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

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Our Paper: What role did fiscal policy play
in shaping U.S. inflation before the pandemic?

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  - Under the Fiscal Theory of the Price Level (FTPL, or Regime F), real debt is stabilized through price level adjustments instead of fiscal surpluses.
    - Fiscal policy is a significant driving force for inflation in the U.S. E.g., Sims (2011&2024); Bianchi, Faccini, and Melosi (2023)

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     - Stochastic targets are realistic U.S. debt and inflation

       $\Rightarrow$ In U.S., no announced debt target

       $\Rightarrow$ Inflation target announced in 2012 but monetary policy framework subject to change, e.g., Average Inflation Targeting (Powell, 2020)

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    3. Transfer shocks have a persistent and positive contribution to inflation throughout the sample, similar to Bianchi, Faccini, Melosi (2023), but with much smaller magnitudes.
3. Positive inflation target shocks significantly contributed to the inflation surge in the 1970s. Negative inflation target shocks contributed to the successful disinflation in the 1980s.

The Model

The Model Overview

- A standard New Keynesian (NK) model for evaluating monetary and fiscal policy, with a rich fiscal specification. (Yang and Traum, 2015; Leeper, Traum, and Walker, 2017)
  - Sticky prices and wages
  - Households: savers and non-savers; habit formation
  - Government consumption in utility function
  - Investment adjustment cost
  - Monetary and fiscal rules with feedback
  - Various fiscal instruments: government consumption, government investment, transfers, labor tax, capital tax
  - Time-varying debt and inflation targets

Stochastic Policy Targets and Policy Regimes

A Simplified Policy Block Example

$$\text{Monetary Policy : Interest Rate} = \phi_\pi(\text{Inflation - Inflation Target})$$
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More details

- Central bank controls nominal interest rate to fight inflation.

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- Time-invariant targets $\Rightarrow$ Conventional regime M (Gali, 2008)
  - Policy target shocks allow temporary deviations from regime M.

Estimation

Calibration

Parameter	Value	Notes
β, quarterly discount factor	0.99	annual real interest rate of 4%
α, capital income share of output	0.33	standard in literature
δ, depreciation rate of private capital	0.025	annual depreciation rate of 10%, LTW(2017)
δ^G, depreciation rate of public capital	0.02	annual depreciation rate of 8%, LTW(2017)
η^p, steady-state price markup	0.14	14% price markup, LTW(2017)
η^w, steady-state wage markup	0.14	14% wage markup, LTW(2017)
$s^{gc} \equiv \frac{G^C}{Y}$	0.077	federal G^C-to-model output average
$s^{gi} \equiv \frac{G^I}{Y}$	0.027	federal G^I-to-model output average
$s^b \equiv \frac{B}{Y}$	1.548	federal B-to-model output average
α^G, output elasticity on public capital	0.05	Traum and Yang(2015), LTW(2017)
τ^l, labor tax rate	0.194	federal labor tax rate average
τ^k, capital tax rate	0.195	federal capital tax rate average
τ^c, consumption tax rate	0.0194	federal consumption tax rate average

Table: Baseline calibration and steady-state fiscal values

Data

- We estimate the model with U.S. quarterly data from 1960Q1 to 2019Q4 using Bayesian methods.

Observables	Structural shocks
Private consumption	ε^a, technology
Private investment	ε^b, preference
Real wage	ε^i, investment
Government consumption	ε^w, wage markup
Government investment	ε^p, price markup
Capital tax revenues	ε^{GC}, government consumption
Labor tax revenues	ε^{GI}, government investment
Transfers	ε^Z, transfer
Hours worked	ε^k, capital tax rate
Inflation	ε^l, labor tax rate
Federal funds rate	ε^R, monetary policy
Debt gaps	ε^{sb*}, debt target
Inflation gaps	$\varepsilon^{\pi*}$, inflation target

- Gaps = Actual data - Targets

Data - Measuring Inflation and Debt Targets

- Inflation and debt targets are not directly observed. U.S. debt and inflation
  - Inflation target not explicitly announced until 2012, also subject to change, e.g., AIT
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- Treat targets as observables and proxy them with moving averages (MA) of actual data.
  - MA components meant to capture the low frequency movements of the variable.
  - Consistent with the literature on trend inflation. (E.g., Stock and Watson, 2007; Cogley, Primiceri and Sargent, 2010; Chan, Koop and Potter, 2013)
  - *"In general equilibrium models, trend inflation is typically pinned down by a central bank's long-run target."* (Cogley, Primiceri and Sargent, 2010)

Data - Measuring Inflation and Debt Targets (Cont'd)

- Baseline case: Quarter t target = MA from Quarter $t-3$ to $t+16$
  - Inflation: the GDP implicit price deflator
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- Uncertainty in measuring policy targets $\Rightarrow$ sensitivity analysis
  1. Extracted trend inflation/debt following Chan, Koop and Potter (2013).
  2. Alternative rolling windows, ranging from fully forward-looking targets (Quarter $t+1$ to $t+20$) and fully backward-looking targets (Quarter $t-20$ to $t-1$)
  3. Alternative inflation measure: PCE and core PCE inflation, the Fed's preferred inflation measure

Prior and Posterior for Structural Parameters

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	$[0.053, 0.187]$

Note: B, G, N, U and IG are beta, gamma, normal, uniform, and inverse gamma distributions.

- Largely consistent with the literature
- $\omega_G < 0 \Rightarrow$ Public and private consumption are complements

Prior and Posterior for Monetary Parameters

Parameters	**Prior**	**Posterior**	
		Mean	90% Interval
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	$[0.670, 0.785]$

- Inflation target highly persistent with an AR coefficient of 0.994.
- Our ϕ_π posterior: 1.364 (> 1)
  - Leeper, Traum, and Walker(2017): 0.9, 90% CI [0.74, 1.6]
  - Smets and Wouters (2024): mode 1.75, 90% CI [1.51, 1.98]
  - Bianchi, Faccini, and Melosi (2023): mode 2.06 and 90% CI [1.94, 2.20]

  $\Rightarrow$ How we model policy regimes can influence the inference of policy regime parameters

Prior and Posterior for Fiscal Parameters

Parameters	**Prior**	**Posterior**	
		Mean	90% Interval
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 output gap	$G(0.1, 0.02)$	0.098	$[0.065, 0.128]$
ϕ_k, capital tax response to output gap	$G(0.15, 0.1)$	0.038	$[0.003, 0.070]$
ϕ_l, labor tax response to output gap	$G(0.15, 0.1)$	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	$[0.196, 0.397]$

Estimation Results

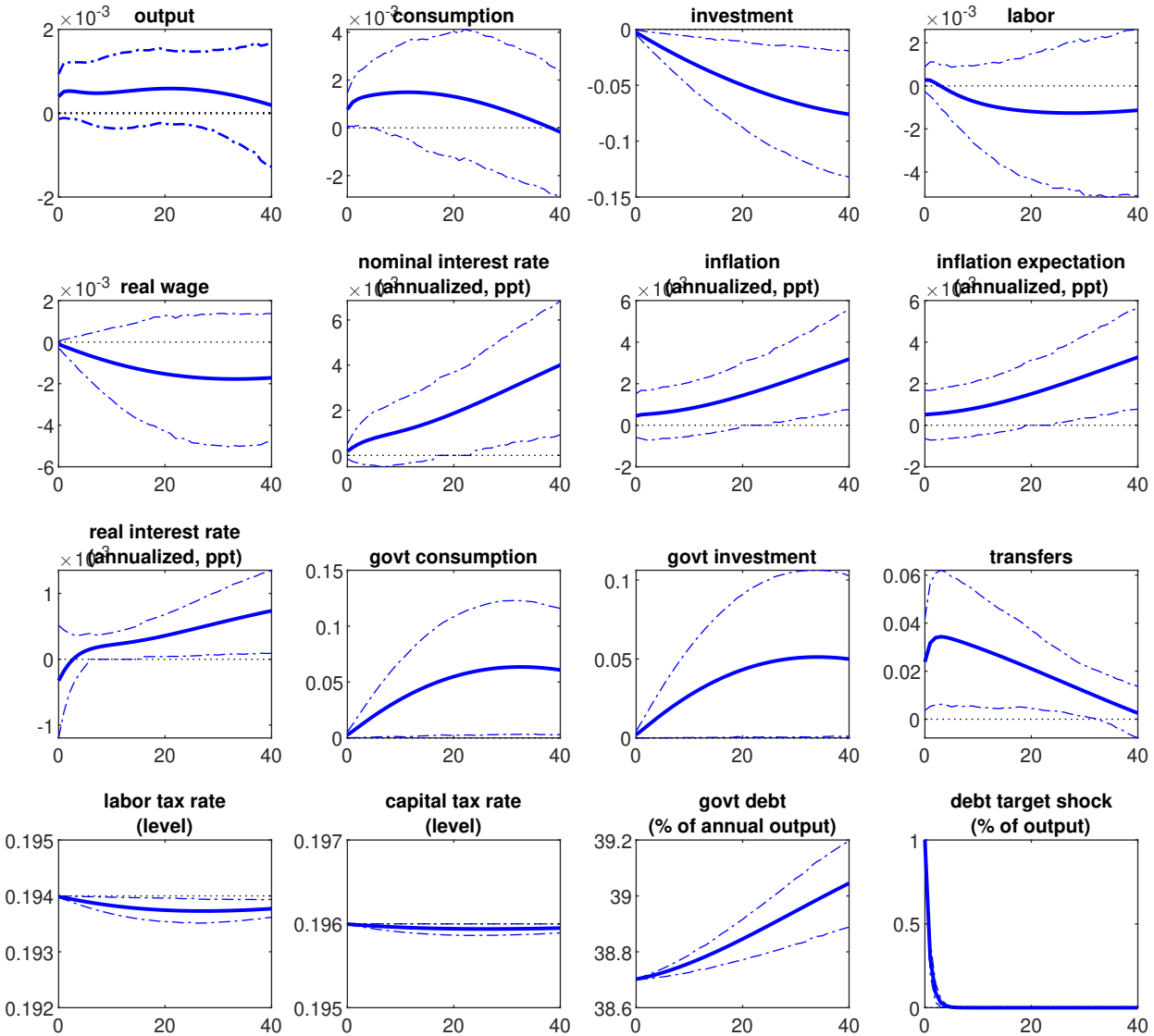
Estimation Results Roadmap

1. What are the effects of the debt target shocks?
2. What are the effects of the inflation target shocks?

   $\Rightarrow$ Posterior IRFs to policy target shocks
3. What are the roles of target shocks in driving inflation?
4. What are the roles of fiscal instruments in driving inflation?

   $\Rightarrow$ Historical decompositions

Posterior Impulse Responses to Debt Target Shock



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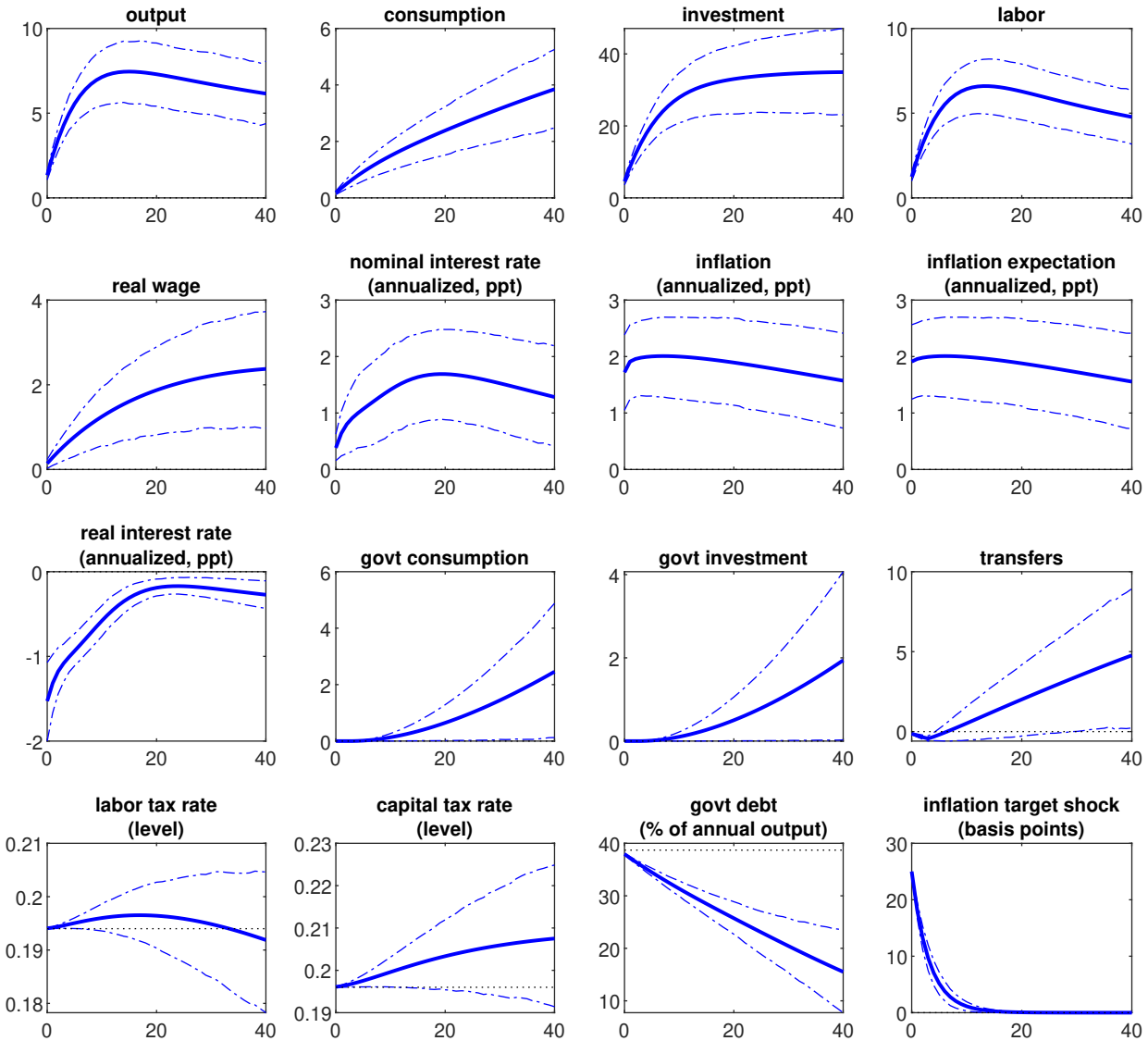

Summary on the Effects of the Target Shocks

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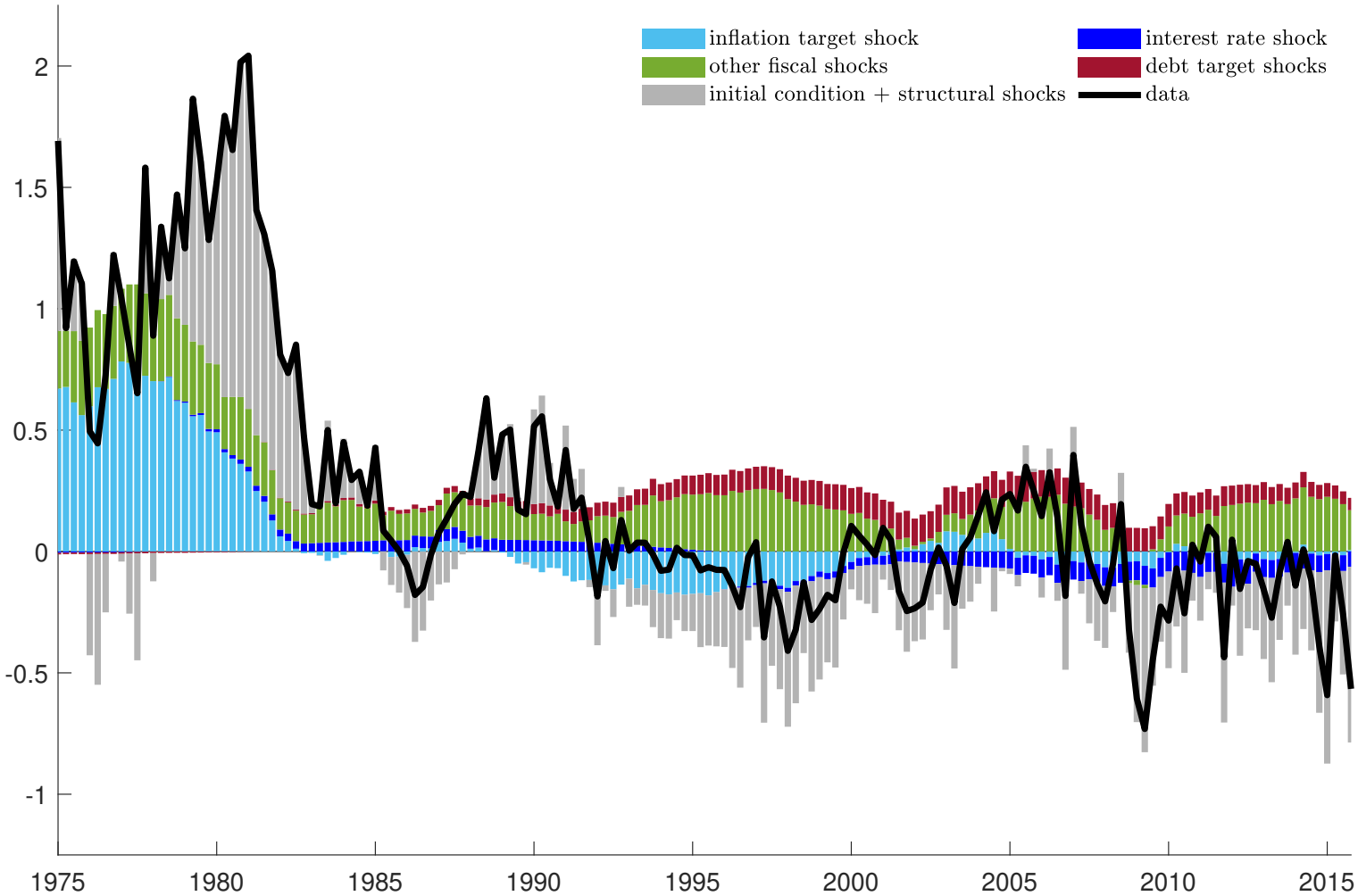
1. Both inflation and debt target shocks are expansionary.
2. The target shocks are highly persistent and their impact on inflation is also very persistent.
3. One important difference with the literature modeling both regimes using regime switching is that fiscal and monetary policy need not be coordinated.

Historical Decomposition of Inflation



- The Great Inflation: a combination of structural shocks, inflation target shocks,and non-debt target fiscal shocks.

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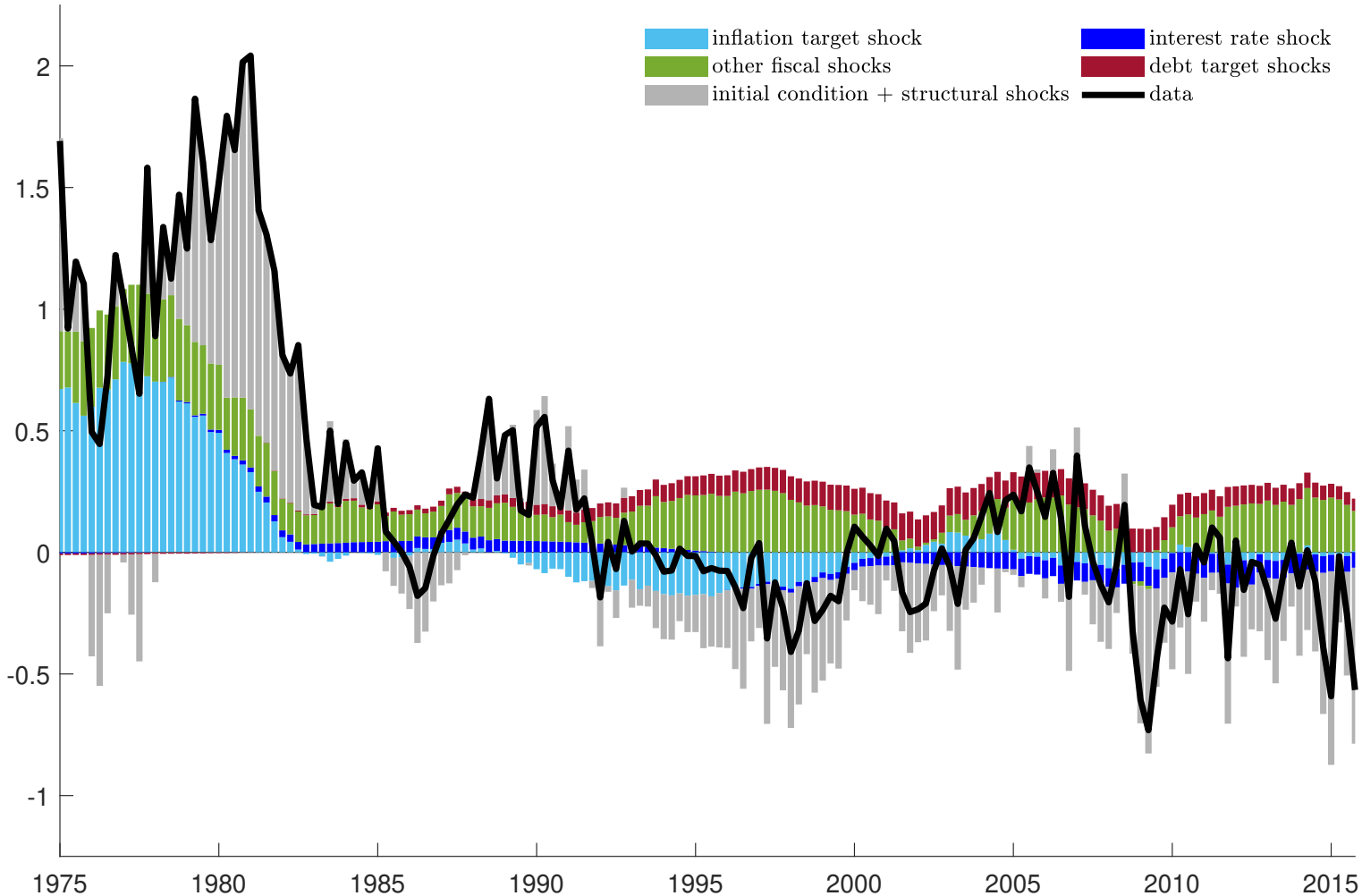

- Disinflation at the end of the 1970s: negative inflation target shocks. Implied shocks
- Consistent with literature attributing the success of disinflation in CB anchoring inflation expectations. E.g., Hazell et al(2022).

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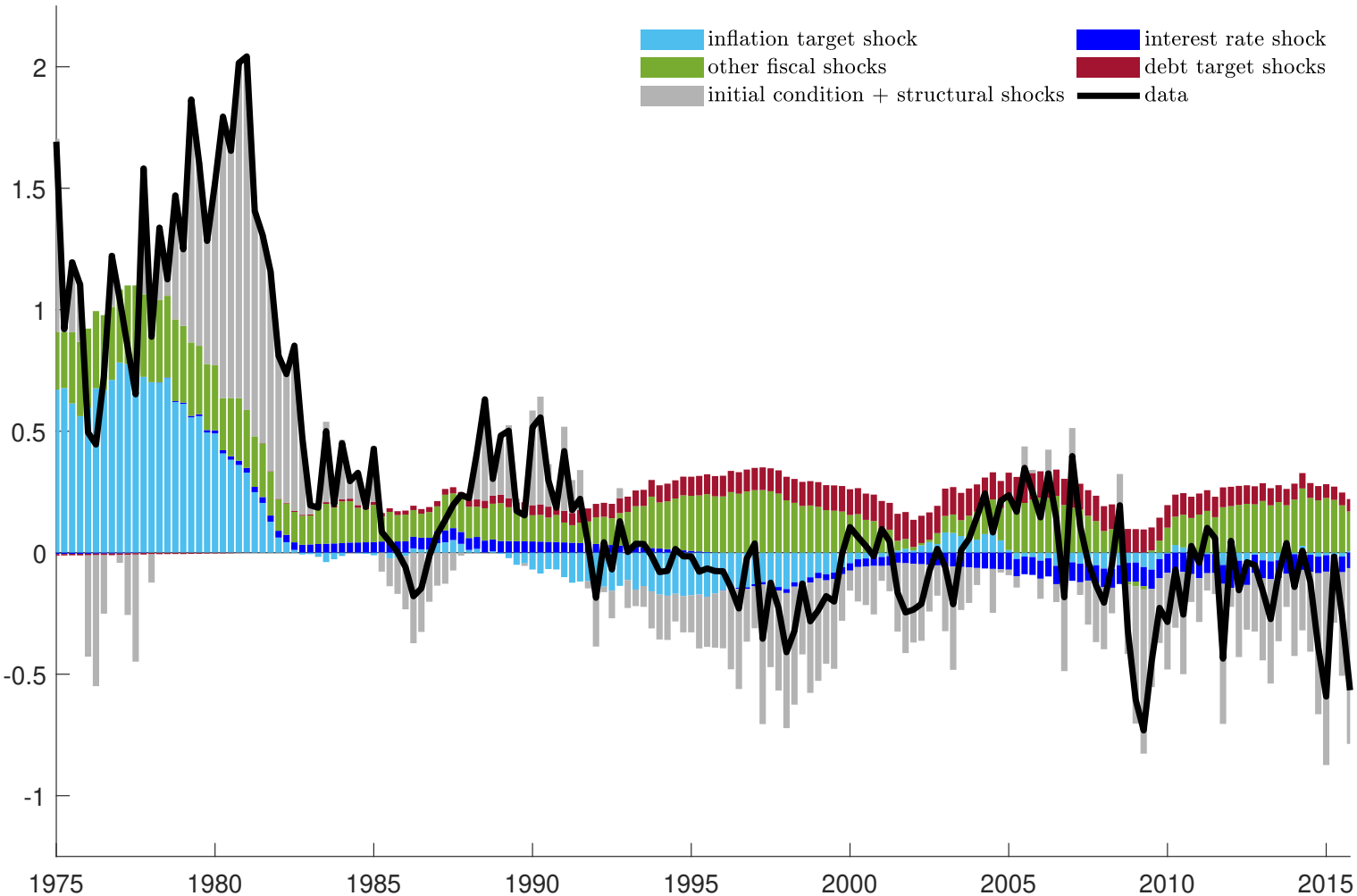

- Debt target shocks contributed to inflation from the mid-1980s onward.

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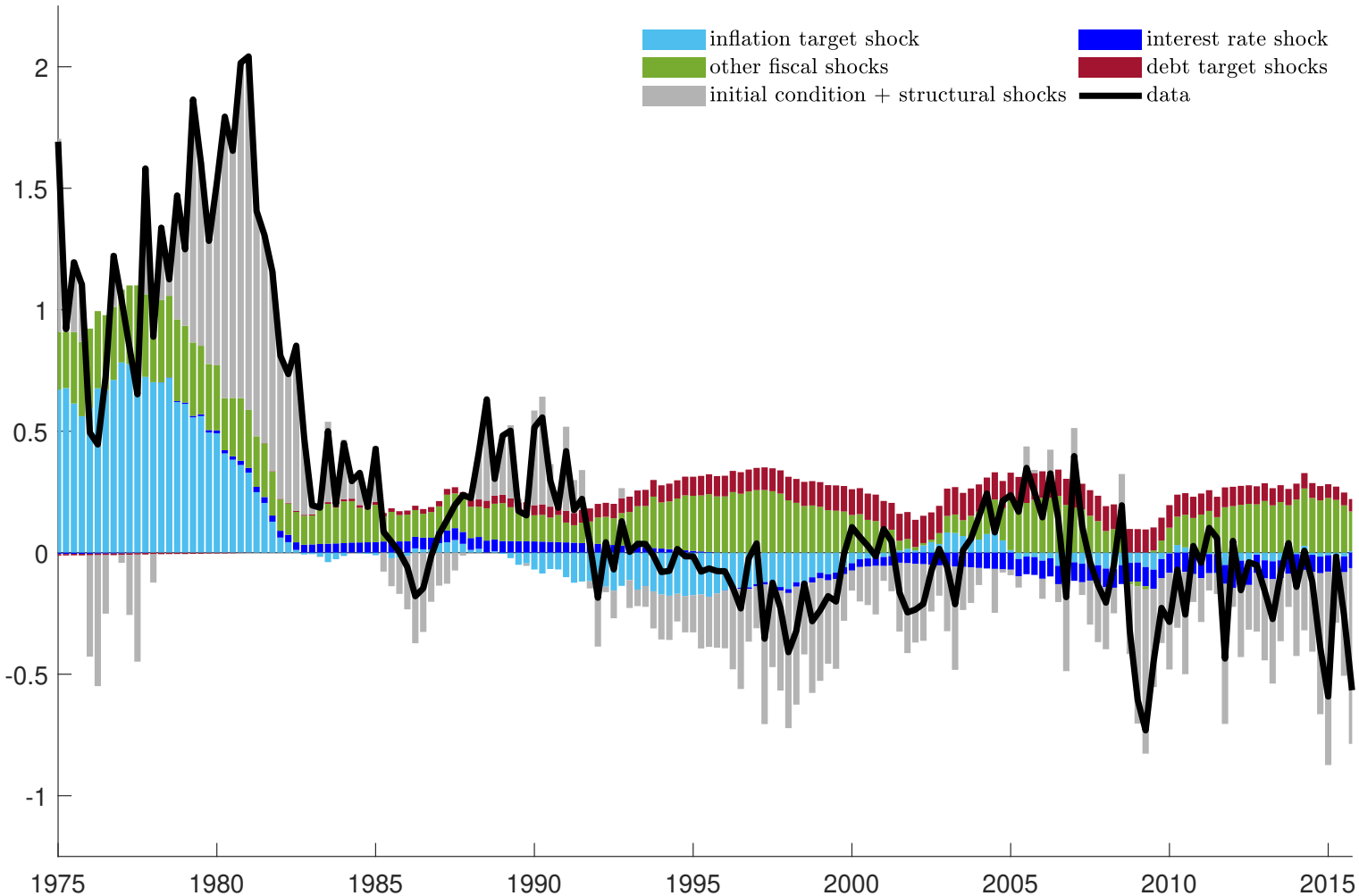
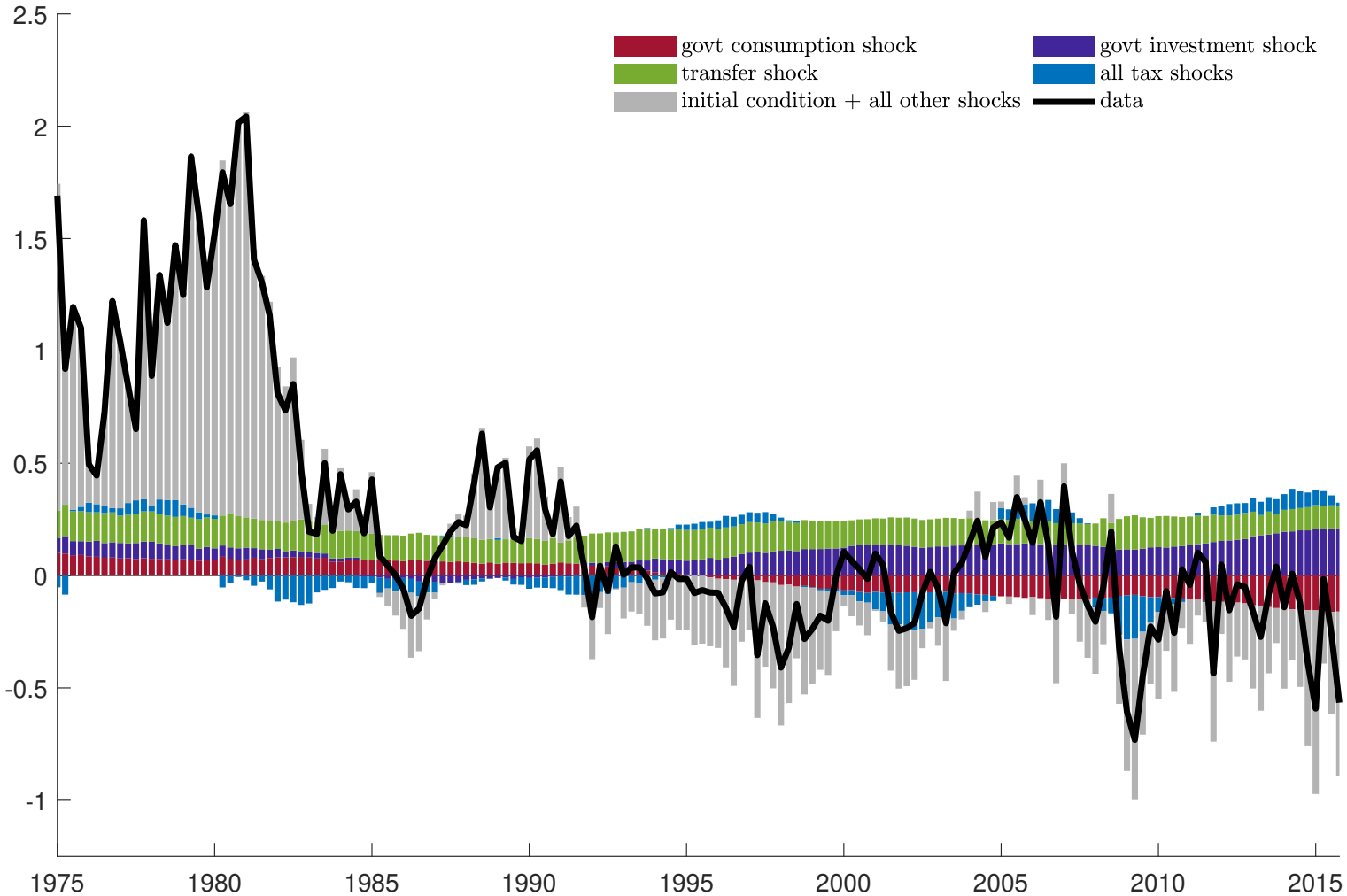


- Key finding: Fiscal policy played a non-trivial role in shaping inflation dynamics.

Historical Decomposition of Inflation: Fiscal Details



- Tax cuts do not always lead to higher inflation.

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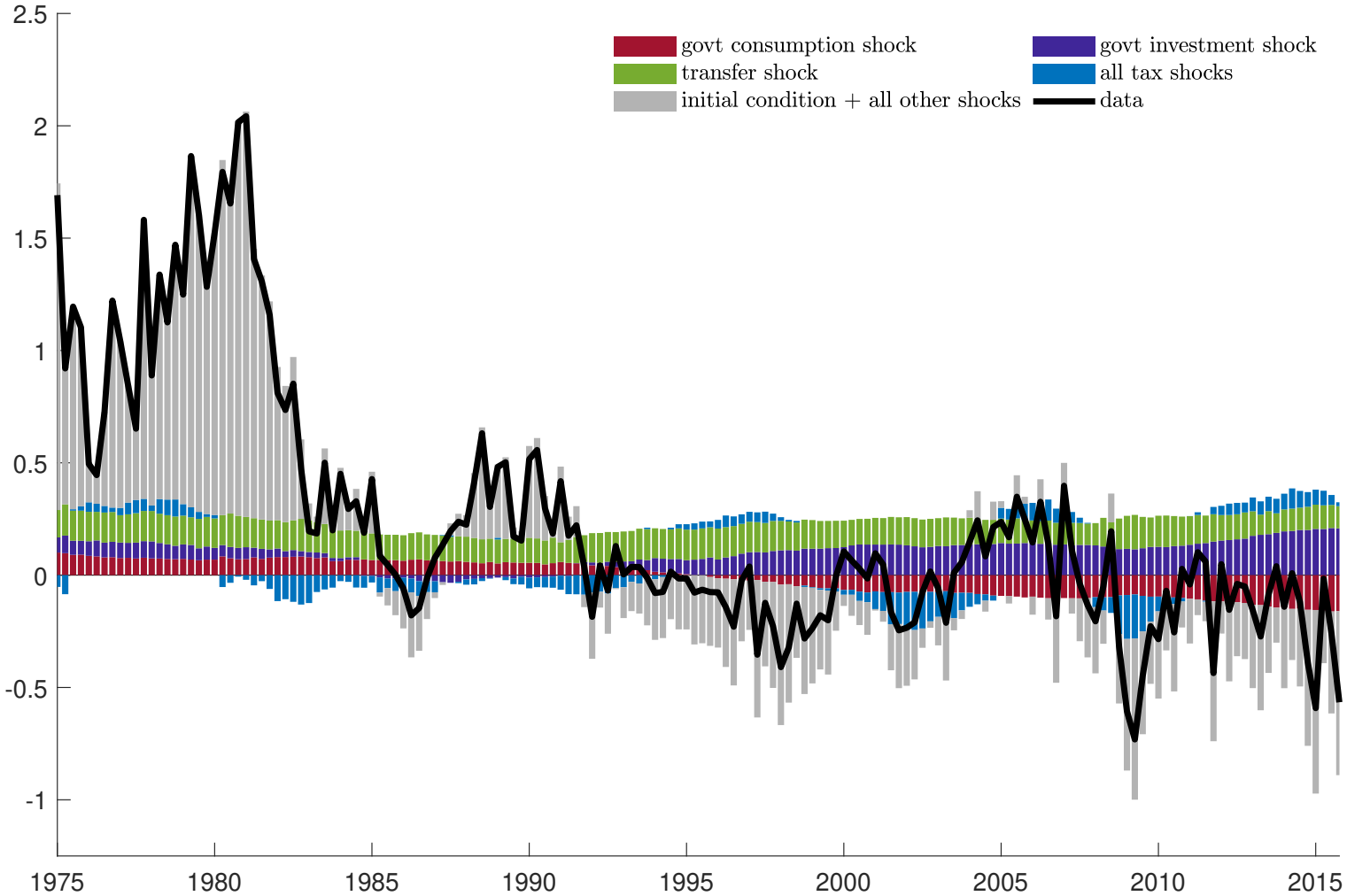

- 1975 - 1977, the tax cuts primarily provided tax credits and rebates for individuals ⇒ boosts demand and higher inflation.

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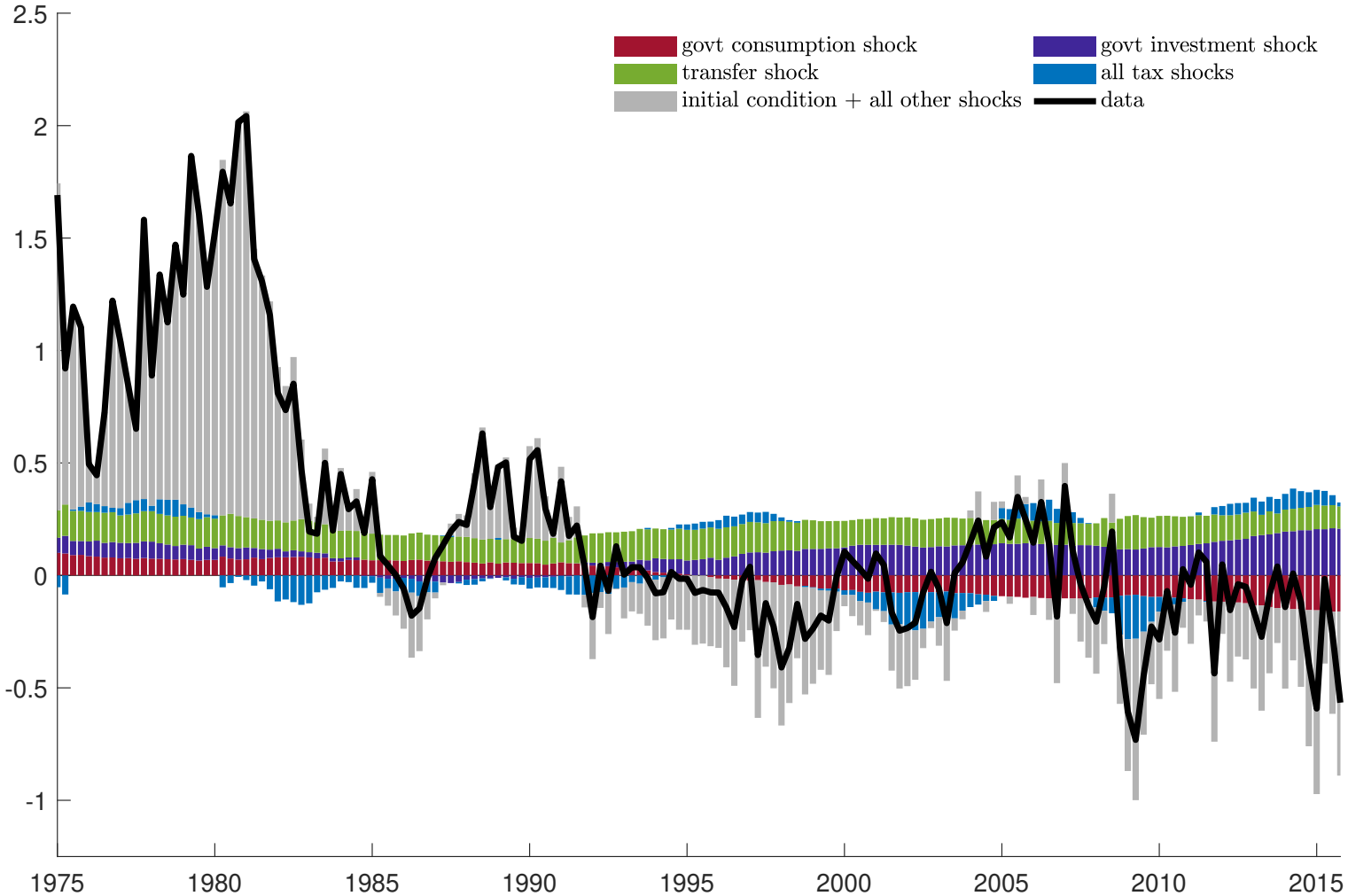
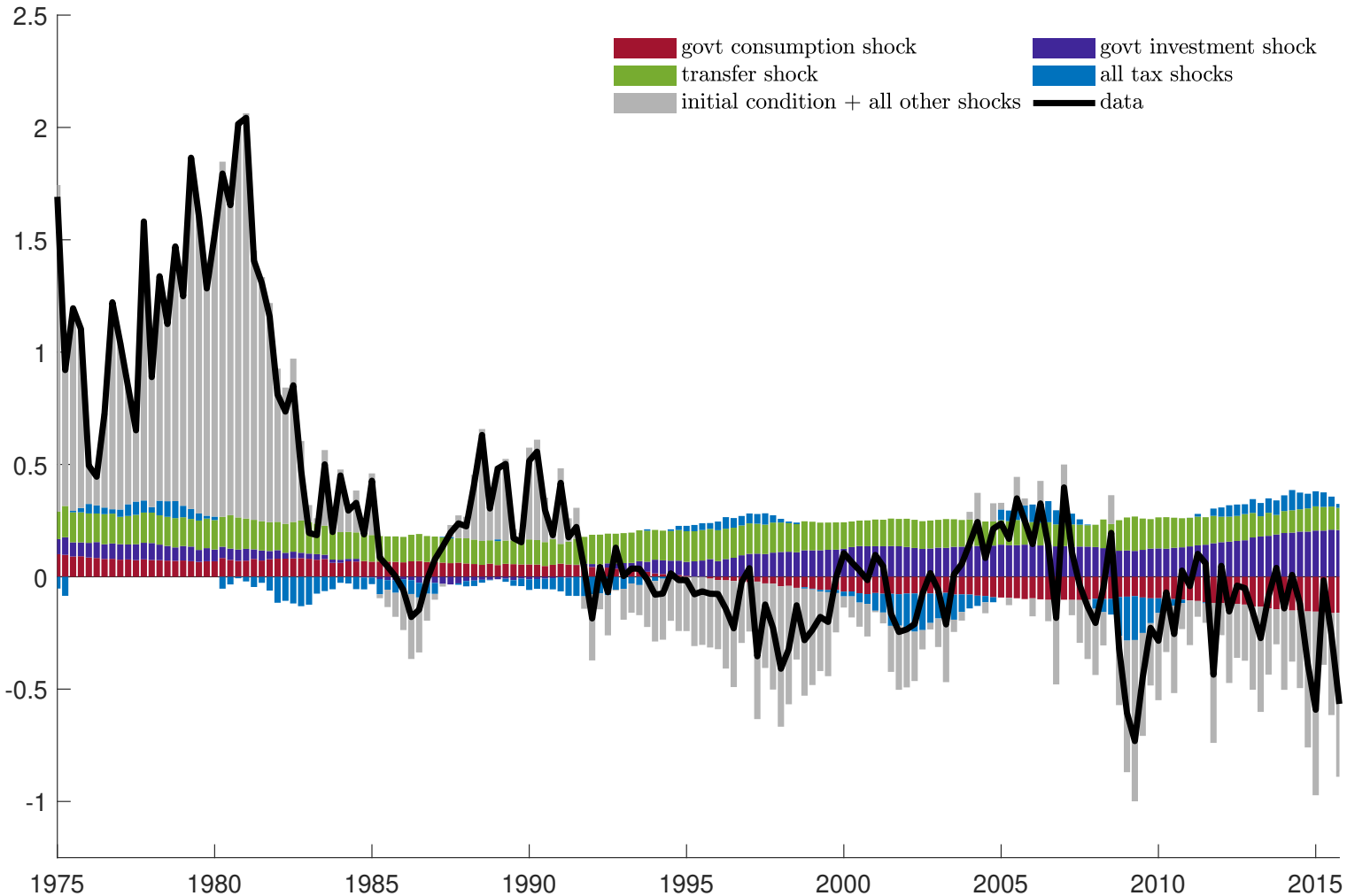


- The 1981, 1986 tax reforms cut individual and corporate income tax rates
- Had supply-side effects, stimulating production and ultimately lowering inflation.

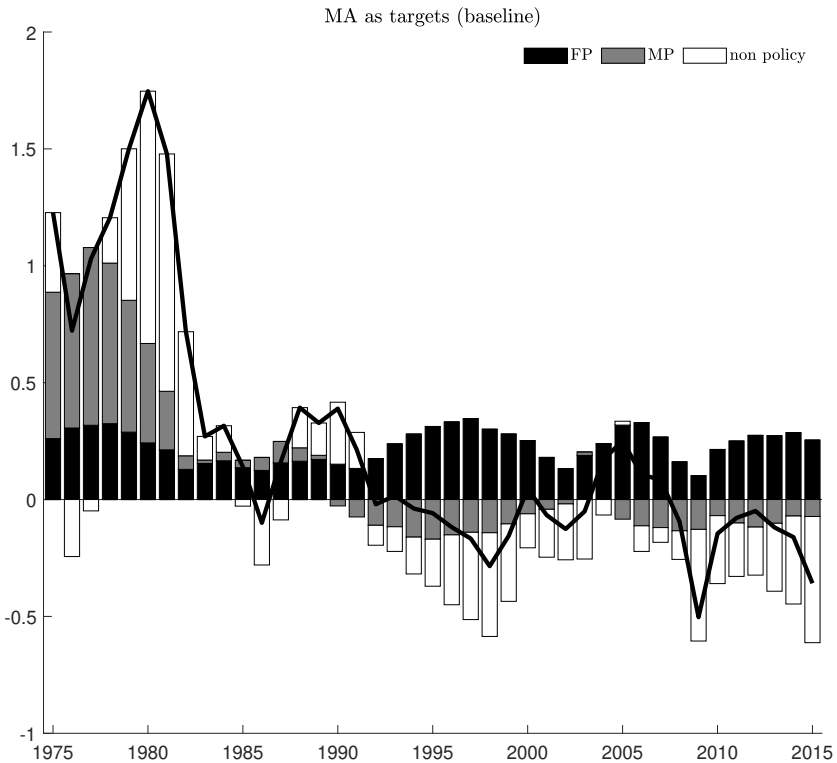
Historical Decomposition of Inflation: Fiscal Details

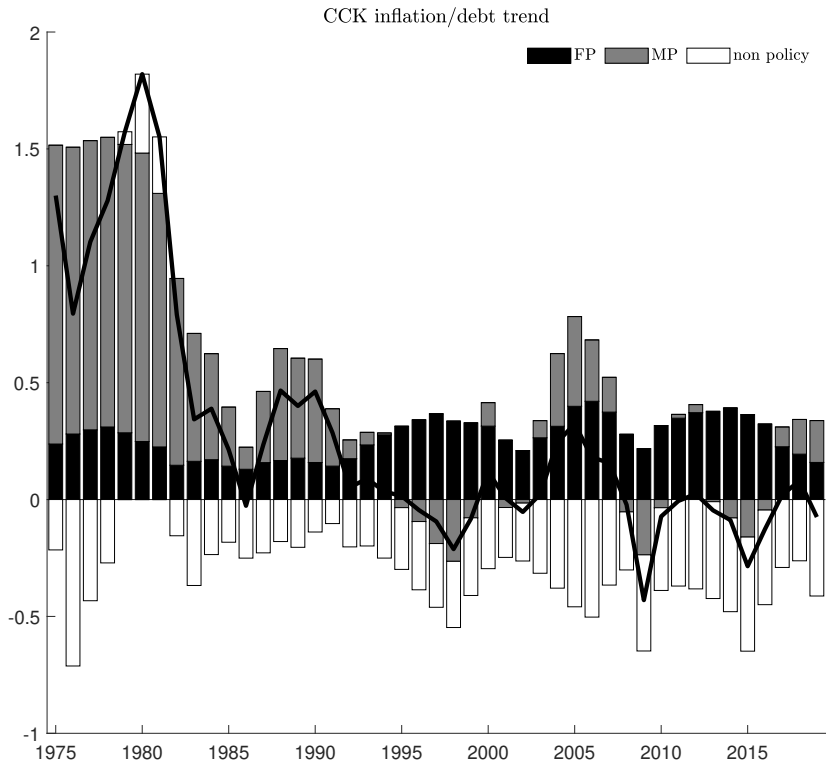


- Transfer shocks had a persistent and positive effect throughout the sample.
- Consistent with the sustained growth of the federal government's mandatory spending: 4.5% to 13.9% of GDP from 1965 to 2023. (CBO, 2024)

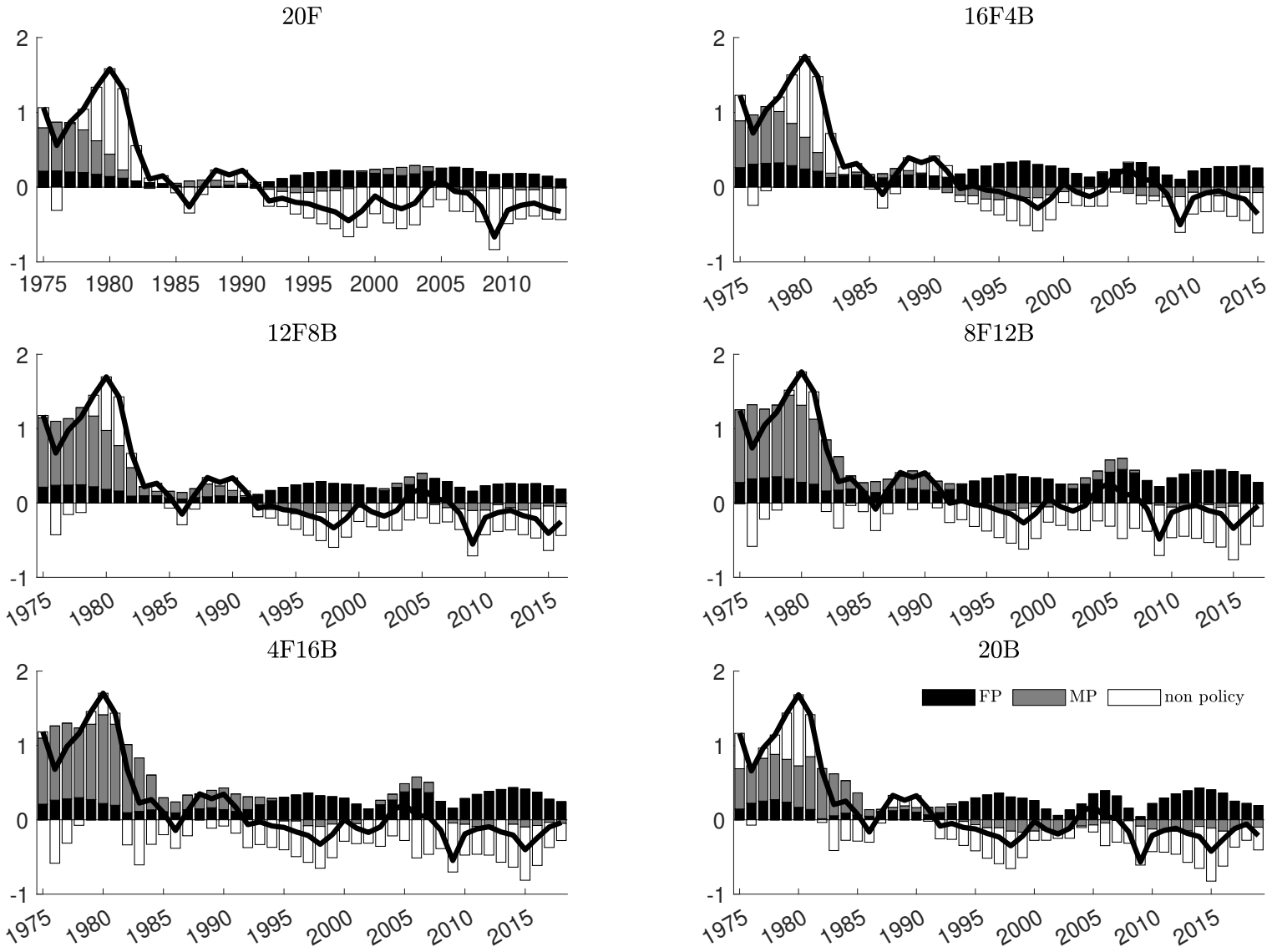
Sensitivity Analysis

Sensitivity Analysis I: CCK Trend as Targets

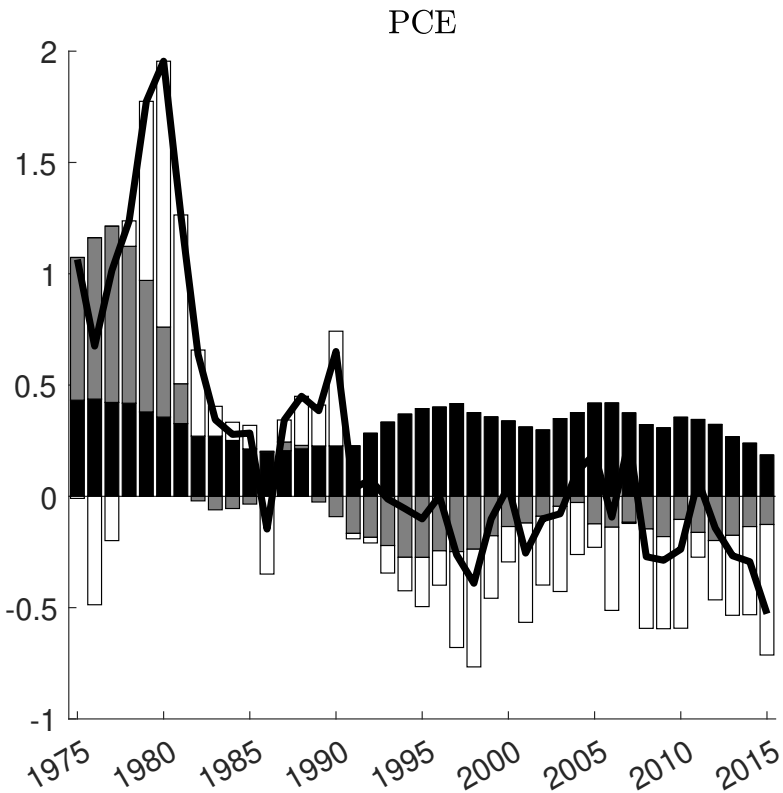


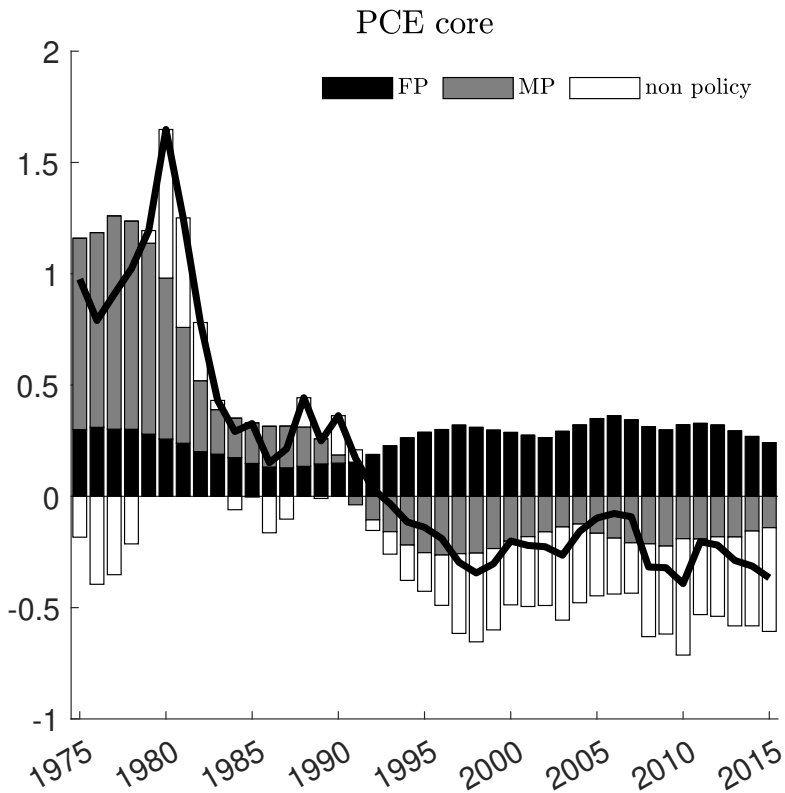


Sensitivity Analysis II: Alternative Rolling Window Policy Targets



Sensitivity Analysis III: PCE and PCE Core Inflation



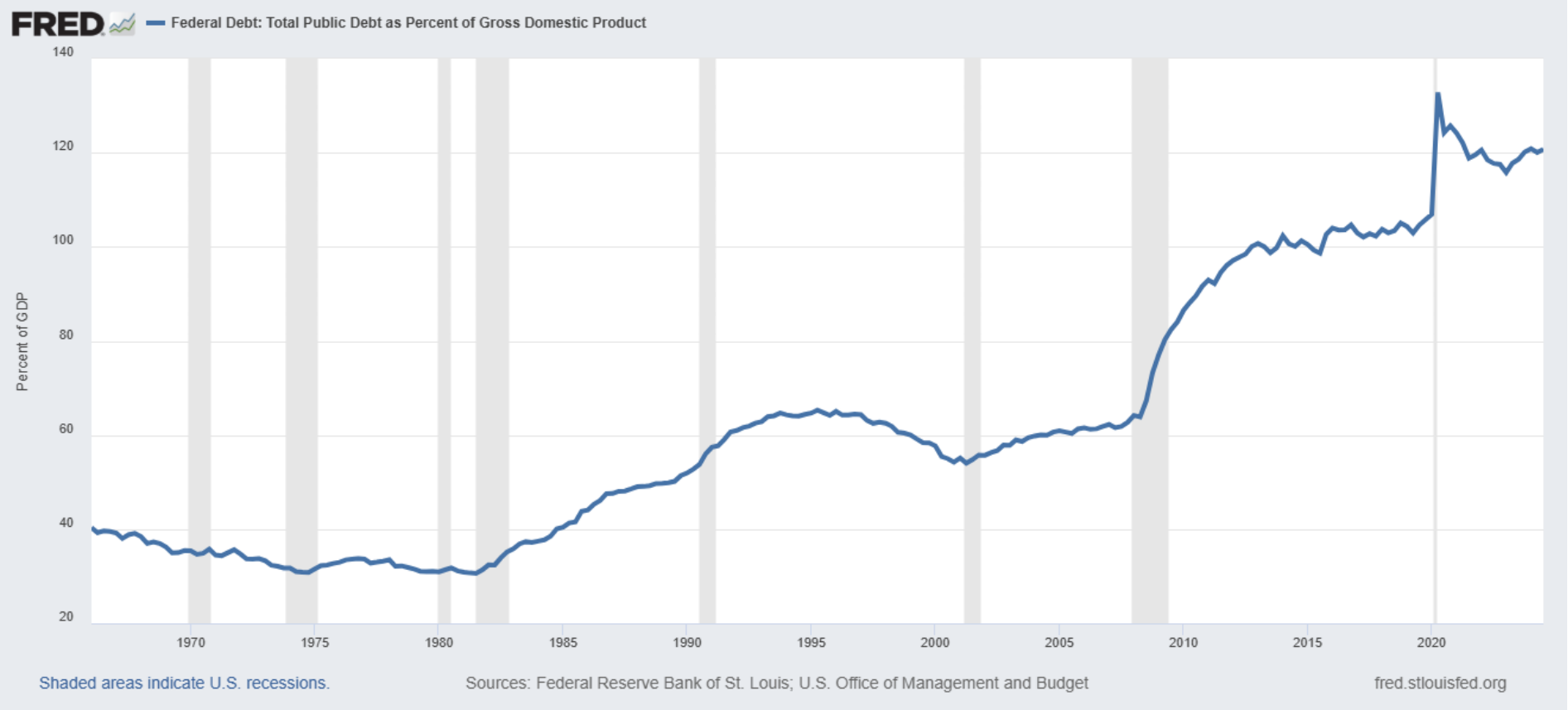


Conclusions

- We estimate a medium-scale DSGE model that accommodates deviation from regime M to study the role of fiscal policy in driving inflation.
- We find fiscal policy plays a nontrivial role in pre-pandemic U.S. inflation.
- 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.

Appendix

U.S. Federal Debt Held by Public (% of GDP)



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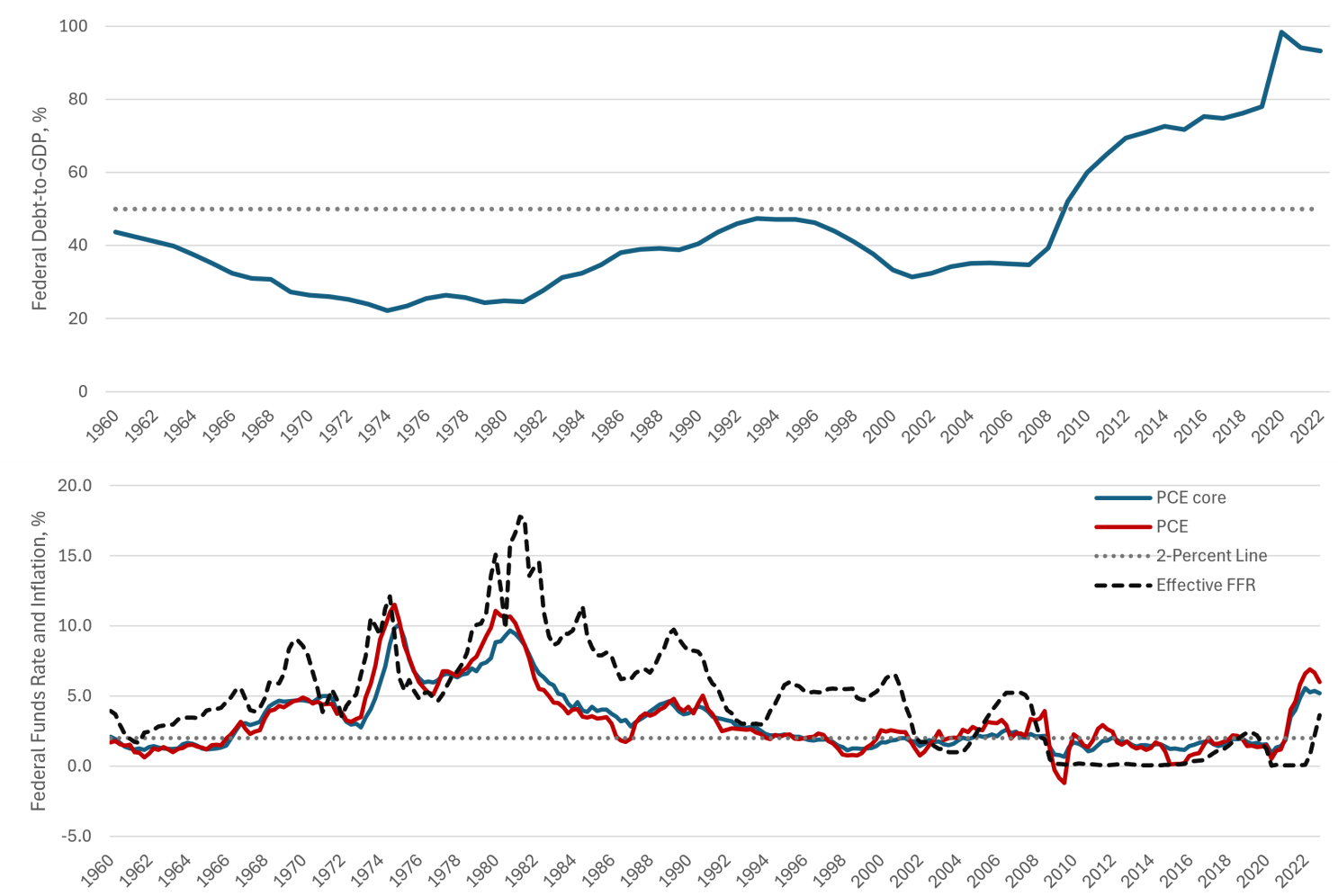
U.S. Debt and Inflation



Note:The federal debt refers to the gross federal debt held by the public. Inflation is calculated based on the annual change in Personal Consumption Expenditure (PCE) and core PCE.

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Monetary Policy

- Taylor-type Rule: Central bank (CB) adjusts nominal interest rate to fight inflation:

$$\hat{R}_t = \rho_R \hat{R}_{t-1} + (1-\rho_R)[\phi_\pi(\hat{\pi}_t - \hat{\pi}_t^*) + \phi_y \hat{Y}_t] + u_t^R$$

  - $\hat{R}_t$: nominal interest rate, set by the CB
  - $\hat{\pi}_t$: actual inflation rate
  - ϕ_π: Taylor rule coefficient $\Rightarrow$ how aggressive CB fights inflation
  - $\hat{\pi}_t^*$: exogenous inflation target and follows

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

anchored long-run inflation expectations

  - $\hat{Y}_t$: output gap
  - $u_t^{\pi^*}$ & u_t^R: inflation target shock and interest rate shock respectively

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

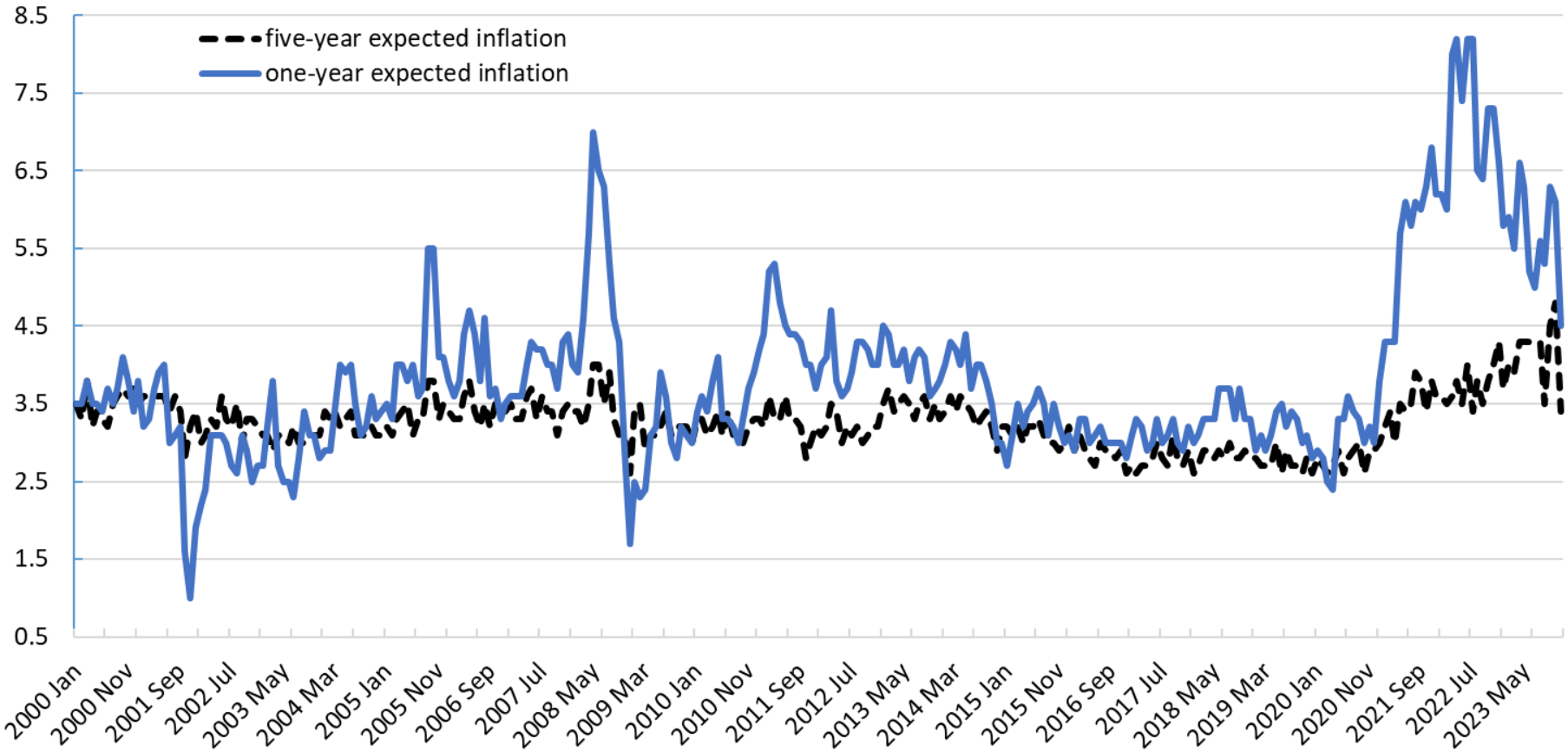
Fiscal Policy

- Fiscal authorities use fiscal instruments to stabilize debt
- Instruments include tax rates (capital and labor) and spending (gov't consumption, gov't investment, transfers)
- Tax rate rules:

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

  - $\iota \in \{l, k\}$
  - $\hat{sb}_{t-4}$: debt to GDP one-year ago (implementation lag of fiscal policy)
  - $\hat{sb}_t^*$: debt target; similar to the inflation target, $\hat{\pi}_t^*$
  - $\hat{Y}_t$: output gap
  - ϕ_{ι}: capture the cyclicality of fiscal policy
  - $\varepsilon_t^{\iota} \sim$ i.i.d. $N(0, \sigma_{\iota}^2)$: tax shock Back

Anchored Long-run Inflation Expectations



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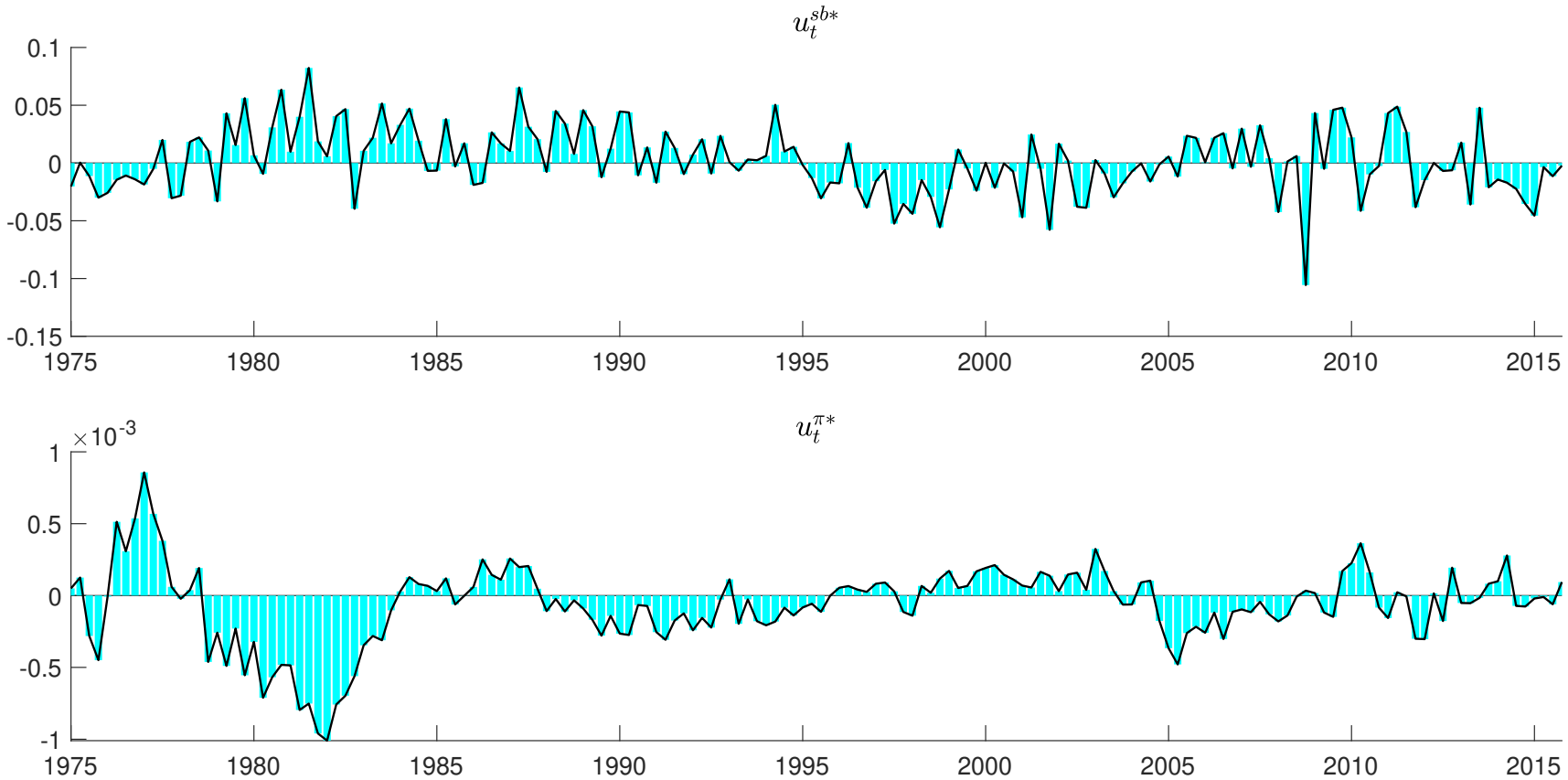
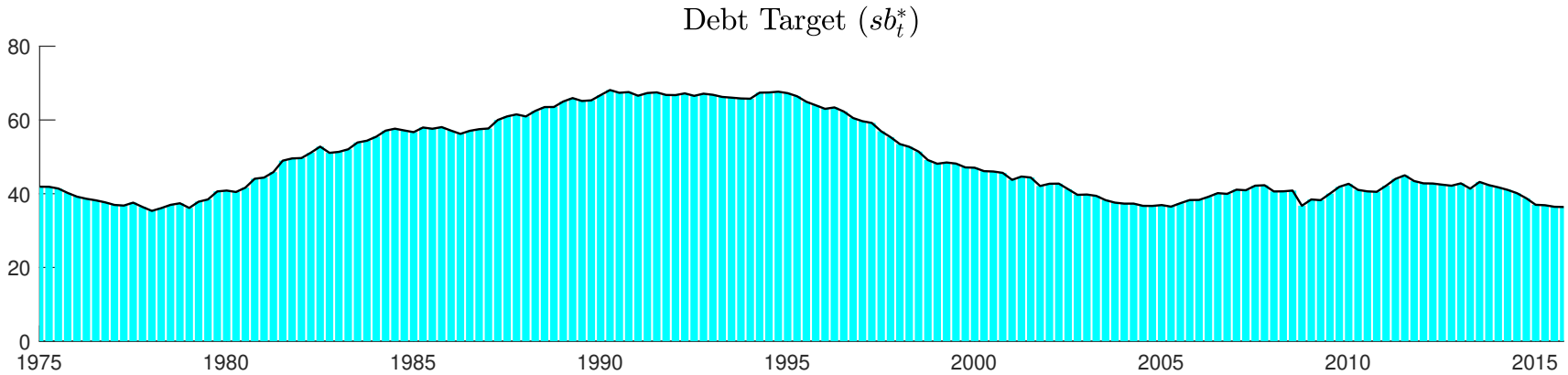
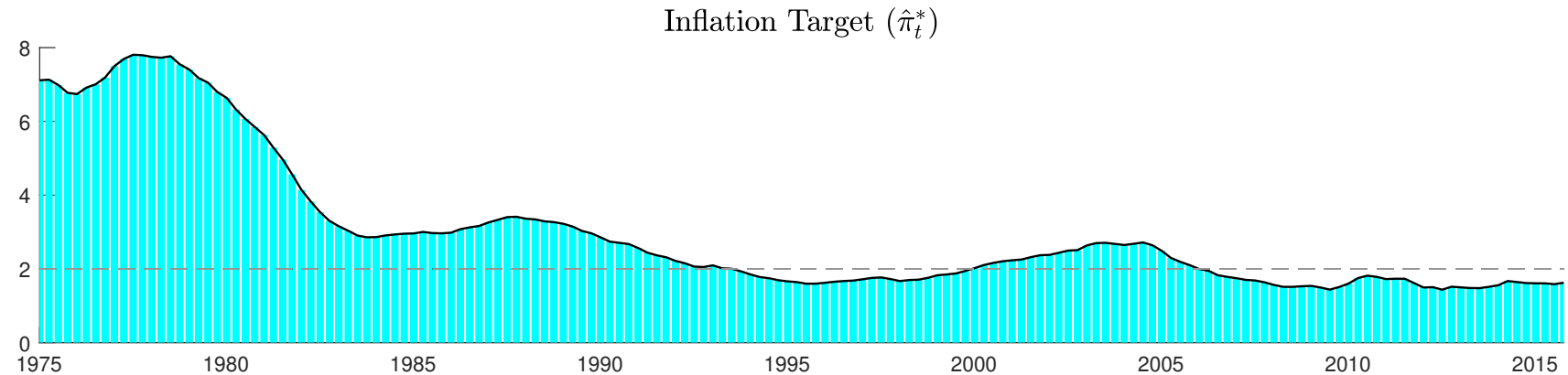
Model-implied Policy Target Shocks



- The implied shocks can roughly capture the major shifts in the federal government's attitudes toward debt and monetary policy stance.
- Model-implied Policy Target Levels Back

Model-implied Policy Target Levels





Model-implied Policy Target Shocks