MERCATUS SPECIAL STUDY

A FISCAL ACCOUNTING OF COVID INFLATION

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Joe Anderson and Eric M. Leeper, "A Fiscal Accounting of COVID Inflation," Mercatus Special Study, Mercatus Center at George Mason University, Arlington, VA, December 2023.

ABSTRACT

Federal COVID-related spending was largely financed through government borrowing with minimal discussion of repayment strategies. Inflation surged in 2021 and remains higher than target. The fiscal theory of the price level helps us examine the intricate interplay of fiscal and monetary policies in shaping this inflation episode.

We focus on two accounting methodologies. *Backward accounting* dissects changes in the government debt–GDP ratio throughout the COVID period, attributing it to changes in primary deficits, interest rates, inflation, and economic growth. Forward accounting links the market value of debt to expected discounted primary surpluses to interpret current inflation and bond prices in terms of changing beliefs about future fiscal and monetary policy actions.

COVID-related spending, predominantly in the form of transfers to individuals and businesses, in combination with the lack of anticipated tax increases, led to increased consumer expenditure, a swift economic recovery, and ensuing inflation. This work underscores how fiscal policy, monetary policy and household expectations shaped inflation dynamics during and after the COVID crisis.

JEL codes: E50, E52, E60, E61, E62, E63, E65, E66

Keywords: COVID inflation, fiscal policy during COVID, monetary policy during COVID, 2021 inflation, 2022 inflation, 2023 inflation, fiscal policy and inflation, monetary policy and inflation, fiscal theory of the price level, fiscal policy monetary policy

The authors acknowledge Soo Kang, whose comments improved the paper.

1 INTRODUCTION

When American inflation began its upward march in 2021, economic analysts lined up the usual suspects. Among the suspects for the source of inflation were overheated markets, supply-chain disruptions, shifts in consumer demand from services to goods, food and energy price rises, excessive corporate profits, and the perennial favorite: price gouging. Many of these candidates affected the evolution of inflation. None caused it.

We focus on the single cause: a large increase in federal COVID-related spending financed by new government borrowing, with little to no discussion of how ultimately to pay for the spending.

Rarely does the economy offer up something close to a natural experiment. COVID is an exception. By typical indicators, 2019 was a good year for the economy: the unemployment rate was 3.7 percent, real gross domestic product (GDP) grew 2.3 percent, overall prices rose by 1.8 percent, and the 10-year Treasury yield sat at 2.1 percent. Then the COVID pandemic hit. Then the federal government responded.[1]

Causal attribution demands economic theory. Data alone cannot do the trick. We draw on the fiscal theory of the price level that Leeper (1991), Sims (1994), Woodford (1995), and Cochrane (2023) developed. The fiscal theory springs from the uncontentious premise that government debt derives its value in large part from how people expect the debt will be repaid. It points to unconventional channels through which fiscal policy affects the economy and underscores the need to bring both monetary and fiscal policy into any examination of inflation.

1. Because policy reacted to an event that was external to the American economy, it is reasonable to attribute many of the subsequent economic developments to that policy response. Because we do not know the counterfactuals—economic outturns after the policy response but without COVID; outcomes with COVID but without the policy response—the experiment is not perfectly controlled. Barro and Bianchi (2023) and Bianchi, Faccini, and Melosi (2023) examine the issue more formally.

Our framework starts with the fact that government accounts must add up. Total spending must equal total revenues plus borrowing. This government budget identity alone permits a “backward accounting” that reports the empirical sources of changes in the government debt–GDP ratio. Backward accounting follows Hall and Sargent’s (2011, 2022) procedure to attribute changes in the debt–GDP ratio over the COVID period to actual outcomes for deficits, interest rates, inflation rates, and economic growth.

An alternative approach couples the budget identity with the behavior of debt-market participants to deliver a valuation expression that links the value of debt today to the present value of expected primary government budget surpluses. This “forward accounting” connects the evolution of nominal debt, debt prices, the price level, and real GDP to changing beliefs about future fiscal and monetary policy actions.

The two accountings answer different questions. Backward accounting tracks why government debt evolved as it did during COVID. Forward accounting describes how the value of debt could have evolved under alternative fiscal and monetary policies. Both accountings shed fresh light on COVID inflation to offer insights different from those that the usual suspects deliver. With new insights come starkly different policy implications.

Economic behavior lies behind the accounting. If government sends you a $1,000 check but tells you that your taxes will rise by $1,000 plus interest in the future, you will be less inclined to spend the full amount. This diminishes the stimulus to demand. Much of the COVID spending was transfers to individuals and businesses, and the tenor of public discourse sent the message that Americans should not expect tax hikes for the foreseeable future. Transfer recipients perceived they could permanently raise their consumption, which created a powerful aggregate stimulus to demand. As people spent their new government-provided wealth, production and prices rose. The result was a swift economic recovery from the COVID recession, followed by inflation.

The $5 trillion in new federal COVID-related spending helped raise the nominal value of total government debt a stunning 43 percent from 2019Q4 to 2023Q2. The *value* of that debt as a share of the economy increased only 14 percent. That 29 percentage point devaluation in debt–GDP is the fiscal theory of the price level in action. Government communications about the new spending focused on the emergency nature of the spending, which emphasized that this spending was different. It would not be offset by higher taxes or cuts in other spending. With no expectations of higher future surpluses, debt’s market value cannot rise to keep pace with its nominal value, triggering falling debt prices and a rapidly rising price level—higher inflation. This is the accounting.

The mechanisms just highlighted bear little resemblance to the usual suspects. Some economists suggested that COVID spending would be inflationary, operating entirely through a Phillips curve relationship; accordingly, fiscal expansion pushes resource utilization rates high enough to produce inflation (prominent examples include Blanchard 2021; Summers 2021; Bernanke and Blanchard 2023). That view downplays—or ignores—the fiscal financing that lies at the heart of this brief.

2 LEGISLATION DURING COVID

Legislation ratified during the pandemic financed vaccine research, extended forgivable loans to businesses, and sent checks directly to households, along with a host of other measures. This section documents this legislative response.

2.1 Spending Amounts

From March 2020 to December 2021, the height of the pandemic, eleven spending bills were enacted. Headlined by the Coronavirus Aid, Relief, and Economic Security (CARES) Act and the American Rescue Plan (ARP), these bills increased federal spending authorization by about $6 trillion. Of that total, $5.7 trillion has been committed to be spent and $4.9 trillion has been disbursed. Table 1 breaks down the spending by bill.

TABLE 1. SPENDING BREAKDOWN BY LEGISLATION

Legislation	Ratification Date	Allowed ($B)	Committed ($B)	Disbursed ($B)
Coronavirus Supplemental Appropriations Act	3/6/20	8	7	2
Families First Act	3/18/20	247	244	312
CARES Act	3/27/20	2,107	2,030	1,887
PPP & Health Care Enhancement Act	4/24/20	803	692	666
Emergency Aid for Returning Americans Act	7/13/20	.009	.009	.009
September 2020 Continuing Resolution	10/1/20	32	31	31
Response & Relief Act	12/27/20	924	854	650
American Rescue Plan (ARP)	3/11/21	1,857	1,774	1,355
Prevent Cuts Act	4/14/21	12	12	12
September 2021 Continuing Resolution	9/30/21	.096	0	0
Protecting Medicare Act	12/10/21	8	8	8
Total		5,998	5,652	4,923

Note: Totals are rounded. CARES = Coronavirus Aid, Relief, and Economic Security; PPP = Paycheck Protection Program.
Source: Committee for a Responsible Federal Budget. Data as of July 21, 2023. https://www.covidmoneytracker.org/.

TABLE 2. ALLOCATION OF COVID SPENDING

Recipient	Allowed ($B)	Committed ($B)	Disbursed ($B)
Households	2,350	2,256	2,033
Businesses	1,984	1,855	1,793
Health spending	467	425	257
State and local governments	1,029	1,003	764
Federal Agencies	168	114	76
Total	5,998	5,652	4,923

Source: Committee for a Responsible Federal Budget. Data as of July 21, 2023. https://www.covidmoneytracker.org/.

2.2 Spending Allocations

Spending on vaccine research and at-home testing had real, positive effects on production. Employees went back to work and places of business reopened their doors earlier. Higher production and income raised the tax base to help revenues recover without changes in tax rates.

The government also gave out stimulus checks to households and bolstered social programs. These transfers expanded American household budgets. For those hit hard by the pandemic, this additional income was used to catch up on overdue hospital or credit card bills. For those more indirectly affected by COVID, these payments were seen as “free money” and were used to purchase additional goods. As immunizations grew, more households went from the first to the second category.

Table 2 outlines how spending was allocated throughout the pandemic. The CARES Act devoted $843 billion (40 percent of the bill) to household transfers, while the ARP, a bill that passed a year later, allocated $979 billion (53 percent of the bill) to households. Total COVID spending was evenly split between households and businesses at $2 trillion each, with state and local governments the next largest recipients at $1 trillion. Very little federal spending was earmarked for health—only 5 percent of the disbursed $5 trillion—but some of the transfers to state and local governments went toward health expenditures.

2.3 Bipartisanship and Deficit Management

As part of the Budget Enforcement Act of 1990, Congress included a pay-as-you-go (PAYGO) rule. Every spending bill that Congress passed had to be accompanied by legislation that would ensure the deficit consequences were offset. If it wanted to cut taxes or raise military spending, Congress needed to enact a law that raised revenues or cut spending somewhere else by an equal

TABLE 3. S-PAYGO SCORING

Legislation	Ratification Date	S-PAYGO
Coronavirus Supplemental Appropriations Act	3/6/20	Partial
Families First Act	3/18/20	Partial
CARES Act	3/27/20	None
PPP & Health Care Enhancement Act	4/24/20	Partial
Emergency Aid for Returning Americans Act	7/13/20	Full
September 2020 Continuing Resolution	10/1/20	Partial
Response & Relief Act	12/27/20	Full
American Rescue Plan (ARP)	3/11/21	Full
Prevent Cuts Act	4/14/21	Full
September 2021 Continuing Resolution	9/30/21	Full
Protecting Medicare Act	12/10/21	None

Note: S-PAYGO = Statutory Pay-As-You-Go Act; CARES = Coronavirus Aid, Relief, and Economic Security; PPP = Paycheck Protection Program.

Source: Individual laws from https://www.congress.gov/.

amount. PAYGO was well honored by Congresses until it was repealed in 2002 (see Blinder 2022).

A different version of this rule was passed in the Statutory Pay-As-You-Go (S-PAYGO) Act of 2010, which is still in effect. S-PAYGO requires that sequestration of current spending offset any new deficit-raising legislation.[2] Every law is subject to this rule by default, but the Senate can exempt individual bills from the S-PAYGO rule with a 60-vote majority, leaving no explicit plan to finance the associated spending. Table 3 reports which COVID bills were subject to S-PAYGO.

A large portion of COVID spending was deliberately unbacked by revenue increases or spending cuts. The CARES Act was entirely exempt from S-PAYGO. And while the ARP is subject to S-PAYGO, the timing of the resulting sequestration continually gets pushed into the future (Protecting Medicare and American Farmers from Sequester Cuts Act, 2021; Consolidated Appropriations Act, 2022). Because of the ARP's size, there is not enough nonexempt funding to cover the required sequestration (see Swagel 2021). What happens when the sequestrations required by law exceed the available funding?

National crises often bring Republicans and Democrats together while presidential elections move them apart. The pattern was no different in 2020–2021. Bills like the Families First Act, CARES Act, and Paycheck Protection

2. Many programs are exempt from this sequestration. Some examples are Social Security, Medicaid, and the Supplemental Nutrition Assistance Program (SNAP). Medicare can be sequestered by 4 percent. These exemptions leave only a small pool of funds available to cut.

TABLE 4. LEGISLATION VOTE SPLITS

Legislation	Ratification Date	House Yea %	Senate Yea %
Coronavirus Supplemental Appropriations Act	3/6/20	99.5	99.0
Families First Act	3/18/20	90.1	91.8
CARES Act	3/27/20	98.6	100
PPP & Health Care Enhancement Act	4/24/20	98.7	100
Emergency Aid for Returning Americans Act	7/13/20	100	100
September 2020 Continuing Resolution	10/1/20	86.3	89.4
Response & Relief Act	12/27/20	87.1	93.9
American Rescue Plan (ARP)	3/11/21	51.0	50.5
Prevent Cuts Act	4/14/21	90.1	97.8
September 2021 Continuing Resolution	9/30/21	59.2	65.0
Protecting Medicare Act	12/10/21	51.2	62.8

Source: Individual laws from https://www.congress.gov/.

Program (PPP) Act passed with strong bipartisan support. After the 2020 election, bills were more hotly contested: the ARP and others narrowly passed Congress. Table 4 breaks down the final passing vote splits in both the House and the Senate for each COVID-related bill.

Tables 3 and 4 show that American political leaders initially reacted to the crisis with little discussion of how new spending would be financed. And after the administration of President Joseph Biden took office in January 2021, much of the bipartisanship disappeared. The prevailing political atmosphere, together with past congressional behavior, were the bases on which Americans formed expectations about fiscal financing.

3 MEASURING GOVERNMENT INDEBTEDNESS

Fiscal accounting tracks how total federal indebtedness to the private sector gets financed. Both the Treasury and the Federal Reserve issue debt instruments that the public buys.

Government obligations to the private sector can be separated into two bins: longer-term securities that the Treasury sells and short-term instruments that the Fed issues.[3] We refer to the Treasury bin, which includes notes, bills, and bonds, as “longer-term privately held debt.” Fed liabilities comprise bank reserves, currency, reverse repurchase agreements, term deposits, and foreign official reserves, which tend to be of short maturity. We call the sum of the two bins “total privately held debt.”

3. The Federal Reserve Bank of Dallas constructs a variety of Treasury debt measures. We supplement their measure of privately held Treasury debt with our measure of Fed debt.

Figure 1 presents several measures of debt over the past twenty years. Figure 1a plots the market values of longer-term privately held and the total privately held debt-to-GDP ratios. The Treasury-based ratio at the beginning of the pandemic is identical to that at the end. Adding short-term government debt yields a ratio that rose 14 percentage points through 2023Q2. Large Fed purchases of government debt during the pandemic make up the difference, as figure 1b shows. The green line is Treasury-only issuances. Adding bank reserves yields the red line, while the blue line adds the remaining Fed liabilities.

Shifting from longer-term debt (Treasury securities) to short-term debt (bank reserves and currency) does not eliminate debt from the consolidated government's ledger. All government debt must be financed in one way or another, which is the topic of the next section.

4 GOVERNMENT BUDGET IDENTITY FRAMEWORK

Government finances must add up. The adding-up condition goes by several names, including the government's "budget constraint" or "budget identity." Hall and Sargent (2011, pp. 193–214) refer to this condition as the "least controversial equation of macroeconomics."

We adopt the accounting convention that gathers all government liabilities into a single object called "total privately held government debt." Two government entities lie behind the budget condition—the Treasury and the Federal Reserve. Each entity has its own budget. Because the entities are part of the same government, economic analyses often consolidate the two budgets into a single "government" budget. Total government liabilities to the private sector include Treasury bills and bonds, currency, and bank reserves. Fed purchases of Treasury securities in the open market do not reduce total government indebtedness. They merely alter the maturity structure, ownership, and labeling of privately held debt.[4]

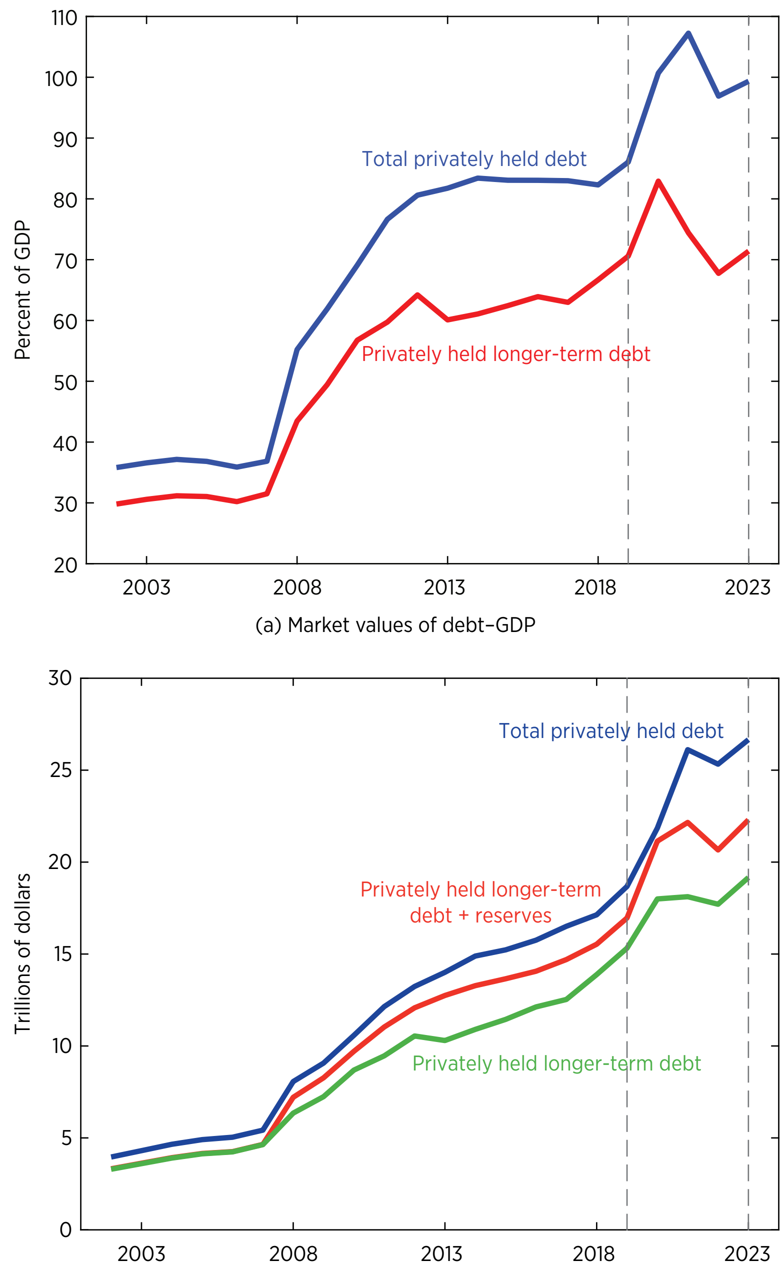
The consolidated government budget identity may be written as[5]

$$\frac{Q_t^P B_t^P}{P_t} + T_t = G_t + \frac{Q_t^P B_{t-1}^P}{P_t},$$

4. In a series of important papers, Hall and Sargent (2011, 2022, 2023) adopt a different convention that focuses on privately held government bills and bonds, treating Fed holdings of Treasury securities as seigniorage.

5. Appendix A describes how to arrive at this form of the consolidated budget identity. We exclude the Fed's holdings of private securities from our accounting. Hall and Sargent (2023) take a more expansive approach and compute the unrealized losses on those assets in 2022.

FIGURE 1. MEASURES OF FEDERAL GOVERNMENT DEBT



(a) Market values of debt–GDP

(b) Face values of three measures of debt

Note: Vertical lines mark 2019 to 2023.

where

Q_t^P = market price of total privately-held government—Treasury plus Federal Reserve—debt portfolio at t,

B_t^P = total nominal privately-held government debt at t,

P_t = aggregate price level at t,

T_t = real value of tax receipts at t,

G_t = real government outlays, excluding interest payments, at t.

Total privately held debt-to-GDP, what we label $Q_t^P B_t^P / P_t Y_t$, is the blue line in figure 1a. The face value of total nominal of privately held debt, B_t^P, is the blue line in figure 1b. The difference between the blue and green lines in that figure is the face value of Federal Reserve debt.

The left side of the budget identity reflects total sources of revenue broadly construed: tax revenues, T_t, and the stock of debt held by the public, B_t^P, at the portfolio price of Q_t^P. Those revenues must equal total outlays: government spending plus redemptions of outstanding debt.

It is natural to measure government debt relative to the size of the economy by scaling everything in the budget identity by real GDP at time t, Y_t. Imposing this and manipulating the right side of the identity leads to useful interpretations of the spending side of the budget.

$$\frac{Q_t^P B_t^P}{P_t Y_t} + \frac{T_t}{Y_t} = \frac{G_t}{Y_t} + i_{t-1,t}^P \frac{Q_{t-1}^P B_{t-1}^P}{(1+\pi_t)(1+g_t)P_{t-1}Y_{t-1}} + \frac{Q_{t-1}^P B_{t-1}^P}{(1+\pi_t)(1+g_t)P_{t-1}Y_{t-1}},$$

where the new notation is

$1 + i_{t-1,t}^P$ = gross one-period nominal weighted holding period return on the total government portfolio between $t-1$ and t,

$1 + \pi_t$ = gross rate of inflation $= P_t/P_{t-1}$,

$1 + g_t$ = gross growth rate of real GDP $= Y_t/Y_{t-1}$.

On the right are three types of spending as shares of GDP—expenditures on goods, services, and transfers; interest on outstanding borrowing; and reduction in debt–GDP due to inflation and economic growth.

A final simplification of the budget identity defines the primary surplus, S_t, as total revenues less total spending—excluding interest payments on the debt—to give us

$$\frac{Q_t^P B_t^P}{P_t Y_t} + \frac{S_t}{Y_t} = \left(\frac{1 + i_{t-1,t}^P}{(1+\pi_t)(1+g_t)} \right) \frac{Q_{t-1}^P B_{t-1}^P}{P_{t-1} Y_{t-1}}. \tag{1}$$

This budget identity lays out precisely how policy can meet its obligations. Start with the obvious ways: government can raise revenues or cut spending to increase the primary surplus, or it can borrow more by selling new debt instruments at the price Q_t^P. These obvious ways receive most of the attention in policy discussions.

But the terms on the right side of the identity embody three other sources of financing. First, the holding period return, $i_{t-1,t}^P$, is negative when debt prices at t fall below those in the previous period. By reducing returns on debt, debt-service costs and the debt–GDP ratio fall. Second, higher inflation—P_t and π_t—has two effects: it reduces the real return on existing debt, and it reduces the real value of new debt. Most government debt instruments are a promise to repay in dollars. By eroding the purchasing power of those dollars, higher inflation makes repayment cheaper in terms of goods and services. Finally, because the identity expresses debt relative to total goods and services the economy produces, higher real GDP—Y_t and g_t—reduces both the (growth-adjusted) return and the debt's share of the economy.

We use versions of budget identity (1) to conduct fiscal accounting of COVID inflation.

5 BACKWARD ACCOUNTING OF FISCAL FINANCING

Backward accounting uses a framework that does not rely on particular assumptions about economic behavior.[6] We view identity (1) as reporting how the debt–GDP ratio evolves over time. It accounts for debt's evolution by quantifying the contribution to observed movements in debt of each component in the condition—surpluses, nominal returns, inflation, and growth. The procedure answers the question: Why did the debt–GDP ratio change from 2019Q4 to 2023Q1? The goal is to explain how government finances behaved using outcomes of economic variables.

The evolution of debt-to-GDP over time brings a *dynamic* component to government finance. Movements in the ratio occur not only through taxes and spending; they also depend on debt price movements, the growth rate of the economy, and the inflation rate, as expression (1) shows. Here is some intuition for these effects:

1. If financing comes from higher taxes or lower outlays, then not as much debt is needed to pay the government's bills. The ratio falls.

6. This approach is based on Hall and Sargent (2022). Appendix A contains derivations.

TABLE 5. CONTRIBUTIONS TO THE EVOLUTION OF THE MARKET VALUE OF TOTAL PRIVATELY HELD DEBT-TO-GDP RATIO BETWEEN 2019Q4 AND 2023Q1 (PERCENTAGE)

End of 2019Q4	End of 2023Q1	Change	Returns on Reserves	Returns on Treasury securities	Inflation	Real Growth	Deficit	Other
86.0	100.7	14.7	0.3	−7.0	−15.1	−6.8	26.1	17.1

2. Unmatured debt is valued at market prices. If prices of debt decrease, the market value of the debt falls even without changes to the debt's face value. The ratio falls.
3. When the economy grows, outstanding government debt becomes a smaller share of the economy. The ratio falls.
4. A government that owes $10 to a lender before a high-inflation quarter still owes $10 to that lender afterward. But inflation erodes the real (inflation-adjusted) debt obligations of the government. The ratio falls.

The total privately held debt-to-GDP rose 15 percentage points from the beginning of COVID to 2023Q1. The country began 2020 with an 86 percent debt-to-GDP ratio and ended 2023Q1 at 100.7 percent.

Table 5 breaks down the movement in the debt-to-GDP ratio from 2019Q4 to 2023Q1 by quantifying the contributions of each component of the budget identity in (1). The first three columns document how the debt-to-GDP ratio changed over time. The next six columns report the contributions of interest payments on reserves, nominal returns on Treasury securities (interest payments and changes in debt prices), inflation, real growth, the primary deficit (spending minus revenues), and other funding sources to the change in debt-to-GDP.[7] Negative numbers contribute to reducing the debt-to-GDP ratio while positive ones contribute to increasing the ratio.

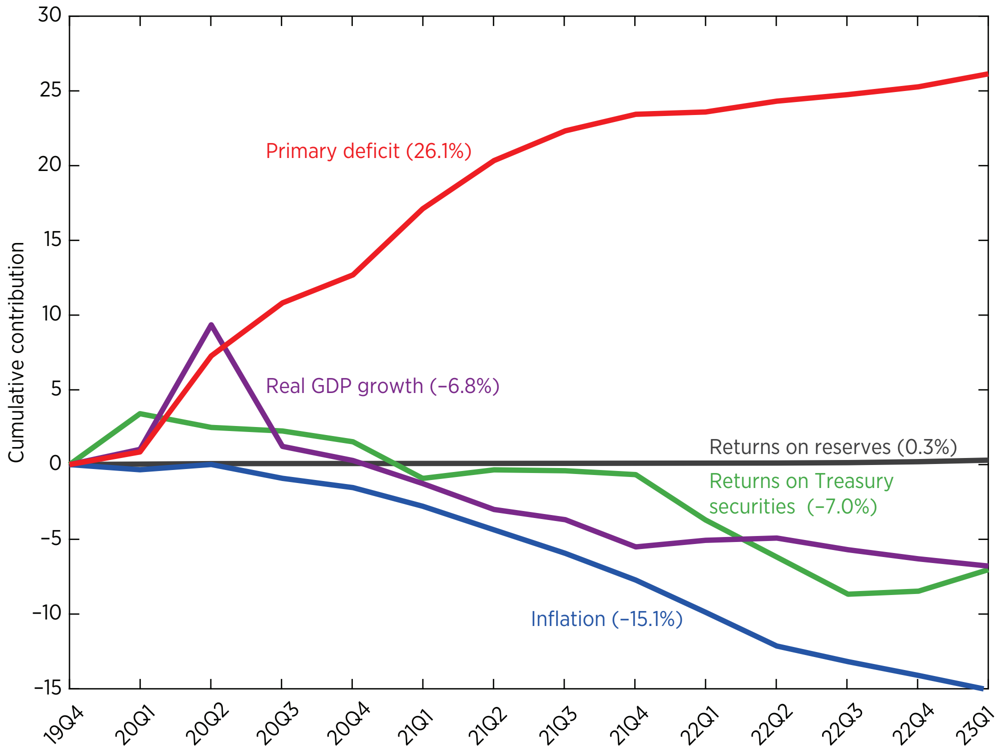
Most striking is that the primary deficit (government spending minus direct taxation) accounted for a whopping 26 percentage point increase in the ratio. If the government had financed all spending through debt *and if* debt prices, inflation, and economic growth all remained constant, the debt-to-GDP ratio would have shot up over 110 percent.

But the government did not finance its spending using only debt. Debt price movements, positive real GDP growth, and high inflation all tempered upward movements in the ratio, combining to finance 29 percent of debt-to-GDP and more than offsetting the deficit's contribution.

Inflation was the largest source of debt financing during COVID. The high-inflation episode beginning in 2021 was equivalent to a large tax on holders

7. Appendix C describes data sources.

FIGURE 2. CONTRIBUTIONS TO THE EVOLUTION OF THE MARKET VALUE OF PRIVATELY HELD DEBT-TO-GDP RATIO BETWEEN 2019Q4 AND THE DATE ON THE HORIZONTAL AXIS



Note: Numbers in parentheses are the percentage of the change in debt–GDP between 2019Q4 and 2023Q1 due to each component, as table 5 reports.

of US bonds, bills, notes, currency, bank reserves, and, other nominal deposits. Whatever the government owed them before COVID bought fewer goods and services after COVID. So even though explicit taxes were not increased during the pandemic, the country experienced a substantial inflation (implicit) tax hike (see discussion in Hall and Sargent 2023).

Figure 2 plots how the numbers in table 5 evolved. The sharp decline in real GDP in the second quarter of 2020 and the subsequent recovery are both apparent. Growth helps to finance spending starting in 2020Q4. Inflation (the implicit debt-holder tax) persistently decreases the debt-to-GDP ratio over the period.

Interest payments on reserves did not contribute much to the debt-to-GDP ratio. Had interest rates on reserves remained low, the contribution would have been about 0.1 percentage points. But the Fed's decision to increase the rate on reserves beginning in 2022Q2 pushed the contribution to 0.3 percentage points.

Nominal returns on longer-term debt (debt price movements and interest payments) rose at the onset of the pandemic but slowly fell throughout 2021 and 2022. Figure 3a displays the movements in the price of debt over this period (the ratio of the red to the blue line). A falling market value of debt relieves pressure on the government's outstanding obligations without any adjustment to the debt's face value. The interest rate on the government's portfolio ($i^P_{t-1,t}$ in identity (1)) is the percentage change in this price over time. The return was negative for most of 2020Q1 to 2023Q1. People and institutions who held government debt in its various forms not only paid the inflation tax, they also found their assets lost value. Both effects helped finance government spending.

6 FISCAL THEORY FRAMEWORK

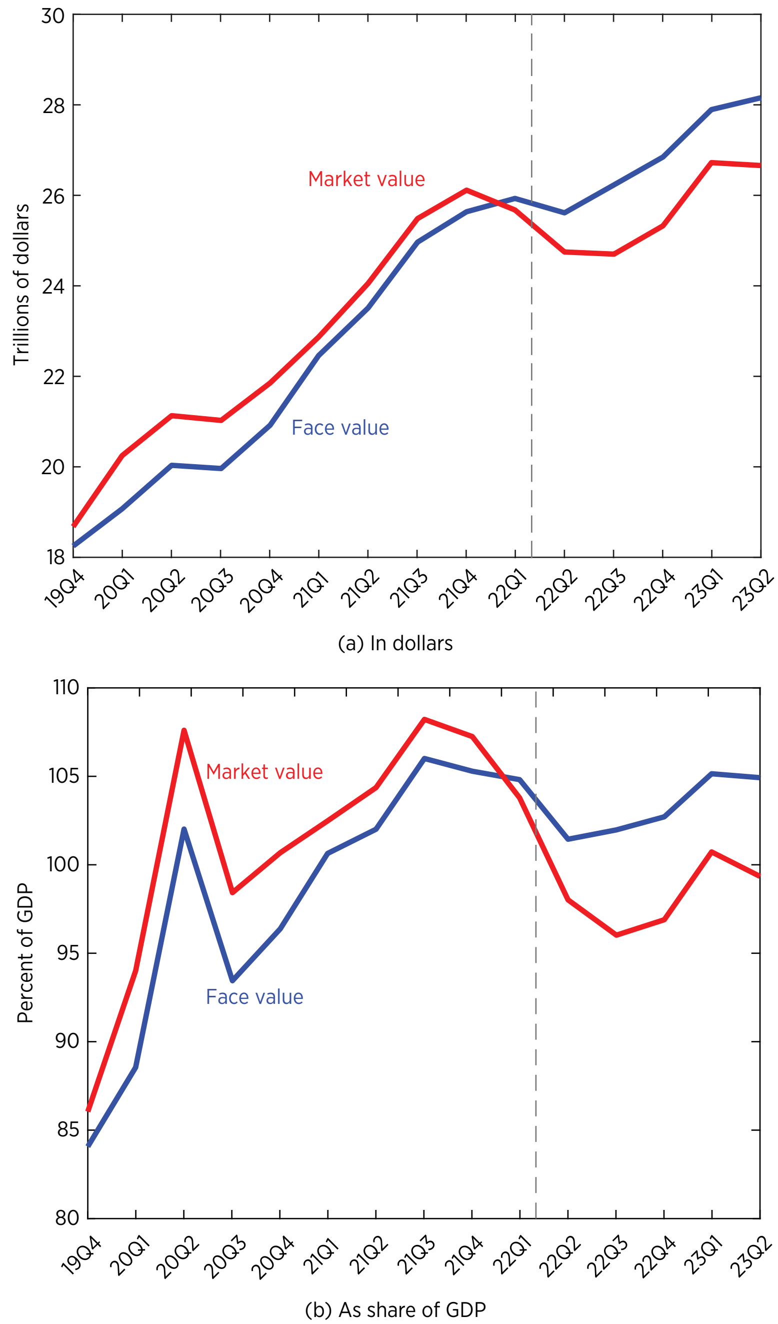
We also interpret the accounting of COVID inflation through the framework that the fiscal theory of the price level (FTPL) provides. The FTPL springs from a few key premises:

1. Like any asset, government liabilities—Treasury bills and bonds, Federal Reserve bank reserves, and currency—derive their value in large part from expected cash flows, discounted to the present.[8] For government-issued debt instruments, those cash flows are primary surpluses: total tax revenues less total expenditures excluding interest payments on outstanding government debt.
2. Because the primary surpluses that back current outstanding debt occur in the future, traders in government debt markets must form expectations of future surpluses and discount rates.
3. The vast majority of government liabilities simply promise to pay in *dollars* rather than purchasing power. Their "value" depends on both their dollar price and the value of the dollar itself.
4. Any interpretation of inflation developments must be consistent with monetary *and fiscal* behavior because both policies affect how the government finances its debt.

Real primary surpluses represent the government's command over resources that can be used to pay off debt while maintaining debt's purchasing power. Primary surpluses back government debt. If the government sells new bonds today that increase the debt–GDP ratio by 1 percent, then investors expect the government will raise future surpluses (in present value) by 1 percent

8. "In large part" because those assets may also yield transactions service flows that have independent value.

FIGURE 3. FACE VALUE AND MARKET VALUE OF TOTAL PRIVATELY-HELD DEBT IN DOLLARS AND AS PERCENT OF GDP



Note: Vertical lines mark beginning of interest rate hikes.

of current GDP. If instead investors believe the present value of surpluses will not change, then with no increased backing, the value of debt cannot increase. Even if the government sells more nominal bonds, their real value and share of GDP cannot change. Prices of debt and of goods and services must adjust to realign the value of debt with its backing.

We summarize how debt instruments are valued with an expression, derived from the government budget identity and some behavioral assumptions, that links the current value of the total government debt–GDP ratio to the present value of future surplus–GDP ratios:[9]

$$\frac{Q_t^P B_t^P}{P_t Y_t} = \text{Expected discounted stream of } \frac{S_{t+1}}{Y_{t+1}}, \frac{S_{t+2}}{Y_{t+2}}, \frac{S_{t+3}}{Y_{t+3}}, \cdots \tag{2}$$

Expression (2) is an asset-pricing relation for government debt that lurks in most macroeconomic models. It says that the value of debt relative to the size of the economy can rise or fall only if the current value of expected backing—in the form of future real surpluses relative to GDP—rises or falls.

Valuation equation (2) provides a framework for interpreting the COVID inflation. Using round numbers, Congress disbursed $5 trillion in new spending—over one-fifth of 2020 GDP—much of it in the form of transfer payments to individuals, businesses, and state and local governments and all of it financed by new Treasury borrowing. Total privately held debt was 100 percent of GDP in 2020, so the increase in borrowing produced an equivalent increase in debt: B_t^P in equation (2) rose 20 percent. If people expected a commensurate increase in the present value of surpluses, then equation (2) could continue to be satisfied with no changes in debt prices, price level, or real GDP but a debt–GDP ratio of 120 percent.

Section 2 documents the unusual legislative atmosphere surrounding COVID spending bills. Congress suspended procedures like S-PAYGO. President Donald Trump insisted his name appear on the Treasury's relief checks. The atmosphere was encapsulated by a later statement by the Biden White House press secretary, Jen Psaki: "It's important to note that [funding] should be provided on an emergency basis, not something that would require offsets" (White House 2022). Government communication about COVID-relief funds was designed to encourage people to spend their relief checks by convincing them that emergency spending would not be offset by higher taxes. Presidents do not put their names on checks that come attached to IOUs for future tax bills.

9. We assume investors make choices that eliminate all arbitrage opportunities across assets and that they do not overaccumulate saving.

People who receive transfers with no offsetting taxes attached will convert the Treasury check into consumption, now or in the future. Higher overall demand raises production and prices, driving up nominal GDP, $P_t Y_t$, in equation (2). If debt prices are unchanged, nominal GDP must eventually rise 20 percent to keep the debt–GDP ratio consistent with no expected change in future surpluses.

Early in 2022, the Fed began to raise interest rates rapidly. An elevated path of interest rates drove down debt prices, Q_t^P, to reduce the market value of outstanding debt and attenuate the expansion in nominal GDP. Section 7 performs this accounting with data.

The fiscal theory frames inflation as a *joint* monetary-fiscal phenomenon. That jointness means that Fed policy alone cannot always combat inflation successfully. We return to that theme in section 8.

7 FORWARD ACCOUNTING OF FISCAL FINANCING

Forward accounting uses valuation equation (2) to answer the question: What beliefs about future policies are consistent with the current value of outstanding government debt? This is the question most relevant to policy making. Backward accounting tracks what has already happened; forward accounting infers what people believe will happen. Policymakers today cannot change the past. But they can influence beliefs, which feed back to affect current economic outcomes.

Figure 3a reports that both the face value (B^P) and the market value ($Q^P B^P$) of privately held debt rose over the period we study. Market value fell below face value once it became clear the Fed would raise interest rates.

What if we account for inflation and economic growth? Figure 3b contrasts the face ($B_t^P / P_t Y_t$) and market ($Q_t^P B_t^P / P_t Y_t$) values of debt–GDP over the COVID period. Although the face value of debt–GDP rose 22 percentage points from 2019Q4 to 2023Q2, the market value increased 14 percentage points. Declining debt prices explain the difference. Viewed through the relation in expression (2), over the three-year period, investors expected a less-than-full increase in discounted primary surpluses. Because they do not anticipate enough additional backing to support COVID-related debt sales, prices must adjust to align with the incomplete backing.

Forward accounting looks at the total market value of privately held government debt-to-GDP and its four components. Valuation equation (2) informs

TABLE 6. TOTAL MARKET VALUE OF PRIVATELY HELD DEBT-TO-GDP AND ITS FOUR COMPONENTS AT THREE DATES

		Percentage Change Relative to Values in 2019Q4			
Date	Debt-GDP ($Q^P B^P/PY$)	Nominal Debt (B^P)	Debt Price (Q^P)	Price Level (P)	Real GDP (Y)
2020Q2	22.4	9.3	3.0	0.0	–10.1
2021Q3	22.9	31.3	–0.3	5.8	2.3
2023Q2	14.4	43.4	–7.8	15.2	6.0

the interpretations of the accounting. Drawing on the red line in figure 3b, we focus on three calendar dates: 2020Q2, 2021Q3, and 2023Q2. Table 6 reports the accounting.

The first two dates roughly line up with the two large spending bills: the CARES Act and ARP. Debt value was almost the same in 2020Q2 and 2021Q3, about 22.5 percent above its 2019Q4 value. Nominal debt grew only 9.3 percent up to 2020Q2, but debt prices rose and real GDP fell sharply as businesses closed down, driving debt–GDP up dramatically. Debt prices rose as the Fed swiftly reduced interest rates. At this early stage of the pandemic, bond traders believe that newly issued debt would be backed.

Much of the backing came from the Fed's unscheduled meeting on March 15, 2020. The Fed announced both the drop in the federal funds rate to near zero and its programs to buy Treasury and private securities and extend a host of repurchase and reverse repurchase agreements. The announcement communicated that interest rates would remain low through the crisis. Lower interest rates reduce discount rates, raising the current value of a given stream of primary surpluses to boost the value of debt.

Five quarters later in 2021Q3, debt–GDP was essentially unchanged, but the composition of its value shifted. Nominal debt had grown 31.3 percent, yet debt–GDP was only 22.9 percent higher. Debt lost value through lower debt prices and a higher price level. And as the economy pulled out of the 2020 recession, higher real GDP reduced debt's share of the economy. Although the expected backing was the same as in 2020Q2, bondholders were beginning to expect the Fed to raise interest rates to combat price increases.

Fast-forward to 2023Q2, three years after the initial date. Debt–GDP has fallen from its earlier peaks and sits at 14.4 percentage points higher than in 2019Q4. Nominal debt has grown an astounding 43.4 percent, leaving 29 percentage points of nominal debt to be devalued relative to GDP. Inflation was the biggest factor that devalued debt, coming in at 15.2 percent higher. Debt prices fell 7.8 percent, driving the market value well below face value, particularly once the Fed began to raise interest rates (see figure 3). Economic growth of 6 percent also contributed to reducing debt's share of the economy.

What do we make of declining debt–GDP in the face of steadily rising nominal debt? The fiscal theory attributes the discrepancy to bondholders' beliefs that policy will not raise the present value of surpluses to fully back new debt issuance. Again, monetary policy enters into the calculus. Fed tightening raises real interest rates in the short run, which transmit to higher discount rates. When discount rates rise, a $1 payment in the future is worth less today: today's value of future surpluses declines and, with it, the value of government debt.

A simple version of the fiscal theory of the price level predicts that nominal debt and the market value of debt–GDP would rise by identical percentages if people believed fiscal policy would fully back debt with higher primary surpluses. The 29 percentage point gap between the two debt measures suggests that people believed a significant chunk of debt-financed COVID spending would be unbacked by primary surpluses, which is consistent with the public discourse at the time. As of 2023Q2, two-thirds of new debt was not expected to be backed by higher primary surpluses. Debt–GDP declines over the period as people's beliefs in incomplete backing of the debt become more firm.

8 MONETARY POLICY IN THE COVID ERA

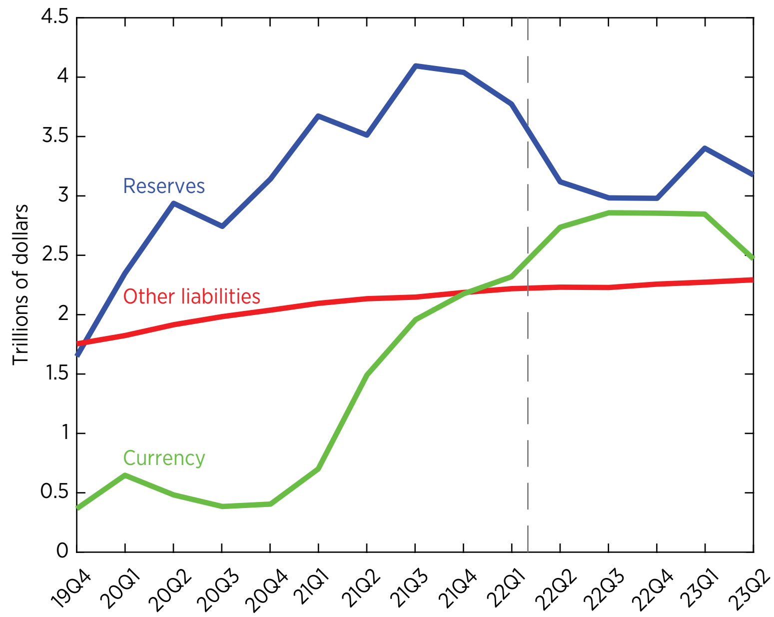
Federal Reserve actions affected the evolution of inflation and the fiscal accounting of inflation over the period.

8.1 The Fed's COVID Response

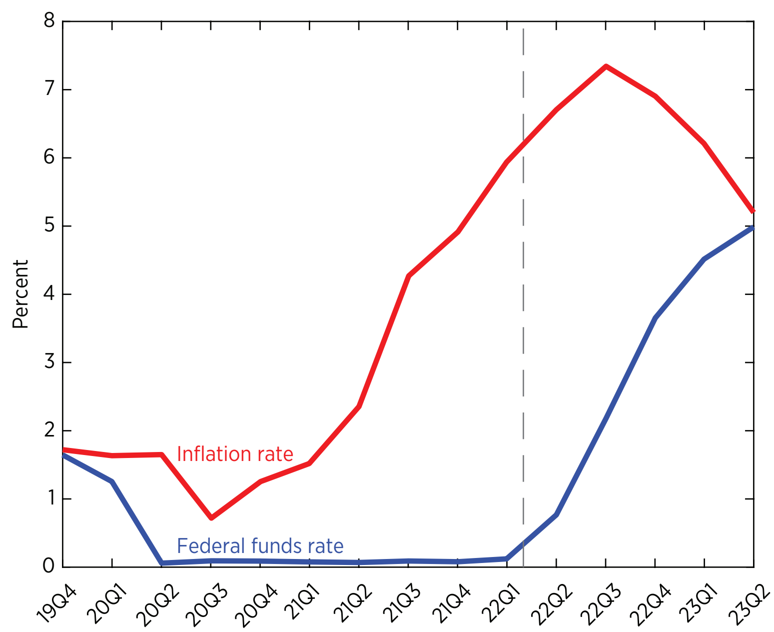
The Fed responded strongly and swiftly to the COVID crisis. It sought to stimulate the economy by lowering the federal funds rate and to stabilize financial markets through large-scale asset purchases and liquidity provision. It ensured that liquidity was readily available for households and businesses during a time when private lending was scarce.

Figure 4 plots the three components of Fed liabilities. In March 2020, the Fed began what turned into a large open market purchase initiative. It initially bought $500 billion in treasury securities and $200 billion in government-sponsored mortgage-backed securities (MBS); it followed that up by purchasing

FIGURE 4. FEDERAL RESERVE POLICY RESPONSES AND THE INFLATION RATE



(a) Federal Reserve liabilities



(b) Federal funds and inflation rates

Note: Vertical lines mark beginning of interest rate hikes.

$80 billion in Treasury securities and $40 billion in MBS per month starting in June 2020. The resulting change in reserves is shown as the blue line in figure 4a. By the time the Fed reversed course and began to shrink its balance sheet in November 2021, it had added, through a variety of initiatives, $4.6 trillion of new liquidity to the economy.

In addition to asset purchases, the Fed dropped the interest rate on reserves to 0.15 percent in March 2020, where it remained until March 2022. Flooding the market with liquidity and keeping interest on reserves low ensured that the federal funds rate hit its target near zero (figure 4b).

Inflation rose quickly. It started below 2 percent before COVID hit, peaked at over 7.5 percent in 2022Q2, and remains about 3.5 percent, above the Fed's target for inflation (figure 4b).

8.2 How Monetary Policy Affects Government Debt

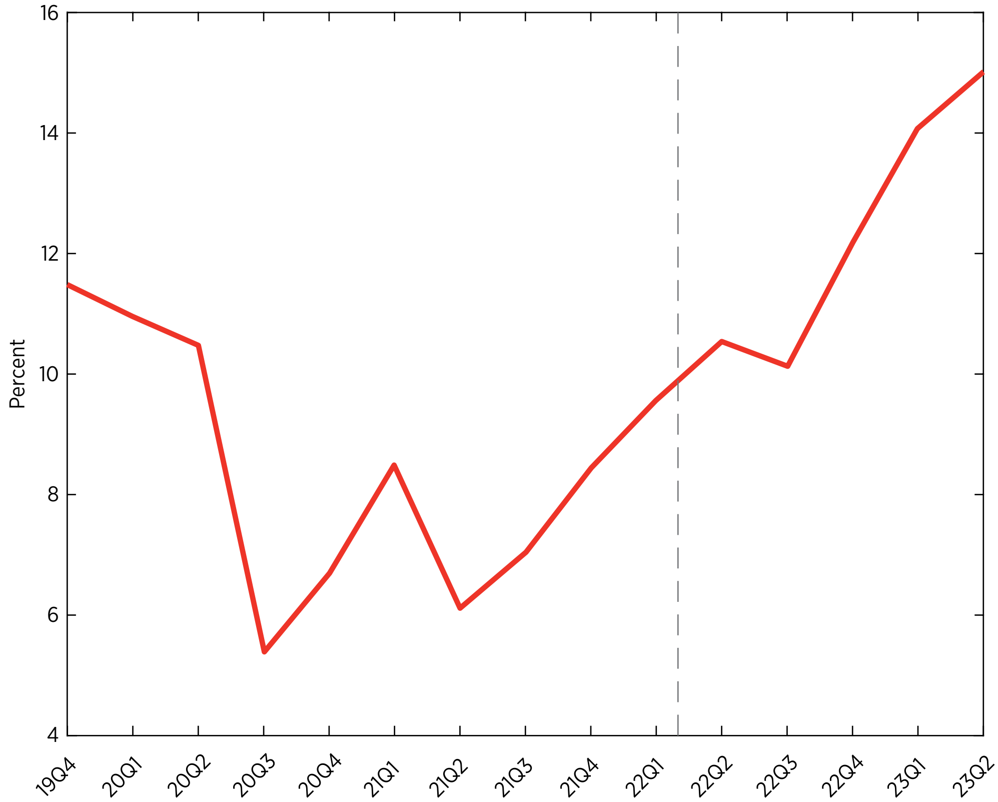
When the Fed cuts the federal funds rate and the rate on reserves, both short-term rates, it reduces incentives for the banking industry to sit on its liquidity and collect interest. The lower the rate, the stronger the incentives for households and businesses to borrow to finance their consumption and investment choices. This is the conventional channel for monetary stimulus, which the Fed pursued for two years starting in March 2020.

The short-term policy interest rate is woven into the fabric of financial markets. Current and expected future rates cascade to affect decisions that banks, firms, and households make. All interest rates tend to rise or fall with the path of short rates. Easier monetary policy in 2020 raised bond prices and reduced interest payments from the Treasury to debt holders. Fed tightening triggered opposite movements. Figure 5 plots interest payments as a share of noninterest federal expenditures. Payments rose slowly in 2021 as borrowing expanded but interest rates remained low. Since the Fed started to tighten in 2022, interest payments have risen rapidly.

Going forward, it matters how the government chooses to finance rising interest payments. Will primary surpluses rise, or will government borrow to meet interest needs? If Congress chooses to roll interest payments into more rapid growth in nominal debt, we can expect more inflation in the future, after contemporaneous revaluation effects wear off.

Both forward and backward accounting emphasize the debt revaluation impacts of monetary policy. A higher expected path of interest rates reduces

FIGURE 5. INTEREST PAYMENTS ON TREASURY BONDS AS PERCENTAGE OF FEDERAL EXPENDITURES LESS INTEREST PAYMENTS



Note: Vertical line marks beginning of interest rate hikes.

bond prices, so the market value of debt declines with no change in face value. The immediate impact on inflation is beneficial because the price level can fall along with bond prices to maintain the debt–GDP ratio in valuation equation (2). But this is only the immediate impact.

Fed tightening raises real rates in the short run and future interest payments over longer horizons. The shorter the maturity structure of government debt, the sooner the interest-rate impacts on interest payments show up. As monetary policy's impacts on real rates diminish, we are left only with higher interest payments on the debt. Eventually, a higher average funds rate manifests as a higher inflation rate. Fed efforts to combat fiscal inflation are ephemeral: tighter monetary policy pushes inflation into the future, but it cannot eliminate the inflation that COVID spending triggered.

9 CONCLUDING REMARKS

The perspective on COVID inflation that the fiscal theory of the price level offers differs starkly from conventional views put forth by Fed policymakers, prominent macroeconomists, and economic journalists. Why?

Conventional analyses embed a dirty little secret: future fiscal policy will always adjust as needed to fully back government debt with primary surpluses. By assuming that fiscal policy is self-neutralizing, conventional analyses assume away the issues this brief highlights.

To sharpen the contrast between conventional views and ours, we posit that primary surpluses do not change at all. Reality probably lies somewhere between no surplus adjustments and full neutralization. How things play out rests entirely with elected officials. It is not a problem the Federal Reserve can fix on its own.

If the COVID spending bills included legislation that adjusts taxes or other spending to pay for COVID relief, then we would not have seen inflation rise substantially. Bond prices would not have needed to fall to devalue debt. If Congress now were to adopt policies that fund increasing interest payments, we would be more sanguine about the prospects for getting inflation back to target.

If fiscal policy continues to refrain from raising revenues or reducing spending and the Fed continues to combat above-target inflation with ever-higher interest rates, there is little reason to expect inflation will return to prepandemic levels.

You cannot extinguish a fiscal fire with only a monetary policy hose.

APPENDIX A: CONSOLIDATED GOVERNMENT BUDGET IDENTITY

To be explicit about the timing of payoffs, in what follows, the interest rate $i_{t,t+1}$ denotes the nominal return between t and $t+1$. $i_{t,t+1}$ may or may not be known at t.

We start by writing the government's flow budget identity as

$$M_t + Q_t^R R_t + \sum_{j=1}^{\infty} Q_t(t+j)B_t(t+j) + P_t s_t = M_{t-1} + R_{t-1} + \sum_{j=1}^{\infty} Q_t(t+j-1)B_{t-1}(t+j-1), \tag{3}$$

where

$M_t =$ currency in circulation at t,

$Q_t^R =$ price of bank reserves, reverse repurchase agreements, and other deposits at t,

$R_t =$ bank reserves, repurchase agreements, and other deposits at t,

$Q_t(t+j) =$ dollar price of a bond sold at t that matures at $t+j$,

$B_t(t+j) =$ face value of bonds privately held at t that mature at $t+j$,

$P_t =$ aggregate price level at t,

$s_t =$ real primary surplus at t.

Define nominal government liabilities at the beginning of t by

$$W_t = M_{t-1} + R_{t-1} + \sum_{j=1}^{\infty} Q_t(t+j-1)B_{t-1}(t+j-1), \tag{4}$$

and at the beginning of period $t+1$ by

$$W_{t+1} = M_t + R_t + \sum_{j=1}^{\infty} Q_{t+1}(t+j)B_t(t+j). \tag{5}$$

Note that W_{t+1} is not known at t because bond prices at $t+1$ are not observed until $t+1$.

It turns out to be most convenient to express the law of motion for nominal liabilities in terms of holding period returns rather than asset prices. Define the one-period holding period return on Treasury bonds between t and

$t+1$, $i^B_{t,t+1}$, as

$$1+i^B_{t,t+1} \equiv \frac{\sum_{j=1}^{\infty} Q_{t+1}(t+j)B_t(t+j)}{\sum_{j=1}^{\infty} Q_t(t+j)B_t(t+j)}.$$

The one-period holding period return on reserves between t and $t+1$ is immediate:

$$1+r^R_{t,t+1} \equiv \frac{1}{Q^R_t}.$$

The law of motion for the supply of total government liabilities is

$$W^s_{t+1} = (1+i^B_{t,t+1})\left[W^s_t - P_t s_t - \frac{i^B_{t,t+1}}{1+i^B_{t,t+1}} M_t - \left(\frac{1}{1+i^R_{t,t+1}} - \frac{1}{1+i^B_{t,t+1}}\right) R_t\right]. \tag{6}$$

Expression (6) reveals that the value of government liabilities as a share of GDP at the beginning of period t, W_t/P_tY_t, depends on expected discounted streams of

$$\begin{aligned}
\text{primary surpluses} &= \frac{s_{t+j}}{Y_{t+j}}, \\
\text{currency seigniorage} &= \frac{i^B_{t,t+1}}{1+i^B_{t,t+1}} \frac{M_{t+j}}{P_{t+j}Y_{t+j}}, \\
\text{reserves seigniorage} &= \left(\frac{1}{1+i^R_{t,t+1}} - \frac{1}{1+i^B_{t,t+1}}\right) \frac{R_{t+j}}{P_{t+j}Y_{t+j}}.
\end{aligned}$$

We now derive the compact formulation for the budget identity in expression (1) that appears in the text. Define the nominal market value of total government debt at the end of period t by

$$Q^P_t B^P_t \equiv M_t + Q^R_t R_t + \sum_{j=1}^{\infty} Q_t(t+j)B_t(t+j),$$

and its corresponding value at the beginning of period t

$$Q^P_t B^P_{t-1} \equiv M_{t-1} + R_{t-1} + \sum_{j=1}^{\infty} Q_t(t+j-1)B_{t-1}(t+j-1).$$

Define the holding period return on total government debt from $t-1$ to t as

$$1+i^P_{t-1,t} \equiv \frac{M_{t-1} + R_{t-1} + \sum_{j=1}^{\infty} Q_t(t+j-1)B_{t-1}(t+j-1)}{M_{t-1} + Q^R_{t-1}R_{t-1} + \sum_{j=1}^{\infty} Q_{t-1}(t+j-1)B_{t-1}(t+j-1)}.$$

Employing the compact notation, (3) becomes

$$Q^P_t B^P_t + P_t s_t = (1+i^P_{t-1,t})Q^P_{t-1}B^P_{t-1}.$$

Dividing this expression through by nominal GDP, $P_t Y_t$, yields expression (1) in the text.

APPENDIX B: BACKWARD-ACCOUNTING FRAMEWORK DERIVATION

From the derivation of the government budget constraint in section 4, we have the consolidated budget identity

$$M_t + Q_t^R R_t + Q_t B_t^P + P_t (T_t - G_t) = M_{t-1} + R_{t-1} + Q_t B_{t-1}^P,$$

which is an expanded version of (1) in the text.

We also have an expression for the holding period return on Treasury bonds from $t-1$ to t,

$$1 + i_{t-1,t}^B = \frac{Q_t B_{t-1}}{Q_{t-1} B_{t-1}},$$

and an expression for the holding period return on reserves between $t-1$ and t:

$$1 + i_{t-1,t}^R = \frac{1}{Q_{t-1}^R}.$$

Combine these three equations to write

$$M_t + Q_t^R R_t + Q_t B_t + P_t (T_t - G_t) = M_{t-1} + \left(1 + i_{t-1,t}^R\right) Q_{t-1}^R R_{t-1} + \left(1 + i_{t-1,t}^B\right) Q_{t-1} B_{t-1}.$$

Divide both sides by nominal GDP, $P_t Y_t$:

$$\frac{M_t}{P_t Y_t} + \frac{Q_t^R R_t}{P_t Y_t} + \frac{Q_t B_t}{P_t Y_t} + \frac{P_t (T_t - G_t)}{P_t Y_t} = \frac{M_{t-1}}{P_t Y_t} + \frac{\left(1 + i_{t-1,t}^R\right) Q_{t-1}^R R_{t-1}}{P_t Y_t} + \frac{\left(1 + i_{t-1,t}^B\right) Q_{t-1} B_{t-1}}{P_t Y_t}.$$

Approximate growth in $(P_t Y_t)^{-1}$ is expressed as

$$(P_t Y_t)^{-1} \approx (1 - \pi_t - g_t)(P_{t-1} Y_{t-1})^{-1},$$

where π_t is inflation and g_t is real GDP growth, both from time $t-1$ to t.

Using the approximation, the identity becomes

$$\frac{P_t G_t}{P_t Y_t} + \frac{(1 - \pi_t - g_t) M_{t-1}}{P_{t-1} Y_{t-1}} + \frac{(1 - \pi_t - g_t)\left(1 + i_{t-1,t}^R\right) Q_{t-1}^R R_{t-1}}{P_{t-1} Y_{t-1}} + \frac{(1 - \pi_t - g_t)\left(1 + i_{t-1,t}^B\right) Q_{t-1} B_{t-1}}{P_{t-1} Y_{t-1}} = \frac{M_t}{P_t Y_t} + \frac{Q_t^R R_t}{P_t Y_t} + \frac{Q_t B_t}{P_t Y_t} + \frac{P_t T_t}{P_t Y_t}.$$

Rearrange to derive an expression for the change in market value of total debt–GDP from $t-1$ to t, as follows:

$$\underbrace{\frac{M_t + Q_t^R R_t + Q_t B_t}{P_t Y_t} - \frac{M_{t-1} + Q_{t-1}^R R_{t-1} + Q_{t-1} B_{t-1}}{P_{t-1} Y_{t-1}}}_{\text{change in debt-to-GDP}}$$

$$= \underbrace{i_{t-1,t}^R \frac{Q_{t-1}^R R_{t-1}}{P_{t-1} Y_{t-1}}}_{\text{nominal return on reserves}} + \underbrace{i_{t-1,t}^B \frac{Q_{t-1} B_{t-1}}{P_{t-1} Y_{t-1}}}_{\text{nominal return on Treasury securities}}$$

$$\underbrace{-\pi_t \frac{M_{t-1} + Q_{t-1}^R R_{t-1} + Q_{t-1} B_{t-1}}{P_{t-1} Y_{t-1}}}_{\text{inflation}} \underbrace{-g_t \frac{M_{t-1} + Q_{t-1}^R R_{t-1} + Q_{t-1} B_{t-1}}{P_{t-1} Y_{t-1}}}_{\text{real growth}}$$

$$\underbrace{-\, i_{t-1,t}^R \left(\pi_t + g_t\right) \frac{Q_{t-1}^R R_{t-1}}{P_{t-1} Y_{t-1}} - i_{t-1,t}^B \left(\pi_t + g_t\right) \frac{Q_{t-1} B_{t-1}}{P_{t-1} Y_{t-1}}}_{\text{residual}} + \underbrace{\frac{P_t \left(G_t - T_t\right)}{P_t Y_t}}_{\text{primary deficit}} .$$

Section 5 employs a multi-period version of this equation to account for the change in debt–GDP from 2019Q4 to 2023Q2.

APPENDIX C: DATA DESCRIPTION

This appendix outlines data sources for the analysis in this paper. Much of this data comes from the Dallas Fed's calculation on the market value of US government debt at https://www.dallasfed.org/research/econdata/govdebt#data, hereafter referred to as DF.

For comparison, analogous data definitions used in Hall and Sargent (2022) are listed where applicable. Much of this data comes from the dataset described in Hall et al. (2022) and found on George Hall's website at https://people.brandeis.edu/∼ghall/, hereafter referred to as HPSS.

B_t Face value of gross longer-term debt (Treasury securities).

- This paper: Par value, gross federal debt. Column B in DF found at https://www.dallasfed.org/research/econdata/govdebt#data.
- Hall and Sargent (2022): Total gross debt, par value. Column F in HPSS found at https://people.brandeis.edu/~ghall/.

B_t^P Face value of privately held longer-term debt (Treasury securities).

- This paper: par value, privately held gross federal debt. Column C in DF found at https://www.dallasfed.org/research/econdata/govdebt#data.

- Hall and Sargent (2022): Calculated as (Debt held by private investors, par value) – (Treasury balance in TGA) – (Noninterest bearing debt)
    - Debt held by private investors, par value. Column H in HPSS found at https://people.brandeis.edu/~ghall/.
    - Treasury balance in TGA. Daily Treasury statements found at https://fiscaldata.treasury.gov/datasets/daily-treasury-statement/operating-cash-balance.
    - Noninterest-bearing debt. Column E in HPSS found at https://people.brandeis.edu/∼ghall/.

$Q_t B_t$ Market value of gross longer-term debt (Treasury securities).

- This paper: Market value, gross federal debt. Column E in DF found at https://www.dallasfed.org/research/econdata/govdebt#data.
- Hall and Sargent (2022): Total gross debt, market value. Column G in HPSS found at https://people.brandeis.edu/~ghall/.

$Q_t^P B_t^P$ Market value of privately held longer-term debt (Treasury securities).

- This paper: Market value, privately held gross federal debt. Column F in the dataset found at https://www.dallasfed.org/research/econdata/govdebt#data.
- Hall and Sargent (2022): Calculated as (Debt held by private investors, market value) – (Treasury balance in TGA) – (Noninterest bearing debt)
    - Debt held by private investors, market value. Column I in HPSS found at https://people.brandeis.edu/~ghall/.
    - Treasury balance in TGA. Daily Treasury statements found at https://fiscaldata.treasury.gov/datasets/daily-treasury-statement/operating-cash-balance.
    - Noninterest-bearing debt. Column E in HPSS found at https://people.brandeis.edu/∼ghall/.

R_t Face value of reserve deposits held at the Fed.

- This paper: Other deposits held by depository institutions. Table H.4.1.T5 on the Fed's weekly balance sheet and found at https://fred.stlouisfed.org/series/WLODLL.

M_t Noninterest-earning currency and other deposit liabilities.

- This paper: Calculated as (Federal Reserve notes, net of F.R. Bank Holdings) + (Deposits with F.R. Banks, other than reserve balances) +

(Other deposits at the Fed) + (Term deposits held by depository institutions) − (US Treasury, Supplementary Financing Account) − (Treasury balance in TGA) + (Reverse repurchase agreements):

  - Federal Reserve notes, net of F.R. Bank Holdings. Table H.4.1.T5 on the Fed's weekly balance sheet and found at https://fred.stlouisfed.org/series/WLFN.
  - Deposits with F.R. Banks, other than reserve balances. Table H.4.1.T5 on the Fed's weekly balance sheet and found at https://fred.stlouisfed.org/series/WDFOL.
  - Other deposits at the Fed. Table H.4.1.T5 on the Fed's weekly balance sheet, found at https://fred.stlouisfed.org/series/WLODL.
  - Term deposits held at depository institutions. Table H.4.1.T5 on the Fed's weekly balance sheet and found at https://fred.stlouisfed.org/series/TERMT.
  - US Treasury, Supplementary Financing Account. Table H.4.1.T5 on the Fed's weekly balance sheet, found at https://fred.stlouisfed.org/series/WLSFAL.
  - Treasury balance in TGA. Daily Treasury statements, found at https://fiscaldata.treasury.gov/datasets/daily-treasury-statement/operating-cash-balance.
  - Reverse repurchase agreements. Table H.4.1.T5 on the Fed's weekly balance sheet and found at https://fred.stlouisfed.org/series/WLRRAL.
- Hall and Sargent (2022): Calculated as (Noninterest-bearing debt) + (Market value of interest-bearing debt, marketable, held by the Federal Reserve) + (Fed-held mortgage-backed securities):
  - Noninterest-bearing debt. Column E in HPSS found at https://people.brandeis.edu/∼ghall/.
  - Market value of interest-bearing debt, marketable, held by the Federal Reserve. Column U in HPSS found at https://people.brandeis.edu/~ghall/.
  - Fed-held mortgage-backed securities. Table H.4.1.T5 on the Fed's weekly balance sheet and found at https://fred.stlouisfed.org/series/WSHOMCB.

i_t^R Interest rate on reserves.

- This paper: Found before 7/29/21 at https://fred.stlouisfed.org/series/IOER and after 7/29/21 at https://fred.stlouisfed.org/series/IORB.

Q_t^R Price of reserve deposits at the central bank.

- This paper: Calculated as $\frac{1}{1+i_t^R}$.

$Q_t^R R_t$ Market value of reserve deposits at the central bank.

Q_t^P Price of privately held longer-term debt (Treasury securities).

- This paper: Calculated as $\frac{Q_t^P B_t^P}{B_t^P}$.

i_t^P Nominal holding period return on privately held longer-term debt (Treasury securities).

- This paper: Approximated as $\ln\left(Q_t^P\right) - \ln\left(Q_{t-1}^P\right)$.
- Hall and Sargent (2022): Aggregated monthly holding period returns on US Treasury debt held by the public as described by Hall and Sargent (2011) and found at https://people.brandeis.edu/~ghall/. Returns are calculated (and reweighed) using data from both CRSP and HPSS. The CRSP Treasury database can be read about at https://www.crsp.org/products/research-products/crsp-us-treasury-database.

$P_t Y_t$ Nominal GDP.

- This paper: Gross domestic product. Section 1, table T10105-Q, line 1 in the National Income and Product Accounts (NIPA) from the BEA. Found at https://apps.bea.gov/iTable/?isuri=1&reqid=19&step=4&categories=flatfiles&nipa_table_list=1.
- Hall and Sargent (2022): Gross domestic product. Section 1, table T10105-A, line 1 in the NIPA from the BEA. Found at https://apps.bea.gov/iTable/?isuri =1&reqid=19&step=4&categories=flatfiles &nipa_table_list=1.

$\frac{1}{P_t}$ Inverse of the price deflator.

- This paper: Gross domestic product. Section 1, table T10109-Q, line 1 in the NIPA from the BEA. Found at https://apps.bea.gov/iTable/?isuri=1&reqid=19&step=4&categories=flatfiles&nipa_table_list=1.
- Hall and Sargent (2022): Gross domestic product. Section 1, table T10109-A, line 1 in the NIPA from the BEA. Found at https://apps.bea.gov/iTable/?isuri =1&reqid=19&step=4&categories=flatfiles &nipa_table_list=1.

P_tY_t Real GDP.

- This paper: Calculated as $\frac{P_tY_t}{P_t}$.
- Hall and Sargent (2022): Calculated as $\frac{P_tY_t}{P_t}$.

P_tG_t Nominal government spending.

- This paper: Calculated as (Total expenditures) – (Interest payments) + (Interest receipts) – (Federal employee pension interest accrual).
  - Total expenditures. Section 3, table T30200-Q, Line 43 in the NIPA from the BEA and found at https://apps.bea.gov/iTable/?isuri=1&reqid=19&step=4&categories=flatfiles&nipa_table_list=1.
  - Interest payments: Section 3, table T30200-Q, line 33 in the NIPA from the BEA and found at https://apps.bea.gov/iTable/?isuri=1&reqid=19&step=4&categories=flatfiles&nipa_table_list=1.
  - Interest receipts: Section 3, table T30200-Q, line 14 in the NIPA from the BEA and found at https://apps.bea.gov/iTable/?isuri=1&reqid=19&step=4&categories=flatfiles&nipa_table_list=1.
  - Federal employee pension interest accrual: Section 3, table T31800(A,B)-Q, line 22 in the NIPA from the BEA and found at https://apps.bea.gov/iTable/?isuri=1&reqid=19&step=4&categories=flatfiles&nipa_table_list=1.
- Hall and Sargent (2022): Calculated as (Total expenditures) – (Interest payments) + (Interest receipts) – (Federal employee pension interest accrual).
  - Total expenditures. Section 3, table T30200-A, line 43 in the NIPA from the BEA and found at https://apps.bea.gov/iTable/?isuri=1&reqid=19&step=4&categories=flatfiles&nipa_table_list=1.
  - Interest payments: Section 3, table T30200-A, line 33 in the NIPA from the BEA and found at https://apps.bea.gov/iTable/?isuri=1&reqid=19&step=4&categories=flatfiles&nipa_table_list=1.
  - Interest receipts: Section 3, table T30200-A, line 14 in the NIPA from the BEA and found at https://apps.bea.gov/iTable/?isuri=1&reqid=19&step=4&categories=flatfiles&nipa_table_list=1.
  - Federal employee pension interest accrual: Section 3, table T31800(A,B)-A, line 22 in the NIPA from the BEA and found at https://apps.bea.gov/iTable/?isuri=1&reqid=19&step=4&categories=flatfiles&nipa_table_list=1.

G_t Real government spending.

- This paper: Calculated as $\frac{P_t G_t}{P_t}$.
- Hall and Sargent (2022): Calculated as $\frac{P_t G_t}{P_t}$.

$P_t T_t$ Nominal government receipts.

- This paper: Section 3, table T30200-Q, line 40 in the NIPA from the BEA and found at https://apps.bea.gov/iTable/?isuri=1&reqid=19&step=4&categories=flatfiles&nipa_table_list=1.
- Hall and Sargent (2022): Section 3, table T30200-A, line 40 in the NIPA from the BEA and found at https://apps.bea.gov/iTable/?isuri=1&reqid=19&step=4&categories=flatfiles&nipa_table_list=1.

T_t Real government receipts.

- This paper: Calculated as $\frac{P_t T_t}{P_t}$.
- Hall and Sargent (2022): Calculated as $\frac{P_t T_t}{P_t}$.

π_t Inflation. Approximated as $\ln(P_t) - \ln(P_{t-1})$.

g_t Real economic growth. Approximated as $\ln(Y_t) - \ln(Y_{t-1})$.

REFERENCES

Barro, R. J., and F. Bianchi. 2023. "Fiscal Influences on Inflation in OECD Countries, 2020–2022: Tests of the Fiscal Theory of the Price Level." Manuscript, Harvard University, September.

Bernanke, B., and O. Blanchard. 2023. "What Caused the U.S. Pandemic-Era Inflation?" Hutchins Center Working Paper 86. The Brookings Institution, June.

Bianchi, F., R. Faccini, and L. Melosi. 2023. "A Fiscal Theory of Persistent Inflation." *Quarterly Journal of Economics* 138, 4, 2127–2179.

Blanchard, O. 2021. "In Defense of Concerns over the $1.9 Trillion Relief Plan." Peterson Institute for International Economics, February 18.

Blinder, A. S. 2022. *A Monetary and Fiscal History of the United States, 1961–2021*. Princeton, NJ: Princeton University Press.

Cochrane, J. H. 2023. *The Fiscal Theory of the Price Level*. Princeton, NJ: Princeton University Press.

Hall, G. J., J. E. Payne, T. J. Sargent, and B. Szőke. 2022. "US Federal Debt 1776–1940: Prices and Quantities." Working Paper 18–25. New York University, Leonard N. Stern School of Business, Department of Economics, periodically updated. https://github.com/jepayne/US-Federal-Debt-Public.

Hall, G. J., and T. J. Sargent. 2011. "Interest Rate Risk and Other Determinants of Post–WWII U.S. Government Debt/GDP Dynamics." *American Economic Journal: Macroeconomics* 3, no. 3: 192–214.

——. 2022. "Three World Wars: Fiscal-Monetary Consequences." *Proceedings of the National Academy of Sciences* 119: e2200349119.

——. 2023. "Fiscal Consequences of the US War on COVID." Manuscript, New York University, May 28.

Leeper, E. M. 1991. "Equilibria under 'Active' and 'Passive' Monetary and Fiscal Policies." *Journal of Monetary Economics* 27: 129–147.

Sims, C. A. 1994. "A Simple Model for Study of the Determination of the Price Level and the Interaction of Monetary and Fiscal Policy." *Economic Theory* 4: 381–399.

Summers, L. 2021. "The Biden Stimulus Is Admirably Ambitious. But It Brings Some Big Risks, Too." *Washington Post*, February 4.

Swagel, P. L. 2021. "Letter to Honorable Kevin McCarthy, February 25, 2021." Congressional Budget Office. https://www.cbo.gov/system/files/2021-02/57030-McCarthy.pdf.

White House. 2022. “Press Briefing by Press Secretary Jen Psaki,” March 15. https://www.whitehouse.gov/briefing-room/press-briefings/2022/03/15/press-briefing-by-press-secretary-jen-psaki-march-15-2022/.

Woodford, M. 1995. “Price-Level Determinacy without Control of a Monetary Aggregate.” *Carnegie-Rochester Conference Series on Public Policy* 43: 1–46.

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