Alternative instruments for inflation such as import demand from trading partners, exposure to US inflation, or supply chain pressure appear to be less valid than commodity price shocks. The results are robust to various thresholds for excluding inflation outliers, excluding country-year observations of debt restructurings with face value reductions, and excluding or including the largest and smallest countries.

The literature on the fiscal impacts of inflation had remained largely dormant as inflation became a secondary concern during the Great Moderation years. However, a few recent studies explore the question employing a range of methods. Using surprises in World Economic Outlook forecasts, IMF (2022) estimates short-term responses of revenue and expenditure to inflation that are similar to the ones in this paper. Model-based simulations of the French economy by Bénassy-Quéré (2022) illustrate the differential impact on the primary balance of supply- and demand-driven inflationary shocks, including the real GDP growth channel. CBO's (2022b) workbook simulates qualitatively similar results as this paper. Focusing on event studies of large inflation surges, Blanco, Ottonello, and Ranosova (2022) observes a mild but statistically insignificant deterioration of the fiscal balance in the second year of a surge.

This paper aims to approximate the component of the fiscal variables' response that is a direct consequence of inflation itself, isolating it from real macroeconomic drivers (e.g., supply- and demand-side driven inflation shocks may cause concurrent responses of real GDP in different directions). This is achieved by either focusing on externally-driven inflation shocks (that are not strongly correlated with GDP) and quarterly frequency responses, or directly controlling for real GDP growth. The paper also contributes to studying the responses of fiscal variables over longer horizons. In particular, the analysis of public debt goes beyond

traditional debt accounting decompositions (e.g., Escolano, 2010) by considering how inflation affects the primary balance, and distinguishing between expected and surprise inflation. Using the estimates in this paper, IMF (2023) quantifies how inflation surprises in 2022 led to an automatic improvement in primary deficits and debt across select economies.

The rest of this paper is organized as follows. Section II lays out the empirical approach. Section III describes the data and sample selection. Section IV presents the main results, with robustness discussed in Section V. Section VI concludes.

II. Empirical Approach

To determine the net effect of inflation on public finance variables over the near and medium term, the chapter estimates local projections of various inflation shocks on fiscal aggregates (Jordà, 2005). The general estimation model is given by:

$$\hat{g}_{i,t+h} = \sum_{l=0}^L \beta_{l,h} \pi_{i,t-l} + \sum_{l=0}^L \beta_{L+l+1,h} x_{i,t-l} + \delta_{i,h} + \delta_{t,h} + \epsilon_{i,t,h}, \quad \hat{g}_{i,t+h} \stackrel{\text{def}}{=} g_{i,t+h} - g_{i,t-1} \quad (1)$$

where g is a given fiscal outcome, π the inflation rate (either CPI or GDP deflator), x other controls, δ fixed effects, and ϵ a potentially autocorrelated independent error term. Index i denotes countries, t time, $h = \{0, \dots, H\}$ the time horizon of the dependent variable, and l the lag on the regressors.

The regressions are estimated at both quarterly and annual frequency. The fiscal outcomes considered are the overall balance, primary balance, cyclically-adjusted primary balance, tax revenue, primary expenditure, the interest bill, and debt, all in ratios to GDP, as well as the outstanding sovereign long-term nominal bond rate in percent. In addition, the model is also estimated for revenue and expenditure sub-items in log nominal terms, which permits to compare the growth rates of variables with different GDP shares.

Inflation can be caused by multiple factors, including fiscal policy itself. The regressions are estimated using both OLS regressions, which are useful at capturing all sources of inflation but may be subject to endogeneity, as well as instrumental variable regressions (2SLS), which allow to better identify the direct effects of a specific inflationary shock but may be less generalizable.

The main instrument used for CPI inflation shocks is the change in the price growth of the commodity import basket, further interacted with an exchange rate peg dummy (lagged). The intuition for the instrument is that commodity price spikes tend to be more surprising and pass through to rises in prices of various goods and services items (see Choi and others, 2018). Yet, pass-through is stronger in more flexible exchange rate regimes, where the exchange rate tends to depreciate when commodity import prices rise. This instrumental variable approach captures mainly the impact of imported inflation shocks, filtering out domestic shocks.¹

The first stage of the IV regression is given by:

¹ The impact of domestic shocks may differ inter alia because they have a more direct effect on the GDP deflator. The first-round effect of import inflation on the GDP deflator is nil, as imports cancel out in the national accounting identity (they enter net exports and total consumption with opposite signs), but passthrough to domestic prices still generates a positive second-round effect.

$$\pi_{i,t} = \beta_1 c_{i,t} + \beta_2 c_{i,t} * peg_{i,t-1} + \beta_3 peg_{i,t-1} + \epsilon_{i,t}, \quad (2)$$

where peg is a dummy variable equal to one if the country's exchange rate is fully pegged, and c is the growth in the commodity import price index weighed by GDP:

$$c_{i,t} = \sum_{j=1}^J \left(\Delta p_{j,t} \frac{1}{3} \sum_{l=1}^3 \frac{m_{i,j,t-l}}{y_{i,t-l}} \right),$$

where p_j is the global price of commodity j , $m_{i,j}$ the imports of commodity j by country i , and y_i is country i 's GDP. The commodity weight is calculated based on the average commodity import GDP shares over the previous 3 years, following Gruss and Kebhaj (2019).

Local projections are in addition estimated decomposing inflation into surprise and expected components, using annual data. Expected inflation is defined as the one-year-ahead forecast made as of one year ago, whereas surprise inflation equals realized minus expected inflation. The two inflation components (surprise and expected) are included as regressors in the same local projection regression, and their respective coefficients compared. In this case, the regression specification is given by:

$$\hat{g}_{i,t+h} = \beta_{1,h} (\pi_{i,t} - E_{t-1}[\pi_{i,t}]) + \beta_{2,h} E_{t-1}[\pi_{i,t}] + \beta_{t>2,h} x_{i,t} + \delta_{i,h} + \delta_{t,h} + \epsilon_{i,t,h}, \quad (3)$$

where $E_{t-1}[\pi_{i,t}]$ indicates expected inflation and the term between parentheses is the inflation surprise.

III. Data

The estimation uses either highly disaggregated quarterly data (1999Q1–2019Q4) from International Financial Statistics or long-ranging annual data (1962–2019) from the IMF Public Finances in Modern History database.² The pandemic period (2020Q1 onwards) is excluded in both cases as the sharp fluctuations in inflation combined with large fiscal policy responses could contaminate the results. Data for annual inflation forecasts and surprises, as well as country groups are from the World Economic Outlook. Additional variables are obtained from other sources, including the commodity price index (Gruss and Kebhaj, 2019), exchange rate regime (Ilzetzki and others, 2019), and annual CPI inflation (International Financial Statistics).

The analysis of quarterly macro-fiscal data has been less explored in the literature. It has the advantage that it allows to capture the immediate or automatic effects of inflation on fiscal variables before policies have time to react, with a fine level of disaggregation of budget sub-items. Instead, annual data permit to study medium-term responses and extend the analysis to advanced economies before the Great Moderation period—when inflation was higher, more volatile, and more persistent—as well as to emerging market economies.

The main regressions decomposing inflation into surprise and expected components (specification (3)) are based on one-year-ahead GDP deflator growth projections from the World Economic Outlook as of the October vintage of the preceding year (as in Blanchard and Leigh, 2013). The surprise is the difference between the historical deflator growth recorded in the October 2022 vintage and the projection.³ As a robustness check, the regressions are also run using CPI inflation forecasts.

² Data and codes are available upon request.

³ Measuring realized deflator growth in period t as the value reported in the WEO vintage of October $t+1$ (instead of October 2022) does not significantly alter the result.

Table 1 lists the countries included in each sample. The annual sample includes 85 advanced and emerging market economies (after excluding economies with a population below 1 million people, where data are noisier). Observations where annual inflation is above 30 percent in absolute terms in the period of the shock, or where the original data source compiled in the Public Finances in Modern History database changed, are also excluded. The quarterly sample includes 28 advanced economies. The original quarterly sample has no observations with implied annual inflation outside the $[-30,30]$ interval nor changes in the original database.

Table 1. List of Countries in the Quarterly and Annual Samples

Group	Countries	Frequency	
		Annual	Quarterly
Advanced Economies	Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, United States	X	X
	Hong Kong SAR, Israel, Japan, Korea, New Zealand, Switzerland	X	
	Cyprus, Iceland, Latvia, Lithuania, Luxembourg, Malta		X
Emerging Market Economies	Albania, Algeria, Angola, Argentina, Azerbaijan, Bahrain, Bolivia, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Croatia, Dominican Republic, Ecuador, El Salvador, Equatorial Guinea, Gabon, Georgia, Guatemala, Hungary, India, Indonesia, Iran, Jamaica, Jordan, Kuwait, Lebanon, North Macedonia, Malaysia, Mexico, Mongolia, Morocco, Namibia, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Qatar, Romania, Russia, Saudi Arabia, South Africa, Sri Lanka, Eswatini, Thailand, Trinidad and Tobago, Tunisia, Türkiye, United Arab Emirates, Ukraine, Uruguay, Venezuela	X	

Table 2 presents summary statistics for the variables included in the regressions with quarterly and annual data, respectively. It shows that after excluding outliers (as described above) all variables are well-behaved.

Table 2. Summary Statistics**Quarterly Data (1999:Q1-2019:Q4)**

Variables	Mean	Median	Standard deviation	25th percentile	75th percentile	Obs.
CPI inflation (annualized, percent)	2.3	2.0	3.6	0.2	4.0	2,508
Overall balance (percent of GDP)	-2.4	-2.0	6.1	-5.4	0.9	2,508
Primary balance (percent of GDP)	0.2	0.4	5.9	-2.7	3.2	2,508
Cyclically-adjusted primary balance (percent of GDP)	0.0	0.3	4.8	-2.2	2.7	2,417
Tax revenue (percent of GDP)	27.0	25.3	8.9	21.2	29.6	2,508
Primary expenditure (percent of GDP)	43.0	41.5	12.2	36.8	47.2	2,508
Interest Expense (percent of GDP)	2.6	2.2	2.0	1.3	3.3	2,508
LT Sovereign Bond Effective Rate (percent)	3.8	3.9	2.3	2.2	4.8	2,056
Real GDP growth (quarterly, percent)	0.5	0.6	2.2	0.1	1.1	2,508
GDP Deflator growth (annualized, percent)	2.4	2.0	4.5	0.4	4.0	2,428
Tax Revenue (nominal growth, quarterly, percent)	1.1	2.0	16.2	-6.5	10.2	2,508
Income and Profit Tax Revenue (nominal growth, quarterly, percent)	1.1	2.0	26.6	-12.1	13.5	2,479
Total Expenditure (nominal growth, quarterly, percent)	1.1	1.3	13.6	-4.7	7.9	2,508
Compensation of Employees (nominal growth, quarterly, percent)	1.1	1.0	13.2	-3.1	5.9	2,508
Expenditure in Goods and Services (nominal growth, quarterly, percent)	1.1	2.0	23.1	-7.7	11.7	2,508
Capital Expenditure (nominal growth, quarterly, percent)	1.1	0.8	6.6	0.1	1.6	2,508
Subsidies (nominal growth, quarterly, percent)	1.4	0.7	41.2	-9.1	12.6	2,493
Social Benefits and Transfers (nominal growth, quarterly, percent)	1.2	1.1	10.3	-2.1	4.9	2,508
Interest Expense (nominal growth, quarterly, percent)	-0.1	0.0	29.8	-5.4	5.0	2,506
Commodity Import Price Index Growth (quarterly, percent)	0.1	0.1	1.1	-0.2	0.5	2,508
Exchange Rate Regime Dummy (Peg=1)	0.7	1.0	0.5	0.0	1.0	2,508

Annual Data (1962-2019)

Variables	Mean	Median	Standard deviation	25th percentile	75th percentile	Obs.
Overall balance (percent of GDP)	-2.8	-2.3	16.5	-4.4	0.0	3,178
Government debt (percent of GDP)	47.8	41.1	33.5	23.7	62.3	3,136
Interest bill (percent of GDP)	2.7	2.1	2.4	1.0	3.5	3,178
Primary expenditure (percent of GDP)	30.1	28.9	19.8	19.5	39.1	3,178
GDP Deflator Growth (percent)	6.1	4.3	6.7	1.9	8.7	3,178
Real GDP growth rate (percent)	3.8	3.5	5.4	1.8	5.6	3,178

Sources: Gruss and Kebhaj (2019); Ilzetzki, Reinhart, and Rogoff (2019); International Financial Statistics; Public Finances in Modern History, and World Economic Outlook.

Note: The cyclically-adjusted primary balance is calculated applying a Hodrick-Prescott filter on a country's primary balance.⁴

IV. Results

Model Selection and IV First Stage

The preferred estimation specification varies for the quarterly and annual datasets. Quarterly regressions are estimated with the instrumental variable approach described in equation (2) and using CPI as the inflation measure, which is more amenable to being instrumented with commodity import price shocks. The instrument is found to be strong, with countries with flexible exchange rate regimes featuring higher passthrough of commodity import prices to CPI inflation, and the standalone exchange rate peg dummy variable not significant at the 5 percent confidence level (Table 3).

⁴ An alternative calculation using residuals from country-specific regressions of the primary balance on the 2-year deviation in real GDP growth rates relative to the average in the previous 4 years yields similar results.

Table 3. IV First-Stage Regression Results, CPI Inflation, 1999-2019

Instrumental Variable	Coefficient	P-Value
Commodity Import Price Growth	1.21	0.00
Commodity Import Price Growth X Lagged Pegged XR	-0.62	0.04
Lagged Pegged XR	-0.02	0.06
Weak instruments test: F-statistic	9.22	0.00
Minimum critical value (10 percent relative bias)	9.08	-
Overidentifying restrictions test: Hansen J statistic	2.68	0.26

Source: Gruss and Kebhaj (2019); Ilzetzki, Reinhart, and Rogoff (2019); International Financial Statistics; World Economic Outlook. Notes: The sample includes 28 advanced economies for 1999:Q1–2019:Q4. First stage of the IV regression, with CPI inflation as the dependent variable, and controlling for quarter indicator variables and country- and year-fixed effects. Standard errors are clustered at the country level. The F-statistic is above the minimum critical value, rejecting that the instruments are weak. The overidentifying restrictions test fails to reject that the instruments are valid.

Moreover, concerns about lack of validity of the instrument seem limited.⁵ The identified CPI shock is not significantly correlated with real GDP growth⁶, and global commodity prices do not appear to be driven by domestic developments in individual advanced economies—excluding the three largest advanced economies does not significantly alter the results (see Section V). Yet, direct effects of commodity import price changes on fiscal variables (e.g., through import tariffs or commodity subsidies) cannot be fully ruled out. In any case, the results for disaggregated budget components (Figure 2 below) show that budget items most related to imports (e.g., subsidies or indirect taxes) are not driving the overall effect on fiscal balances.

Other instruments for inflation have been tested with quarterly data, but found to be less appropriate. One potential instrument is trading partner import growth, which captures demand-side driven inflation shocks for the domestic economy. Although the results for fiscal variables are qualitatively in the same direction, trading partner demand growth is highly correlated with real GDP, which has a direct impact on fiscal variables, making it harder to disentangle the effect of inflation per se. Another possible instrument is US inflation interacted with countries' trade exposure to the US. This instrument is valid, but yields much less precisely estimated fiscal responses. Finally, a global value chain distress index was also tested. Such instrument would capture similar supply-side channels as commodity import prices, and proved to be statistically weak once included simultaneously with commodity import prices.⁷

The regressions with annual data instead are estimated with OLS, since all instruments are weak at the annual frequency. The preferred inflation measure in this case is GDP deflator growth, since it is better at capturing the denominator channel, key for medium-term debt dynamics.⁸ In OLS regressions, real GDP growth is added to control for the business cycle.

⁵ The test of overidentifying restrictions does not reject the null hypothesis that the instruments are valid (Table 3).

⁶ This may be due to commodity prices being driven by both positive global demand shocks, which would correlate positively with domestic GDP growth, and negative supply shocks in commodity producers, which would tend to drag on domestic GDP.

⁷ The variable used is the Federal Reserve Bank of New York, Global Supply Chain Pressure Index (<https://www.newyorkfed.org/research/gscpi.html>). Carrière-Swallow and others (2023) obtain a significant and persistent impact of global shipping costs on inflation in a regression without time fixed effects and including the pandemic period.

⁸ Regarding the fiscal balance, in theory it is not obvious whether the best measure of inflation would be CPI or GDP deflator changes. Some budget items like indexed spending and indirect taxes are more directly linked to the CPI, while others such as unemployment benefits and direct taxes are more related to the deflator (see Bénassy-Quéré, 2022).

The number of lags included for inflation is based on statistical significance, resulting in $L = 0$ for the quarterly sample and $L = 1$ for the annual sample. Time fixed effects are at the annual frequency, including for the quarterly sample, to avoid absorbing too much relevant variation in the sample. Quarterly regressions include quarter indicator variables to control for seasonality (Table 5 shows results are robust to including country-specific quarter indicators).

Initial Effect of Inflation

The estimation of regression (1) with quarterly data covering advanced economies over the last two decades and using the instrument described in equation (2) is considered first. These high-frequency responses capture the immediate effects of inflation on public finances before policies have time to react.

The estimated cumulative local projections confirm that CPI inflation spikes tend to improve fiscal balances in the short term (Figure 1). The finding holds for either the overall, primary, or cyclically-adjusted primary balances, although the effect on the latter is slightly less positive. In particular, for a 1 percentage-point initial increase in inflation, overall and primary balances go up by about 0.5 percent of GDP. Balances improve because revenue broadly tracks nominal GDP, whereas expenditures tend to be stable in nominal terms in initial quarters, driven by primary expenditure. Interest expense climbs gradually over time as debt in the sample tends to feature fixed rates and long maturities, leading to a slow pick-up in effective nominal rates of public bonds.⁹ The relatively short-lived effects on fiscal variables are also related to the limited persistence of the identified inflation shock (see top-left panel in Figure 1).

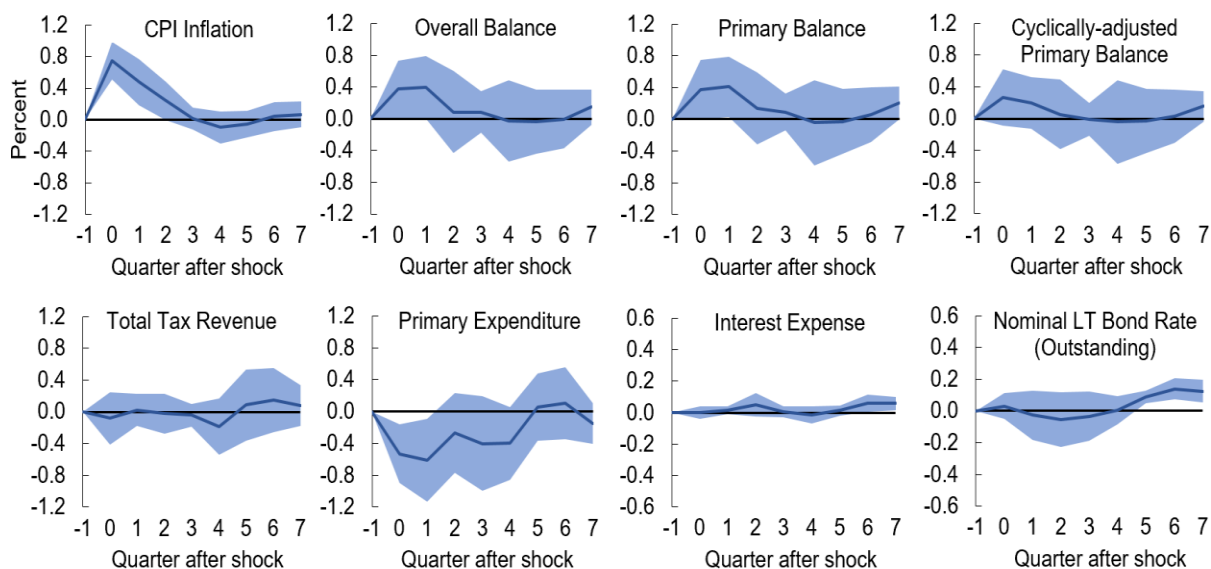
Table 4 compares the results for the initial quarter of the shock ($t=0$) presented in Figure 1 with the corresponding OLS estimate for each outcome variable of interest. The difference in key results highlights the importance of using the instrument. For example, the coefficient of primary expenditure turns positive in the OLS, likely reflecting fiscal expansions causing CPI inflation. In turn, this affects the coefficients for the primary and overall balances. Other variables such as revenue or interest expense are less affected by the choice of regression method.

The quarterly data further enable analyzing budget sub-items individually. Figure 2 uses the same sample and estimation approach as Figure 1, but focuses on sub-components of revenue and spending. Unlike Figure 1, Figure 2 plots the subcomponents in log nominal terms, so the cumulative impulse response functions show percentual growth rates relative to quarter -1. Plotting nominal growth rates allows to compare items with widely different sizes as a share of GDP, and serves as a cross-check for the interpretation of Figure 1 (e.g., showing how categories that are flat as a share of GDP evolve in nominal terms).

While total tax revenue in nominal terms grows at about the same rate as inflation, some sub-items like profit and income taxes rise more than proportionally.¹⁰ Comparing total revenue and expenditure, the smaller and more delayed response of the latter owes to the stickiness of some specific spending categories. These include compensation of employees, which accounts for a large share of total expenditure, and social benefits, which fall initially, perhaps as a fraction of beneficiaries jump over nominal income thresholds. Over time, automatic or de facto indexation bring those expenditures back to their initial levels in real terms. Other categories like purchases of goods and services and capital expenditure tend to react faster to inflation.

⁹ The average term to maturity in advanced economies as of 2023 is about 7 years (Bloomberg Finance L.P).

¹⁰ Available observations for other revenue sub-items are too limited to perform similar estimations as for income and profit taxes.

Figure 1. Initial Gains in Fiscal Balances from CPI Inflation Shocks, AEs, 1999:Q1-2019:Q4*(Percent of GDP; unless stated otherwise)*

Source: Gruss and Kebhaj (2019); Ilizetzi, Reinhart, and Rogoff (2019); International Financial Statistics; World Economic Outlook. Notes: The sample includes 28 advanced economies. Regressions estimated between 1999:Q1–2019:Q4 using instrumental variables and controlling for quarter indicator variables, and country- and year-fixed effects (FE-2SLS). The charts plot 90 percent confidence bands with standard errors clustered at the country level.

Table 4. Impact of CPI Inflation Spikes in Initial Quarter, 1999:Q1-2019:Q4*(percent of GDP)*

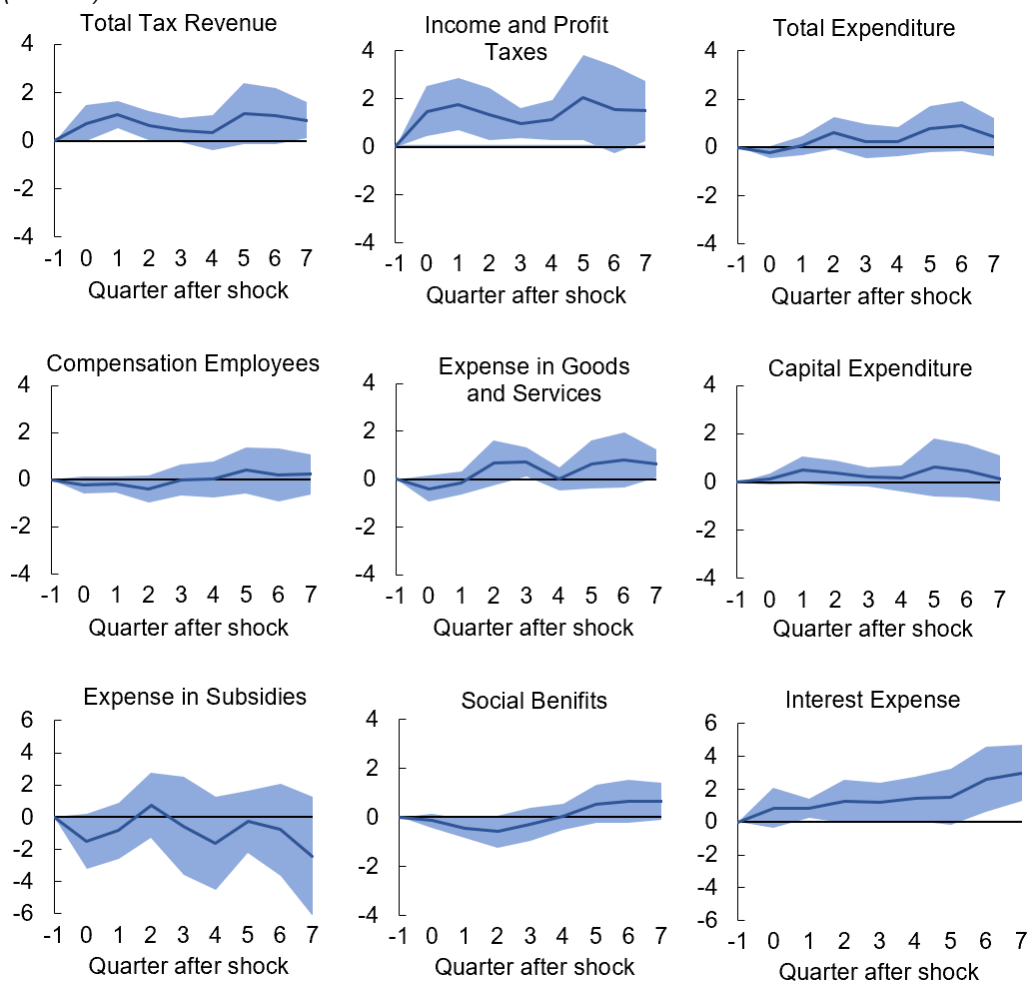
	CPI inflation		Overall Balance		Primary Bal.		Revenue		Primary Exp.		Interest Expense	
	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS
Slope Coefficient	0.73	1.04	0.37	-0.23	0.37	-0.18	-0.08	-0.07	-0.53	0.18	0.00	0.05
p value	0.00	0.00	0.09	0.10	0.10	0.22	0.68	0.33	0.02	0.09	0.97	0.15

Sources: Gruss and Kebhaj (2019), Ilizetzi and others (2019), International Financial Statistics, and World Economic Outlook database.

Note: Fiscal variables are in percent of GDP. The data cover the period from the first quarter of 1999 to the fourth quarter of 2019, excluding the COVID-19 period. Both regressions control for quarter indicator variables (to absorb seasonality) and country and year fixed effects. OLS regressions also control for real GDP growth. P values below 0.10 indicate significant results at the 10 percent confidence level.

Figure 2. Initial Gains in Fiscal Balances from CPI Inflation Shocks, Sub-Items, AEs, 1999:Q1-2019:Q4

(Percent)



Sources: Gruss and Kebhaj (2019), Ilzetki and others (2019), International Financial Statistics, and World Economic Outlook.

Notes: The sample includes 28 advanced economies. All variables are in log nominal terms. The Covid period is excluded. IV regressions, controlling for quarter indicator variables (to absorb seasonality), and country and year fixed effects. The charts plot 90 percent confidence bands, with standard errors clustered at the country level.

Effects over the Medium Term

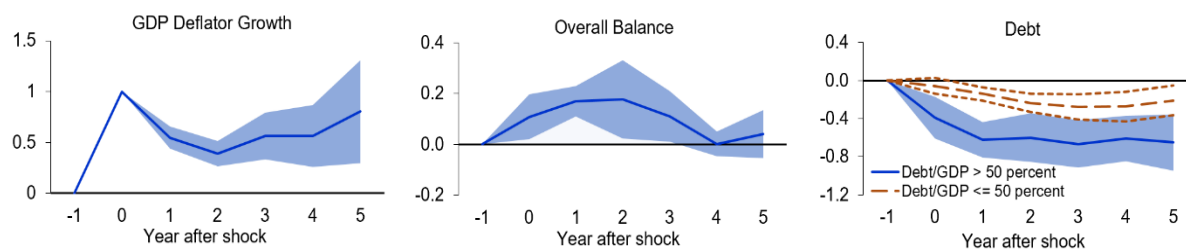
Inflation surprises appear to improve budget balances in the near term, but are these gains maintained? And what do they imply for debt dynamics? The effects of inflation on public finance could ebb over time owing to three main reasons. First, public spending could catch up with revenues through indexation, which is often based on past inflation realizations. Second, public policies and decisions, including in terms of remuneration policies for wages and pensions, could lead to higher spending caused by inflation over time, reducing initial

gains. Third, if central banks attempt to rein in on inflation by raising policy rates, nominal borrowing costs would rise, including for the government.¹¹

To analyze the response of fiscal variables over the medium term, the estimation with annual data for 85 advanced and emerging market economies since the 1960s is considered next. Figure 3 shows that, on average, spikes in the GDP deflator growth are associated with temporary improvements in the overall balance. The greater persistence of the fiscal balance response in Figure 3 compared with the quarterly regressions in Figure 1 is partly due to the more persistent inflation shock in the annual sample, which includes the Great Inflation period in advanced economies as well as emerging market economies.¹²

The fiscal balance improvement, together with the increase in the nominal GDP denominator, tend to lower the debt-to-GDP ratio persistently. As expected, the drop in debt to GDP is larger in countries with higher initial debt (i.e., above the sample median of about 50 percent of GDP). In those economies, the fall in public debt also persists over time: an initial rise of 1 percentage point in the GDP deflator growth is associated with a cumulative fall in the debt ratio of 0.6 percentage points of GDP. The results in Figure 3 are qualitatively robust to the use of CPI inflation shocks (Table 6), although deflator shocks are more strongly associated with the debt-to-GDP denominator, leading to larger and more statistically significant debt declines.

Figure 3. Response to a 1 Percentage Point GDP Deflator Growth Shock, 1962-2019
(Percent of GDP)



Source: Public Finances in Modern History and World Economic Outlook.

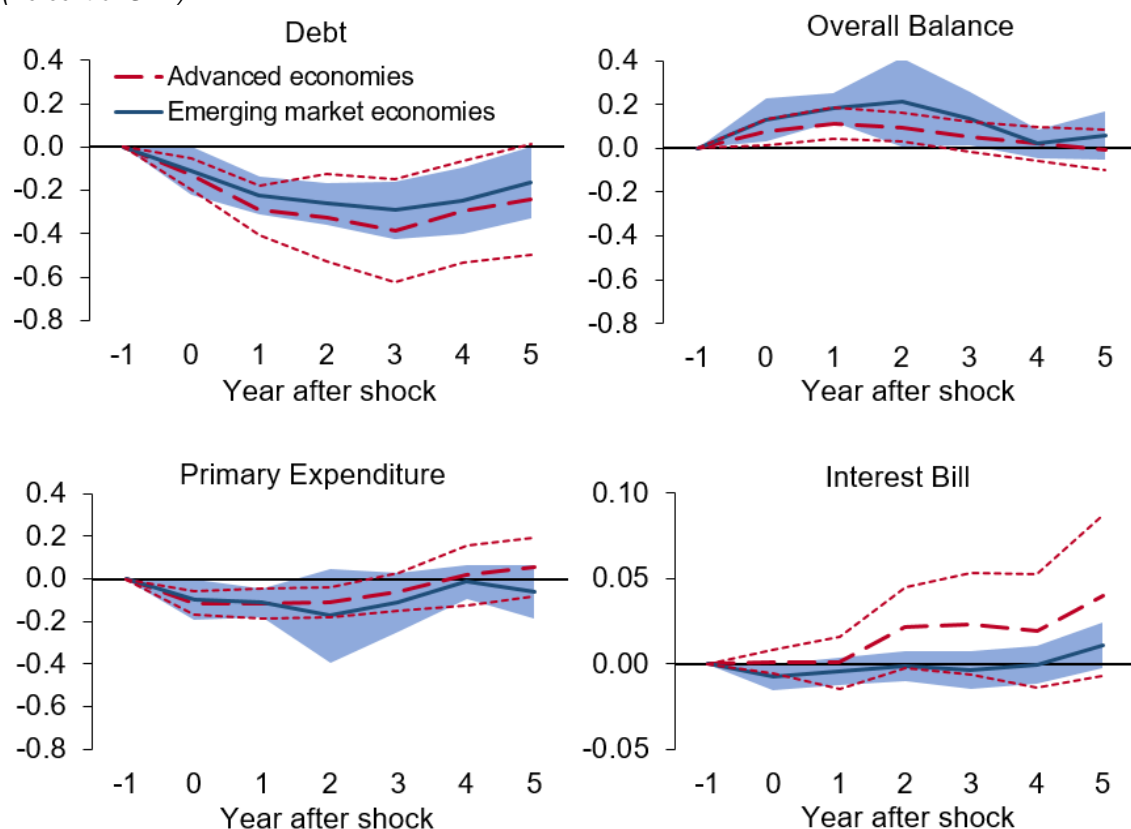
Note: FE-OLS regressions using the GDP deflator as inflation indicator and including 85 countries. Countries with population below 1 million in 2019 are excluded, as well as observations with annual GDP deflator inflation higher than 30 percent in absolute terms in period 0, or where the original data source changes. The first two charts show the entire sample; the third one splits it by the initial debt level. The charts plot 90 percent confidence bands, with standard errors clustered at the country level.

The debt and fiscal balance responses to a deflator growth spike are similar between advanced and emerging market economies (Figure 4), with a slightly larger debt reduction in advanced economies. The latter may be due to the higher average debt ratios in advanced economies. However, the interest bill does not climb with inflation in emerging markets, probably as interest payments on foreign currency debt (more common in emerging markets) decline as a share of domestic GDP in countries with fixed exchange rates. Figure 5 confirms that inflation reduces debt and the interest bill more in countries with a fixed exchange rate (measured as of the year before the shock), as those countries avoid an increase in the domestic value of foreign-currency debt principal and interest.

¹¹ It is important to note, however, that if the government borrows mostly on its own currency and in long maturities, and the country's monetary authority has a reputation of maintaining price stability, the adjustment of long-term interest rates may be only gradual. In such case, exchange risks may be muted, market expectations well anchored and the roll-over of public debt may take time, leading to only minor increases in public debt interest payments in the medium term.

¹² The path of GDP deflator growth in Figure 3, panel 1, shows a slight pickup at the end of the horizon as the truncation of outliers is done based on period zero only, to avoid introducing bias.

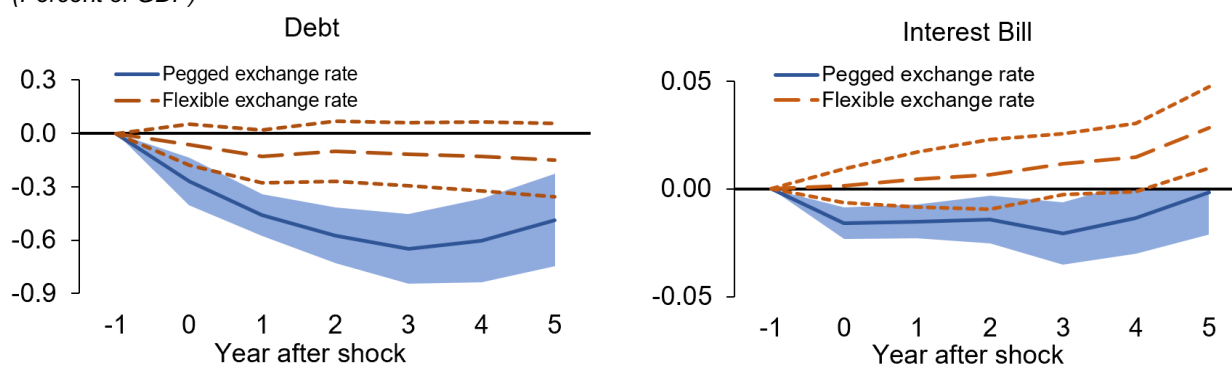
Figure 4. Response to a 1 Percentage Point GDP Deflator Growth Shock, AEs vs EMs, 1962-2019
(Percent of GDP)



Sources: Public Finances in Modern History and World Economic Outlook.

Notes: OLS regressions. Observations with annual inflation higher than 30 percent in absolute terms (representing about 5 percent of the sample), or where the original data source changes, are excluded. Controls include real GDP growth, lagged inflation, and country and year fixed effects. The charts plot 90 percent confidence bands, with standard errors clustered at the country level.

Figure 5. Response to a 1 Percentage Point GDP Deflator Shock, by FX regime, 1962-2019
(Percent of GDP)



Sources: Ilzetzki and others (2019), Public Finances in Modern History, and World Economic Outlook.

Note: Fixed effects-ordinary least squares (FE-OLS) regressions. Observations with annual inflation higher than 30 percent in absolute terms (representing about 5 percent of the sample), or where the original data source changes, are excluded. Controls include real GDP growth, lagged inflation, and country and year fixed effects. Pegged exchange rate regimes include de jure and de facto pegs (Ilzetzki and others, 2019) and the regime is measured as of year -1. The charts plot 90 percent confidence bands, with standard errors clustered at the country level.

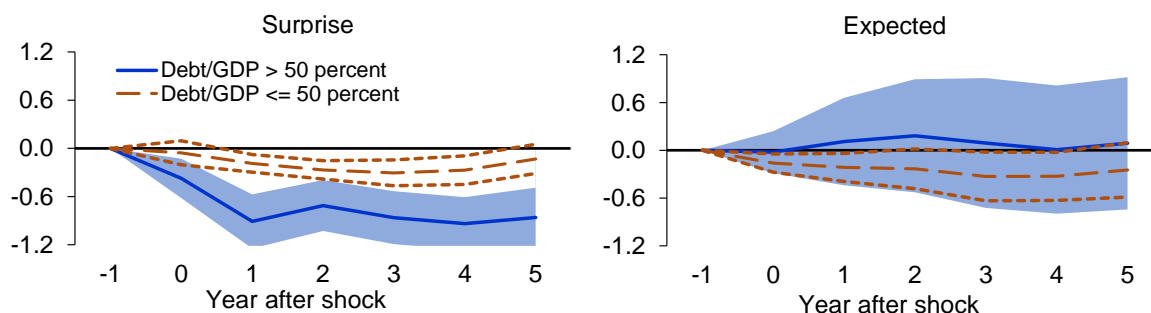
Surprise vs Expected Inflation

The regressions shown above capture all changes in inflation rates, regardless of whether they were anticipated or not. In fact, most of the oscillations in inflation come as a surprise, whereas inflation expectations tend to adjust slowly.

Estimating specification (3) allows to separate the effects of surprise (coefficients $\beta_{1,t}$) and expected (coefficients $\beta_{2,t}$) changes in inflation. Figure 6 illustrates that only unanticipated inflation spikes reduce the debt ratio, while oscillations in inflation expectations do not. The difference is larger for countries with high initial debt levels. Rises in expected inflation do not lead to a decline in expenditure to GDP, as both primary expenditure and interest costs react faster when stakeholders and markets are not surprised. Moreover, periods of increases in inflation expectations tend to be associated with declining *realized* inflation—inflation is mean-reverting and inflation expectations seem to be backward-looking or adaptive—negating the denominator effect. Notably, the smaller variation in expectations relative to surprises tends to widen confidence intervals.

While in general the reduction in debt is smaller for shocks to CPI growth than to deflator growth (because CPI inflation is less correlated with the nominal GDP denominator), the result that inflation surprises are the only component reducing debt remains when measuring inflation with CPI forecasts from Consensus Economics (see Section V).

Figure 6. Debt Reaction to Surprise vs. Expected GDP Deflator Growth Spikes, 1992-2019
(Percent of GDP)



Source: Public Finances in Modern History and World Economic Outlook.

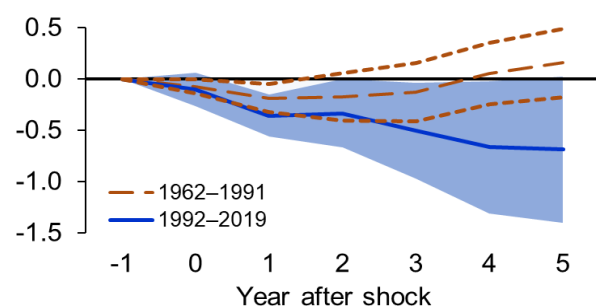
Notes: FE-OLS regressions including 85 countries during the period with available data 1992–2019. Countries with population below 1 million in 2019 are excluded, as well as observations with annual surprise or expected inflation higher than 30 percent in absolute terms, or where the original data source changes. 90-percent confidence bands plotted with standard errors clustered at the country level.

Splitting the sample of advanced economies into the periods before and during the Great Moderation (1962–1991 and 1992–2019, respectively) appears to confirm the hypothesis that anticipated inflation hikes do not help to reduce debt (Figure 7).¹³ The response of debt to inflation is estimated to be smaller and less persistent before the Great Moderation, when inflationary surges were more common and economic agents were less surprised. However, the degrees of financial repression and indexation of budget items may also have differed before and during the Great Moderation. Further panel data on such structural variables would

¹³ The sample is split in 1992 since this is the year when median inflation across advanced economies converged down to close to 2 percent, as inflation targeting regimes started to become widespread. This also splits the number of observations in about half for each subsample. The result is similar splitting the sample in 1985, another commonly used marker of the beginning of the Great Moderation.

be required to firmly establish the drivers of the change over time. Moreover, even if the elasticity for a given shock (1 percentage point increase in GDP deflator growth) is smaller, large inflation shocks would still lead to a larger overall debt reduction.

Figure 7. Response of Debt to a 1 Percentage Point GDP Deflator Shock, AEs
(Percent of GDP)



Sources: Public Finances in Modern History and World Economic Outlook.

Note: Including 31 advanced economies. Fixed effects-ordinary least squares (FE-OLS) regressions. Observations with annual inflation higher than 30 percent in absolute terms (representing about 5 percent of the sample), or where the original data source changes, are excluded. Controls include real GDP growth, lagged inflation, and country and year fixed effects. The charts plot 90 percent confidence bands, with standard errors clustered at the country level.

V. Robustness

Initial Effect of Inflation

Table 5 shows robustness of the estimated initial impact of inflation (in the same quarter of the shock) on the overall balance to GDP, as this variable summarizes the net effect of all flow-variable channels.

Modifications to the sample such as excluding a) the three largest countries—the US, Germany, and Japan—which could generate endogeneity in global commodity prices when using that instrumental variable, or b) countries with population below 1 million people (as done in the annual sample baseline regressions), do not sizably alter the results. Adding quarter fixed effects makes the coefficient insignificant, as with relatively few countries and long time series ($N < T$) the model becomes overparametrized, whereas dropping the time fixed effects altogether increases statistical significance without a major change in the coefficient. Adding country-specific quarter indicators to capture different seasonal patterns across countries, or setting the number of lags for inflation and the instrumental variables $L = 1$ (coefficients for $l = 1$ are not significant) do not substantially change the result—the p-value is still below 10 percent in either case. Using Discroll-Kraay standard errors to adjust for cross-country correlation in errors increases the p-value to 15 percent.

Table 5. Impact of CPI Inflation Spikes on the Overall Balance in the Initial Quarter, 1999:Q1-2019:Q4*(percent of GDP)*

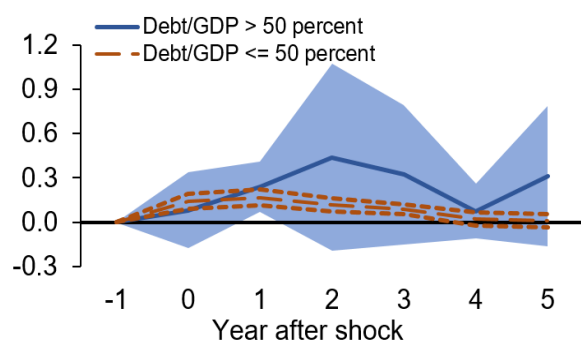
	Baseline	Excluding 3 Largest Countries	Excluding Small Countries	Quarter FE	No Time FE	Country- Quarter Indicators	Discroll- Kraay Std. Errors	Add 1 Lag
Slope Coefficient	0.37	0.39	0.38	0.04	0.42	0.32	0.37	0.46
p value	0.09	0.09	0.09	0.31	0.02	0.10	0.15	0.06

Sources: Gruss and Kebhaj (2019), Ilzetki and others (2019), International Financial Statistics, and World Economic Outlook database.

Note: Fiscal variables are in percent of GDP. The data cover the period from the first quarter of 1999 to the fourth quarter of 2019, excluding the COVID-19 period. Both regressions control for quarter indicator variables (to absorb seasonality) and country and year fixed effects. OLS regressions also control for real GDP growth. P values below 0.10 indicate significant results at the 10 percent confidence level.

Effects over the Medium Term

In Figure 3 above, the debt level was found to matter for the impact of inflation on debt, but flow variables were reported for the overall sample. In principle, primary balances should not exhibit a mechanical relationship with the debt level. Interest payments could, but they tend to be smaller as a share of GDP. Figure 8 replicates the overall balance chart of Figure 3 splitting the sample by initial debt level, and shows that the response is statistically indistinguishable between the two groups.

Figure 8. Response of Overall Balance to a 1 Percentage Point GDP Deflator Shock, 1962-2019
(Percent of GDP)

Source: Public Finances in Modern History and World Economic Outlook.

Notes: FE-OLS regressions including 85 countries during the period with available data 1992–2019. Countries with population below 1 million in 2019 are excluded, as well as observations with annual surprise or expected inflation higher than 30 percent in absolute terms, or where the original data source changes. 90-percent confidence bands plotted with standard errors clustered at the country level.

Turning to the robustness of the debt estimates over the medium term, Table 6 shows a series of alternative regressions. The negative and statistically significant impact of inflation on debt over the medium term (by year 4 after the shock) is maintained: a) including countries with a population of less than 1 million people, b) excluding country-year observations of debt restructurings with face value reductions¹⁴, c) winsorizing annual

¹⁴ Using the dating from Asonuma, Niepelt, and Ranciere (2023).

inflation (in absolute terms) at 100 percent instead of 30 percent, d) using CPI as the inflation measure instead of the GDP deflator, e) using Discroll-Kraay standard errors, or f) adding one more lag for the regressors so $L = 2$. However, including larger inflation outliers in the sample tends to reduce the strength and precision of the estimates, consistent with the finding in Blanco, Ottonello, and Ranosova (2022) that large inflation episodes are not associated with a statistically significant response of the overall balance. Using CPI inflation shocks also dampens the estimate as they have less of an impact on the debt ratio denominator.

Table 6. Impact of a 1 Percentage Point Inflation Spike on Debt by Year 4, 1962–2019
(percent of GDP)

	Baseline	Including Small Countries	Excluding Face Value Reductions	Winsorizing Inflation at 100%	CPI Inflation	Discroll-Kraay Std. Errors	2 Lags
Slope Coefficient	-0.36	-0.43	-0.36	-0.16	-0.24	-0.26	-0.33
p value	0.00	0.00	0.00	0.05	0.04	0.01	0.00

Sources: Asonuma, Niepelt, and Ranciere (2023), International Financial Statistics, Public Finances in Modern History, and World Economic Outlook database.

Notes: FE-OLS regressions. The slope coefficients measure the cumulative impact of a 1 percentage point inflation shock by year 4. The baseline column corresponds to the entire sample average of the result shown in the RHS panel of Figure 3. It measures inflation with GDP deflator shocks, includes 85 countries (i.e., excludes those with a population below 1 million), and winsorizes inflation at 30 percent in absolute terms. The other columns introduce only one change each. P values below 0.10 indicate significant results at the 10 percent confidence level.

VI. Conclusions

This paper has shown that inflation surprises help to reduce deficits temporarily and debt ratios persistently. Deficit-to-GDP ratios decline as the nominal values of the economy's output and of tax bases generally rise, generating more revenues, while spending—often set in nominal terms in the budget—initially fails to keep up. Absent indexation, real incomes may decline for civil servants, pensioners, and transfer recipients. The quality of public services and overall productivity may also suffer, as nominal spending ceilings clash with higher costs of goods and services.

The early decline in deficits as a share of GDP may not last in the medium term, however, as inflation becomes expected, spending catches up, and the cost of borrowing rises as investors require an inflation risk premium and central bank policy rates are hiked. However, an unexpected bout of inflation will erode part of the real value of government debt persistently, both owing to the initial improvement in fiscal balances and the nominal GDP denominator effect. The effect of inflation also depends on the size of government debt. The larger the debt, the greater potential erosion from inflation.

However, unlike inflation surprises, rises in inflation *expectations* are not associated with a fall in debt ratios, suggesting that inflating debt away is neither a desirable nor a sustainable strategy. Unexpected inflation may offer some breathing room for debt ratios but attempts to keep surprising markets and economic agents have historically proven futile or harmful.

This study has abstracted from other important drivers of the fiscal responses to inflation given the lack of available panel data. For example, debt structure would matter. The fall of debt with inflation would be attenuated if a portion of the debt is inflation-linked (as inflation automatically leads to higher borrowing

costs); floating-rate (as inflation prompts higher policy and hence higher short-term, benchmark rates); foreign-currency denominated (if the country has a flexible exchange rate, as inflation may lead to depreciation and thus higher repayments when expressed in domestic currency); or has shorter maturity (as investors will ask for higher rates on newly issued bonds). Investors may also require higher returns to compensate for higher inflation volatility (an inflation risk premium).

Another important dimension is which budget items are automatically or de facto indexed for inflation and by which mechanism. For example, some countries index expenditure items to inflation forecasts, whereas others use past realizations of inflation, leading to more protracted effects of inflation. Whereas data on indexation practices across a wide sample of countries are available for recent years (Balasundharam, Kayastha, and Poplawski-Ribeiro, 2023), systematic data over time are not. Further data collection efforts on debt structure and indexation would allow for a deeper understanding of the consequences of inflation on fiscal accounts across countries and over time.

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