Fiscal Policy and Inflation in Pre-Pandemic U.S. History*

Ruoyun Mao[†]
University of Arkansas

Wenyi Shen[‡]
Oklahoma State University

Shu-Chun S. Yang[§]
Academia Sinica

November 19, 2024

Abstract

The literature on inflation focuses mainly on monetary and structural factors, a notable exception being the Fiscal Theory of the Price Level. Using a model with a conventional regime M and policy target shocks, we demonstrate that fiscal policy played a nontrivial role in inflation in pre-pandemic U.S. history. Policy target shocks allow for deviations from regime M while keeping long-term expectations anchored in this regime. Historical decomposition reveals that inflation target shocks were substantial during the inflation surges of the 1970s. Tax cuts during the Reagan administration eased inflation, while rising debt targets after the mid-1980s exerted inflationary pressure.

Keywords: inflation, fiscal policy, fiscal and monetary policy interaction, policy target shocks, New Keynesian models, Bayesian estimation

JEL Classifications: E31, E52, E62, E63, H30

*We thank Bill Dupor, David W. Savitski, and participants at the Western Economic Association Annual Conference for their comments. Yang acknowledges financial support from the National Science and Technology Council of R.O.C. (Grant Number: NSTC 112-2410-H-001-092).

[†]Department of Economics, University of Arkansas; ruoyunm@uark.edu.

[‡]Department of Economics, Oklahoma State University; wenyi.shen@okstate.edu.

[§]Institute of Economics, Academia Sinica; ssyang@econ.sinica.edu.tw.

1 Introduction

The inflation surge following the COVID-19 pandemic has sparked interest in understanding its causes. Initially, supply-side factors, such as disruptions in production and shipping, were seen as major contributors (e.g., Yellen, 2021; Caldara et al., 2022). Many studies also emphasize the importance of demand-side factors, notably fueled by the substantial fiscal support programs during the pandemic (Baqaee and Farhi, 2022; di Giovanni et al., 2022; Firat and Hao, 2023; Dao et al., 2023; de Soyres et al., 2023; Ferrante et al., 2023; Harding et al., 2023; Giannone and Primiceri, 2024). Using an estimated New Keynesian (NK) model with a detailed fiscal specification and stochastic policy target processes, we analyze inflation drivers in pre-pandemic U.S. history. Among various factors, we focus particularly on fiscal policy, which was largely overlooked in the inflation literature prior to the pandemic.

Conventionally, discussions about the influence of fiscal policy on inflation focus on aggregate demand (see, e.g., International Monetary Fund, 2023). Before 1970, legislation aimed at controlling inflation often involved revenue-raising or spending controls as part of demand management.[1] The development of the Fiscal Theory of the Price Level (FTPL), stemming from Leeper (1991), attributes a prominent role to fiscal policy in inflation by positing that price adjustments ensure the real value of government debt equates to the expected discounted sum of future primary surpluses (e.g., Sims, 1994; Woodford, 1994, 1995, 2001; Schmitt-Grohé and Uribe, 2000; Cochrane, 1998, 2001, 2023). Since this equivalence holds across rational expectation models via the intertemporal government budget constraint, the observational equivalence in time series under different fiscal and monetary interactions (Cochrane, 2011; Leeper et al., 2017) makes inferences about the role of fiscal policy on inflation highly sensitive to the imposed policy regime.

Like most macroeconomic models that assume regime M and abstract from detailed fiscal specifications, Smets and Wouters (2007) find that fiscal shocks play a minimal role in U.S. inflation.[2]

[1] Examples include the Revenue Act of 1948, the Revenue Act of 1951, the extension of the Excess Profits Tax Act of 1950 in 1953, the Revenue and Expenditure Control Act of 1968, and the Tax Reform Act of 1969; see Yang (2009). In January of 1980, the Carter administration proposed an "austere" budget in response to persistently high inflation (Stein, 1996).

[2] We follow Leeper (1991) and Leeper et al. (2017) in defining regime terminology. In regime M, the monetary authority adopts a Taylor-type rule to control inflation, while the fiscal authority adjusts taxes or spending to ensure fiscal sustainability. In regime F, the monetary authority does not actively control inflation, and the fiscal authority does not sufficiently adjust to stabilize debt growth. Bianchi and Melosi (2017) refer to regimes F and M as fiscally led and monetary led regimes, respectively.

Sims (2011, 2024), in contrast, develops a compelling narrative for the interaction between fiscal policy and inflation under FTPL through the early 1980s. Furthermore, the estimation by Bianchi et al. (2023) supports a significant role for fiscal policy in postwar U.S. history, including the pandemic era, within a framework where the fiscal authority does not fully back its debt and the monetary authority allows for some inflation. Recently, Smets and Wouters (2024) extend this analysis by allowing for partial fiscal backing, finding that most inflation episodes in the U.S. were primarily monetary in origin, except during the 1970s.

The markedly different conclusions about the role of fiscal policy in inflation motivate this study. Theoretically, the policy regime influences how fiscal policy affects inflation in two main ways. First, passive monetary policy enhances the inflationary impact of fiscal stimulus via increased aggregate demand.[3] Second, central to the FTPL, government debt can be revalued and stabilized through inflation, implying that fiscal policies leading to debt accumulation inherently affect inflation. Moreover, the presence of non-Ricardian consumers can amplify the inflationary effects of fiscal policy, regardless of the monetary-fiscal policy regime.[4] To capture these theoretical channels and evaluate the role of fiscal policy in U.S. inflation, we estimate an NK model with detailed fiscal instruments, non-Ricardian consumers, and stochastic target shocks. Our key finding is that fiscal policy plays a nontrivial role in driving inflation fluctuations even when the economy is in the conventional M regime.[5]

Unlike most macroeconomic models with constant policy targets (e.g., Traum and Yang, 2011; Bianchi, 2012; Zubairy, 2014; Li et al., 2021), we introduce stochastic debt and inflation targets to provide a more realistic and flexible monetary-fiscal policy framework. In reality, the federal government has never adopted a formal debt target.[6] The common practice is to set the steady-state debt to the average federal debt-to-GDP ratio (the debt ratio) over the sample period, implying a mean-reverting process (e.g., Leeper et al., 2010; Zubairy, 2014; Chang et al., 2021).[7] However, the top panel of Figure 1 shows an upward trend in the debt ratio since 2008, with no signs

[3] See, for example, Christiano et al. (2011) and Davig and Leeper (2011).

[4] See, for example, Ravn et al. (2006), Galí et al. (2007), and Leeper et al. (2017).

[5] In a recent work, Angeletos et al. (2024) theoretically shows that a heterogeneous agent NK (HANK) model with sufficiently delayed fiscal adjustment can generate inflation levels comparable to those predicted by the FTPL.

[6] There is an official debt limit on the amount the U.S. government is authorized to borrow, but this limit has never been binding. Since 1960, Congress has acted 78 times to permanently raise, temporarily extend, or revise the definition of the debt limit (U.S. Department of the Treasury, 2024).

[7] Aside from static policy targets, another approach is to model policy targets as a regime-switching process, as in Davig (2004) for debt targets and Schorfheide (2005), Liu et al. (2011), and Foerster (2016) for inflation targets.

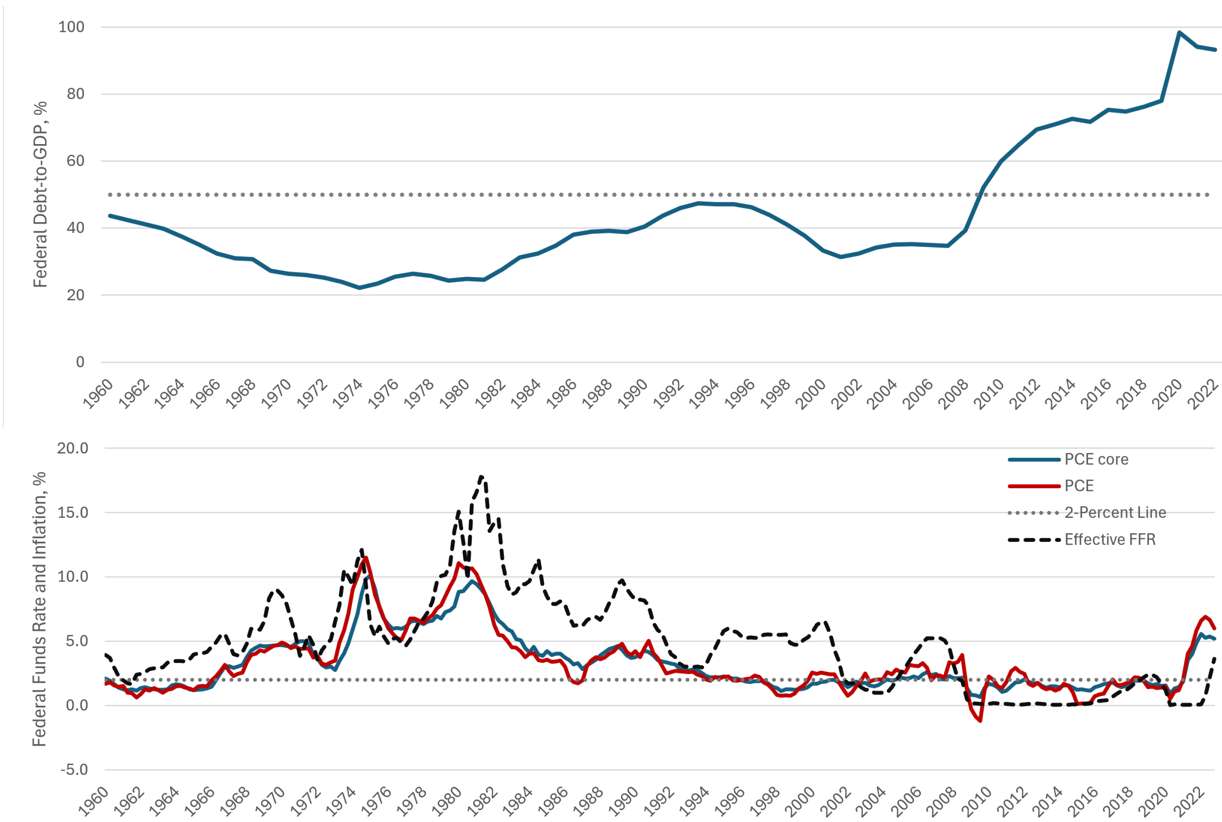

Figure 1: **Federal debt, inflation, and the federal funds rate.** The federal debt refers to the gross federal debt held by the public, as compiled and published by the Office of Management and Budget and the Congressional Budget Office. Inflation is calculated based on the annual change in Personal Consumption Expenditure (PCE) and core PCE. See Appendix A.1 for a description of the federal funds rate.

of reversion to the average level of around 50 percent (the dotted line). Regarding the inflation target, the Federal Reserve did not formally adopt a 2-percent target until 2012 (Fedearl Open Market Committee, 2012). Since then, the target has also been subject to adjustments, including the "flexible inflation targeting" described in Blanchard et al. (2010) for practical application and "average inflation targeting" during the pandemic (Powell, 2020; Martínez-García et al., 2021).[8]

Furthermore, the stochastic policy targets provide a flexible framework for monetary-fiscal interactions, where policy target shocks under regime M can be viewed as temporary deviations from the original regime M.[9] For instance, a positive inflation target reflects the central bank's tolerance

[8]In addition, numerous empirical studies support shifts in inflation targets during the 1970s and the Volcker-Greenspan era (Favero and Rovelli, 2003; Ireland, 2007).

[9]Mathematically, it is straightforward to show that an intercept change (the policy shock) can be replicated by a change in the slope (the monetary/fiscal policy response coefficient). This temporary deviation does not mean that the economy enters regime F. With a positive inflation target shock, it means that monetary policy becomes *less* active but can still be considered "active" in the sense of Leeper (1991).

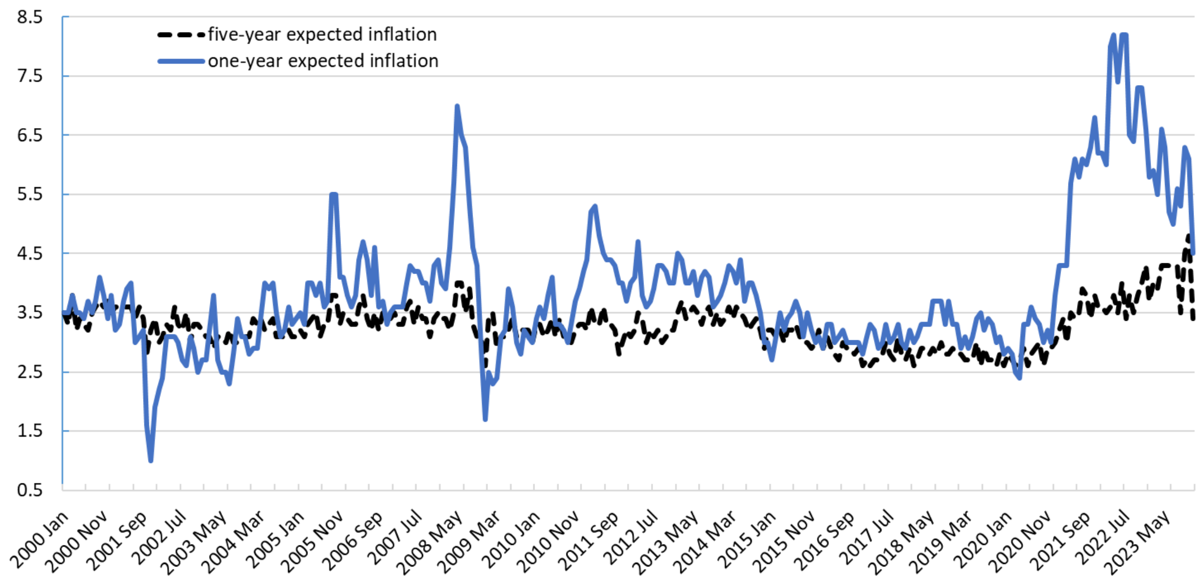

Figure 2: **Consumer inflation expectations.** The data plotted are the mean series in Tables 32 and 33 of the Survey of Consumers, University of Michigan (2024). The standard deviations of one-year and five-year inflation expectations from 2000 to 2023 are 1.2 percent and 0.4 percent, suggesting that the longer-run inflation expectations are better anchored.

for higher inflation to help stabilize debt, while a positive debt target shock allows fiscal authorities to reduce or delay fiscal adjustments. These deviations, driven by stationary target shocks, are temporary, thereby anchoring long-term inflation expectations under regime M. In the aftermath of the GFC and the COVID-19 pandemic (2008–2009 and 2020–2022), extended periods of relatively loose monetary policy raised short-term, but not long-term, inflation expectations (see Figure 2). This observation suggests that agents expect an eventual return to the conventional regime M, consistent with our regime modeling.

The estimations show that target deviations are both present and persistent in U.S. data. A positive inflation target shock is expansionary: when the monetary authority is willing to tolerate higher inflation, expected inflation rises, which lowers the real interest rate and induces a positive intertemporal substitution effect that encourages consumption and investment. A positive debt target shock that triggers a combination of expansionary fiscal measures is, on average, expansionary. Increased government consumption and investment, higher transfers, or lower tax rates all stimulate output. A higher debt ratio, however, drives up the real interest rate, reducing private investment. On balance, the net effect on output can be negative, depending largely on the magnitude of the fiscal instruments' response to the rising debt ratio.

The historical decomposition robustly demonstrates the significance of fiscal policy for inflation. Notably, debt target shocks become increasingly important in explaining inflation fluctuations beginning in the mid-1980s. Bianchi and Ilut (2017) argue that the decline in inflation during the early 1980s occurred only when agents' beliefs about fiscal backing shifted. We show that these beliefs were likely complicated by debt target shocks working in the opposite direction. The increasing magnitude of the positive debt target shocks we identify aligns with Stein's (1996) observation of a gradual shift in the notion of acceptable deficit sizes in his accounts of the U.S. fiscal revolution.

Apart from the debt target, shocks to various fiscal instruments also contributed to inflation fluctuations throughout the sample period. For example, during the severe economic downturn in the mid-1970s, expansionary fiscal measures—–including the 1975 tax rebate, followed by a series of tax laws aimed at increasing individual disposable income—moderately contributed to the surging inflation from 1975 to 1978. In contrast, the sharp reductions in individual and corporate income tax rates, as outlined in the Economic Recovery Tax Act of 1981 and the Tax Reform Act of 1986, acted like positive supply-side shocks and aided the disinflation process. Like Bianchi et al. (2023), we also find a persistent, positive contribution of transfer shocks to inflation, though with much smaller magnitudes.

In addition to fiscal policy, we shed new light on how monetary policy affected inflation in the 1970s. We find that positive inflation target shocks significantly contributed to the inflation surges during this period, with a notable reduction in these contributions around 1980, coinciding with Volcker's appointment.[10] This shift signaled a change in the Federal Reserve's stance on inflation and altered agents' beliefs about future monetary policy. This finding aligns with Hazell et al.'s (2022) assertion that "the sharp drop in core inflation in the early 1980s was mostly due to shifting expectations about long-run monetary policy..." (p. 1299). Through the lens of our model with inflation target shocks, an increase in the inflation target suggests that the Federal Reserve would accommodate rising inflation, raising inflation expectations. These self-fulfilling expectations plausibly led to uncontrollable inflation in the pre-Volcker era, as pointed out by Poole et al. (2013)

[10] This finding contradicts Liu et al. (2011), who argue that changes in the inflation target were not important in the 1970s.

and Goodfriend and King (2013).

Our paper contributes to the literature on the fiscal implications for inflation under various monetary-fiscal policy interactions by providing a useful and realistic empirical reference. Bianchi et al. (2023) estimate the role of fiscal policy in driving inflation using a DSGE model that includes a shadow economy under regime F, attributing the remaining effects to regime M. Similarly, Smets and Wouters (2024) estimate the share of fiscal backing through a partial fiscal backing model and find that, on average, approximately 70 to 80 percent of government debt is funded by future surpluses.[11] Our estimated fiscal impact on inflation is, on average, smaller than that of Bianchi et al. (2023), as our policy targets, measured by data averages, are more conservative than their endogenously measured targets in the shadow regime F. It is slightly larger than that of Smets and Wouters (2024), which utilizes a more simplified fiscal framework.

Another line of research relevant to our paper is the regime-switching literature on monetary-fiscal interactions. A key advantage of our approach is the ability to estimate a medium-scale DSGE model using standard methods for fixed regimes while capturing features that deviate from a fixed regime M, along with a rich fiscal specification.[12] In contrast, existing DSGE models with fiscal and monetary policy regime switching often use simplified structures. For example, the regime-switching NK models in Baele et al. (2015), Bianchi and Ilut (2017), and Bianchi and Melosi (2017) exclude capital and distortionary taxes, while other models estimate regime-switching fiscal and monetary policies separately and then combine them with calibrated DSGE models (e.g., Davig and Leeper, 2006) and (Davig and Leeper, 2011). From a modeling perspective, our model offers more flexible interactions between fiscal and monetary policy, allowing the two policies to operate independently without needing to switch simultaneously to achieve equilibrium.[13]

2 The Baseline Model

We construct an NK model with a rich fiscal specification, similar to those in Traum and Yang (2015) and Leeper et al. (2017). The main difference from those papers is that our model features

[11]A detailed discussion on the connections and differences with Bianchi et al. (2023) and Smets and Wouters (2024) can be found in the online appendix.

[12]Utilizing standard linear methods for fixed regimes also minimizes the risk of indeterminacy issues, as noted by Farmer et al. (2009).

[13]Our model does, however, rule out the expectation effects of transitioning from regime M to regime F.

policy target shocks meant to capture temporary deviations from the conventional regime M.

2.1 Firms

The numeraire is the final good, Y_t. The representative firm producing the final good uses a variety of intermediate goods, $y_t(i)$, $i \in [0,1]$, to produce the final good

$$\left[\int_0^1 y_t(i)^{\frac{1}{1+\eta_t^p}} di\right]^{1+\eta_t^p} \geq Y_t, \tag{1}$$

where η_t^p is an exogenous markup of the intermediate goods prices, following the process

$$\ln \eta_t^p = (1-\rho_p)\ln \eta^p + \rho_p \ln \eta_{t-1}^p + \varepsilon_t^p, \tag{2}$$

where $\varepsilon_t^p \sim$ i.i.d. $N(0, \sigma_p^2)$. This firm maximizes profits subject to equation (1). The demand for $y_t(i)$ is derived as

$$y_t(i) = Y_t \left[\frac{p_t(i)}{P_t}\right]^{-\frac{1+\eta_t^p}{\eta_t^p}}, \tag{3}$$

where $p_t(i)$ is the price of $y_t(i)$, P_t is the price of Y_t, and $\frac{1+\eta_t^p}{\eta_t^p}$ is the elasticity of substitution between intermediate goods.

Following Drautzburg and Uhlig (2015), we assume that intermediate goods firm i produces with the production function

$$y_t(i) = [k_t(i)]^{\alpha} [A_t l_t(i)]^{1-\alpha} \left(\frac{K_{t-1}^G}{\int_0^1 y_t(i)di + A_t\Omega}\right)^{\frac{\alpha^G}{1-\alpha^G}} - A_t\Omega, \tag{4}$$

where $k_t(i)$ is effective capital, $\alpha \in [0,1]$, and $\Omega > 0$ is the fixed production cost. Public capital, K_{t-1}^G, provides a positive externality to production, but its service flow decreases when intermediate output rises to capture the negative congestion effect. A_t is technology with the growth rate $u_t^a \equiv \ln A_t - \ln A_{t-1}$, which follows the AR(1) process

$$u_t^a = (1-\rho_A)\gamma + \rho_A u_{t-1}^a + \varepsilon_t^a, \tag{5}$$

where $\varepsilon_t^a \sim$ i.i.d. $N(0, \sigma_a^2)$ and γ is the steady-state growth rate.

The intermediate goods firm i optimally reset its price each period with probability $(1-\omega_p)$, à la Calvo (1983). Those who cannot do so index their prices to past inflation according to the rule

$$p_t(i) = p_{t-1}(i)\pi_{t-1}^{\chi_p}\pi^{1-\chi_p}, \tag{6}$$

where $\chi_p \in [0,1]$, $\pi_{t-1} \equiv \frac{P_{t-1}}{P_{t-2}}$, and π denotes the steady-state gross final good inflation rate. Firms resetting the price maximize expected discounted profits,

$$E_t \sum_{s=0}^{\infty} (\beta\omega_p)^s \frac{\lambda_{t+s}}{\lambda_t} \left[\left(\prod_{k=1}^{s} \pi_{t+k-1}^{\chi_p} \pi^{1-\chi_p} \right) p_t(i) y_{t+s}(i) - MC_{t+s} y_{t+s}(i) \right], \tag{7}$$

subject to equations (3) and (4). The variable λ_t is the marginal utility of savers, and MC_t is the nominal marginal cost, given by

$$MC_t = (1-\alpha)^{\alpha-1}\alpha^{-\alpha}\left(R_t^k\right)^{\alpha} W_t^{1-\alpha} A_t^{\alpha-1} \left(\frac{K_{t-1}^G}{\int_0^1 y_t(i)di + A_t\Omega} \right)^{\frac{-\alpha^G}{1-\alpha^G}}, \tag{8}$$

where R_t^k is the nominal return to effective capital and W_t is the nominal wage to a composite labor service, to be specified later.

2.2 Households

The economy is populated by a continuum of households on the interval $[0,1]$, of which a fraction $(1-\mu)$ are savers and a fraction μ are nonsavers. Savers are forward-looking and have access to financial and capital markets, while nonsavers are liquidity-constrained, relying solely on labor income and government transfers. Variables associated with savers and nonsavers are denoted by the superscripts S and N.

Each saver j derives utility from composite consumption, $C_t^{*S}(j)$, consisting of private consumption, $C_t^S(j)$, and government consumption, G_t^C: $C_t^{*S}(j) = C_t^S(j) + \omega_G G_t^C$. When $\omega_G > 0$ (< 0), private consumption and government consumption are substitutes (complements). Saver j maximizes his/her expected utility, given by

$$E_t \sum_{s=0}^{\infty} \beta^s u_{t+s}^b \left[\ln\left(C_{t+s}^{*S}(j) - \theta \tilde{C}_{t+s-1}^{*S} \right) - \frac{L_{t+s}^S(j)^{1+\xi}}{1+\xi} \right], \tag{9}$$

where $\beta \in (0,1)$ is the constant part of the discount factor, $\theta \in (0,1)$ is the external habit parameter, and $\xi \geq 0$ is the inverse of the Frisch labor elasticity. The stochastic part of the discount factor follows an AR(1) process:

$$\ln u_t^b = (1-\rho_b)\ln u^b + \rho^b \ln u_{t-1}^b + \varepsilon_t^b, \tag{10}$$

where $\varepsilon_t^b \sim$ i.i.d. $N(0, \sigma_b^2)$.

Saver j's budget constraint is

$$\begin{aligned} &(1+\tau_t^c)\, C_t^S(j) + I_t^S(j) + b_t(j) + \frac{b_t(j)}{R_t} = \frac{b_{t-1}(j)R_{t-1}}{\pi_t} + \frac{b_{t-1}(j)}{\pi_t} + \\ &(1-\tau_t^l)\frac{\int_0^1 W_t(l)L_t^S(j,l)dl}{P_t} + (1-\tau_t^k)R_t^k \nu_t(j)\bar{K}_{t-1}^S(j) - \Psi(\nu_t)\bar{K}_{t-1}^S + Z_t^S(j) + D_t(j), \end{aligned} \tag{11}$$

where τ_t^c, τ_t^l, and τ_t^k are the consumption, labor, and capital income tax rates; $I_t^S(j)$ is private investment; $\nu_t \in [0,1]$ is the capital utilization rate; $Z_t(j)$ is a lump-sum government transfer; and $b_t \equiv \frac{B_t}{P_t}$ is the real government debt, which pays a nominal interest rate of R_t at $t+1$. Each saver owns an equal share of all intermediate firms and receives dividends, $D_t(j)$.

Define $K_t^S(j) \equiv v_t \bar{K}_{t-1}^S$ as effective private capital. Capital utilization above the steady-state level entails a unit cost, $0 \leq \Psi(v_t) < 1$. In the steady state, $v = 1$, $\Psi(1) = 0$, and $\frac{\Psi''(1)}{\Psi'(1)} \equiv \frac{\psi}{1-\psi}$. The law of motion for private capital is

$$\bar{K}_t = (1-\delta)\bar{K}_{t-1} + u_t^i \left[1 - \mathbb{S}\left(\frac{I_t}{I_{t-1}}\right)\right] I_t, \tag{12}$$

where $\mathbb{S}\left(\frac{I_t}{I_{t-1}}\right)$ is an investment adjustment cost, as in Christiano et al. (2005). By assumption, $\mathbb{S}'(e^\gamma) = 0$ and $\mathbb{S}''(e^\gamma) \equiv s > 0$. The investment efficiency shock, u_t^i, evolves according to

$$\ln u_t^i = (1-\rho_i)\ln u^i + \rho^i \ln u_{t-1}^i + \varepsilon_t^i, \tag{13}$$

where $\varepsilon_t^i \sim$ i.i.d. $N(0, \sigma_i^2)$.

Each saver supplies sufficient labor to meet the market demand for the chosen monopolistic wage rate. Analogous to the price setting condition, a saver has a probability of $(1-\omega_w)$ of resetting the nominal wage for input l each period. Those who cannot reoptimze index his/her wages to past inflation according to

$$W_t(l) = W_{t-1}(l)\left(\pi_{t-1}e^{u^a_{t-1}}\right)^{\chi_w}(\pi e^{\gamma})^{1-\chi_w}, \qquad \chi_w \in [0,1]\,. \tag{14}$$

Nonsavers have the same utility function and labor supply as savers. They consume all the disposable income each period, and their budget constraints are of the form

$$(1+\tau^c_t)\,C^N_t(j) = \left(1-\tau^l_t\right)\frac{\int_0^1 W_t(l)L^N_t(j,l)dl}{P_t} + Z^N_t(j). \tag{15}$$

2.3 Labor Packers

A perfectly competitive labor packer purchases a continuum of differentiated labor inputs, $l_t(l)$, where $l \in [0,1]$. The labor demand is uniformly allocated among households. The representative packer assembles labor inputs to produce a composite labor service, L_t, by the technology

$$L_t = \left[\int_0^1 l_t\,(l)^{\frac{1}{1+\eta^w_t}}\,dl\right]^{1+\eta^w_t}. \tag{16}$$

The wage markup, η^w_t, follows the AR(1) process

$$\ln\eta^w_t = (1-\rho_w)\ln\eta^w + \rho_w\ln\eta^w_{t-1} + \varepsilon^w_t, \tag{17}$$

where $\varepsilon^w_t \sim$ i.i.d. $N(0,\sigma^2_w)$.

Solving the labor packer's profit maximization problem yields the demand for labor input l,

$$L_t\,(l) = L^d_t\left[\frac{W_t(l)}{W_t}\right]^{-\frac{1+\eta^w_t}{\eta^w_t}}, \tag{18}$$

where L^d_t is the composite labor service demand and $W_t(l)$ is the nominal wage for input l. In equilibrium, $L^S_t(j) = L^N_t(j) = \int_0^L l_t(l)dl = L_t$.

2.4 Aggregation

Aggregate consumption and transfers are determined by

$$C_t = \int_0^1 c_t(j)dj = (1-\mu)c_t^S + \mu c_t^N \tag{19}$$

and

$$Z_t = \int_0^1 z_t(j)dj = (1-\mu)z_t^S + \mu z_t^N. \tag{20}$$

Since only savers have access to the financial and capital markets, aggregate bonds, private capital, investment, and dividends are given by

$$B_t = \int_0^{1-\mu} b_t(j)dj = (1-\mu)b_t^S, I_t = \int_0^{1-\mu} i_t(j)dj = (1-\mu)I_t^S, K_t = \int_0^{1-\mu} k_t(j)dj = (1-\mu)K_t^S,$$

and

$$D_t = \int_0^{1-\mu} d_t(j)dj = (1-\mu)D_t^S. \tag{21}$$

Lastly, the goods market clearing condition is

$$Y_t = C_t + I_t + G_t^I + G_t^C + \psi(v_t)\bar{K}_{t-1}. \tag{22}$$

2.5 Monetary Policy

Denote a variable in percent deviations from its steady-state value by a hat, as in $\hat{R}_t$. The monetary authority adopts the Taylor-type rule

$$\hat{R}_t = \rho_R \hat{R}_{t-1} + (1-\rho_R)\phi_\pi \hat{\pi}_t^{gap} + \phi_y \hat{Y}_t + u_t^R. \tag{23}$$

The inflation target gap, $\hat{\pi}_t^{gap} \equiv \hat{\pi}_t - \hat{\pi}_t^*$, measures the difference between the current inflation rate and the stochastic inflation target, where $\hat{\pi}_t = \ln \pi_t - \ln \pi$. The stochastic inflation target follows the process

$$\hat{\pi}_t^* = \rho_{\pi^*} \hat{\pi}_{t-1}^* + u_t^{\pi^*}. \tag{24}$$

The interest rate and inflation target shocks follow the processes

$$u_t^\iota = \rho_u^\iota u_{t-1}^\iota + \varepsilon_t^\iota, \tag{25}$$

where $\varepsilon_t^\iota \sim$ i.i.d. $N(0, \sigma_\iota^2), \quad \iota \in \{R, \pi^*\}$.

2.6 Fiscal Policy

In each period the government collects tax revenues and sells bonds to finance its consumption (G_t^C), investment (G_t^I), transfers (Z_t), and debt payments ($\frac{B_{t-1}}{P_t}$). The flow budget constraint is

$$\frac{B_t}{R_t P_t} + \tau_t^c C_t + \tau_t^k r_t^k K_t + \tau_t^l w_t L_t = \frac{B_{t-1}}{P_t} + G_t^C + G_t^I + Z_t, \tag{26}$$

where $r_t^k \equiv \frac{R_t^k}{P_t}$ and $w_t \equiv \frac{W_t}{P_t}$ are the real rate of return to capital and the real wage rate.

We allow income tax rates, government consumption and investment, and transfers to serve as fiscal adjustment instruments for maintaining debt sustainability.[14] Similar to how monetary policy responds to the inflation gap, fiscal policy responds to the debt gap—the difference between the government debt-to-output ratio (the debt ratio) and the debt target. Denote the debt ratio as $sb_t \equiv \frac{B_t}{Y_t}$. The debt gap is defined relative to the time-t debt target, i.e., $\hat{sb}_t^{gap} \equiv \hat{sb}_t - \hat{sb}_t^*$, where the hatted variables represent the log-linearized values of their corresponding lowercase variables.

Instead of the typical one-quarter lag in fiscal adjustments (e.g., as in Leeper et al., 2010; Zubairy, 2014), and (Traum and Yang, 2015), we allow for a one-year delay, reflecting the tendency of governments to procrastinate on fiscal adjustments: $\hat{sb}_{t-4}^{gap} \equiv \hat{sb}_{t-4} - \hat{sb}_t^*$. Fiscal rules consist of the tax and spending rules, described by

$$\hat{\tau}_t^\iota = \rho_\iota \hat{\tau}_{t-1}^\iota + (1 - \rho_\iota)\gamma_\iota \hat{sb}_{t-4}^{gap} + \phi_\iota \hat{Y}_t + \varepsilon_t^\iota, \tag{27}$$

where $\varepsilon_t^\iota \sim$ i.i.d. $N(0, \sigma_\iota^2), \iota \in \{l, k\}$. Since labor and capital income tax rates in the U.S. are progressive, we allow both tax rates to respond to output, with $\gamma_l > 0$ and $\gamma_k > 0$.

[14]Although the model includes the consumption tax rate, we fix it at the steady-state level during estimation, as consumption taxes account for a small fraction of federal government revenues.

Transfers are also known to be countercyclical, following a similar process

$$\hat{Z}_t = \rho_Z \hat{Z}_{t-1} - (1-\rho_Z)\gamma_Z \hat{sb}^{gap}_{t-4} - \phi_Z \hat{Y}_t + u^Z_t, \tag{28}$$

where $\phi_Z > 0$. Government consumption and investment are assumed to be acyclical, following the processes

$$\hat{G}^C_t = \rho_{GC} \hat{G}^C_{t-1} - (1-\rho_{GC})\gamma_{GC} \hat{sb}^{gap}_{t-4} + u^{GC}_t, \tag{29}$$

and

$$\hat{G}^I_t = \rho_{GI} \hat{G}^I_{t-1} - (1-\rho_{GI})\gamma_{GI} \hat{sb}^{gap}_{t-4} + u^{GI}_t. \tag{30}$$

The spending shocks also follow an AR(1) process, given by $u^\iota_t = \rho^\iota_u u^\iota_{t-1} + \varepsilon^\iota_t$, where $\varepsilon^\iota_t \sim i.i.d.N\left(0, \sigma^2_\iota\right)$ and $\iota \in \{Z, GC, GI\}$.

Lastly, the debt target follows a process similar in the format to that of the inflation target:

$$\hat{sb}^*_t = \rho_{sb^*} \hat{sb}^*_{t-1} + u^{sb^*}_t, \tag{31}$$

where $u^{sb^*}_t$ is an AR(1) process with $\rho^{sb^*}_u$ as the serial correlation parameter and $\varepsilon^{sb^*} \sim N\left(0, \sigma^2_{sb^*}\right)$ as the i.i.d. shock, similar to equation (25).

3 Model Solution, Calibration, and Estimation

We solve the log-linearized equilibrium system using the method described in Sims (2001). The log-linearized equilibrium conditions and steady-state conditions are detailed in the online appendix. Several structural parameters take standard values from the literature, including those in Leeper et al. (2017), while steady-state fiscal values are based on sample averages (see Table 1). The remaining parameters are estimated using Bayesian methods. To initialize posterior mode estimation, we draw 5,000 samples from the prior distributions and select the 10 with the highest posterior likelihood to search for the posterior mode. For constructing the posterior distribution, we draw 1.5 million samples, discard the first 500,000, and thin every 50 draws, resulting in a final sample size of 20,000 for inference.

The baseline estimation uses U.S. quarterly data from 1960Q1 to 2019Q4, with thirteen ob-

Parameter	Value	Notes
β, quarterly discount factor	0.99	an annual real interest rate of 4%
α, capital income share of output	0.33	Leeper et al. (2017)
δ, depreciation rate of private capital	0.025	an annual depreciation rate of 10%, Leeper et al. (2017)
δ^G, depreciation rate of public capital	0.02	an annual depreciation rate of 8%, Leeper et al. (2017)
η^p, steady-state price markup	0.14	14% price markup, Leeper et al. (2017)
η^w, steady-state wage markup	0.14	14% wage markup, Leeper et al. (2017)
$s^{gc} \equiv \frac{G^C}{Y}$	0.077	federal G^C-to-model output average, 1959Q2–2019Q4
$s^{gi} \equiv \frac{G^I}{Y}$	0.027	federal G^I-to-model output average, 1959Q2–2019Q4
$s^b \equiv \frac{B}{Y}$	0.387×4	federal B-to-model output average, 1959Q2–2019Q4
α^G, output elasticity on public capital	0.05	Traum and Yang (2015) and Leeper et al. (2017)
τ^l, labor tax rate	0.194	federal labor tax rate average, 1959Q2–2019Q4
τ^k, capital tax rate	0.195	federal capital tax rate average, 1959Q2–2019Q4
τ^c, consumption tax rate	0.0194	federal consumption tax rate average, 1959Q2–2019Q4
π, steady-state inflation	1	Traum and Yang (2015) and Leeper et al. (2017)

Table 1: **Baseline calibration and steady-state fiscal values**.

servables: real consumption, investment, wages, government consumption, government investment, transfers, capital and labor tax revenues, labor, inflation, the federal funds rate, the government debt target, and the inflation target. See Appendix A.1 for the data description and the mapping between the observables and the model variables.

Since both inflation and debt targets are not directly observed, we proxy these targets in Quarter t using five-year averages from Quarter $t-3$ to $t+16$ for inflation (measured by the GDP implicit price deflator) and the federal debt-to-output ratio (see Appendix A.1 for details) in the baseline estimation.[15] Given the uncertainty in measuring policy targets, the sensitivity analysis in Section 6 includes estimations with alternative rolling windows, ranging from fully forward-looking targets (with Quarter-t target proxied by averages from Quarter $t+1$ to $t+20$) and fully backward-looking targets (averages from Quarter $t-20$ to $t-1$).[16] Additionally, because the Federal Reserve's preferred inflation indicator is PCE inflation, we also estimate the model using PCE and core PCE inflation as proxies for the inflation target in the sensitivity analysis.[17] Our key message that fiscal policy played a nontrivial role in pre-pandemic U.S. inflation is robust across different measurements.

Table 2 presents the priors and posterior estimates for selected parameters.[18] Given the similar

[15]In total, the average spans over 20 quarters, beginning from Quarter $t-3$ instead of $t-4$.

[16]Since we use data only up to 2019Q4, sample lengths vary slightly across cases. For example, for backward-looking targets, the sample spans 1959Q1–2019Q4, while for forward-looking targets, the sample spans 1959Q1–2015Q4, allowing inflation and debt data from 2016Q1–2019Q4 to serve as targets. Similar rolling windows apply to the intermediate cases.

[17]See https://www.federalreserve.gov/economy-at-a-glance-inflation-pce.htm.

[18]The complete list for all 57 estimated parameters can be found in the online appendix.

model structure, most of our prior assumptions follow those in Leeper et al. (2017) under regime M. Since we focus on inflation dynamics within the parameter space of regime M, we tighten slightly the prior for the interest rate response to inflation to $N(1.5, 0.15)$, compared to their $N(1.5, 0.2)$. Additionally, we assume a Gamma distribution for all debt response parameters (γ's) in fiscal rules. The analysis is restricted to the parameter space that yields a unique equilibrium.

The estimated values of the structural parameters are largely consistent with those in Leeper et al. (2017) under regime M, using the 1955Q1–2014Q2 sample. For the parameters governing the fiscal stimulus effects, similar to their estimation, we find a high degree of external habit formation in private consumption and very sticky nominal prices and wages. One difference is the parameter ω_G. They estimate that government and private consumption are complements ($\omega_G < 0$). While our mean estimate of ω_G is also negative, the 90-percent interval encompasses zero, suggesting that the two are neither complements nor substitutes. This negative but insignificant ω_G is consistent with the posterior in Bianchi et al. (2023).

Regarding policy responses, our posterior mean of the Taylor rule coefficient, ϕ_π, is 1.36.[19] This value aligns with estimates in the literature for similar models. Specifically, our posterior mean is larger than the 0.9 mean reported in the Regime M case from Leeper et al. (2017) with the 1955Q1–2014Q2 sample (90% interval [0.74, 1.06]), close to the independent shocks case in Smets and Wouters (2024) (mode 1.32 and 90% interval [1.00, 1.6]) and the baseline case in Smets and Wouters (2024) (mode 1.75 and 90% interval [1.51, 1.98]), but lower than the baseline in Bianchi et al. (2023) (mode 2.06 and 90% interval [1.94, 2.20]).

These results suggest that the way deviations from extreme policy regimes are modeled can influence the inference of policy regime parameters. Our higher ϕ_π compared to the fixed regime M in Leeper et al. (2017) suggests that our policy target shocks can match the same observed inflation dynamics without requiring a relatively low monetary policy response coefficient (0.9). In contrast, our smaller ϕ_π relative to Bianchi et al. (2023) indicates that using inflation dynamics from the shadow regime F economy as targets allows for more inflation, requiring a larger ϕ_π to match the observed inflation behavior.

[19] Although 0.04% of our 1.5 million draws have $\phi_\pi < 1$, with the lowest value being 0.7534, we verified that all draws fall within regime M. See the online appendix for details.

Parameters	**Prior**	**Posterior**	
		Mean	90% Interval
Preference			
ξ, Frisch labor elasticity	$G(2, 0.5)$	2.152	$[1.334, 2.935]$
θ, external habit	$B(0.5, 0.2)$	0.995	$[0.992, 0.999]$
μ, share of nonsavers	$B(0.3, 0.1)$	0.060	$[0.028, 0.090]$
ω_G, substitutability between C_t and G_t^C	$U(-1.75, 1.75)$	-0.120	$[-0.378, 0.129]$
Production			
100γ, steady-state growth rate	$N(0.4, 0.05)$	0.253	$[0.187, 0.317]$
ψ, capital utilization	$B(0.6, 0.15)$	0.116	$[0.044, 0.184]$
s, investment adjustment cost	$N(6, 1.5)$	5.121	$[3.343, 6.784]$
ω_p, price rigidity	$B(0.5, 0.2)$	0.941	$[0.924, 0.957]$
ω_w, wage rigidity	$B(0.5, 0.2)$	0.923	$[0.900, 0.946]$
χ_p, price indexation	$B(0.5, 0.2)$	0.117	$[0.008, 0.199]$
χ_w, wage indexation	$B(0.5, 0.2)$	0.120	$[0.053, 0.187]$
Monetary policy			
ϕ_π, interest rate response to inflation	$N(1.5, 0.15)$	1.364	$[1.130, 1.591]$
ϕ_y, interest rate response to output	$N(0.125, 0.05)$	0.125	$[0.102, 0.147]$
ρ_R, serial correlation in interest rate	$B(0.5, 0.2)$	0.767	$[0.714, 0.820]$
ρ_{π^*}, serial correlation in inflation target	$B(0.5, 0.2)$	0.994	$[0.988, 0.999]$
$\rho_u^{\pi^*}$, serial correlation in inflation target shocks	$B(0.5, 0.15)$	0.726	$[0.670, 0.785]$
Fiscal policy			
γ_{GC}, government consumption response to debt	$G(0.15, 0.1)$	0.207	$[0.024, 0.373]$
γ_{GI}, government investment response to debt	$G(0.15, 0.1)$	0.188	$[0.018, 0.347]$
γ_Z, transfer response to debt	$G(0.15, 0.1)$	0.100	$[0.014, 0.177]$
γ_k, capital tax response to debt	$G(0.15, 0.1)$	0.090	$[0.004, 0.171]$
γ_l, labor tax response to debt	$G(0.15, 0.1)$	0.282	$[0.071, 0.476]$
ϕ_Z, transfer response to debt	$G(0.1, 0.02)$	0.098	$[0.065, 0.128]$
ϕ_k, capital tax response to debt	$G(0.15, 0.1)$	0.038	$[0.003, 0.070]$
ϕ_l, labor tax response to debt	$G(0.15, 0.1)$	0.028	$[0.003, 0.051]$
ρ_{GC}, serial correlation in government consumption	$B(0.5, 0.2)$	0.987	$[0.979, 0.996]$
ρ_{GI}, serial correlation in government investment	$B(0.5, 0.2)$	0.990	$[0.982, 0.998]$
ρ_k, serial correlation in capital tax	$B(0.5, 0.2)$	0.978	$[0.951, 0.999]$
ρ_l, serial correlation in labor tax	$B(0.5, 0.2)$	0.975	$[0.963, 0.988]$
ρ_Z, serial correlation in transfer	$B(0.5, 0.2)$	0.048	$[0.006, 0.088]$
ρ_{sb^*}, serial correlation in debt target	$B(0.5, 0.2)$	0.989	$[0.980, 0.998]$
$\rho_u^{sb^*}$, serial correlation in debt target shocks	$B(0.5, 0.15)$	0.294	$[0.196, 0.397]$

Table 2: **Prior and Posterior Distributions**. B, G, N, U and IG denote beta, gamma, normal, uniform, and inverse gamma distributions.

4 The Effects of Policy Target Shocks

The stochastic policy targets capture temporary deviations from regime M. While they appear in previous models, we are likely the first to include them as observables in DSGE estimation.[20] Without observables for policy targets, distinguishing a change in a target variable from a change in the magnitude of a policy instrument's response may be challenging, as noted by Bianchi (2013). We begin by examining the model-implied target processes and analyzing the effects of policy target

[20] Bhattarai et al. (2016) and Ettmeier and Kriwoluzky (2024) also specify stochastic inflation and debt targets but treat them as unobservables. Also, they do not analyze the effects of policy target shocks.

shocks.

4.1 Model-Implied Policy Target Shocks

Figures 3 and 4 display the model-implied debt and inflation target shocks and levels.[21] While precise measures of the debt and inflation target are unavailable, the dynamics of implied policy target levels broadly capture the major shifts in the federal government's attitudes toward debt and the monetary policy stance.

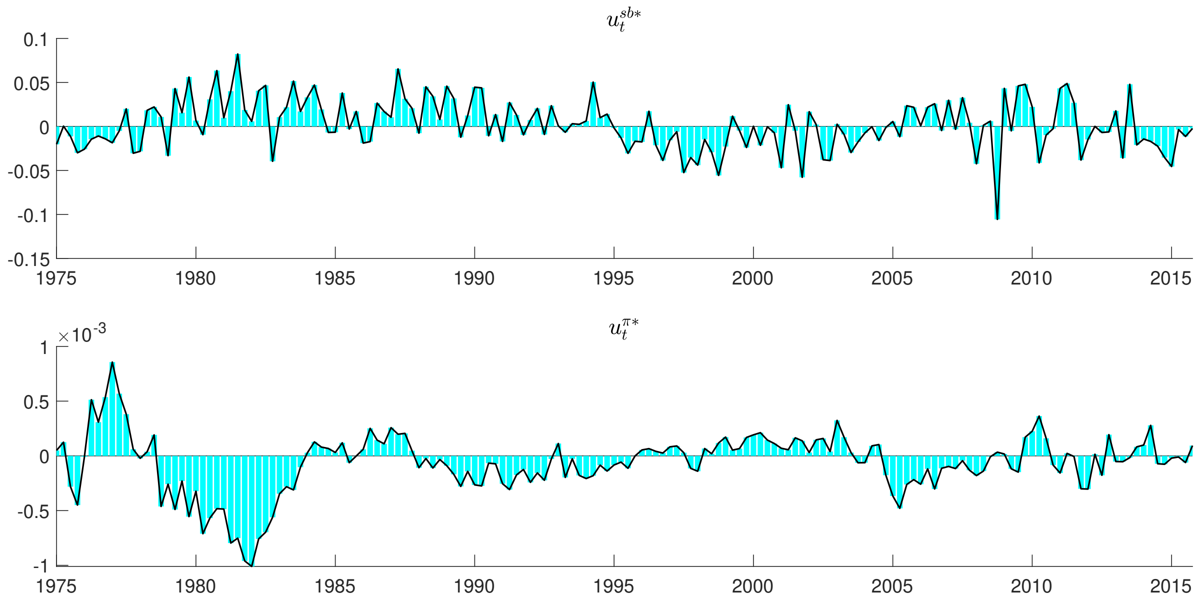

Figure 3: **Model-implied policy target shocks.** See equations (24) and (31) for the debt target and inflation target processes.

From the late 1970s to the mid-1990s, the federal debt target experienced a series of positive shocks, leading to an upward shift in the implicit target between 1980 and the early 1990s. This shift was partly a response to the slow recovery following the recession that ended in the first quarter of 1975. To stimulate demand, the federal government implemented a range of tax cuts.[22] Notably, the tax cuts enacted in 1977 and 1978 led to significant revenue losses (totaling over $100 billion in 2000 dollars, Yang, 2009), thereby reversing the post-World War II trend of declining federal debt.

[21] The model-implied series for the shock innovations (ε_t's) of the 13 shocks are plotted in Figure A.1 of Appendix A.2.

[22] These countercyclical measures included the Tax Reduction Act of 1975, the Revenue Adjustment Act of 1975, the Tax Reform Act of 1976, the Tax Reduction and Simplification Act of 1977, and the Revenue Act of 1978.

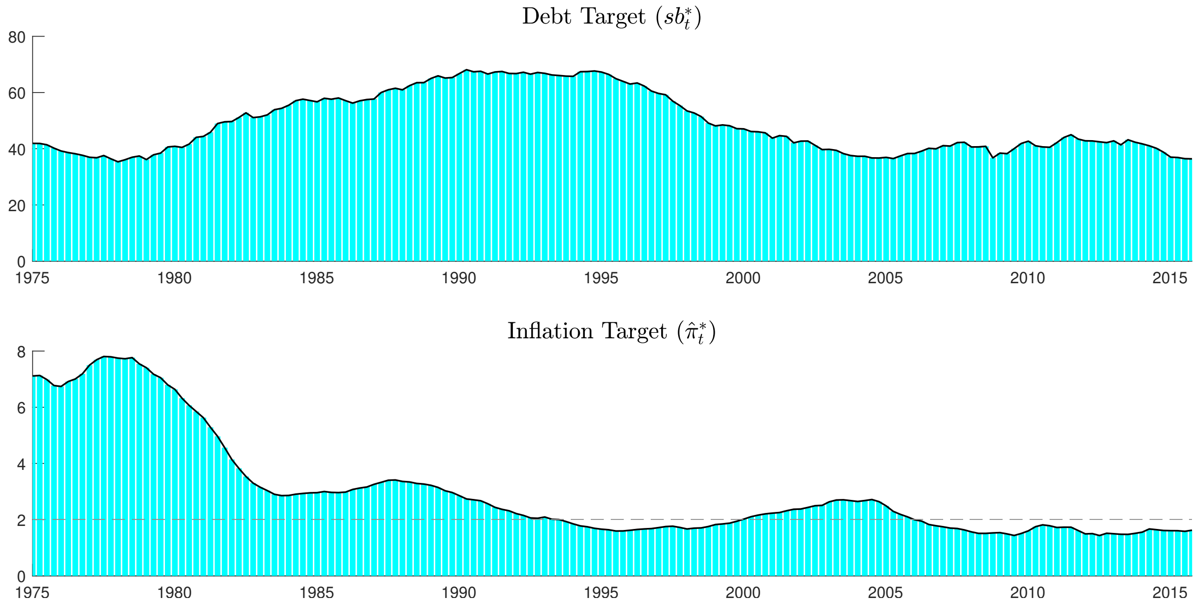

Figure 4: **Model-implied policy targets.** The top panel is the government debt target in percent of output. The bottom panel is the net annualized inflation target rate in percentage points. The dashed line represents the Federal Reserve's 2-percent inflation target.

The accommodative stance toward government debt continued during the Reagan administration, driven by increased defense spending and significant income tax cuts.[23] Federal debt growth did not slow until the mid-1990s, when the Clinton administration raised taxes, particularly on high-income earners, to reduce the deficits. These fiscal adjustments were reflected in negative debt target shocks starting in 1995. Positive debt target shocks re-emerged after 2005, however, following a series of gradually phased-in tax cuts enacted during the second Bush administration.[24] The substantial deficit-financed stimulus measures in response to the GFC, such as the Economic Stimulus Act of 2008 and the American Recovery and Reinvestment Act of 2009, led to significant debt target shocks after 2009, indicating that the debt target rose once again.

The most notable phenomenon regarding the inflation target shocks is the rate-hiking cycle that began around 1977, marked by a shift in the sign of these shocks (see the bottom plot of Figure 3). The magnitude of these shocks intensified further with Paul Volcker's appointment in 1979, reflecting a significant reduction in the inflation target (see the bottom plot of Figure 4). During

[23]Federal government consumption expenditures and gross investment in defense rose from 6.3 percent of GDP in the first quarter of 1980 to 7.9 percent of GDP in the third quarter of 1986, peaking during the 1980s.

[24]These tax cuts included the Economic Growth and Tax Relief Reconciliation Act of 2001, which gradually reduced individual income tax rates and was fully phased in by 2006, and the Jobs and Growth Tax Relief Reconciliation Act of 2003, which accelerated these cuts from 2006 to 2003.

the Great Moderation, inflation target shocks remained relatively small, except for a brief period of positive shocks following the outbreak of the GFC, which led to a slight increase in the inflation target after 2009.

From the two model-implied series of policy shocks, we observe that fiscal and monetary policies are not always coordinated, as characterized by regimes F or M. The period from the late 1970s to the early 1980s was predominantly marked by positive debt target shocks and negative inflation target shocks, indicating active fiscal and monetary policies, as estimated by Bianchi and Ilut (2017).

4.2 Impulse Responses to Policy Target Shocks

Figures 5 and 6 show the impulse responses to a 1-percentage-point increase in the debt target and a 25-basis-point increase in the inflation target. Given the high estimates of serial correlation in the target disturbance processes (with posterior means of $\rho_{sb^*} = 0.989$ and $\rho_{\pi^*} = 0.994$), both transitory shocks have long-lasting effects on the economy.

4.2.1 Debt Target Shock

A positive debt target shock leads to increased government spending on consumption, investment, and transfers, while also slightly reducing tax rates. In this environment, increased spending and lower tax rates result in greater government debt accumulation, but fiscal adjustments are further delayed due to the debt target shock. The prolonged period of higher debt accumulation without immediate fiscal adjustments fosters an active fiscal policy stance. Compared to a scenario without the debt target shock, the present value of the fiscal backing required for the same level of expansionary fiscal measures is smaller, which reduces the negative wealth effect in anticipation of higher future taxes.

Under a positive debt target shock, expansionary fiscal measures increase goods demand, primarily from the government, driving up inflation and inflation expectations. In response, the central bank raises the nominal interest rate. Although the average real interest rate initially decreases, it quickly increases and becomes significant. This rising real interest rate triggers crowding-out effects similar to those seen in the standard regime M without debt target shocks.

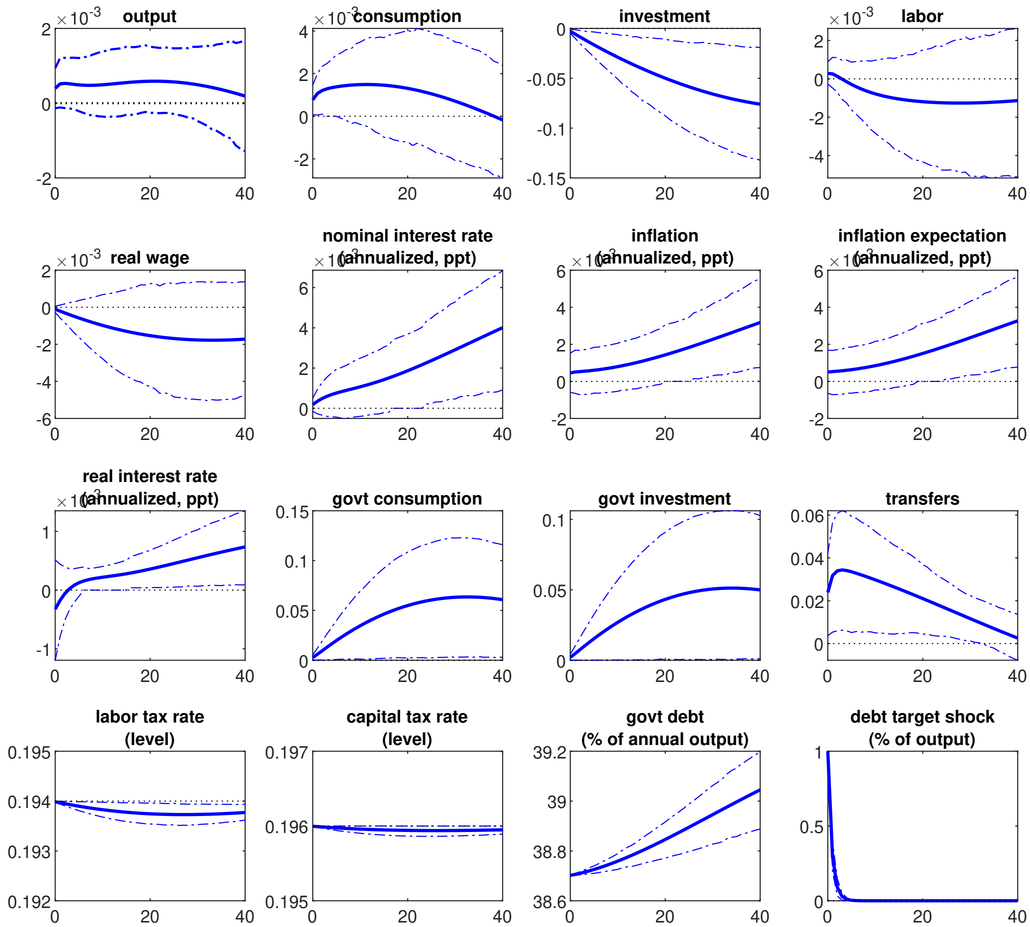

Figure 5: **Impulse responses to a debt target shock.** The x-axis is in quarters and the y-axis is in percent deviation from the steady-state value of a variables except those specified otherwise in parentheses. The solid lines are the mean responses, the dotted lines are the 90-percent bands, and "ppt" stands for percentage points.

Our estimation shows that most of the combined expansionary fiscal measures under a positive debt target shock have an expansionary effect on output; however, the 90-percent confidence interval includes zero. In regime M, where the central bank conducts active monetary policy, the crowding-out effect from the higher real interest rate sometimes outweighs the positive output effects of the expansionary fiscal measures. As shown in Figure 5, the mean consumption response is positive, as higher transfers immediately boost nonsavers' consumption, but the 90-percent interval also includes zero. This is partly due to the small estimated share of nonsavers (with the upper bound of the interval being less than 0.1) and partly due to the crowding-out effect from the rising real interest rate. Additionally, since investment is unambiguously crowded out, firms reduce their labor demand due to lower marginal labor productivity. Meanwhile, a lower labor tax rate resulting from the rising debt target encourages labor supply, leading to an overall insignificant labor response.

4.2.2 Inflation Target Shock

A positive inflation target shock raises inflation and inflation expectations substantially. In response to a 25-basis-point increase in the inflation target, the annualized inflation rate jumps by nearly 2 percentage points in the short run and remains elevated, about 1.5 percentage points above the steady-state level, even 10 years after the shock. In addition to the high serial correlation in the inflation target process (with the 90-percent interval above 0.98), sticky nominal prices and wages (with the 90-percent intervals of ω^p and ω^w above 0.90) contribute to the persistently elevated inflation level following the inflation target shock.

The inflation target shock affects the real side of the economy mainly through changes in the real interest rate. Higher inflation expectations lower the real interest rate, generating a positive intertemporal substitution effect that encourages private consumption and investment. Firms, in turn, increase labor demand in response to higher goods demand, which raises real wages and further reinforces consumption and investment through the positive wealth effect. Unlike a debt target shock, the output response to a positive inflation target shock is unambiguously positive. From the perspective of counteracting an economic downturn, our results show that unexpectedly raising the inflation target can be an effective tool.

On the fiscal side, higher output lowers the government debt ratio, leading to an increase in government consumption, investment, and transfers. Higher output, however, also reduces the automatic stabilizing component of transfers. As a result, the 90-percent confidence interval includes some negative transfer responses. Similarly, the responses of the two tax rates are mostly positive but also include zero, as progressive income tax rates also function as automatic stabilizers.

As government spending increases with a positive inflation target shock, its effects resemble those of an expansionary fiscal shock in regime F. In both regime F and under a positive inflation target shock, passive monetary policy generates higher expected inflation, which lowers the real interest rate and amplifies the expansionary effects of government spending (see, e.g., Kim, 2003;

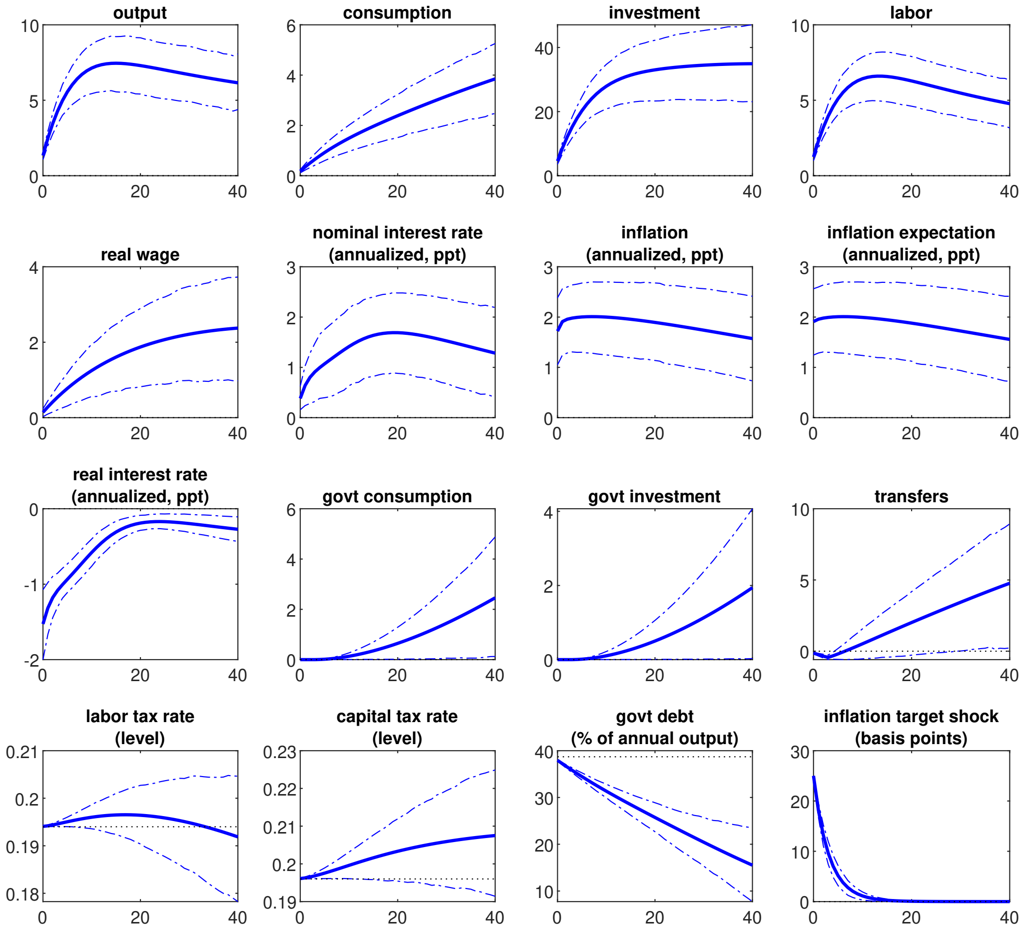

Figure 6: **Impulse responses to an inflation target shock.** See Figure 5 for axis units.

Davig and Leeper, 2011; Dupor and Li, 2015; Galí, 2020). Additionally, a higher price level reduces the real value of existing nominal government debt, thereby lowering the government's real debt burden. Since the inflation target shock is expansionary, the debt ratio declines despite the largely expansionary fiscal measures.[25]

Unlike regime F, where active fiscal policy must be coordinated with passive monetary policy, our regime specification allows for flexibility in capturing uncoordinated behavior between the

[25]Without regime uncertainty in a model, an expansionary fiscal measure reduces the government's debt burden, as shown in, e.g., Galí (2020), Elenev et al. (2021), and Billi and Walsh (2022). With regime uncertainty, however, an expansionary fiscal measure does not necessarily reduce government debt, especially when the government is heavily indebted, as shown in Mao et al. (2024).

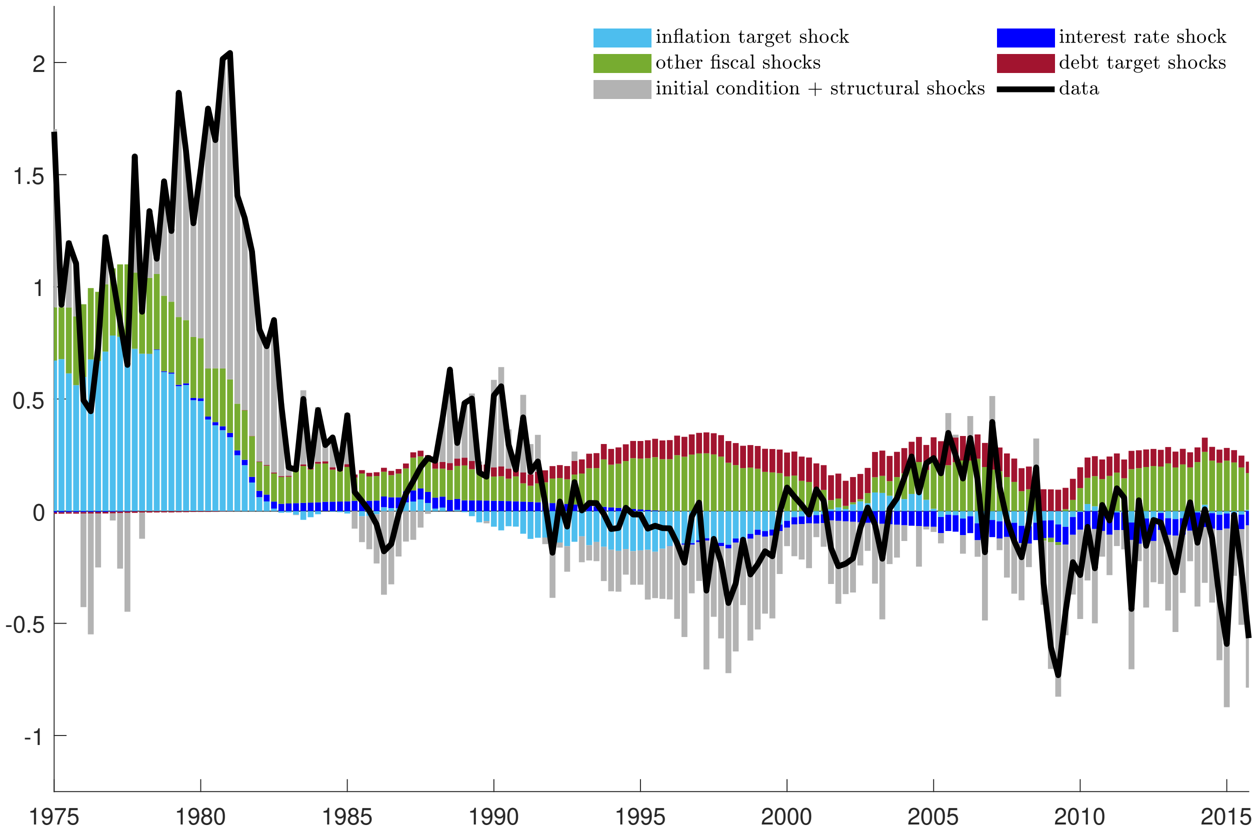

Figure 7: **Historical decomposition of inflation.** The black solid line for "data" refers to inflation deviations from the steady state, computed by the GDP price deflator (see Appendix A.1 for data description). "Other fiscal shocks" include ε_t^{GC}, ε_t^{GI}, ε_t^{Z}, ε_t^{tk}, and ε_t^{tl}. "Structural shocks" include ε_t^{a}, ε_t^{b}, ε_t^{w}, and ε_t^{p}.

central bank and the government. However, this flexibility comes with a trade-off: our regime specification can only accommodate temporary deviations from regime M, thereby eliminating both the possibility and the expectation effects associated with switching to regime F.

5 The Drivers of Inflation Fluctuations

The primary objective of this study is to examine how various policy and structural shocks have influenced U.S. inflation dynamics, with a focus on fiscal policy. Figure 7 decomposes the inflation dynamics, showing the contributions of different types of shocks: policy target shocks, policy instrument shocks, and structural shocks, which consist of technology, discount factor, and price and wage markup shocks.

5.1 An Overview

Before examining the fiscal influence on inflation, we note that structural shocks, inflation target shocks, and non-debt target fiscal shocks (referred to as "other fiscal" in Figure 7) all contributed to the Great Inflation. The positive structural shocks align with the widely accepted explanation of the production disruptions caused by the oil crises (e.g., Langford, 1978; Blinder, 1982). On the monetary side, inflation target shocks were particularly significant, driving up inflation expectations, illustrated in Figure 6. This finding contrasts with models that do not distinguish between interest rate and inflation target shocks, which attribute the monetary influence solely to interest rate shocks (see Smets and Wouters, 2007, 2024). Although the federal funds rate increased considerably during this period in response to rising inflation (as shown in the bottom panel of Figure 1), monetary tightening did not curb inflation as expected. Our estimation attributes nearly all of the monetary impact during this period to inflation target shocks, suggesting a lack of resolve in lowering inflation through unexpected increases in the inflation target.

Paul Volcker's determination to combat inflation was evident in the sharp negative inflation target shocks implemented toward the end of the 1970s. Since inflation target shocks have strong and persistent effects on inflation expectations (as shown in Figure 6), the cumulative impact of positive shocks throughout the 1970s, followed by negative shocks from the late 1970s to the early 1980s, resulted in a minimal net contribution of the inflation target shocks to inflation in the 1980s. Given that inflation targets are particularly important in shaping inflation expectations, our historical decomposition of the 1980s disinflation reflects the central bank's credibility in anchoring expectations. This interpretation aligns with the literature attributing the success of disinflation to monetary policy's role in anchoring inflation expectations (e.g., Hazell et al., 2022).

In addition to inflation target shocks, debt target shocks also contributed to inflation from the mid-1980s onward. Following several years of large deficits beginning in the early 1980s—driven by significant tax cuts and increased defense spending, Stein (1996) observes that budget balancing became less effective as an anchor for fiscal policy. This shift is reflected in the persistent positive debt target shocks starting in the mid-1980s. Although there were negative debt target shocks from the mid-1990s to the mid-2000s (as shown in the upper panel of Figure 3), coinciding with a pause in the debt ratio during that period, debt target shocks continued to contribute positively

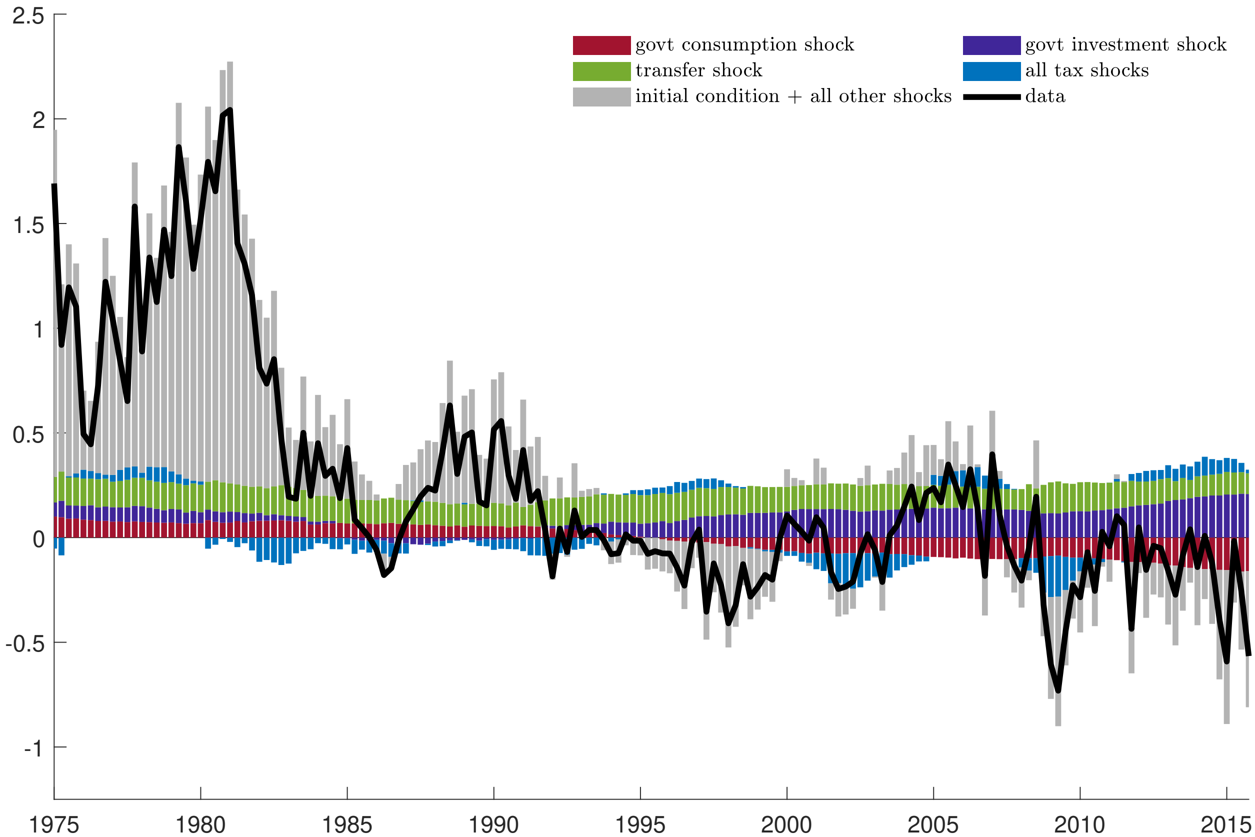

Figure 8: **Historical decomposition of inflation with fiscal detail.** All other shocks include the monetary policy shock (ε_t^R), policy target shocks ($\varepsilon_t^{sb^*}$ and $\varepsilon_t^{\pi^*}$), and structural shocks (ε_t^a, ε_t^b, ε_t^w, and ε_t^p).

to inflation. This may be attributed to the long-lasting cumulative effects of the earlier positive shocks from the 1980s.

Overall, fiscal-related shocks—including debt target (red bars) and fiscal instrument (green bars) shocks—played a nontrivial role throughout the sample period, shaping the pre-pandemic inflation dynamics.

5.2 A Closer Look of Fiscal Drivers on Inflation

To examine the fiscal drivers of inflation more closely, we further break down the impact of various fiscal instrument shocks on inflation, as illustrated in Figure 8. Several observations emerge. The first is that tax cuts do not always lead to higher inflation. While federal fiscal policies in the mid-1970s and 1980s were dominated by tax cuts (see Section 4.1), their effects on inflation varied significantly depending on the types of cuts implemented. Between 1975 and 1977, these measures primarily provided tax credits and rebates for individuals. These included increases in low-income allowances and the standard deduction, as well as the introduction of the earned income tax credit for families with children.[26] Although the corporate tax rate was temporarily reduced from 22 percent to 20 percent on the first $25,000 of taxable income between 1975 and 1978, the overall inflationary impact was primarily driven by demand-side measures, which directly boosted household income.

Starting from the end of the 1970s, the impact of the tax cuts on inflation became negative, largely due to significant reductions in both individual and corporate income tax rates. The top corporate tax rate was reduced from 48 to 46 percent under the Revenue Act of 1978. More notably, the Economic Recovery Tax Act of 1981 introduced widespread cuts to individual income tax rates and gradually reduced the corporate tax rate from 17 to 15 percent on the first $25,000 of income and from 20 to 18 percent on the next $25,000. The Tax Reform Act of 1986 further streamlined the tax system by reducing the number of individual tax brackets to two: 15 and 28 percent, while lowering the top corporate tax rate from 46 to 34 percent. These reductions in income tax rates had supply-side effects, stimulating production and ultimately lowering inflation. By the early to mid-1990s, the contribution of tax shocks to inflation turned positive again, likely driven by supply-side effects following the increase in individual income tax rates for high earners under the Omnibus Budget Reconciliation Acts of 1990 and 1993.

The second observation is that transfer shocks had a persistent and positive effect throughout the sample period (represented by the green bars in Figure 8). The federal government's mandatory spending, including for Social Security, Medicare, and Medicaid, rose significantly, from 4.5 percent of GDP in 1965 to 13.9 percent in 2023 (Congressional Budget Office, 2024). In our regime-M model, which includes nonsavers and distortionary fiscal financing, Ricardian equivalence does not hold, making transfer shocks influential for both inflation and the real economy. In contrast, in the regime-M model of Smets and Wouters (2024) (where the degree of fiscal backing is set to 1), transfers have little effect on inflation or other macroeconomic variables. This is because their model is populated by infinitely-lived, forward-looking agents, and transfers are lump-sum.[27]

Figure 9 presents the impulse responses to a transfer shock equal to 1 percent of steady-state

[26]These tax measures were part of the Tax Reduction Act of 1975, the Revenue Adjustment Act of 1975, the Tax Reform Act of 1976, and the Tax Reduction and Simplification Act of 1977. See Yang (2009) for details.

[27]Similarly, fiscal shocks in Smets and Wouters (2007) have no impact on inflation because government spending is financed through lump-sum taxes, and their model includes only forward-looking agents.

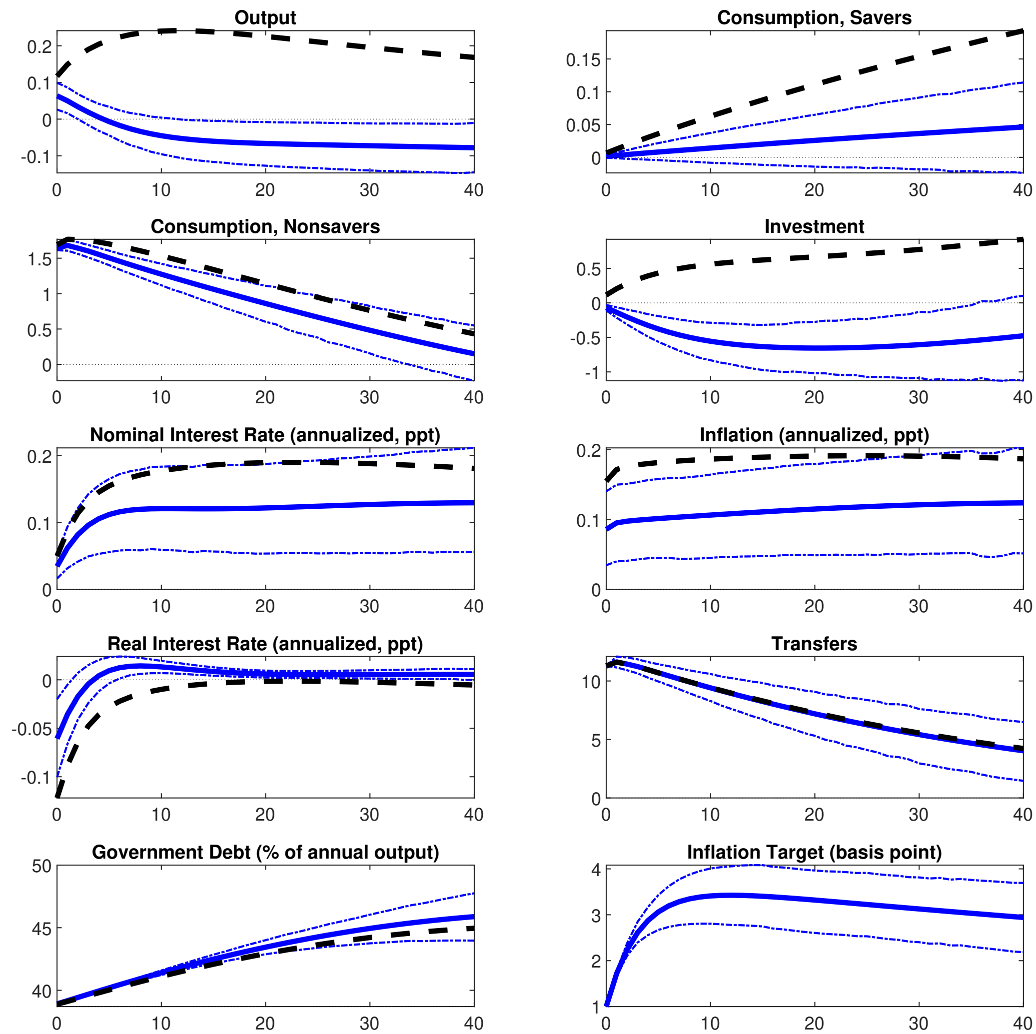

Figure 9: **Impulse responses to a positive transfer shock.** The solid lines represent the mean responses to a transfer shock equivalent to 1 percent of steady-state output, while the dot-dashed lines indicate the corresponding 90 percent confidence intervals. The dashed lines show the mean responses when the same transfer shock is combined with a positive inflation target shock.

output. The solid lines represent the mean responses to this positive transfer shock. Despite the prevailing regime M, the transfer shock significantly boosts nonsavers' consumption. While the mean response of savers' consumption is also positive, the 90-percent confidence interval (dot-dashed lines) includes zero, as savers reduce consumption to increase savings, anticipating higher taxes to absorb the additional government debt.

Although the share of nonsavers is relatively small (with a mean estimated share of 0.06) and private investment is crowded out, the transfer shock still leads to a short-run increase in output. The initial rise in aggregate demand increases inflation. Given the high degree of nominal price rigidity (with a mean estimated $\omega_p = 0.941$), the inflationary effect persists over time. In response, the central bank raises the nominal interest rate to control inflation.

On the fiscal side, the transfer shock contributes to government debt accumulation, prompting fiscal adjustments through a combination of higher income tax rates and reduced government consumption and investment. These adjustments gradually dampen the expansionary effects of the transfer shock, leading to a negative output response over the longer term.

Similar to Bianchi et al. (2023), our estimated model finds that transfers play a nontrivial role in post-war U.S. inflation, even when conditioned on regime M. Bianchi et al. (2023) distinguish between funded and unfunded transfer shocks, identifying the latter as significantly more impactful on inflation. Their estimation specifies a regime-F economy as a shadow economy to isolate the effects of unfunded transfer shocks, comparable to having an endogenous inflation target aligned with regime F. Since the inflation target in our model is exogenous, to generate a scenario where the central bank deviates from the conventional target level in regime M during an expansionary fiscal shock, we simulate the model by combining the transfer shock with a positive inflation target shock. The mean responses are shown by the dashed lines in Figure 9.

When the same transfer shock is introduced in an alternative scenario with higher inflation targets, the output and inflation responses become more positive and persistent, as shown by the comparison of the dashed and solid lines in Figure 9. As the central bank raises the inflation target, the nominal interest rate increases less than it would otherwise, resulting in a more prolonged and pronounced decline in the real interest rate. This larger negative response in the real interest rate boosts savers' consumption and investment responses, ultimately leading to a stronger inflation response. It is therefore unsurprising that when estimation is conditioned on inflation targets aligning with regime F, the model suggests a more significant role for transfer shocks in driving inflation dynamics, as demonstrated in Bianchi et al. (2023).

Lastly, the influence of government spending on inflation was also evident. Government consumption shocks contributed positively to inflation before the mid-1990s but negatively afterward. This pattern was driven by a gradual decline in federal government expenditure share, from 9.4 percent of GDP in 1960 to 5.2 percent of GDP in 2015 (Bureau of Economic Analysis, 2024). A positive government consumption shock increases inflation due to rising aggregate demand. In contrast, a positive government investment shock has a negative effect on inflation, primarily because of its supply-side effect in expanding the economy's production capacity.

Figure 10 shows the output and inflation responses to a one-percent shock in government consumption and investment. While both shocks positively impact output, inflation responds in opposite directions. An increase in government spending typically raises aggregate demand, creating inflationary pressure. Government investment, considered productive spending, however, also boosts the productivity of private production factors, leading to an expansion in the supply of goods. In our estimation, this supply-side effect outweighs the demand-side effect, causing inflation to decrease in response to an increase in government investment.

Like government consumption, relative government investment also fell, from 4.0 percent of GDP in 1960 to 1.5 percent of GDP in 2015. A series of negative government investment shocks over the sample period meant that government investment mostly contributed to inflation. Its effect has been opposite to that of government consumption since around 2000, leading to an overall small impact of government spending on inflation.

In summary, our estimation highlights the significant role of fiscal policy in driving inflation fluctuations in pre-pandemic U.S. history. While our estimated policy regime is conditional on regime M, the specification of stochastic policy targets allows for temporary regime deviations. In this environment, positive inflation and debt target shocks enable partial fiscal backing within regime M, similar to the findings of Smets and Wouters (2024). Additionally, Smets and Wouters (2024) estimate an NK model that allows for partial fiscal backing in a DSGE framework combining regimes F and M, though their fiscal specification is simplified, relying only on lump-sum transfers. While they also conclude that fiscal policy played a role in inflation fluctuations in U.S. prepandemic history, they find a much smaller contribution than we do, using a model with a relatively

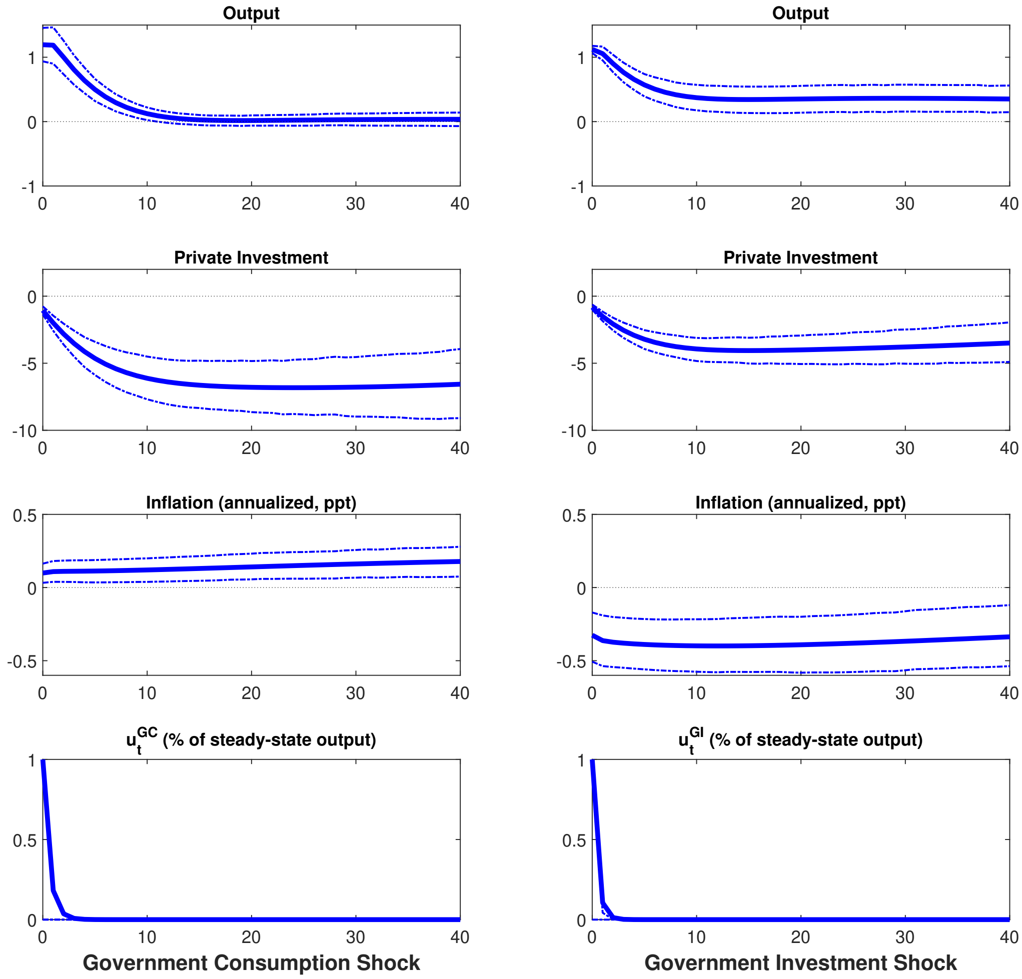

Figure 10: **Impulse responses to government consumption and investment shocks.** The output responses are expressed as percentage deviations from the steady state, with the dot-dashed lines representing the 90-percent confidence intervals.

detailed fiscal specification and distorting fiscal instruments.

6 Sensitivity Analysis

As one of the first studies to estimate an NK model incorporating policy targets as observables, we face significant uncertainty in constructing data for inflation and debt targets. To address this, our sensitivity analysis explores various rolling windows and alternative measurements for inflation targets when constructing these target observables. The results indicate that the role of fiscal shocks in driving inflation is robust across different measurements. The influence of inflation target shocks on inflation, however, varies depending on the data window. Given that the inflation target plays a crucial role in shaping inflation expectations, this variation aligns with existing findings in the literature. For instance, Mavroeidis et al. (2014) emphasize that the estimation of the Phillips Curve's slope is highly sensitive to the choice of data used to proxy for inflation expectations. Finally, measuring inflation using either CPI or PCE data does not alter our results.

6.1 Different Data Windows

For the baseline estimation, we use a window of 16 quarters forward and four quarters backward (from $t-3$ to $t+16$, labeled as '16F4B'), based on the assumption that policymakers adopt a forward-looking approach while also considering recent inflation and the debt ratio when setting policy targets.[28] Figure 11 presents the historical decomposition of inflation across various data windows used to construct the policy target observables, including '20F' (from $t+1$ to $t+20$), '12F8B' (from $t-7$ to $t+12$), '8F12B' (from $t-11$ to $t+8$), '4F16B' (from $t-15$ to $t+4$), and '20B' (from $t-20$ to $t-1$). The black bars represent contributions from fiscal-related shocks, comprising debt target and fiscal instrument shocks. The gray bars represent contributions from monetary-related shocks, comprising interest rate and inflation target shocks. The white bars represent contributions from all other shocks and the initial condition.

In all six plots, fiscal-related shocks play a notable role in driving inflation dynamics. Overall, fiscal policy contributed positively to inflation throughout much of U.S. history prior to the pandemic, with its influence increasing after the 1980s compared to earlier periods. The importance of monetary policy during the 1970s and 1980s, however, varies across different windows. Since inflation targets heavily influence inflation expectations, which in turn affect inflation, the choice of data windows used to construct the inflation target can lead to varying implications for inflation expectations and, consequently, alter the effects of monetary policy-related shocks on inflation.

[28] When the contemporaneous data point is included, as in the data window '16F4B,' the time-t data is used, meaning the backward data spans from $t-3$ to $t-1$.

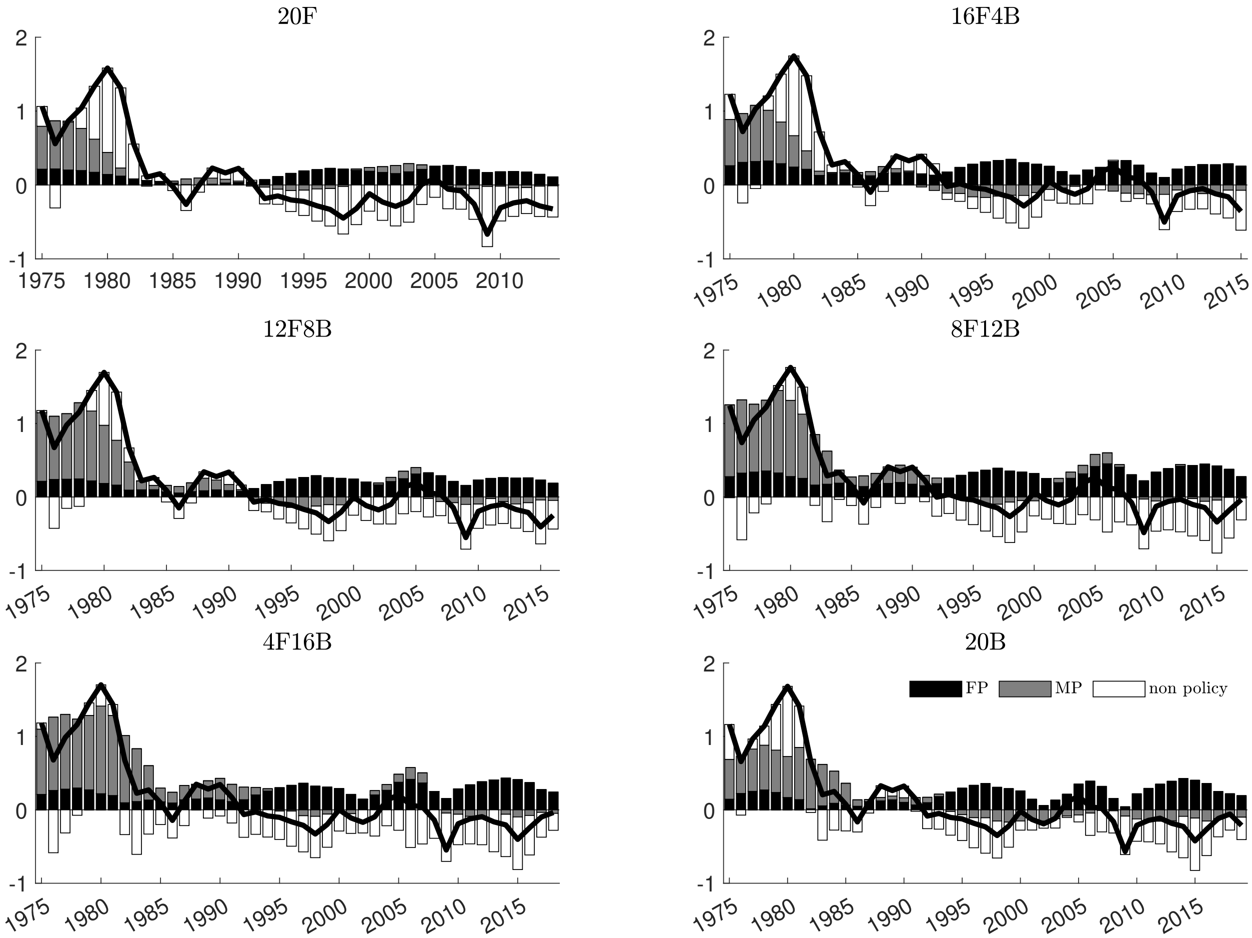

Figure 11: **Sensitivity analysis with different data windows.** "F" and "B"represent forward and backward data, while the numbers following each indicate the number of quarters used to construct the policy targets.

6.2 Alternative Measurements for the Inflation Target

The baseline estimation uses the GDP deflator to measure inflation and construct inflation targets. Since the Federal Reserve's preferred measure of the inflation target is PCE inflation, however, we also estimate the model using both PCE and core PCE inflation data to measure inflation and construct inflation targets. In both cases, we maintain the same 16F4B data window as in the baseline estimation.

The historical decomposition of inflation is shown in Figure 12. The role of fiscal policy in driving inflation fluctuations remains qualitatively consistent with our baseline estimation. Compared to the baseline estimation (shown in the top right panel of Figure 11), using PCE inflation to construct the inflation target increases the contribution of fiscal policy to the inflation surges observed during

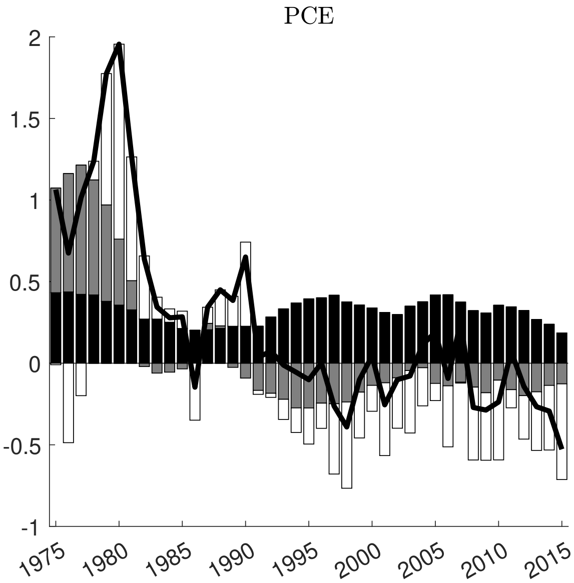

Figure 12: **Historical decomposition of inflation with alternative measurements for the inflation target.** The inflation target is constructed using personal consumption expenditures (PCE) and core PCE.

the Great Inflation. Additionally, the comparison between the PCE and core PCE cases indicates that most of the discrepancy between the two inflation dynamics is driven by non-policy shocks, consistent with the understanding that this difference arises from fluctuations in food and energy prices.

7 Conclusion

We examine the role of fiscal policy in driving U.S. inflation using an estimated NK model with stochastic inflation and government debt target shocks, demonstrating that fiscal policy plays a nontrivial role in pre-pandemic U.S. inflation. Recognizing the significance of fiscal and monetary policy interactions for understanding inflation drivers, we allow for temporary deviations from regime M, capturing delayed fiscal adjustments or monetary accommodation that tolerates higher inflation. Our findings fall between those of Bianchi et al. (2023), who identify a substantial impact of unfunded fiscal shocks on U.S. inflation using an estimated NK model conditioned on a shadow economy of regime F, and Smets and Wouters (2024), who report a much smaller influence of fiscal shocks on inflation using an estimated NK model with partial fiscal backing and a relatively simplified fiscal setup.

In addition to analyzing inflation drivers, our study contributes to the body of work that models the interaction between fiscal and monetary policies more realistically, moving beyond the two extreme policy regimes (F or fiscal-led and M or monetary-led). We posit that the pre-pandemic U.S. economy largely operated under regime M, consistent with Smets and Wouters (2024), who conclude that the degree of fiscal backing was generally large, suggesting an average policy interaction leaning toward regime M. Our approach offers flexibility in modeling policy interactions without requiring explicit fiscal and monetary policy coordination. Moreover, by incorporating inflation target shocks, we present new evidence from an estimated DSGE model showing that anchored inflation expectations—maintained through credible inflation targets—were crucial to the successful disinflation in the 1980s.

Appendices

A Bayesian Estimation

This section describes the data used in the baseline estimation and presents the estimation results. There are thirteen observable variables in total, described as follows. For most data series, we follow the definitions in Traum and Yang (2015) and Leeper et al. (2017).

A.1 Data Description

1. **Consumption.** Private consumption is the sum of nondurable goods and services in personal consumption expenditures (PCE, NIPA Table 1.1.5, lines 5 and 6).

2. **Investment.** Private investment is the sum of durable goods in personal consumption expenditures and gross private domestic investment (NIPA Table 1.1.5, lines 4 and 7).

3. **Wages.** Wages are the index for hourly compensation of the nonfarm sector for all workers, where 2012 is the base year (Bureau of Labor Statistics, series COMPNFB).

4. **Government consumption.** Government consumption is the current consumption expenditure of the federal government (NIPA Table 3.2, line 25).

5. **Government investment.** Government investment is the gross government investment expenditure of the federal government (NIPA Table 3.2, line 45).

6. **Capital tax revenues.** Capital tax revenues are calculated based on the definition in Jones (2002), applied only to the federal government. The average personal income tax rate is calculated as

$$\tau_t^p = \frac{IT_t}{WS_t + \frac{PRI_t}{2} + CI_t},$$

where IT_t is personal current tax revenues (NIPA Table 3.2, line 3), WS_t is wage and salary accruals (NIPA Table 1.12, line 3), PRI_t is proprietors' income (NIPA Table 1.12, line 9), and CI_t is capital income, defined as the sum of rental income (NIPA Table 1.12, line 12), corporate profits (NIPA Table 1.12, line 13), interest income (NIPA Table 1.12, line 18), and half of proprietors' income. Next, capital tax revenue is calculated as

$$\tau_t^p CI_t + CT_t,$$

where CT_t is taxes on corporate income (NIPA Table 3.2, line 8).

7. **Labor tax revenues.** Labor tax revenues are also calculated based on the definition in Jones (2002), applied only to the federal government, and are calculated as

$$\tau_t^p \left(WS_t + \frac{PRI_t}{2} \right) + CSI_t,$$

where CSI_t is contributions for government social insurance (NIPA Table 3.2, line 10).

8. **Transfers.** Transfers are defined as the sum of net current transfers, net capital transfers, and subsidies (NIPA Table 3.2, line 36), minus the federal government's tax residual. Net current transfers are calculated as current transfer payments (NIPA Table 3.2, line 26) minus current transfer receipts (NIPA Table 3.2, line 19). Net capital transfers are defined as capital transfer payments (NIPA Table 3.2, line 46) minus capital transfer receipts (NIPA Table 3.2, line 42). The tax residual is the sum of current tax receipts (NIPA Table 3.2, line 2), contributions for government social insurance (NIPA Table 3.2, line 10), income receipts on assets (NIPA Table 3.2, line 13), and the current surplus of government enterprises (NIPA Table 3.2, line 23), minus total tax revenue, which consists of labor, capital, and consumption tax revenues. Labor and capital tax revenues are described above, while consumption tax revenues are taxes on production and imports (NIPA Table 3.2, line 4).

9. **Hours worked.** Hours worked are calculated as

$$N_t = \frac{H_t \times Emp_t}{100},$$

where H_t is the index for average weekly hours per person in the nonfarm business sector (2012Q1 = 100), and Emp_t is the nonfarm employment level index (2012Q1 = 100), constructed from civilian employment for individuals 16 years old and over (BLS, series CE16OV).

10. **Inflation.** The inflation rate is calculated using the GDP price deflator (NIPA Table 1.1.9, line 1).

11. **Nominal Rates.** The nominal interest rate is measured by the effective federal funds rate (H.15 Selected Interest Rates, Board of Governors of the Federal Reserve System).

12. **Government Debt Gaps.** Debt gaps are defined as the differences between the actual debt ratio and the debt target. The actual debt ratio is calculated as the quarterly average of privately held gross federal debt (Federal Reserve Bank of Dallas, series MVPHGFD027MNFRBDAL) as a share of model-implied output, which includes the sum of private consumption, private investment, government consumption, and government investment. The government debt target is proxied by the five-year VAMA(4,16) average of actual debt ratios.

13. **Inflation Gaps.** Inflation gaps are defined as the differences between the actual inflation rate and the inflation target. The inflation target is proxied by the five-year VAMA(4,16) average of inflation rates calculated from the GDP deflator.

Data transformation. The nominal level variables in the above sections, except for ratios and rates, are scaled by the implicit GDP price deflator (NIPA Table 1.1.9, line 1) to obtain real level variables. These real level variables are then transformed into observable per capita real terms using the following equation:

$$X = \ln\left(\frac{x}{Popindex}\right) \times 100,$$

where *Popindex* is the index of population, constructed such that 2012Q1 = 1. Population is measured by the civilian noninstitutional population (BLS, series CNP16OV). Here, x represents consumption, investment, government consumption, government investment, capital tax revenue, labor tax revenue, transfers, or hours worked.

Lastly, we convert all level series with trends—i.e., all variables except hours worked, inflation, the nominal interest rate, debt gaps, and inflation gaps—into growth rates. The model variables are linked to the observables with the following equation:

$$\begin{bmatrix} \text{dl}Cons_t \\ \text{dl}Inv_t \\ \text{dl}Wage_t \\ \text{dl}GovCons_t \\ \text{dl}GovInv_t \\ \text{dl}CapTaxRev_t \\ \text{dl}LabTaxRev_t \\ \text{dl}Trans_t \\ \text{l}Hours_t \\ \text{l}Inflation_t \\ \text{l}R_t \\ \text{l}DebtGap_t \\ \text{l}InflationGap_t \end{bmatrix} = \begin{bmatrix} 100\gamma \\ 100\gamma \\ 100\gamma \\ 100\gamma \\ 100\gamma \\ 100\gamma \\ 100\gamma \\ 100\gamma \\ \bar{L} \\ \bar{\Pi} \\ \bar{R} \\ \bar{sb}^{gap} \\ \bar{\Pi}^{gap} \end{bmatrix} + \begin{bmatrix} \hat{c}_t - \hat{c}_{t-1} + \hat{u}_t^a \\ \hat{i}_t - \hat{i}_{t-1} + \hat{u}_t^a \\ \hat{w}_t - \hat{w}_{t-1} + \hat{u}_t^a \\ \hat{g}_t^C - \hat{g}_{t-1}^C + \hat{u}_t^a \\ \hat{g}_t^I - \hat{g}_{t-1}^I + \hat{u}_t^a \\ \hat{T}_t^K - \hat{T}_{t-1}^K + \hat{u}_t^a \\ \hat{T}_t^L - \hat{T}_{t-1}^L + \hat{u}_t^a \\ \hat{z}_t - \hat{z}_{t-1} + \hat{u}_t^a \\ \hat{L}_t \\ \hat{\pi}_t \\ \hat{R}_t \\ \hat{sb}_t^{gap} \\ \hat{\pi}_t^{gap} \end{bmatrix}, \tag{A.1}$$

where "dl" and "l" stand for 100 times the log difference and the log of each variable, and $\bar{R}^f \equiv \bar{\Pi} + \left(\frac{e^{\gamma}}{\beta} - 1\right) 100$. We estimate $\bar{L}, \bar{\Pi}, \bar{sb}^{gap}$, and $\bar{\Pi}^{gap}$, where the prior means are calculated from data averages over the sample. For example, the prior mean of $\bar{L}$ is the sample average of 100 times the logarithm of transformed hours worked. The two target-related variables are defined as $\hat{\pi}_t^{gap} \equiv \hat{\pi}_t - \hat{\pi}_t^*$ and $\hat{sb}_t^{gap} \equiv \hat{sb}_t - \hat{sb}_t^*$.

A.2 Estimation Results

Figure A.1 plots the model implied series for shocks that are estimated directly from the data.

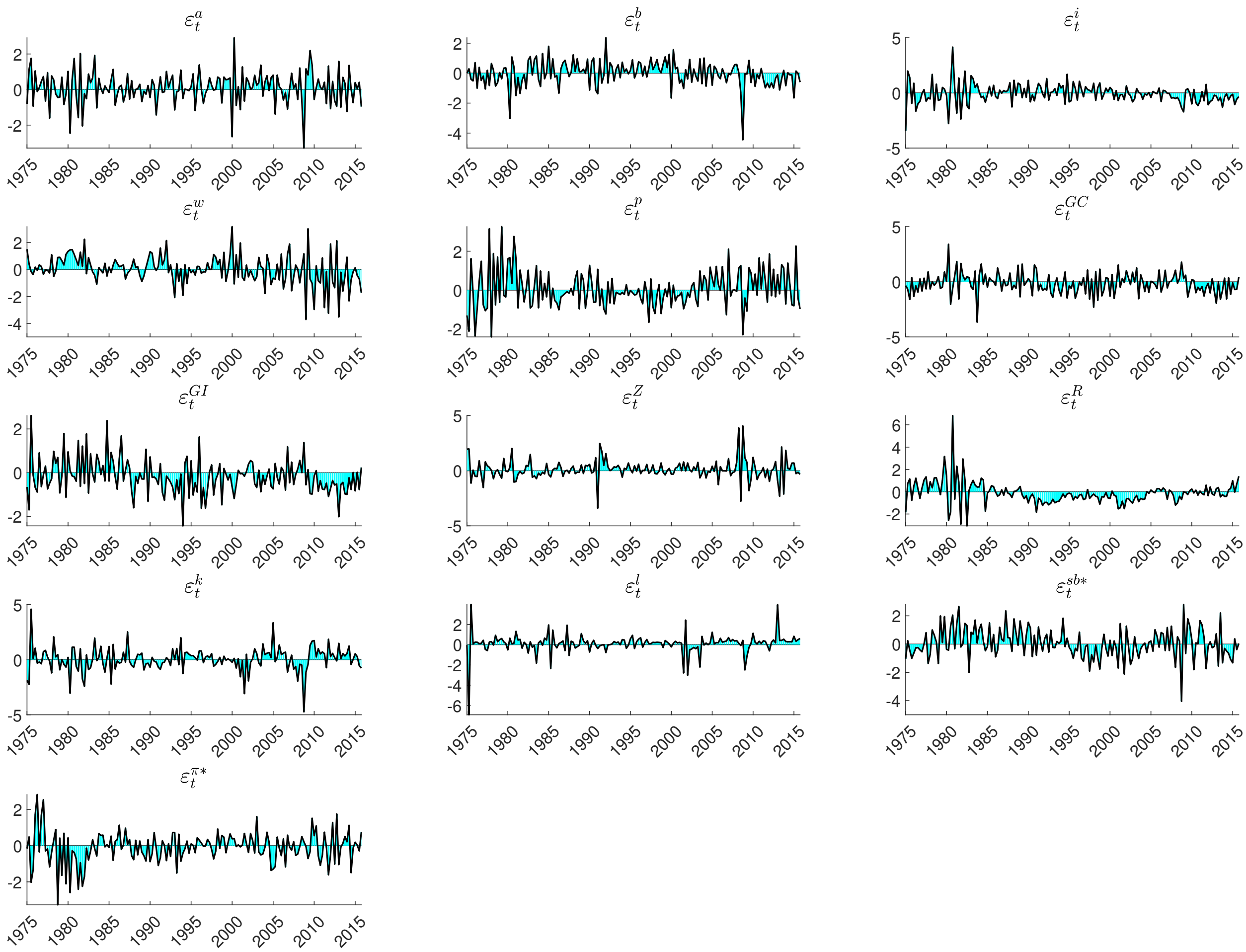

Figure A.1: **Model implied shocks.**

References

Angeletos, G.M., Lian, C., Wolf, C.K., 2024. Deficits and Inflation: HANK meets FTPL. Working Paper 33102. National Bureau of Economic Research.

Baele, L., Bekaert, G., Cho, S., Inghelbrecht, K., Moreno, A., 2015. Macroeconomic regimes. Journal of Monetary Economics 70, 51–71.

Baqaee, D., Farhi, E., 2022. Supply and demand in disaggregated Keynesian economies with an application to the COVID-19 crisis. American Economic Review 112, 1397–1436.

Bhattarai, S., Lee, J.W., Park, W.Y., 2016. Policy Regimes, Policy Shifts, and U.S. Business Cycles. The Review of Economics and Statistics 98, 968–983.

Bianchi, F., 2012. Evolving monetary/fiscal policy mix in the United States. American Economic review: Papers & Proceedings 102, 167–172.

Bianchi, F., 2013. Regime switches, agents' beliefs, and post-Wolrd War II U.S. macroeconomic dynamics. Review of Economics Studies 80, 463–490.

Bianchi, F., Faccini, R., Melosi, L., 2023. A fiscal theory of persistent trend inflation. Quarterly Journal of Economics 138, 2127–2179.

Bianchi, F., Ilut, C., 2017. Monetary/fiscal policy mix and agents' beliefs. Review of Economic Dynamics 26, 113–139.

Bianchi, F., Melosi, L., 2017. Escaping the Great Recession. American Economic Review 107, 1030–1058.

Billi, R.M., Walsh, C.E., 2022. Seemingly irresponsbile but welfare improving fiscal policy at the lower bound. Sveriges Riksbank Working Paper Series 410, Sveriges Riksbank, Stockholm.

Blanchard, O.J., Dell'Ariccia, G., Mauro, P., 2010. Rethinking macroeconomic policy. Journal of Monetary , Credit and Banking 42, 119–213.

Blinder, A.S., 1982. The Anatomy of Double-Digit Inflation in the 1970s. In *Inflation: Causes and Effects*, edited by Robert E. Hall, 261– 282. University of Chicago Press, Chicago.

Bureau of Economic Analysis, 2024. National income and product accounts. Department of Commerce, Washington, D.C.

Caldara, D., Conlisk, S., Iacoviello, M., Penn, M., 2022. The effect of the war in Ukraine on global activity and inflation. FEDS Notes, May 27, 2022, Board of Governors of Federal Reserve System, Washington, D.C.

Calvo, G.A., 1983. Staggered prices in a utility maxmimizing model. Journal of Monetary Economics 12, 383–398.

Chang, J.J., Lin, H.Y., Traum, N., Yang, S.C.S., 2021. Fiscal consolidation and public wages. Journal of Money, Credit and Banking 53, 503–533.

Christiano, L.J., Eichenbaum, M., Evans, C.L., 2005. Nominal rigidities and the dynamic effects of a shock to monetary policy. Journal of Political Economy 113, 1–45.

Christiano, L.J., Eichenbaum, M., Rebelo, S., 2011. When is the government spending multiplier large? Journal of Political Economy 119, 78–121.

Cochrane, J.H., 1998. A frictionless view of U.S. inflation. NBER Macroeconomics Annual 1998, 13, 323–384.

Cochrane, J.H., 2001. Long term debt and optimal policy in the fiscal theory of the price level. Econometrica 69, 69–116.

Cochrane, J.H., 2011. Understanding policy in the great recession: Some unpleasant fiscal arithmetic. European Economic Review 55, 2–30.

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

Congressional Budget Office, 2024. Historical budget data. February, https://www.cbo.gov/system/files/2024-02/51134-2024-02-Historical-Budget-Data.xlsx, retrived March 20, 2024, Congressional Budget Office, Washington, D.C.

Dao, M.C., Dizioli, A., Jackson, C., Gourinchas, P.O., 2023. Unconventional fiscal policy in times of high inflation. IMF Working Paper 23/178, International Monetary Fund, Washington, D.C.

Davig, T., 2004. Regime-switching debt and taxation. Journal of Monetary Economics 51, 837–859.

Davig, T., Leeper, E.M., 2006. Fluctuating macro policies and the fiscal theory. NBER Macroeconomic Annual 2006 21, 247–315.

Davig, T., Leeper, E.M., 2011. Monetary-fiscal policy interactions and fiscal stimulus. European Economic Review 55, 211–227.

Drautzburg, T., Uhlig, H., 2015. Fiscal stimulus and distortionary taxation. Review of Economic Dynamics 18, 894–920.

Dupor, B., Li, R., 2015. The expected inflation channel of government spending in the postwar U.S. European Economic Review 74, 36–56.

Elenev, V., Landvoigt, T., Shultz, P., Van Nieuwerburgh, S., 2021. Can monetary policy create fiscal capacity? NBER Working Paper 29129, National Bureau of Economic Research, Cambridge, MA.

Ettmeier, S., Kriwoluzky, A., 2024. Active or passive? revisiting the role of fiscal policy during high inflation. European Economic Review 170, 104874.

Farmer, R.E., Waggoner, D.F., Zha, T., 2009. Understanding markov-switching rational expectations models. Journal of Economic Theory 144, 1849–1867.

Favero, C.A., Rovelli, R., 2003. Macroeconomic stability and the preferences of the fed: A formal analysis, 1961-98. Journal of Money, Credit and Banking 35, 545–556.

Fedearl Open Market Committee, 2012. FOMC statement of longer-run goals and policy strategy. Press Release, https://www.federalreserve.gov/newsevents/pressreleases/monetary20120125c.htm, Board of Governors of the Federal Reserve System.

Ferrante, F., Graves, S., Iacoviello, M., 2023. The inflationary effects of sectoral reallocation. Joural of Monetary Economics 140, 64–81.

Firat, M., Hao, O., 2023. Demand vs. supply decomposition of inflation: Cross-country evidence with applications. IMF Working Paper WP/23/205, International Monetary Fund, Washington, D.C.

Foerster, A.T., 2016. Monetary policy regime switches and macroeconomic dynamics. International Economic Review 57, 211–229.

Galí, J., 2020. The effects of a money-financed fiscal stimulus. Journal of Monetary Economics 115, 1–19.

Galí, J., López-Salido, J.D., Vallés, J., 2007. Understanding the effects of government spending on consumption. Journal of the European Economic Association 5, 227–270.

Giannone, D., Primiceri, G., 2024. The drivers of post-pandemic inflation. NBER Working Paper 32859, Cambridge, MA.

di Giovanni, J., Kalemli-Ozcan, S., Silva, A., Yildirim, M.A., 2022. Global supply chain pressures, international trade, and inflation. Prepared for the ECB Forum on Central Banking: Challenges for Monetary Policy in a Rapidly Changing World, June 27-29, European Central Bank.

Goodfriend, M., King, R.G., 2013. The great inflation drift. In the Great Inflation: The Rebirth of Modern Central Banking, edited by Michael D.Bordo and Athanasios Orphanides, 181-209. University of Chicago Press, Chicago.

Harding, M., Lind'é, J., Trabandt, M., 2023. Understanding post-COVID inflation. Journal of Monetary Economics 140, S101–S118.

Hazell, J., no, H., Nakamura, E., Steinsson, J., 2022. The slope of the Phillips curve: Evidence from U.S. states. Quarterly Journal of Economics 137, 1299–1344.

International Monetary Fund, 2023. Inflation and disinflation: What role for fiscal policy? Chapter 2 in Fiscal Monotior April 2023, Washington, D.C.

Ireland, P.N., 2007. Changes in the Federal Reserve's inflation target: Causes and consequences. Journal of Money, Credit and Banking 39, 1851–1882.

Jones, J.B., 2002. Has fiscal policy helped stabilize the postwar U.S. economy? Journal of Monetary Economics 49, 709–746.

Kim, S., 2003. Structural shocks and the fiscal theory of the price level in the sticky price model. Macroeconomic Dynamics 7, 759–782.

Langford, D.A., 1978. Agriculture in the seventies—a decade of turbulence. Economic Perspectives II, 3–11. Septebmer/October, Federal Reserve Bank of Chicago.

Leeper, E.M., 1991. Equilibria under 'active' and 'passive' monetary and fiscal policies. Journal of Monetary Economics 27, 129–147.

Leeper, E.M., Plante, M., Traum, N., 2010. Dynamics of fiscal financing in the United States. Journal of Econometrics 156, 304–321.

Leeper, E.M., Traum, N., Walker, T.B., 2017. Clearing up the fiscal multiplier morass: Prior and posterior analysis. American Economic Review 107, 2409–2454.

Li, B., Pei, P., Tan, F., 2021. Financial distress and fiscal inflation. Journal of Macroeconomics 70, 103353.

Liu, Z., Waggoner, D.F., Zha, T., 2011. Sources of macroeconomic fluctuations: a regime-switching DSGE approach. Quantitative Economics 2, 251–301.

Mao, R., Shen, W., Yang, S.C.S., 2024. Can passive monetary policy decrease the debt burden? Journal of Economic Dynamics and Control 159, 104802.

Martínez-García, E., Coulter, J., Grossman, V., 2021. Fed's new inflation targeting policy seeks to maintain well-anchored inflation expectations. Federal Reserve Bank of Dallas.

Mavroeidis, S., Plagborg-M, Stock, J.H., 2014. Empirical evidence on inflation expectations in the New Keynesian Phillips curve. Journal of Economic Literature 52, 124–188.

Poole, W., Rasche, R.H., Wheelock, D.C., 2013. The great inflation: Did the shadow know better? In the Great Inflation: The Rebirth of Modern Central Banking, edited by Michael D.Bordo and Athanasios Orphanides, 61-107. University of Chicago Press, Chicago.

Powell, J.H., 2020. New economic challenges and the Fed's monetary policy review. Speech delivered at "Navigating the Decade Ahead: Implications for Monetary Policy," an economic policy syumposium sponsored by the Federal Reserve Bank of Kansas city, Jackson Hole, Wyoming (via webcast), August 27, 2020, Board of Governors of the Federal Reserve System.

Ravn, M., Schmitt-Grohe, S., Uribe, M., 2006. Deep habits. Review of Economic Studies 73, 195–218.

Schmitt-Grohé, S., Uribe, M., 2000. Price level determinacy and monetary policy under a balanced-budget requirement. Journal of Monetary Economics 45, 211–246.

Schorfheide, F., 2005. Learning and monetary policy shifts. Review of Economic Dynamics 8, 392–419.

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.

Sims, C.A., 2001. Solving linear rational expectations models. Journal of Computational Economics 20, 1–20.

Sims, C.A., 2011. Stepping on a rake: the role of fiscal policy in the inflation of the 1970s. European Economic Review 55, 48–56.

Sims, C.A., 2024. Origins of US inflation. AEA Papers and Proceedings 114, 90–94.

Smets, F., Wouters, R., 2007. Shocks and frictions in US business cycles: A Bayesian DSGE approach. American Economic Review 97, 586–606.

Smets, F., Wouters, R., 2024. Fiscal backing, inflation and US business cycles. Manuscript, European Central Bank, University of Ghent and CEPR, and National Bank of Belgium.

de Soyres, F., Santacreu, A.M., Young, H., 2023. Demand-supply imbalance during the Covid-19 pandemic: the role of fiscal policy. Review 105, 21–50. Federal Reserve Bank of St. Louis.

Stein, H., 1996. The Fiscal Revolution in America. Second revised ed., AEI Press, Washington, D.C.

Traum, N., Yang, S.C.S., 2011. Monetary and fiscal policy interactions in the post-war U.S. European Economic Review 55, 140–164.

Traum, N., Yang, S.C.S., 2015. When does government debt crowd out investment? Journal of Applied Econometrics 30, 24–45.

University of Michigan, 2024. Surveys of consumers. Retrived on February 28, 2023, https://data.sca.isr.umich.edu/.

U.S. Department of the Treasury, 2024. Debt limit. Policy Issues: Financial Markets, Financial Institutions, and Fiscal Service, available at https://home.treasury.gov/policy-issues/financial-markets-financial-institutions-and-fiscal-service/debt-limit, Washington, D.C.

Woodford, M., 1994. Monetary policy and price level determinacy in a cash-in-advance economy. Economic Theory 4, 345–380.

Woodford, M., 1995. Price-level determinacy without control of a monetary aggregate. Carneige-Rochester Conference Series on Public Policy 43, 1–46.

Woodford, M., 2001. Fiscal requirements for price stability. Journal of Money, Credit and Banking 33, 669–728.

Yang, S.C.S., 2009. A chronology of federal income tax policy: 1947-2009. CAEPR Working Paper No. 2007-021, Center for Applied Economics and Policy Research, Indiana University Bloomington.

Yellen, J., 2021. In Morning Edition, National Public Radio, November 3, Washington, D.C.

Zubairy, S., 2014. On fiscal multipliers: Estimates from a medium scale DSGE model. International Economic Review 55, 169–195.

Online Appendix:
Fiscal Policy and Inflation in Pre-Pandemic U.S. History*

Ruoyun Mao† University of Arkansas
Wenyi Shen‡ Oklahoma State University
Shu-Chun S. Yang§ Academia Sinica

November 19, 2024

This online appendix provides supplementary material for the paper, "Fiscal Policy and Inflation in Pre-Pandemic U.S. History." Sections 1 and 2 present the equilibrium system and the steady-state calculations. Section 3 provides the complete list of priors and posteriors for the parameters. Section 4 examines the policy regime for posterior draws where $\phi_\pi < 1$. Lastly, Section 5 compares our approach to exogenous policy targets with those adopted by Bianchi et al. (2023) and Smets and Wouters (2024) to model intermediate regimes between regimes F and M.

1 Model Equilibrium

This section lists the system of equations that characterize the model equilibrium. The original nominal-level variables are denoted by uppercase letters, while lowercase letters represent detrended variables, $x_t = \frac{X_t}{A_t}$, except for $\tilde{y}_t(i) = \frac{y_t(i)}{A_t}$, $w_t = \frac{W_t}{P_t A_t}$, $r_t^k = \frac{R_t^k}{P_t}$, and $\lambda_t^S = \Lambda_t^S A_t$, where λ_t^S is the Lagrangian multiplier associated with the savers' budget constraint.

Lowercase variables with hats represent log-linearized variables, $\hat{x}_t = \ln x_t - \ln x$, except for $\hat{u}_t^a = u_t^a - \gamma$, $\hat{\eta}_t^p = \ln(1+\eta_t^p) - \ln(1+\eta^p)$, and $\hat{\eta}_t^w = \ln(1+\eta_t^w) - \ln(1+\eta^w)$. A few shocks are also normalized; see below for further details. For the readers' convenience, the log-linearized equations are presented immediately after the original equations.

*We thank David W. Savitski for helpful comments. Yang acknowledges the financial support from the National Science and Technology Council of R.O.C. (Taiwan).
†Department of Economics, University of Arkansas; ruoyunm@uark.edu.
‡Department of Economics, Oklahoma State University; wenyi.shen@okstate.edu.
§Institute of Economics, Academia Sinica; ssyang@econ.sinica.edu.tw.

1.1 Production Side

- Aggregate production function

$$y_t pd_t = \big(k_t\big)^{\alpha} L_t^{1-\alpha} \left(\frac{k^G_{t-1} e^{-u^a_t}}{\int_0^1 \tilde{y}_t(i)di + \Omega} \right)^{\frac{\alpha_G}{1-\alpha_G}} - \Omega, \tag{1.1}$$

where pd_t is price dispersion and $k_t = \nu_t e^{-u^a_t} k_{t-1}$ is detrended effective capital.

Linearized equation:

$$\hat{y}_t = \frac{y+\Omega}{y} \Big[\alpha(1-\alpha^G)\hat{k}_t + (1-\alpha)(1-\alpha^G)\hat{L}_t + \alpha^G(\hat{k}^G_{t-1} - \hat{u}^a_t) \Big] \tag{1.2}$$

where $\hat{u}^a_t \equiv u^a_t - \gamma$ and log-linearized effective capital is $\hat{k}_t = \hat{\nu}_t + \hat{k}_{t-1} - \hat{u}^a_t$.

- Capital-labor share

$$\frac{k_t}{L_t} = \frac{\nu_t e^{-u^a_t} k_{t-1}}{L_t} = \frac{w_t}{r^k_t} \frac{\alpha}{1-\alpha} \tag{1.3}$$

Linearized equation:

$$\hat{r}^k_t - \hat{w}_t = \hat{L}_t - \hat{k}_t \tag{1.4}$$

- Marginal cost equation (from cost minimization)

$$mc_t = (1-\alpha)^{\alpha-1} \alpha^{-\alpha} (r^k_t)^{\alpha} w_t^{1-\alpha} \left(\frac{k^G_{t-1} e^{-u^a_t}}{\int_0^1 \tilde{y}_t(i)di + \Omega} \right)^{\frac{-\alpha^G}{1-\alpha^G}} \tag{1.5}$$

Linearized equation:

$$\hat{mc}_t = \alpha \hat{r}^k_t + (1-\alpha)\hat{w}_t - \frac{\alpha^G}{1-\alpha^G}\hat{k}^G_{t-1} + \frac{\alpha^G}{1-\alpha^G}\hat{u}^a_t + \frac{\alpha^G}{1-\alpha^G}\frac{y}{y+\Omega}\hat{y}_t \tag{1.6}$$

- Intermediate firm's FOC for price ($\tilde{p}_t \equiv \tilde{P}_t/P_t$) and aggregate price index

$$0 = E_t\Bigg\{\sum_{s=0}^{\infty}(\beta\omega_p)^s\lambda^S_{t+s}\bar{y}_{t+s}\Bigg[\tilde{p}_t\prod_{k=1}^{s}\Bigg[\Bigg(\frac{\pi_{t+k-1}}{\pi}\Bigg)^{\chi^p}\Bigg(\frac{\pi}{\pi_{t+k}}\Bigg)\Bigg]-(1+\eta^p_{t+s})mc_{t+s}\Bigg]\Bigg\},$$

where

$$\bar{y}_{t+s} = \Bigg(\tilde{p}_t\prod_{k=1}^{s}\Bigg[\Bigg(\frac{\pi_{t+k-1}}{\pi}\Bigg)^{\chi^p}\Bigg(\frac{\pi}{\pi_t+k}\Bigg)\Bigg]\Bigg)^{-\frac{1+\eta^p_{t+s}}{\eta^p_{t+s}}} y_{t+s} \tag{1.7}$$

$$1 = \Bigg\{(1-\omega_p)\tilde{p}_t^{\frac{1}{\eta^p_t}} + \omega_p\Bigg[\Bigg(\frac{\pi_{t-1}}{\pi}\Bigg)^{\chi^p}\Bigg(\frac{\pi}{\pi_t}\Bigg)\Bigg]^{\frac{1}{\eta^p_t}}\Bigg\}^{\eta^p_t}.$$

Linearized and combined with the marginal cost equation to get the linearized price Phillips curve:

$$\hat{\pi}_t = \frac{\beta}{1+\chi^p\beta}\mathbb{E}_t\hat{\pi}_{t+1} + \frac{\chi^p}{1+\chi^p\beta}\hat{\pi}_{t-1} + \kappa_p\hat{mc}_t + \hat{u}^p_t, \tag{1.8}$$

where $\kappa_p = [(1-\beta\omega_p)(1-\omega_p)]/[\omega_p(1+\beta\chi^p)]$, and we have normalized the price shock $\hat{u}^p_t = \kappa_p\hat{\eta}^p_t$ and directly estimate the process for $\hat{u}^p_t = \rho_p\hat{u}^p_{t-1} + \varepsilon^p_t$

- Law of motion for private capital

$$\bar{k}_t = (1-\delta)e^{-u^a_t}\bar{k}_{t-1} + u^i_t\Bigg[1-\mathbb{S}\Bigg(\frac{i_t e^{u^a_t}}{i_{t-1}}\Bigg)\Bigg]i_t \tag{1.9}$$

Linearized equation:

$$\hat{\bar{k}}_t = (1-\delta)e^{-\gamma}(\hat{\bar{k}}_{t-1} - \hat{u}^a_t) + \big[1-(1-\delta)e^{-\gamma}\big]\big((1+\beta)se^{2\gamma}\hat{u}^i_t + \hat{i}_t\big), \tag{1.10}$$

where $s \equiv \mathbb{S}''(1)$, and $\mathbb{S}(1) = \mathbb{S}'(1) = 0$ by assumption.

- Law of motion for public capital

$$k^G_t = (1-\delta^G)e^{-u^a_t}k^G_{t-1} + g^I_t \tag{1.11}$$

Linearized equation:

$$\hat{k}_t^G = (1-\delta^G)e^{-\gamma}(\hat{k}_{t-1}^G - \hat{u}_t^a) + [1-(1-\delta^G)e^{-\gamma}]\hat{g}_t^I \tag{1.12}$$

1.2 Households Problem

- Nonsavers' budge constraint

$$(1+\tau_t^c)c_t^N = (1-\tau_t^l)w_t L_t + z_t^N \tag{1.13}$$

Linearized equation:

$$\tau^c c^N \hat{\tau}_t^C + (1+\tau^c)c^N \hat{c}_t^N = (1-\tau^l)wL[\hat{w}_t + \hat{L}_t] - \tau^l wL\hat{\tau}_t^l + z\hat{z}_t \tag{1.14}$$

- Savers' FOC for consumption

$$(1+\tau_t^c)\lambda_t^S = \frac{u_t^b}{c_t^{*S} - \theta c_{t-1}^{*S} e^{-u_t^a}} \tag{1.15}$$

Linearized equation:

$$\hat{\lambda}_t^S = \hat{u}_t^b + \hat{u}_t^a - \frac{e^\gamma}{e^\gamma - \theta}(\hat{c}_t^* + \hat{u}_t^a) + \frac{\theta}{e^\gamma - \theta}\hat{c}_{t-1}^* - \frac{\tau^c}{1+\tau^c}\hat{\tau}_t^c \tag{1.16}$$

- Composite consumption aggregation

$$c_t^{*S} = c_t^S + \omega_g g_t^C \tag{1.17}$$

Linearized equation:

$$\hat{c}_t^* = \frac{c^S}{c^S + \omega_g g}\hat{c}_t^S + \frac{\omega_g g}{c^S + \omega_g g}\hat{g}_t \tag{1.18}$$

- Euler equation

$$\lambda_t^S = \beta R_t^f \mathbb{E}_t \frac{\lambda_{t+1}^S e^{-u_{t+1}^a}}{\pi_{t+1}} \tag{1.19}$$

Linearized equation:

$$\hat{\lambda}_t^s = \hat{R}_t^f + \mathbb{E}_t \hat{\lambda}_{t+1}^s - \mathbb{E}_t \hat{\pi}_{t+1} - \mathbb{E}_t \hat{u}_{t+1}^a \tag{1.20}$$

- Savers' FOC for capacity utilization

$$(1-\tau_t^k) r_t^k = \Psi'(\nu_t), \tag{1.21}$$

where $\Psi(\nu_t)$ is the capital utilization cost function and $\nu = 1, \Psi(1) = 0$, and $\frac{\Psi''(1)}{\Psi'(1)} \equiv \frac{\psi}{1-\psi}$.

Linearized equation:

$$\hat{r}_t^k - \frac{\tau^k}{1-\tau^k} \hat{\tau}_t^k = \frac{\psi}{1-\psi} \hat{\nu}_t. \tag{1.22}$$

- Households' FOC for capital (Tobin's q, $q_t \equiv \frac{\lambda_t^K}{\lambda_t^C}$)

$$q_t = \beta \mathbb{E}_t \frac{\lambda_{t+1}^S e^{-u_{t+1}^a}}{\lambda_t^S} \left[\left(1 - \tau_{t+1}^k\right) r_{t+1}^k \nu_{t+1} - \Psi(\nu_{t+1}) + (1-\delta) q_{t+1} \right] \tag{1.23}$$

Linearized equation:

$$\hat{q}_t = \mathbb{E}_t \hat{\lambda}_{t+1}^S - \hat{\lambda}_t^S - \mathbb{E}_t \hat{u}_{t+1}^a + \beta e^{-\gamma}(1-\tau^k) r^k \mathbb{E}_t \hat{r}_{t+1}^k - \beta e^{-\gamma} \tau^k r^k \mathbb{E}_t \hat{\tau}_{t+1}^k + \beta e^{-\gamma}(1-\delta) \mathbb{E}_t \hat{q}_{t+1}. \tag{1.24}$$

- Households' FOC for investment

$$\begin{aligned} 1 = {} & q_t u_t^i \left[1 - \mathbb{S}\Big(\frac{i_t e^{u_t^a}}{i_{t-1}}\Big) - \mathbb{S}'\Big(\frac{i_t e^{u_t^a}}{i_{t-1}}\Big) \frac{i_t e^{u_t^a}}{i_{t-1}} \right] \\ & + \beta \mathbb{E}_t \left[q_{t+1} \frac{\lambda_{t+1}^S e^{-u_{t+1}^a}}{\lambda_t^S} u_{t+1}^i \mathbb{S}'\Big(\frac{i_{t+1} e^{u_{t+1}^a}}{i_t}\Big) \Big(\frac{i_{t+1} e^{u_{t+1}^a}}{i_t}\Big)^2 \right] \end{aligned} \tag{1.25}$$

Linearized equation:

$$(1+\beta)\hat{i}_t + \hat{u}_t^a - \frac{1}{s e^{2\gamma}} [\hat{q}_t + \hat{u}_t^i] - \beta \mathbb{E}_t \hat{i}_{t+1} - \beta \mathbb{E}_t \hat{u}_{t+1}^a = \hat{i}_{t-1}, \tag{1.26}$$

where the investment shock is normalized as $\hat{u}_t^i = \frac{1}{s \cdot e^{2\gamma}} \hat{\tilde{u}}_t^i$ and directly estimate the AR(1) process for $\hat{u}_t^i$, with AR coefficient ρ_i and innovation $\varepsilon_t^i \sim \mathcal{N}\big(0, \sigma_i^2\big)$.

- Effective capital

$$k_t = \nu_t \bar{k}_{t-1} e^{-u_t^a} \tag{1.27}$$

Linearized equation:

$$\hat{k}_t = \hat{\nu}_t + \hat{\bar{k}}_{t-1} - \hat{u}_t^a \tag{1.28}$$

- Wage setting FOC ($\tilde{w}_t \equiv \tilde{W}_t/(A_t P_t)$) and aggregate wage index:

$$0 = E_t \left\{ \sum_{t=1}^{\infty} (\beta\omega_\omega)^s \lambda_{t+s}^S \bar{L}_{t+s} \left[\tilde{w}_t \prod_{k=1}^{s} \left\{ \left(\frac{\pi_{t+k-1} e^{u_{t+k-1}^a}}{\pi e^\gamma} \right)^{\chi^w} \left(\frac{\pi e^\gamma}{\pi_{t+k} e^{u_{t+k}^a}} \right) \right\} - \frac{(1+\eta_{t+s}^w) u_{t+s}^b \bar{L}_{t+s}^\xi}{(1-\tau_{t+s}^L)\lambda_{t+s}^S} \right] \right\} \tag{1.29}$$

where

$$\bar{L}_{t+s} = \left(\tilde{w}_t \prod_{k=1}^{s} \left\{ \left(\frac{\pi_{t+k-1} e^{u_{t+k-1}^a}}{\pi e^\gamma} \right)^{\chi^w} \left(\frac{\pi e^\gamma}{\pi_{t+k} e^{u_{t+k}^a}} \right) \right\} \right)^{-\frac{1+\eta_{t+s}^w}{\eta_{t+s}^w}} L_{t+s} \tag{1.30}$$

$$w_t^{\frac{1}{\eta_t^w}} = (1-\omega_w)\tilde{w}_t^{\frac{1}{\eta_t^w}} + \omega_w \left[\left(\frac{\pi_{t-1} e^{u_{t-1}^a}}{\pi e^\gamma} \right)^{\chi^w} \left(\frac{\pi e^\gamma}{\pi_t e^{u_t^a}} \right) w_{t-1} \right]^{\frac{1}{\eta_t^w}} \tag{1.31}$$

Linearizing and combining the above two equations gives the wage Phillips curve:

$$\begin{aligned} \hat{w}_t = {} & \frac{1}{1+\beta}\hat{w}_{t-1} + \frac{\beta}{1+\beta}\mathbb{E}_t \hat{w}_{t+1} - \kappa_w \left[\hat{w}_t - \xi \hat{L}_t - \hat{u}_t^b + \lambda_t^S - \frac{\tau^l}{1-\tau^l}\hat{\tau}_t^l \right] \\ & + \frac{\chi^w}{1+\beta}\hat{\pi}_{t-1} - \frac{1+\beta\chi^w}{1+\beta}\hat{\pi}_t + \frac{\beta}{1+\beta}\mathbb{E}_t\hat{\pi}_{t+1} + \frac{\chi^w}{1+\beta}\hat{u}_{t-1}^a - \frac{1+\beta\chi^w - \rho_a\beta}{1+\beta}\hat{u}_t^a + \kappa_w \hat{\eta}_t^w, \end{aligned} \tag{1.32}$$

where $\kappa_w = [(1-\beta\omega_w)(1-\omega_w)]/[\omega_w(1+\beta)((1+\eta^w)\xi)/\eta^w)]$.

1.3 Market Clearing Conditions and Policy Rules

- Aggregation of households' consumption

$$c_t = \mu c_t^S + (1-\mu)c_t^N \tag{1.33}$$

Linearized equation:

$$c\hat{c}_t = c^S(1-\mu)\hat{c}_t^S + c^N \mu \hat{c}_t^N \tag{1.34}$$

- Aggregate resource constraint

$$y_t = c_t + i_t + g_t^I + g_t^C + \Psi(\nu_t)\bar{k}_{t-1}e^{-u_t^a} \tag{1.35}$$

Linearized equation:

$$y\hat{y}_t = c\hat{c}_t + i\hat{i}_t + g^I\hat{g}_t^I + g^C\hat{g}_t^C + \psi'(1)\kappa\hat{\nu}_t \tag{1.36}$$

- Interest rate rule

$$\hat{R}_t = \rho_R\hat{R}_{t-1} + (1-\rho_R)\phi_\pi\hat{\pi}_t^{gap} + \phi_y\hat{Y}_t + u_t^R. \tag{1.37}$$

- Inflation target gap ($\hat{\pi}_t^{gap} \equiv \hat{\pi}_t - \hat{\pi}_t^*$)

$$\hat{\pi}_t^* = \rho_{\pi^*}\hat{\pi}_{t-1}^* + u_t^{\pi^*}. \tag{1.38}$$

- Interest rate and inflation target shocks

$$u_t^\iota = \rho_u^\iota u_{t-1}^\iota + \varepsilon_t^\iota, \quad \varepsilon_t^\iota \sim \text{i.i.d. } N(0,\sigma_\iota^2), \quad \iota \in \{R, \pi^*\}. \tag{1.39}$$

- Government budget constraint

$$b_t + \tau_t^k r_t^k k_t + \tau_t^l w_t L_t + \tau_t^c c_t = \frac{R_{t-1}b_{t-1}}{\pi_t e^{u_t^a}} + g_t^C + g_t^I + z_t \tag{1.40}$$

Linearized equation:

$$\begin{aligned} &\frac{b}{y}\hat{b}_t + \tau^k r^k \frac{k}{y}[\hat{\tau}_t^k + \hat{r}_t^k + \hat{k}_t] + \tau^l w \frac{L}{y}[\hat{\tau}_t^l + \hat{w}_t + \hat{L}_t] + \tau^c \frac{c}{y}[\tau_t^c + \hat{c}_t] \\ &= \frac{R}{e^\gamma}\frac{b}{y}[\hat{R}_{t-1} + \hat{b}_{t-1} - \hat{\pi}_t - \hat{u}_t^a] + \frac{g^C}{y}\hat{g}_t^C + \frac{g^I}{y}\hat{g}_t^I + \frac{z}{y}\hat{z}_t. \end{aligned} \tag{1.41}$$

- Tax policy rules and shocks

$$\hat{\tau}_t^\iota = \rho_\iota\hat{\tau}_{t-1}^\iota + (1-\rho_\iota)\gamma_\iota s\hat{b}_{t-4}^{gap} + \phi_\iota\hat{Y}_t + \varepsilon_t^\iota, \quad \varepsilon_t^\iota \sim \text{i.i.d. } N(0,\sigma_\iota^2), \quad \iota \in \{l, k\}. \tag{1.42}$$

- Transfers rule

$$\hat{Z}_t = \rho_Z \hat{Z}_{t-1} - (1-\rho_Z)\gamma_Z \hat{sb}^{gap}_{t-4} - \phi_Z \hat{Y}_t + u^Z_t, \tag{1.43}$$

- Government consumption and investment rules

$$\hat{G}^C_t = \rho_{GC}\hat{G}^C_{t-1} - (1-\rho_{GC})\gamma_{GC}\hat{sb}^{gap}_{t-4} + u^{GC}_t, \tag{1.44}$$

$$\hat{G}^I_t = \rho_{GI}\hat{G}^I_{t-1} - (1-\rho_{GI})\gamma_{GI}\hat{sb}^{gap}_{t-4} + u^{GI}_t. \tag{1.45}$$

- Government spending shocks

$$u^\iota_t = \rho^\iota_u u^\iota_{t-1} + \varepsilon^\iota_t, \quad \varepsilon^\iota_t \sim i.i.d.N\left(0, \sigma^2_\iota\right), \iota \in \{Z, GC, CI\}. \tag{1.46}$$

- Debt target gap

$$\hat{sb}^{gap}_t \equiv \hat{sb}_t - \hat{sb}^*_t \hat{sb}^{gap}_{t-4} \equiv \hat{sb}_{t-4} - \hat{sb}^*_t. \tag{1.47}$$

- Debt target shock

$$\hat{sb}^*_t = \rho_{sb^*}\hat{sb}^*_{t-1} + u^{sb^*}_t, \tag{1.48}$$

$$u^{sb^*}_t = \rho^{sb^*}_u u^{sb^*}_{t-1} + \varepsilon^{sb^*}_t, \quad \varepsilon^{sb^*}_t \sim \text{i.i.d. } N(0, \sigma^2_\iota). \tag{1.49}$$

2 The Steady State

Given the calibrated parameter values in Table 1 of the main text, the steady-state values of other endogenous variables can be computed as follows.

$$R = e^\gamma/\beta \tag{2.1}$$

$$P^B = 1/R \tag{2.2}$$

$$r^k = \frac{e^\gamma/\beta - 1 + \delta}{1 - \tau^k} \tag{2.3}$$

$$\psi'(1) = r^k(1-\tau^k) \tag{2.4}$$

$$mc = \frac{1}{1+\eta^p} \tag{2.5}$$

$$\frac{\Omega}{y} = \eta^p \quad \text{(assuming zero profit)} \tag{2.6}$$

$$s^{kg} = \frac{k^g}{y} = \frac{1}{1-(1-\delta^G)e^{-\gamma}} \frac{g^I}{y} \tag{2.7}$$

Define

$$\xi^{kg} = \left(\frac{s^{kg} e^{-u_t^a}}{1+\Omega/y} \right)^{\frac{\alpha_G}{1-\alpha_G}} \tag{2.8}$$

Then

$$w = \left(mc(1-\alpha)^{1-\alpha} \alpha^\alpha (r^k)^{-\alpha} \xi^{kg} \right)^{\frac{1}{1-\alpha}} \tag{2.9}$$

$$\frac{k}{l} = \frac{w}{r^k} \frac{\alpha}{1-\alpha} \tag{2.10}$$

$$\frac{y}{l} = \frac{(k/l)^\alpha \xi^{kg}}{\left(1+\frac{\Omega}{y}\right)} \tag{2.11}$$

$$\frac{i}{l} = (1-(1-\delta)e^{-\gamma})e^\gamma \frac{k}{l} \tag{2.12}$$

$$\frac{c}{l} = \frac{y}{l}(1-s^{gc}-s^{gi}) - \frac{i}{l} \tag{2.13}$$

$$\frac{z}{l} = \left[(1-Re^{-\gamma})s^b - s^{gc} - s^{gi} \right] \frac{y}{l} + \tau^c \frac{c}{l} + \tau^l w + \tau^k r^k \frac{k}{l} \tag{2.14}$$

$$\frac{c^n}{l} = \frac{(1-\tau^l)w + \frac{z}{l}}{1+\tau^c} \tag{2.15}$$

$$\frac{c^s}{l} = \frac{\frac{c}{l} - \mu \frac{c^n}{l}}{1-\mu} \tag{2.16}$$

$$\frac{c^{*s}}{l} = \frac{c^s}{l} + \omega_g s^{gc} \left(\frac{y}{l} \right) \tag{2.17}$$

$$l = \left[\frac{w(1-\tau^l)}{1+\eta^w} \frac{1}{(1+\tau^c)(1-\theta e^{-\gamma})\frac{c^{*s}}{l}} \right]^{\frac{1}{\xi+1}} \tag{2.18}$$

3 Estimation Results

Table 1 lists the priors and posteriors of the estimated parameters. Figure 1 shows the prior-posterior plot for the baseline estimation.

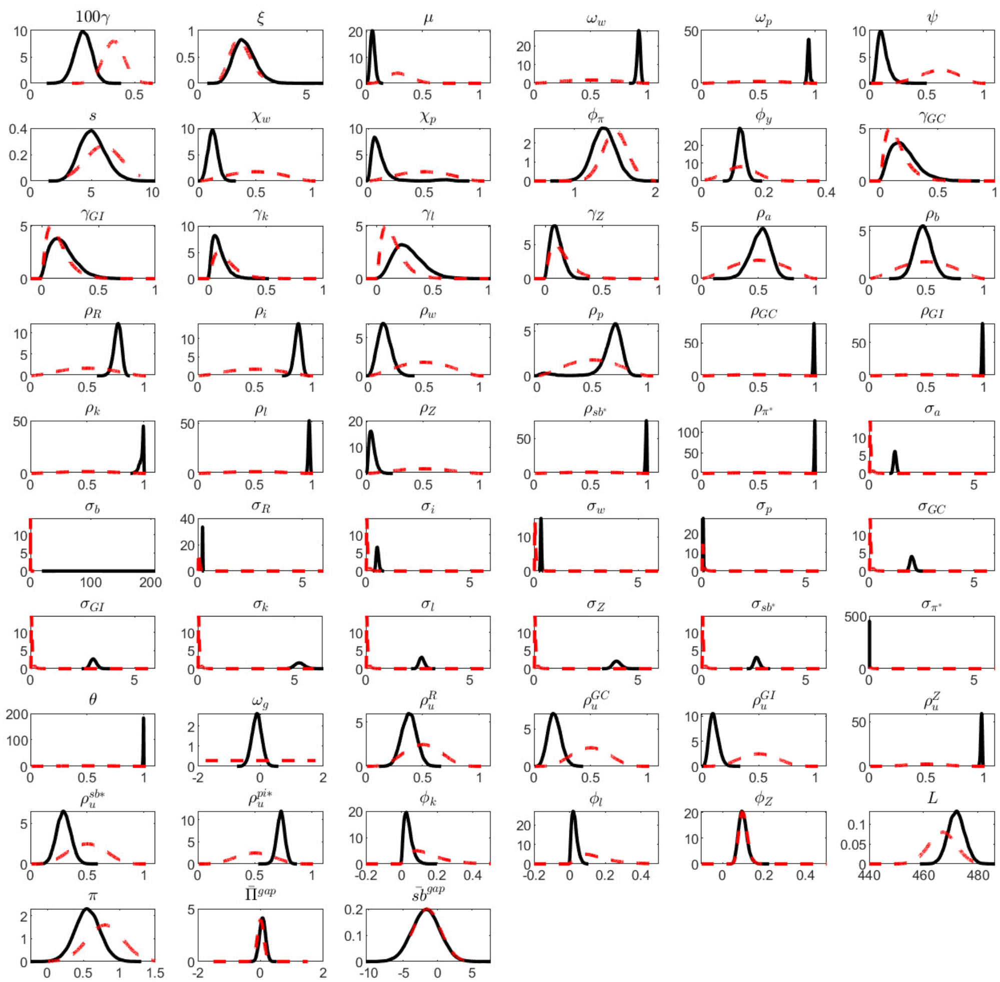

Figure 1: **Prior-Posterior Plots: Baseline Estimation.** The dashed (solid) lines are prior (posterior) distribution distributions.

Parameters	Priors	Posterior Mean	Posterior 90% Interval
100γ, steady-state growth rate	$N(0.4, 0.05)$	0.253	$[0.187, 0.317]$
ξ, Frisch labor elasticity	$G(2, 0.5)$	2.152	$[1.334, 2.935]$
μ, share of non-savers	$B(0.3, 0.1)$	0.060	$[0.028, 0.090]$
ω_w, wage rigidity	$B(0.5, 0.2)$	0.923	$[0.900, 0.946]$
ω_p, price rigidity	$B(0.5, 0.2)$	0.941	$[0.924, 0.957]$
ψ, capital utilization	$B(0.6, 0.15)$	0.116	$[0.044, 0.184]$
s, investment adjustment cost	$N(6, 1.5)$	5.121	$[3.343, 6.784]$
θ, external habit	$B(0.5, 0.2)$	0.995	$[0.992, 0.999]$
ω_G, substitutability between C_t and G_t^C	$U(-1.75, 1.75)$	-0.120	$[-0.378, 0.129]$
χ_w, wage indexation	$B(0.5, 0.2)$	0.120	$[0.053, 0.187]$
χ_p, price indexation	$B(0.5, 0.2)$	0.117	$[0.008, 0.199]$
ϕ_π, interest rate response to inflation	$N(1.5, 0.15)$	1.364	$[1.130, 1.591]$
ϕ_y, interest rate response to output	$N(0.125, 0.05)$	0.125	$[0.102, 0.147]$
γ_{GC}, government consumption response to debt	$N(0.15, 0.1)$	0.207	$[0.024, 0.373]$
γ_{GI}, government investment response to debt	$N(0.15, 0.1)$	0.188	$[0.018, 0.347]$
γ_k, capital tax response to debt	$N(0.15, 0.1)$	0.090	$[0.004, 0.171]$
γ_l, labor tax response to debt	$N(0.15, 0.1)$	0.282	$[0.071, 0.476]$
γ_Z, transfer response to debt	$N(0.15, 0.1)$	0.100	$[0.014, 0.177]$
ϕ_k, capital tax response to debt	$G(0.15, 0.1)$	0.038	$[0.003, 0.070]$
ϕ_l, labor tax response to debt	$G(0.15, 0.1)$	0.028	$[0.003, 0.051]$
ϕ_Z, transfer response to debt	$G(0.1, 0.02)$	0.098	$[0.065, 0.128]$
$\bar{L}$, steady state labor	$N(467, 5)$	472.119	$[467.325, 477.346]$
$\bar{\Pi}$, steady state inflation rate	$N(0.8, 0.25)$	0.556	$[0.265, 0.841]$
$\bar{\Pi}^{gap}$, steady state inflation gap	$N(0, 0.1)$	0.062	$[-0.096, 0.221]$
$\bar{sb}^{gap}$, steady state debt gap	$N(-1.6, 2)$	-1.724	$[-5.006, 1.571]$
ρ_a, serial correlation in technology shock	$B(0.5, 0.2)$	0.517	$[0.379, 0.654]$
ρ_b, serial correlation in preference shock	$B(0.5, 0.2)$	0.472	$[0.350, 0.590]$
ρ_R, serial correlation in interest rate	$B(0.5, 0.2)$	0.767	$[0.714, 0.820]$
ρ_i, serial correlation in investment	$B(0.5, 0.2)$	0.876	$[0.828, 0.922]$
ρ_w, serial correlation in wage markup shock	$B(0.5, 0.2)$	0.147	$[0.050, 0.239]$
ρ_p, serial correlation in price markup shock	$B(0.5, 0.2)$	0.665	$[0.546, 0.815]$
ρ_{GC}, serial correlation in government consumption	$B(0.5, 0.2)$	0.987	$[0.979, 0.996]$
ρ_{GI}, serial correlation in government investment	$B(0.5, 0.2)$	0.990	$[0.982, 0.998]$
ρ_k, serial correlation in capital tax	$B(0.5, 0.2)$	0.978	$[0.951, 0.999]$
ρ_l, serial correlation in labor tax	$B(0.5, 0.2)$	0.975	$[0.963, 0.988]$
ρ_Z, serial correlation in transfer	$B(0.5, 0.2)$	0.048	$[0.006, 0.088]$
ρ_{sb^*}, serial correlation in debt target	$B(0.5, 0.2)$	0.989	$[0.980, 0.998]$
ρ_{π^*}, serial correlation in inflation target	$B(0.5, 0.2)$	0.994	$[0.988, 0.999]$
ρ_u^R, serial correlation in monetary policy shock	$B(0.5, 0.15)$	0.381	$[0.275, 0.490]$
ρ_u^{GC}, serial correlation in government spending shock	$B(0.5, 0.15)$	0.182	$[0.090, 0.271]$
ρ_u^{GI}, serial correlation in government investment shock	$B(0.5, 0.15)$	0.105	$[0.043, 0.167]$
ρ_u^Z, serial correlation in transfer shock	$B(0.5, 0.15)$	0.981	$[0.971, 0.992]$
ρ_u^{sb*}, serial correlation in debt target shock	$B(0.5, 0.15)$	0.294	$[0.196, 0.397]$
$\rho_u^{\pi*}$, serial correlation in inflation target shock	$B(0.5, 0.15)$	0.726	$[0.670, 0.785]$
$100\sigma_a$, technology shock precision	$IG(0.1, 1)$	1.233	$[1.126, 1.340]$
$100\sigma_b$, preference shock precision	$IG(0.1, 1)$	83.534	$[40.603, 120.951]$
$100\sigma_R$, monetary policy shock precision	$IG(0.1, 1)$	0.233	$[0.213, 0.252]$
$100\sigma_i$, investment shock precision	$IG(0.1, 1)$	0.560	$[0.460, 0.657]$
$100\sigma_w$, wage markup shock precision	$IG(0.1, 1)$	0.341	$[0.298, 0.383]$
$100\sigma_p$, price markup shock precision	$IG(0.1, 1)$	0.082	$[0.054, 0.105]$
$100\sigma_{GC}$, government consumption shock precision	$IG(0.1, 1)$	2.048	$[1.882, 2.208]$
$100\sigma_{GI}$, government investment shock precision	$IG(0.1, 1)$	3.032	$[2.794, 3.276]$
$100\sigma_k$, capital tax shock precision	$IG(0.1, 1)$	5.282	$[4.867, 5.688]$
$100\sigma_l$, labor tax shock precision	$IG(0.1, 1)$	2.688	$[2.476, 2.896]$
$100\sigma_Z$, transfer shock precision	$IG(0.1, 1)$	3.990	$[3.683, 4.315]$
$100\sigma_{sb*}$, debt target shock precision	$IG(0.1, 1)$	2.650	$[2.439, 2.854]$
$100\sigma_{\pi*}$, inflation target shock precision	$IG(0.1, 1)$	0.018	$[0.017, 0.020]$

Table 1: **Prior and Posterior Distributions**. B, G, N, U and IG denote beta, gamma, normal, uniform, and inverse gamma distributions.

4 Regime Checking

Among the 1.5 million draws used to simulate the posterior distributions, 0.04% have $\phi_\pi < 1$, with the lowest value being 0.7534. Since ϕ_π can be smaller than one in regime M (as shown in Leeper et al., 2017), we further examine the responses to a positive government consumption shock, u_t^{GC} (see equation (28) in the main text), focusing on the real interest rate and private investment to verify the presence of regime M.[1] Figure 2 shows the 5,950 draws, all of which exhibit negative investment responses. The real interest rate generally responds positively to the government consumption shock, except for slight initial negative responses, confirming that all draws fall within regime M.

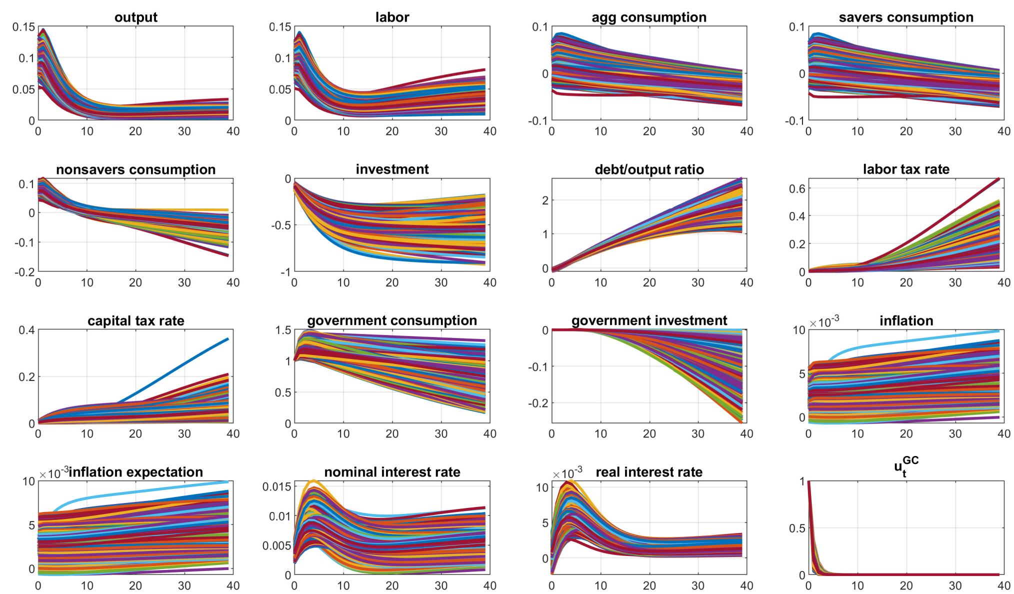

Figure 2: **Impulse responses to a government consumption shock.** The x-axes are in quarters. The y-axis are in percent deviations from the steady state.

[1] It is well established that a deficit-financed increase in government consumption crowds out private demand in a permanent regime M (F), partly due to opposing real interest rate responses (see, e.g., Kim, 2003; Davig and Leeper, 2011; Dupor and Li, 2015; Galí, 2020; Mao et al., 2023).

5 Connections with Partial Fiscal Backing

A common feature of our model and partial fiscal backing models, such as those in Bianchi et al. (2023) and Smets and Wouters (2024), is the attempt to characterize an intermediate policy regime that captures key features of both Regime M and Regime F, without relying on regime-switching models where the economy alternates between the two regimes. In this section, we examine the connections and distinctions between our exogenous policy target shocks and the approaches of Bianchi et al. (2023) and Smets and Wouters (2024).

We start with the fiscal and monetary policy rules in Bianchi et al. (2023),

$$\tau_t = \gamma^M \left(sb_{t-1} - sb_{t-1}^F\right) + \gamma^F sb_{t-1}^F + u_{\tau,t}^M + u_{\tau,t}^F \tag{5.1}$$

$$R_t = \phi^M \left(\pi_t - \pi_t^F\right) + \phi^F \pi_t^F \tag{5.2}$$

where τ_t, without loss of generality, represents a fiscal instrument,[2] sb_t is the debt-to-GDP ratio, sb_t^F is the debt-to-GDP ratio in the shadow Regime F, $u_{\tau,t}^M$ is the funded fiscal shock, $u_{\tau,t}^F$ is the unfunded fiscal shock, R_t is the nominal interest rate, π_t is the inflation rate, and π_t^F is the inflation rate in the shadow Regime F.

As shown in Bianchi et al. (2023), the policy rules can be interpreted as responding to endogenous policy targets, where the targets are determined in a shadow Regime F economy. Specifically, the time-varying policy targets, sb_t^* and π_t^*, respond to the Regime F debt (sb_{t-1}^F) and inflation (π_t^F) according to the following equations:

$$sb_t^* = \tilde{\rho}_{sb^*} sb_{t-1}^F + \tilde{\sigma}^{sb^*} u_{\tau,t}^F \tag{5.3}$$

$$\pi_t^* = \tilde{\rho}_\pi \pi_t^F \tag{5.4}$$

where $\tilde{\rho}^{sb^*} = \frac{\gamma^M - \gamma^F}{\gamma^M}$, $\tilde{\sigma}^{sb^*} = \frac{1}{\gamma^M}$, $\tilde{\rho}_\pi = \frac{\phi^M - \phi^F}{\phi^M}$.

[2] In Bianchi et al. (2023), τ_t is interpreted as a transfer.

To see this, rearrange the fiscal policy rule as follows.

$$\begin{aligned}
\tau_t &= \gamma^M \left(sb_{t-1} - sb^F_{t-1}\right) + \gamma^F sb^F_{t-1} + u^M_{\tau,t} + u^F_{\tau,t} \\
&= \gamma^M sb_{t-1} - \gamma^M \Bigg(\underbrace{\frac{\gamma^M - \gamma^F}{\gamma^M} sb^F_{t-1} + \frac{1}{\gamma^M} u^F_{\tau,t}}_{\equiv sb^*_t} \Bigg) + u^M_{\tau,t} \\
&= \gamma^M (sb_{t-1} - sb^*_t) + u^M_{\tau,t}.
\end{aligned}$$

Similarly, the monetary policy rule can be arranged as follows.

$$\begin{aligned}
R_t &= \phi^M \left(\pi_t - \pi^F_t\right) + \phi^F \pi^F_t \\
&= \phi^M \pi_t - \phi^M \Bigg(\underbrace{\frac{\phi^M - \phi^F}{\phi^M} \pi^F_t}_{\equiv \pi^*_t} \Bigg) \\
&= \phi^M (\pi_t - \pi^*_t).
\end{aligned}$$

Instead of assuming a funded fiscal shock, $u^M_{\tau,t}$, and an unfunded fiscal shock, $u^F_{\tau,t}$, separately, Smets and Wouters (2024) introduce the following structure: $u^M_{\tau,t} = \lambda u^\tau_t$ and $u^F_{\tau,t} = (1-\lambda)u^\tau_t$, and interpret the parameter λ as the degree of fiscal backing.[3] In our paper, rather than assuming that debt and inflation targets respond to the shadow Regime F economy as in Equations (5.3) and (5.4), we assume an exogenous ARMA(1,1) process for the targets.[4]

Although exogenous policy target shocks may not be ideal from both modeling and estimation perspectives — as monetary and fiscal authorities adjust policy targets intentionally, and the targets are not directly observed — this assumption is not overly restrictive. From the perspective of economic agents within the model, the public remains unaware of when or how policy targets will shift, making these changes effectively function as shocks. To estimate the model, we use rolling data windows to construct target observables, incorporating future data that already contains some information about how targets respond to economic conditions.

Exogenous target shocks also provide a more realistic representation of the timing of financing

[3]This setup does not nest the framework of Bianchi et al. (2023). In Smets and Wouters (2024), the funded and unfunded shocks are perfectly correlated. The extreme cases, $\lambda = 1$ or $\lambda = 0$, imply that only funded or unfunded shocks exist, respectively. However, in Bianchi et al. (2023), these two shocks always coexist.

[4]The target shocks both follow an AR(1) process.

decisions. From a modeling perspective, in both Bianchi et al. (2023) and Smets and Wouters (2024), whether a fiscal shock is funded or unfunded is determined *ex ante*, with agents in the economy fully aware of the economic structure, including the share of fiscal shocks that are funded versus unfunded. In practice, however, the decision to finance deficits through debt revaluation and inflation (unfunded) or through future surpluses (funded) is often made *ex post*, after deficits occur, and is influenced by subsequent monetary and fiscal policy. Exogenous targets allow for this flexibility. For example, a positive target shock can occur *after* a fiscal shock has increased debt, resulting in some of the existing debt becoming unfunded.

Another advantage of modeling inflation and debt target shocks is that it allows the inflation and debt targets to move either in the same or opposite directions, providing flexibility for temporary uncoordinated monetary and fiscal policies. For instance, a combination of a negative inflation target shock and a positive debt policy shock creates conditions *as if* both monetary and fiscal policies became more 'active.' Since both shocks are stationary, this regime is inherently short-lived, similar to the setups in Davig and Leeper (2007) and Bianchi and Melosi (2019), which account for temporary conflicts between monetary and fiscal policy.

Finally, imposing some endogenous structure on the target shocks is equivalent to imposing cross-equation restrictions on the stochastic shocks, effectively pinning down the degree of fiscal backing in the model with rational expectations. However, with target shocks, the degree of fiscal backing naturally fluctuates over time, as it is shaped by the realizations of these shocks. For example, when both target shocks are positive, there is less fiscal backing. Conversely, if a positive inflation target shock is counterbalanced by a large negative debt target shock, there is more fiscal backing.

References

Bianchi, F., Faccini, R., Melosi, L., 2023. A fiscal theory of persistent trend inflation. Quarterly Journal of Economics 138, 2127–2179.

Bianchi, F., Melosi, L., 2019. The dire effects of the lack of monetary and fiscal coordination. Journal of Monetary Economics 104, 1–22.

Davig, T., Leeper, E.M., 2007. Generalizing the Taylor principle. American Economic Review 97, 607–635.

Davig, T., Leeper, E.M., 2011. Monetary-fiscal policy interactions and fiscal stimulus. European Economic Review 55, 211–227.

Dupor, B., Li, R., 2015. The expected inflation channel of government spending in the postwar U.S. European Economic Review 74, 36–56.

Galí, J., 2020. The effects of a money-financed fiscal stimulus. Journal of Monetary Economics 115, 1–19.

Kim, S., 2003. Structural shocks and the fiscal theory of the price level in the sticky price model. Macroeconomic Dynamics 7, 759–782.

Leeper, E.M., Traum, N., Walker, T.B., 2017. Clearing up the fiscal multiplier morass: Prior and posterior analysis. American Economic Review 107, 2409–2454.

Mao, R., Shen, W., Yang, S.C.S., 2023. Uncertain policy regimes and government spending effects. European Economic Review 152, 104330.

Smets, F., Wouters, R., 2024. Fiscal backing, inflation and US business cycles. Manuscript, European Central Bank, University of Ghent and CEPR, and National Bank of Belgium.