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Fiscal Policy in a Permanent Liquidity Trap: Evidence from Japan*

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Abstract

We consider a medium-scale macroeconomic model where the zero lower bound on interest rates remains binding permanently. We estimate the model for the Japanese economy, encompassing both active and passive fiscal policy scenarios. Our findings reveal a predominantly passive fiscal policy stance during the period spanning from 1995 to 2023. We compute fiscal multipliers for various policy instruments, showing that under the backdrop of passive fiscal policy: i) multipliers are lower than in an active fiscal policy regime; ii) government spending multipliers remain below one; iii) tax reductions can be associated with a decrease in output and inflation. A counterfactual analysis suggests that a more active fiscal policy would have resulted in a higher price level without increasing output volatility.

Keywords: permanent liquidity trap, indeterminacy, active and passive fiscal policy, fiscal multipliers, Japan

JEL classification: E52, E62, H63.

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1 Introduction

Over the past decades, a central question in macroeconomics has been how effective fiscal policy can be when nominal interest rates are constrained by the zero lower bound (ZLB). Following the Great Recession, theoretical and empirical contributions ((e.g., Christiano et al., 2011; Eggertsson, 2011; Woodford, 2011; Auerbach and Gorodnichenko, 2012, 2013)) emphasized that fiscal multipliers tend to be larger when the ZLB binds. Yet, most of this literature has focused on temporary liquidity traps. Much less is known about fiscal multipliers in the case of a permanent liquidity trap, where the ZLB ceases to be a short-lived constraint and instead becomes a long-run feature of the monetary stance.

This paper addresses this gap by studying fiscal multipliers under a permanent liquidity trap. Japan offers a unique and natural case study. Since the collapse of its asset price bubble in the early 1990s, Japan has experienced persistently low inflation, weak growth, and nominal interest rates at or near zero for more than two decades, that is, until 2023. Despite repeated fiscal stimulus packages and large public debt accumulation, inflation has remained subdued. This experience raises a central question: should Japan's persistent deflation be viewed solely as a monetary phenomenon, or does it also reflect the consequences of a predominantly passive fiscal policy stance? Our estimation sample ends in 2023 in order to discipline the model using Japanese data from the period during which inflation dynamics were primarily shaped by domestic monetary-fiscal interactions under a persistent liquidity trap. After 2023, inflationary pressures were largely driven by international cost shocks and global developments, which lie outside the scope of the theoretical mechanism analyzed in this paper.[1]

Among Japan's repeated attempts to escape stagnation, the most prominent was the Abenomics strategy launched in 2013. It rested on three pillars: (i) aggressive monetary easing, with the Bank of Japan implementing large-scale asset purchases to reduce borrowing costs and stimulate inflation; (ii) significant fiscal stimulus, including infrastructure spending, job creation programs, and transfers to households; and (iii) structural reforms aimed at raising productivity and long-term growth potential. Bold as they were, these measures did not succeed in durably lifting inflation. Figure 1 illustrates this potential disconnect: output growth remained subdued, inflation stayed near zero, interest rates were stuck at the ZLB, while government spending, deficits, and debt ratios all expanded.

To address this puzzle, we develop and estimate a medium-scale DSGE model for Japan in which the nominal interest rate is permanently constrained at the ZLB. Building on Smets and Wouters

[1] Restricting the sample ensures that the model is calibrated and estimated on a period consistent with its assumptions, avoiding structural breaks or foreign-driven shocks that could distort the identification of active versus passive fiscal regimes.

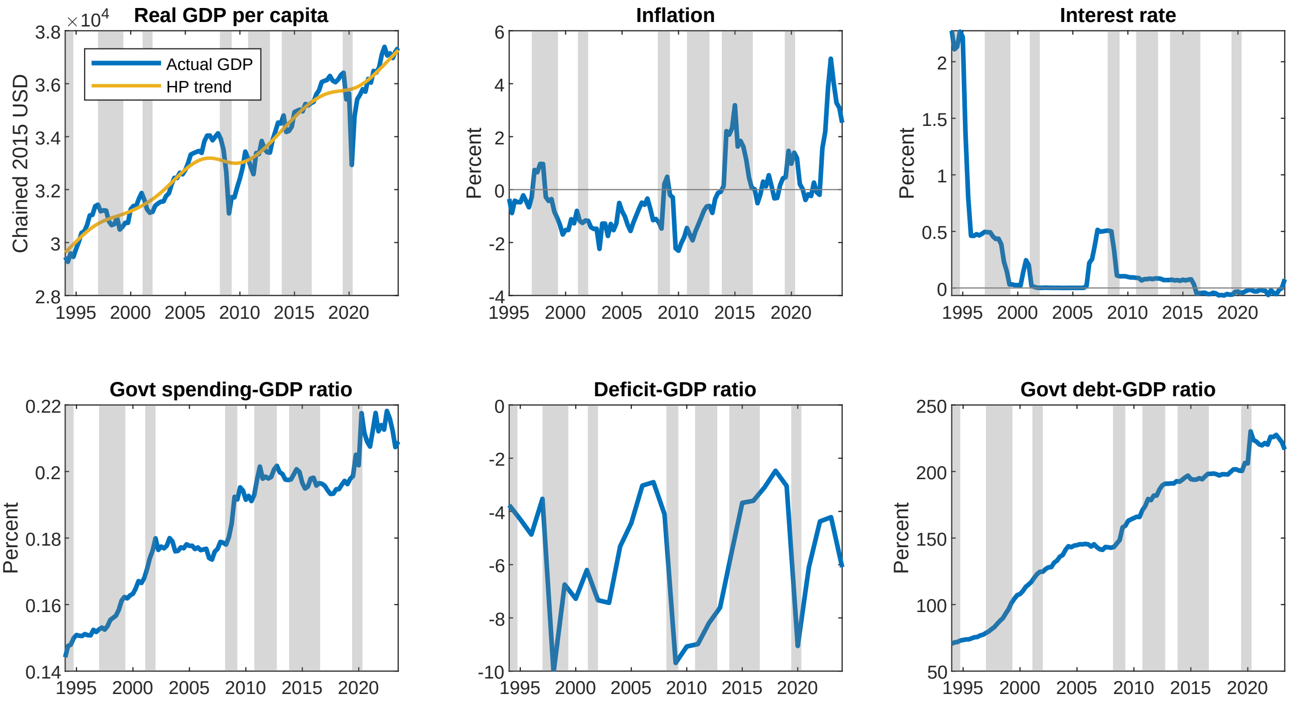

Figure 1: Japan data, 1995Q1-2024Q3

(2007), our framework incorporates a rich set of fiscal instruments, including government spending, transfers, and distortionary taxes, and allows for both active and passive fiscal policy regimes in the sense of Leeper (1991). Unlike most of the existing literature, which assumes monetary policy is active and fiscal policy passive, we focus on the opposite scenario: monetary policy is permanently passive, and the effects of fiscal instruments depend critically on whether fiscal policy is active or passive.

To achieve this, we rely on the recent advances in techniques for handling models with indeterminacy. In particular, we apply Bianchi and Nicolò (2021) methodology to Japan's economy as a prominent example of a permanent liquidity trap. This approach allows us to estimate a model where the ZLB is binding and fiscal policy can be either active or passive, providing insights into their respective effects on economic outcomes. Bianchi and Nicolò (2021) introduce a novel approach for solving and estimating linear rational expectations models that allows us to address both determinacy and indeterminacy. Their representation of indeterminate equilibria is equivalent to Lubik and Schorfheide (2003, 2004) and Farmer et al. (2015).

Our findings show that Japan's fiscal policy during 1995-2023 is best characterized as passive. Under this regime, government spending multipliers remain below one, and tax cuts can even be contractionary, reducing output and inflation. These results reflect the presence of indeterminacy and the influence of expectation-driven shocks, which can offset the stimulative effect of fiscal interventions and contribute to deflationary pressures. In contrast, under an active fiscal regime, multipliers are larger and positive: spending shocks have strong expansionary effects, while tax cuts raise both output and prices, consistent with the Fiscal Theory of the Price Level (FTPL). The estimated impulse responses highlight that fiscal expansions may even trigger deflation under passive fiscal policy, whereas they generate a sustained rise in inflation and demand under active fiscal policy. Robustness checks confirm the preference for the passive fiscal specification, even when alternative assumptions — such as zero correlation of shocks or a Taylor-type monetary rule — are introduced. Finally, our counterfactual simulations indicate that a shift toward an active fiscal stance would have raised the price level substantially, helping Japan escape deflation without affecting output volatility significantly. These results suggest that the predominance of a passive fiscal regime could help explain Japan's prolonged stagnation and weak inflation during its permanent liquidity trap.

Our findings are consistent with recent empirical evidence on Japans fiscal transmission at the zero lower bound. In particular, Miyamoto et al. (2018) show that government spending shocks have substantially stronger expansionary effects when monetary policy is constrained by the ZLB. Their results highlight the state-dependent nature of fiscal multipliers in Japan and reinforce the relevance of studying fiscal policy regimes in a prolonged liquidity trap.

Our results also contribute to the broader literature on monetary-fiscal policy interactions. Building on the seminal contribution by Lubik and Schorfheide (2004), Bhattarai et al. (2012, 2016) study U.S. policy regimes, showing how different monetary-fiscal combinations affect equilibrium determinacy and inflation dynamics. With a similar focus, Bhattarai et al. (2014) examine how changes in debt and inflation targets shape inflation outcomes. Our work also relates to Aruoba et al. (2018), Hirose (2020), and Cuba-Borda and Singh (2024), who estimate DSGE models for Japan under the ZLB constraint, but without examining the role of fiscal policy regimes. Finally, our results complement Beck-Friis and Willems (2017), who derive analytical fiscal multipliers under the FTPL, by showing empirically that under a passive fiscal stance, multipliers are systematically lower.

Overall, our contribution is twofold: (i) to advance the theoretical and empirical analysis of fiscal multipliers in a permanent liquidity trap, and (ii) to provide a new perspective on the long-standing puzzle of Japan's stagnation and deflation despite decades of expansionary policy.

The paper is organized as follows. Section 2 presents the model. We describe the empirical strategy in section 3. Section 4 explains the results. In section 5 we conduct a counterfactual exercise. Section 6 concludes.

2 The Model

We use a medium scale DSGE model in line with Smets and Wouters (2007). With respect to this paper, we introduce a richer fiscal structure, comprising lump-sum and distortionary taxes on consumption and labor income. The model incorporates the standard features and frictions commonly found in medium-scale New-Keynesian frameworks. These include consumption habits, variable capital utilization rates, investment adjustment costs, sticky prices and wages, and indexation to both past inflation and trend inflation.

2.1 Households

Households maximize utility by allocating their income stream between consumption, investment, and holdings of government bonds. They receive income from hours worked, interest on bonds, capital services rented to firms, and dividends distributed by firms. At the same time, households pay lump-sum taxes and distortionary taxes on consumption expenditure and labor income. We consider the following utility function:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left\{ \frac{(C_t - \zeta C_{t-1})^{1-\sigma}}{1-\sigma} - \frac{(h_t)^{1+\phi_l}}{1+\phi_l} \right\}. \tag{1}$$

C_t denotes consumption and h_t is hours worked. There are external habits in consumption captured by parameter ζ. $0 < \beta < 1$ is the discount factor.

The period-by-period budget constraint is:

$$\begin{aligned} \left(1+\tau_t^c\right) P_t C_t + P_t I_t + \frac{B_{t+1}}{\varepsilon_t^b} &= R_{t-1} B_t + \left(1-\tau_t^w\right) W_t h_t + P_t D_t \\ &+ \left[R_t^k u_t - a\left(u_t\right) P_t\right] K_t - T_t \end{aligned} \tag{2}$$

where I_t are investments, B_t are government-issued bonds, K_t is the physical capital stock and u_t defines capital utilization. T_t are lump-sum taxes and D_t are profits. R_t is the gross nominal interest rate, P_t is the price index and W_t is the nominal wage. ε_t^b is a risk premium shock that affects the intertemporal margin, creating a wedge between the interest rate controlled by the central bank and the return on assets held by the households. The capital accumulation equation is:

$$K_{t+1} = (1-\delta) K_t + \varepsilon_t^i \left[1 - S\left(\frac{I_t}{I_{t-1}}\right)\right] I_t, \tag{3}$$

where δ is the capital depreciation rate and ε_t^i is a shock to the marginal efficiency of investment (see Justiniano et al. (2010)).

Wage decisions are made by unions which optimally reset the nominal wage according to a Calvo (1983) scheme.[2]

2.2 Firms

The final good Y_t is produced under perfect competition. There is a continuum of intermediate firms indexed by $z \in [0, 1]$, each producing a differentiated good, which are then combined as in Kimball (1995). All firms operate under monopolistic competition and use the same technology represented by a Cobb-Douglas production function with labor and capital services as factors of production, so we have that $Y_t^z = \varepsilon_t^a [u_t^z K_t^z]^\alpha [h_t^z]^{1-\alpha} - z_t \Phi$ where Φ are fixed costs of production and ε_t^a is a technology shock, modeled as an AR(1) process.

Prices are sticky *à la* Calvo (1983), so that each firm can reset its price only with a probability $1 - \xi_p$ in any given period. Those firms which cannot reset the price adjust the price according to the following scheme:

$$P_t^z = \pi_{t-1}^{\chi_p} \bar{\pi}^{1-\chi_p} P_{t-1}^z \tag{4}$$

where $\bar{\pi}$ is gross steady state inflation, which is lower than 1 in our framework. [3]

2.3 Government

Monetary policy. The central bank is constrained by the zero lower bound, so that we simply set $R_t = 1$. Thus, the Fisher equation reads:

$$1 + r_t = \frac{1}{E_t \pi_{t+1}}, \tag{5}$$

where r_t is the real interest rate and π_t is gross inflation.

Fiscal policy. The government's budget constraint in nominal terms is:

$$P_t G_t + R_{t-1} B_t = B_{t+1} + P_t T_t + \tau_t^c P_t C_t + (\tau_t^w) W_t h_t, \tag{6}$$

[2]See the Appendix for more details on the labor market.
[3]See the Appendix for more details.

where G_t is government spending, it is exogenous and is introduced as an AR(1) process. Lump-sum taxes and distortionary taxes follow feedback rules on debt and include an auto-regressive and an exogenous component. In linear form, we can express the rules as:

$$\tilde{t}_t = \rho_t \tilde{t}_{t-1} + (1-\rho_t)\,\phi_{tb}\tilde{b}_{t-1} + \upsilon_t^t, \tag{7}$$

$$\hat{\tau}_t^c = \rho_c \hat{\tau}_{t-1}^c + (1-\rho_c)\,\phi_{\tau cb,}\tilde{b}_{t-1} + \upsilon_t^{\tau c}, \tag{8}$$

$$\hat{\tau}_t^w = \rho_w \hat{\tau}_{t-1}^w + (1-\rho_w)\,\phi_{\tau wb,}\tilde{b}_{t-1} + \upsilon_t^{\tau w}, \tag{9}$$

where we define $\tilde{t}_t = \frac{T_t - T}{Y}$, $\tilde{b}_t = \frac{B_t - B}{Y}$, $\hat{\tau}_t^c = log\left(\frac{\tau_t^c}{\tau^c}\right)$, and $\hat{\tau}_t^w = log\left(\frac{\tau_t^w}{\tau^w}\right)$.

The feedback parameters on debt in (7) and (8) are crucial for equilibrium determinacy and enable to classify fiscal policy as 'active' or 'passive', in the Leeper (1991) sense (see Figure 2). Thus, an active fiscal policy does not take into account the state of government debt and it is free to adjust its policy instrument. A passive fiscal authority responds to debt changes and it is constrained by private optimization. Leeper (1991) shows that in a context where both monetary and fiscal authorities can be active or passive, there are only two policy combinations leading to determinacy. This happens when monetary policy is active and fiscal policy is passive, or when monetary policy is passive and fiscal policy is active. The first case is the most commonly used in standard macro models, where the Taylor principle holds, thus the monetary authority is moving interest rates more than one-to-one with inflation. In our framework, we are ruling out active monetary policy by imposing that the zero lower bound is always binding. Therefore, we consider the case where fiscal policy is active and also the case where both policies are passive, which delivers equilibrium indeterminacy.[4] The case where both authorities are active cannot be handled because it leads to explosiveness.

In our model, where we consider three different fiscal policy instruments, different combinations of fiscal feedback parameters values lead to determinacy (active fiscal policy) or indeterminacy (passive fiscal policy).

2.3.1 Market clearing

Equilibrium in the goods market implies that:

$$Y_t = C_t + I_t + G_t + a(u_t)\,K_t. \tag{10}$$

[4] Section 3 explains how we deal with indeterminacy in the estimation.

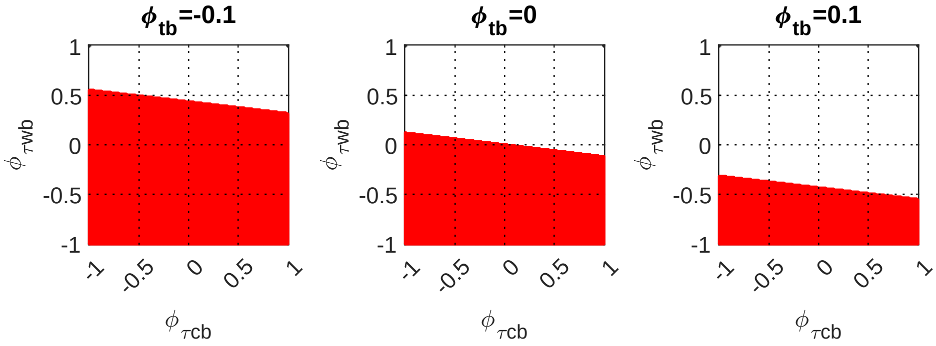

Figure 2: Determinacy region (red area) for different fiscal feedback parameters.
Notes: The remaining parameters are calibrated or set at the prior mean, according to Table 1.

3 Estimation Strategy

3.1 Methodology

We estimate the model using Bayesian techniques with Japanese quarterly data spanning 1995:Q1 to 2023:Q4. We consider nine observable variables: real GDP, consumption, investment, government debt, employee compensation, and tax revenues on consumption and income, along with inflation and hours worked. GDP, consumption, investment, and government debt are adjusted for the GDP deflator and the working-age population, then expressed in first log-differences. Employee compensation is also deflator-adjusted and used in first log-differences. Inflation is measured as the quarterly log-difference of the GDP deflator. Total hours worked (adjusted for working-age population) are taken in logs and detrended using a Hodrick-Prescott filter. Notice that data on tax revenues are available only at annual frequency, so we need to define the corresponding annual variables. We adjust tax revenues by the GDP deflator and working-age population and then use annual log first-differences as observables. Given that the model is estimated in log-deviations from the steady state and we do not consider growth trends, we also take into account and remove sample means in the corresponding measurement equations. These can be expressed as follows:

$$\begin{bmatrix} \Delta lnGDP_t \\ \Delta lnC_t \\ \Delta lnI_t \\ \Delta lnw_t \\ \Delta lnP_t \\ ln(H_t) \\ \Delta lnDEBT_t \\ \Delta lnREV_t^c \\ \Delta lnREV_t^w \end{bmatrix} = \begin{bmatrix} const_y \\ const_c \\ const_i \\ const_w \\ \overline{\pi} \\ \\ const_b \\ const_{revc} \\ const_{revw} \end{bmatrix} + \begin{bmatrix} \hat{y}_t - \hat{y}_{t-1} \\ \hat{c}_t - \hat{c}_{t-1} \\ \hat{i}_t - \hat{i}_{t-1} \\ \hat{w}_t - \hat{w}_{t-1} \\ \hat{\pi}_t \\ \hat{h}_t \\ \frac{Y}{B}\left(\tilde{b}_t - \tilde{b}_{t-1}\right) \\ r\hat{e}v_t^{c,ann} - r\hat{e}v_{t-4}^{c,ann} \\ r\hat{e}v_t^{w,ann} - r\hat{e}v_{t-4}^{w,ann} \end{bmatrix} \tag{11}$$

Our model features nine exogenous shocks, including four fiscal shocks: a technology shock, a risk premium shock, a marginal efficiency of investment shock, a price markup shock, a wage markup shock, a government spending shock, a shock to lump-sum taxes, a shock to consumption taxes and a shock to labor income taxes.

To accommodate both active and passive fiscal policy, thus determinacy and indeterminacy, we rely on the solution method of Bianchi and Nicolò (2021). In essence, the original linear rational expectations model is augmented with an additional process ω_t, which could be either stable or unstable:

$$\omega_t = \frac{1}{\gamma}\omega_{t-1} + \nu_t + \varphi_{f,t}, \tag{12}$$

where ν_t is the sunspot shock and $\varphi_{f,t}$ can be any element of the one-step ahead forecast error vector for the endogenous variables. When the original model is determinate, the auxiliary process must be stationary so that the augmented representation also satisfies the Blanchard-Kahn condition. For our model, this happens when fiscal policy is active. In this case, we set $|1/\gamma| < 1$. Then, the autoregressive process for ω_t does not affect the solution for the endogenous variables of the model. On the contrary, under indeterminacy, the auxiliary process should be explosive so that the Blanchard-Kahn conditions are satisfied for the augmented system, though it is not for the original model. Consequently, $|1/\gamma|$ should be higher than one.

3.2 Calibration and priors

A subset of parameters is calibrated on the basis of average sample data. The discount factor β is set in order to match the steady state deflation rate over the sample.[5] The steady state ratios of government spending and debt over GDP are set at 0.18% and 158% respectively in annualized terms. Steady state tax rates are set based on Japanese data to 7% (consumption tax rate) and 50% (labor income tax rate). The capital share in production α is set at one third. The depreciation rate δ is set to 6% quarterly, in line with Sugo and Ueda (2007). The steady state wage and price markups are set to 20%.

Most of the prior distributions of structural parameters are set in line with Sugo and Ueda (2007).[6] Feedback parameters of tax rates on debt are set looking at the determinacy/indeterminacy area. We consider prior distributions which assign roughly equal probability of having a unique solution or indeterminacy. With our prior distributions, 50.2% of the prior support gives determinacy and 49% gives indeterminacy, while only 0.7% gives explosiveness. Under the active fiscal policy regime, we initialize the estimation of these parameters at 0, while when we consider passive fiscal policy (indeterminacy) we set the initial values at 0.1 for $\phi_{\tau cb}$, 0.22 $\phi_{\tau wb}$ and at 0.02 for ϕ_{tb}. Shock parameters are set in line with the literature. The persistences of the shocks are Beta distributed with 0.5 means and 0.1 standard deviations. We assume an Inverse Gamma distribution $(0.1, 2)$ for the standard deviations of structural shocks. For the sunspot shock, we instead use a uniform distribution between 0 and 1. The correlations of structural shocks with the sunspot shock are all uniformly distributed over the interval (-1,1).

4 Results

4.1 Parameters estimates

In Table 2, we report the posterior estimates of parameters for the two regime specifications. Posterior distributions are well shaped and convergence diagnostics are fine.

The data for Japan show a strong preference for the passive fiscal policy (indeterminacy) specification, the likelihood being higher in this case. According to Kass and Raftery (1995) criterion, the Bayes factor[7] (around 110) strongly favors the model characterized by passive fiscal policy. This

[5] Notice that $R = 0$ implies $\bar{\pi} = \beta$.

[6] Table 1 collects prior distributions for the estimated parameters.

[7] The Bayes factor is calculated as 2(log-data density PF - log-data density AF), where AF and PF stand for ‘active fiscal’ and ‘passive fiscal’.

Table 1: Prior distributions

Parameters		Distribution	Mean	St. dev.
Intertemporal elasticity of substitution	σ	normal	1	0.375
Consumption habits	ζ	beta	0.7	0.15
Inverse of the Frisch elasticity	ϕ_l	normal	2	0.75
Investment adjustment cost	γ_I	gamma	4	1.5
σ_u	beta	0.5	0.15	
Price indexation	χ_p	beta	0.5	0.25
Calvo price probability	ξ_p	beta	0.375	0.1
Wage indexation	χ_w	beta	0.5	0.25
Calvo wage probability	ξ_w	beta	0.375	0.1
Fiscal feedback parameters	ϕ_{tb}, $\phi_{\tau cb}$, $\phi_{\tau wb}$	norm	0	0.05
Persistence paramters of structural shocks	$\rho_{a,b,i,p,w,g,t,\tau c,\tau w}$	beta	0.5	0.1
Standard deviations of structural shocks	$\sigma_{a,b,i,p,w,g,t,\tau c,\tau w}$	inv-gamma	0.1	2
Standard deviation of the sunspot shock	σ_s	uniform	0.5	0.2884
Shock Correlation	$\rho(\upsilon^{a,b,i,p,w,g,t,\tau c,\tau w}, \nu)$	uniform	0	0.5774

suggests that fiscal policy was passive in Japan during the period of permanent liquidity trap.[8]

The different policy environments lead to very different estimates of preference parameters. The intertemporal elasticity of substitution is lower than one under PF while being 1.94 under AF. The converse is true for the inverse of the Frisch elasticity, which is quite low in the AF specification while 2.73 under PF. The habit parameter is estimated to be double under AF than PF. Also, the adjustment cost parameter is much higher under AF, thus somehow suggesting a greater need of real frictions needed to match the data. The degree of price rigidity is quite low under passive fiscal policy, more on the upper side under active fiscal policy, implying a steeper New Keynesian Phillips Curve under passive fiscal policy. The fiscal feedback parameters are in general lower under active fiscal policy, as expected. The coefficient on lump-sum taxes is positive while the ones on distortionary taxes are negative (see Figure 2). There are some differences across shocks parameters. In this respect the most affected parameter is the standard deviation of the risk premium shock.

Looking at the correlations of structural shocks with the sunspot shock, the lump-sum tax shock and the risk premium shock are not significantly correlated with the sunspot shock, the technology shock is negatively correlated with the sunspot, while all the other correlations are positive and significant, as the Highest Posterior Density (HPD) interval does not comprise 0.

[8] This result is robust also to different specifications. In particular, i) we re-estimate the model imposing zero correlations of fundamental shocks with the sunspot and the log data density is -1420; ii) we relax the assumption of permanent ZLB and estimate a version where we have Taylor rule and passive monetary policy, using the shadow rate as an observable for Japan's interest rate. Also in this case, passive fiscal policy is preferred and Bayesian IRFs analysis is in line with the baseline. Results are available upon request.

Table 2: Posterior estimates

	Passive fiscal		**Active fiscal**	
	post. mean	90% HPD interval	post. mean	90% HPD interval
Parameters				
σ	0.588	[0.439, 0.734]	1.941	[1.543, 2.328]
ζ	0.224	[0.125, 0.323]	0.571	[0.418, 0.728]
ϕ_l	2.726	[1.713, 3.718]	0.339	[0.250, 0.459]
γ_I	2.959	[2.000, 3.883]	8.416	[6.048, 10.730]
σ_u	0.750	[0.629, 0.870]	0.402	[0.256, 0.542]
χ_p	0.105	[0.002, 0.205]	0.052	[0.000, 0.107]
ξ_p	0.497	[0.426, 0.569]	0.781	[0.693, 0.876]
χ_w	0.073	[0.001, 0.147]	0.061	[0.000, 0.125]
ξ_w	0.886	[0.871, 0.900]	0.885	[0.871, 0.900]
$\phi_{\tau tb}$	0.054	[0.029, 0.077]	0.032	[0.027, 0.037]
$\phi_{\tau cb}$	-0.020	[-0.068, 0.030]	-0.050	[-0.095, -0.007]
$\phi_{\tau wb}$	-0.056	[-0.100, -0.015]	-0.132	[-0.148, -0.116]
ρ_a	0.833	[0.774, 0.893]	0.751	[0.655, 0.850]
ρ_b	0.503	[0.329, 0.678]	0.379	[0.204, 0.557]
ρ_i	0.829	[0.762, 0.898]	0.748	[0.664, 0.834]
ρ_p	0.670	[0.579, 0.766]	0.536	[0.387, 0.682]
ρ_w	0.311	[0.184, 0.438]	0.286	[0.180, 0.391]
ρ_g	0.772	[0.704, 0.838]	0.803	[0.748, 0.860]
ρ_t	0.527	[0.421, 0.639]	0.555	[0.444, 0.668]
$\rho_{\tau c}$	0.812	[0.736, 0.891]	0.795	[0.706, 0.885]
$\rho_{\tau w}$	0.677	[0.541, 0.821]	0.644	[0.497, 0.794]
Standard deviations				
σ_a	0.843	[0.754, 0.934]	0.892	[0.790, 0.991]
σ_b	0.093	[0.023, 0.174]	0.676	[0.529, 0.822]
σ_i	0.384	[0.324, 0.443]	0.335	[0.274, 0.399]
σ_p	0.483	[0.378, 0.586]	0.265	[0.203, 0.326]
σ_w	0.303	[0.257, 0.349]	0.266	[0.223, 0.305]
σ_g	0.733	[0.653, 0.814]	0.766	[0.677, 0.851]
σ_t	4.658	[4.036, 5.280]	4.639	[4.017, 5.276]
$\sigma_{\tau c}$	4.454	[3.066, 5.888]	4.446	[2.946, 5.894]
$\sigma_{\tau w}$	6.240	[4.156, 8.253]	6.319	[4.311, 8.308]
σ_s	0.470	[0.421, 0.519]		
Correlations				
$\rho(\upsilon^a, \nu)$	-0.386	[-0.473, -0.299]		
$\rho(\upsilon^b, \nu)$	0.043	[-0.268, 0.340]		
$\rho(\upsilon^i, \nu)$	0.236	[0.152, 0.321]		
$\rho(\upsilon^p, \nu)$	0.649	[0.542, 0.761]		
$\rho(\upsilon^w, \nu)$	0.285	[0.204, 0.369]		
$\rho(\upsilon^g, \nu)$	0.217	[0.124, 0.307]		
$\rho(\upsilon^t, \nu)$	0.010	[-0.070, 0.091]		
$\rho(\upsilon^{\tau c}, \nu)$	0.174	[0.000, 0.342]		
$\rho(\upsilon^{\tau w}, \nu)$	0.239	[0.123, 0.350]		
Log data density	-1369.9		-1425.3	

4.2 Multipliers

In Table 3 we compare the multipliers for a fiscal expansion under the alternative policy regimes. We compute present value multipliers for government spending as:

$$\text{Present value multiplier }(k) = \frac{\sum_{j=0}^{k}\prod_{i=0}^{j}(1+r_{t+i})^{-1}\Delta Y_{t+j}}{\sum_{j=0}^{k}\prod_{i=0}^{j}(1+r_{t+i})^{-1}\Delta G_{t+j}}.$$

For taxes, the multiplier is computed as the discounted sum of changes in output relative to the discounted sum of the changes in total tax revenues due to a change in either lump-sum taxes, consumption or labor taxes:

$$\text{Present value multiplier }(k) = -\frac{\sum_{j=0}^{k}\prod_{i=0}^{j}(1+r_{t+i})^{-1}\Delta Y_{t+j}}{\sum_{j=0}^{k}\prod_{i=0}^{j}(1+r_{t+i})^{-1}\Delta TREV_{t+j}},$$

where $TREV_t$ are total tax revenues. For $k=0$, we obtain the impact multipliers.

We compute fiscal multipliers both ex-ante (based on prior distributions) and ex-post (based on posterior estimated distributions), following Leeper et al. (2017). A priori, the presence of the sunspot shock tends to widen the credible intervals for multipliers under passive fiscal policy. As a result, under the passive fiscal regime, these intervals generally include zero, indicating limited precision and weak effects, with one notable exception: the impact multiplier of consumption taxes, which is negative even at the prior level. In contrast, under the active fiscal regime, credible intervals clearly indicate positive multipliers.

When turning to the posterior results, we observe that active fiscal policy systematically generates larger and positive multipliers. This is consistent with Beck-Friis and Willems (2017), who show that in a passive-monetary/active-fiscal configuration the stimulative impact of fiscal interventions is amplified by a nominal wealth effect. In this environment, bondholders perceive higher nominal wealth, raising consumption beyond what standard Ricardian behavior would predict. These findings align with existing empirical evidence for Japans ZLB. Miyamoto et al. (2018) show that government spending shocks have significantly stronger expansionary effects when the economy is constrained by the zero lower bound, highlighting the state-dependent nature of fiscal transmission.

The difference in multipliers between regimes is strongest for government spending and tax instruments, while it is somewhat less marked for labor taxes, where credible intervals partially overlap. Under the active fiscal regime, spending multipliers exceed one, similar to the findings in Leeper et al. (2017), and tax multipliers display the expected sign: a reduction in taxes raises output, while a tax

Table 3: Fiscal multipliers: 90 percent credible sets

		prior			posterior		
		impact	4 qtrs	8 qtrs	impact	4 qtrs	8 qtrs
Govt spending	Passive fiscal	[-2.53, 4.48]	[-5.28, 6.52]	[-6.17, 6.51]	[0.92, 1.27]	[0.65, 1.15]	[0.50, 1.02]
	Active fiscal	[0.97, 1.42]	[0.43, 1.13]	[0.32, 0.99]	[1.23, 1.41]	[1.35, 1.60]	[1.44, 1.71]
Lump-sum taxes	Passive fiscal	[-3.97, 2.92]	[-6.09, 5.48]	[-3.51, 3.94]	[-0.02, 0.03]	[-0.04, 0.08]	[-0.03, 0.17]
	Active fiscal	[0.03, 0.18]	[0.04, 0.27]	[0.03, 0.26]	[0.03, 0.07]	[0.16, 0.27]	[0.33, 0.53]
Cons taxes	Passive fiscal	[-2.44, -0.24]	[-12.4, 10.6]	[-5.98, 6.61]	[-1.38, 0.29]	[-2.42, 0.02]	[-7.35, 1.10]
	Active fiscal	[0.04, 1.79]	[0.11, 2.62]	[0.08, 2.37]	[0.25, 0.65]	[0.71, 1.45]	[1.03, 1.99]
Labor taxes	Passive fiscal	[-4.52, 2.83]	[-9.42, 10.4]	[-4.86, 5.45]	[-0.12, 0.04]	[-0.12, 0.23]	[-0.01, 0.57]
	Active fiscal	[-0.06, 0.29]	[0.29, 1.30]	[0.37, 1.63]	[0.01, 0.07]	[0.11, 0.25]	[0.28, 0.54]

increase lowers it.

Under passive fiscal policy, however, government spending multipliers fall below one, and tax multipliers can even become negative, implying that tax cuts may reduce output. This counterintuitive result reflects the behavior of a passive fiscal regime. When fiscal policy is passive, agents expect that higher deficits today will eventually be offset by future fiscal tightening. As a consequence, fiscal expansions do not raise perceived wealth or inflation expectations, limiting their stimulative effect on private demand. Moreover, our estimates reveal a positive correlation between tax shocks and the sunspot shock, implying that a tax cut can be accompanied by an adverse, expectation-driven disturbance that further depresses consumption and output. As a result, private demand does not rise and may even fall, despite the intended expansionary intervention.

In the context of Abenomics interventions — which, among other measures, involved transfers to low-income households — our results suggest that these transfers might have inadvertently dampened economic activity. This outcome contrasts with the expansionary effect policymakers typically expect from such fiscal actions. Among the tax instruments, consumption taxes seem to be the most effective under both regimes.

Overall, the results support the view that Japan's fiscal policy over 1995-2023 has been best characterized as passive, leading to modest or even adverse short-run effects of fiscal stimulus when the economy is trapped at the ZLB.

To gain deeper insight into the mechanisms underlying these results, the next section examines the impulse response functions to the four fiscal shocks.

4.3 Bayesian impulse response functions

In this section, we aim to provide a clearer understanding of fiscal multipliers through a comprehensive analysis of the impulse response functions to the four fiscal shocks and the sunspot shock – see Figures 3-7. This allows us to highlight how fiscal transmission differs under active and passive fiscal policy regimes within a permanent liquidity trap.

Under active fiscal policy, the fiscal theory of the price level is in place. In this regime, an increase in government spending does not necessarily lead to higher future primary surpluses. Instead, individuals perceive the government bonds they receive as a form of net wealth, which raises demand for consumption goods and places upward pressure on the price level.

In case of a government spending increase, both fiscal regimes result in an increase in output. However, under passive fiscal policy, this measure is accompanied by a higher inflation response compared to active fiscal policy. Under passive fiscal policy, the FTPL mechanism is absent, and inflation rises mainly because of the correlation with the sunspot shock that characterizes indeterminacy. Once this correlation is shut down (black dashed line), inflation declines. In this scenario, agents anticipate future tax increases and reduce consumption further, which is more pronounced when the sunspot shock correlation is turned off. Hence, the higher inflation observed under passive fiscal policy reflects not demand pressures, but rather self-fulfilling expectations captured by the sunspot component.

The effects of a lump-sum tax cut can be qualitatively different under the two regimes. Under active fiscal policy, output and inflation increase, consistent with standard FTPL predictions: lower taxes raise private demand through a positive wealth effect. Under passive fiscal policy, the output response is uncertain and often negative within the 90% HPD interval. This result mirrors the earlier multiplier analysis, where tax cuts can be contractionary. Without the stabilizing mechanism of active fiscal backing, expectations become indeterminate, and the perceived future need for fiscal adjustment dampens current demand.

Distortionary taxes also exhibit regime-dependent effects. Distortionary taxes stimulate economic activity unambiguously under active fiscal policy, while leading to a credible decrease in output under passive fiscal policy. This occurs because distortionary tax shocks are positively correlated with the sunspot shock (see Figure 7). The sunspot component behaves like a demand disturbance: when positive, it raises inflation and lowers real rates; when negative, as after a tax cut, it depresses inflation and output. Thus, under passive fiscal policy, a tax reduction triggers a negative sunspot shock, reinforcing the contractionary and deflationary impulse.

Moreover, the two tax shocks affect inflation differently even under active fiscal policy, reflecting distinct wage and marginal cost dynamics: wages and prices rise following a consumption tax cut, but fall after a labor tax cut, producing opposite inflation paths.

These deflationary effects obtained in response to tax shocks are reminiscent of the paradox of toil described by Eggertsson (2011), where policies or shocks that would typically boost supply-side activity can have contractionary effects in a liquidity trap. One example is a reduction in labor income taxes, which increases labor supply and puts downward pressure on wages. However, lower wages lead to lower prices and thus to deflation. At the ZLB, this raises real interest rates, reducing aggregate demand and ultimately output. In this context, a tax cut deepens the recession by amplifying deflationary pressures. This effect is particularly pronounced under passive fiscal policy, where indeterminacy and the associated sunspot shock provide an additional deflationary impulse. The impulse responses observed here are consistent with this mechanism: tax cuts, particularly under passive regimes, can lead to deflation and lower output, running counter to conventional expectations.

The deflationary pressures observed after tax cuts could help explain the economic dynamics in Japan during the period under consideration. Typically, fiscal expansions are followed by inflationary pressures. However, inflation remained subdued throughout much of the sample period. Active fiscal policy predicts a rise in inflation, whereas passive fiscal policy does not, offering a plausible explanation for why passive fiscal policy may better capture the Japanese economic experience during this time.

4.4 Robustness exercises

We conduct two robustness exercises. To ensure a fair comparison in terms of parameter parsimony, we re-estimate the passive fiscal model by setting the correlations between the sunspot shock and fundamental shocks to zero, aligning it more closely with the active fiscal specification. First, we find that this version still outperforms compared to the active fiscal one, further confirming the passive fiscal regime's ability to match the data – the log data density being -1420. The impulse response analysis also confirms what we obtained before. The results from this estimated version are in line with our counterfactual with zero correlations. Again, most of the time fiscal expansions go with deflationary pressures. The only exception is after labor tax decreases, where in this case we observe an increase in inflation.

As a second robustness exercise, we introduce a Taylor rule in the model, where the nominal interest rate responds to inflation and output deviations from steady state. We use the shadow rate by Krippner (2013, 2015) to possibly account for unconventional monetary policy. We re-estimate the model, assuming a passive monetary policy, so that the feedback parameter on inflation is lower than one. Again, the passive fiscal policy specification performs better with respect to the active fiscal policy regime (-1315 versus -1362 respectively, in terms of log data density). Moreover, it is also better with respect to the standard active monetary - passive fiscal environment, where we get a log data density of -1345. In terms of impulse response analysis, we obtain very similar results, the only differences being obviously in the responses of the nominal interest rate, which is not constrained to zero in this case.

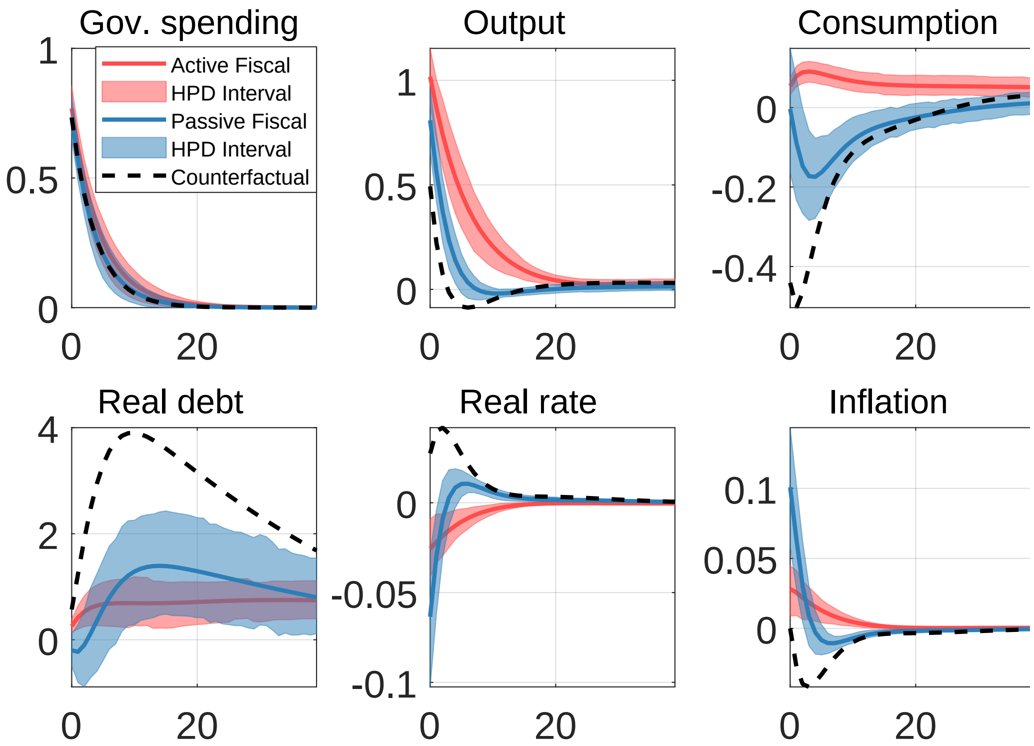

Figure 3: Posterior impulse responses to a one standard deviation government spending shock.
Notes: Red = Active Fiscal, Blue = Passive Fiscal. Solid lines are mean responses, shaded areas indicate 90% bands. Counterfactual (dotted black lines) = passive fiscal with zero correlation with sunspot.

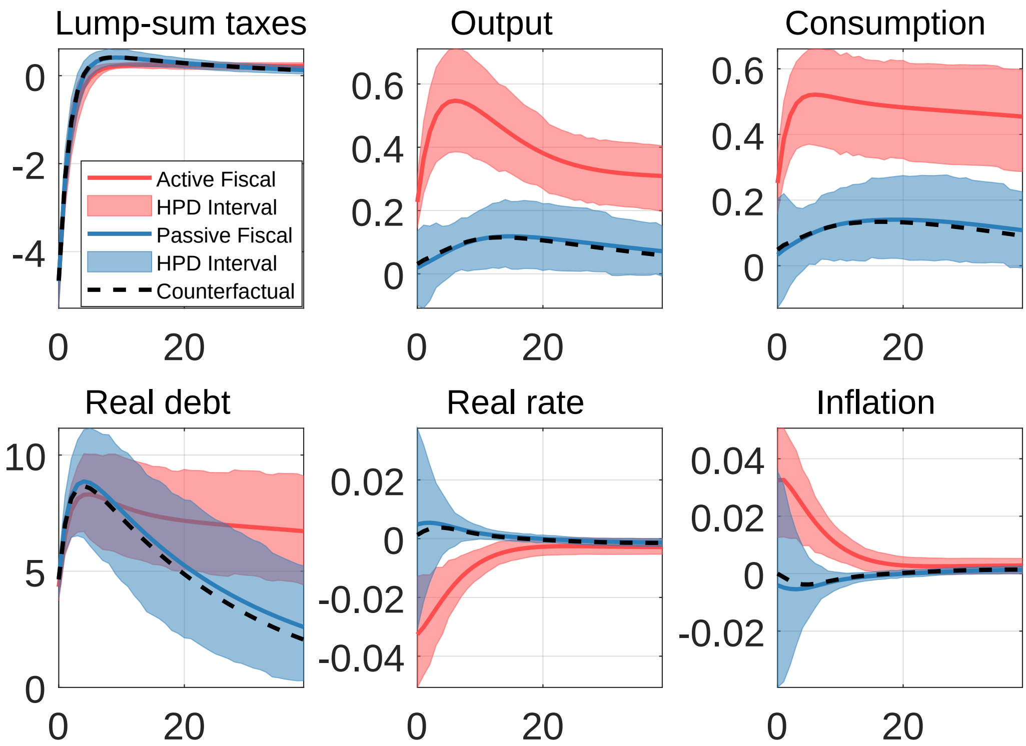

Figure 4: Posterior impulse responses to a one standard deviation lump-sum tax shock.

Notes: Red = Active Fiscal, Blue = Passive Fiscal. Solid lines are mean responses, shaded areas indicate 90% bands. Counterfactual (dotted black lines) = passive fiscal with zero correlation with sunspot.

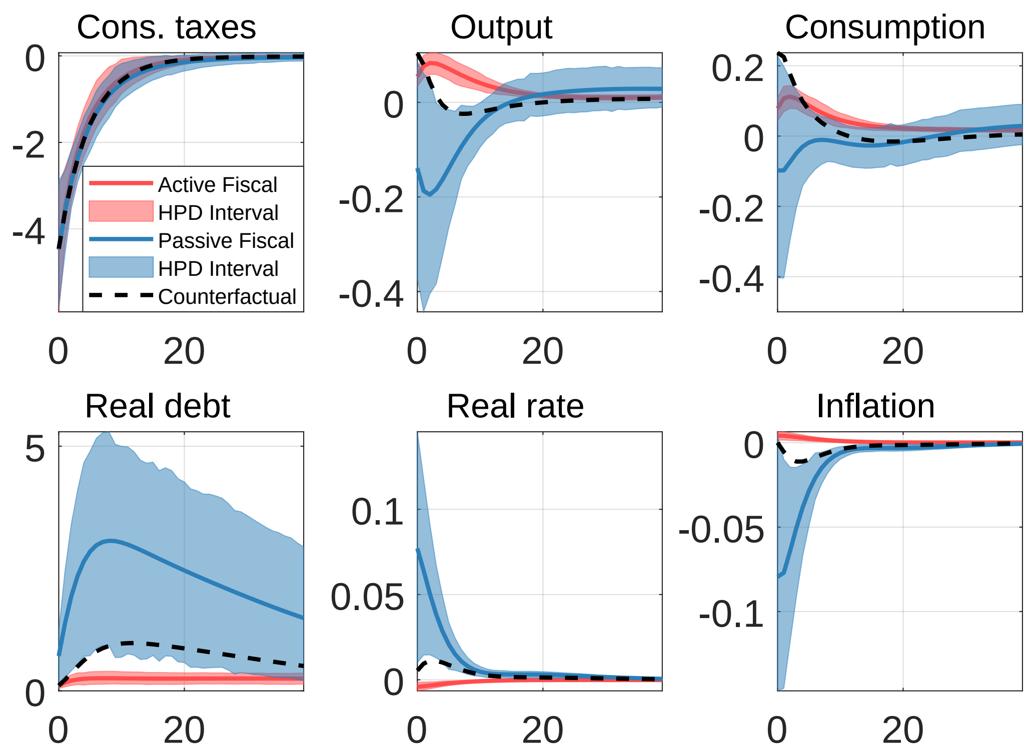

Figure 5: Posterior impulse responses to a one standard deviation consumption tax shock.

Notes: Red = Active Fiscal, Blue = Passive Fiscal. Solid lines are mean responses, shaded areas indicate 90% bands. Counterfactual (dotted black lines) = passive fiscal with zero correlation with sunspot.

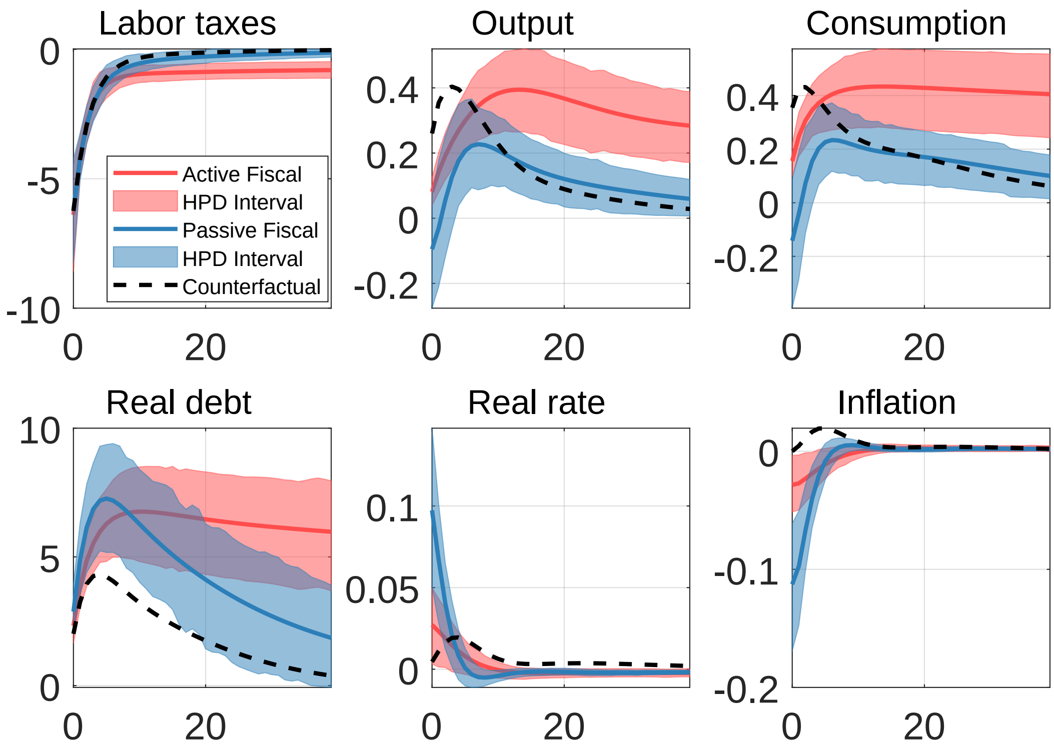

Figure 6: Posterior impulse responses to a one standard deviation labor tax shock.
Notes: Red = Active Fiscal, Blue = Passive Fiscal. Solid lines are mean responses, shaded areas indicate 90% bands. Counterfactual (dotted black lines) = passive fiscal with zero correlation with sunspot.

Figure 7: Posterior impulse responses to a one standard deviation sunspot shock.
Notes: Blue = Passive Fiscal. Solid lines are mean responses, shaded areas indicate 90% bands.

5 Counterfactual analysis: Evaluating the effect of fiscal policy on the Japanese economy

According to our previous estimation, the data for the Japanese economy point to the prevalence of a passive fiscal regime over the alternative active fiscal regime, coupled with a persistently passive monetary authority. We now turn to a simulation exercise aimed at assessing the role of fiscal policy in shaping the observed dynamics of inflation and other key macroeconomic variables over the 1995-2023 period. Specifically, we seek to answer the following question: had the Japanese government followed an active fiscal policy stance rather than a passive one, what would have been the resulting trajectory of inflation and output?

Before turning to the simulations, it is important to clarify that, within the structure of our DSGE model, the dynamics of macroeconomic variables depend on two dimensions of fiscal policy. First, aggregate fluctuations are influenced by fiscal policy shocks — in particular, shocks to government spending and taxation — together with the other demand- and supply-side disturbances. Moreover, if fiscal policy is passive, self-fulfilling disturbances (i.e., sunspot shocks) emerge as an additional source of volatility, whereas this channel is shut down under an active fiscal configuration. Second, the evolution of macroeconomic variables is shaped by the systematic component of fiscal policy. For example, the effects of a technology shock of a given magnitude depend on the sign and strength of the feedback coefficients in the tax rules.

To address these two issues, we conduct a simulation exercise in multiple stages, each corresponding to a distinct set of assumptions regarding fiscal policy and a specific simulated trajectory. Results are reported in Figure 8, with simulations starting in 1999Q2, when the policy rate effectively hit the zero bound.

We initialize the counterfactual analysis by setting the structural and policy parameters at the posterior mean of the passive fiscal specification (see Table 2, left column). When all smoothed shocks are activated, the model replicates the observed dynamics of the macroeconomic variables, depicted by the blue lines in Figure 8. The analysis proceeds in three steps. First, we set all fiscal shocks to zero to isolate the effects of the non-systematic component of policy under a passive fiscal configuration (red lines with crosses). Second, we assign the tax-rule parameters to the posterior mean of the active-fiscal specification, while holding structural parameters constant. This allows us to evaluate the contribution of the systematic component of active fiscal policy relative to its passive counterpart (yellow lines with triangles). Third, we reintroduce fiscal shocks and re-simulate the model to quantify the role of non-systematic fiscal policy under an active fiscal configuration (purple lines with asterisks).

Focusing on the price level across counterfactual scenarios reveals the cumulative impact of fiscal policy on inflation. Comparing the red and blue lines indicates that non-systematic passive fiscal policy played only a limited role in explaining price fluctuations. In contrast, the response of systematic policy to demand and supply shocks (i.e., non-policy shocks) proves decisive, as evidenced by the gap between the red and yellow lines. The adoption of an active fiscal configuration would have prevented the sharp decline in prices observed between 2000 and 2014, largely attributable to the passive fiscal stance of Japanese authorities. Moreover, under active fiscal policy, the overall effect of fiscal shocks would have supported the price level and mitigated deflationary pressures, except in the final quarters of the simulation period.

The output gap exhibits broadly similar behavior across fiscal regimes, although output volatility increases slightly when fiscal shocks are included under the active configuration. The standard deviation of the output gap rises from 2.25% in the benchmark case to 2.60% in the active-fiscal counterfactual. However, once fiscal shocks are removed — thereby isolating the systematic component of policy (yellow and red lines) — output volatility declines markedly under the active regime (1.88%) compared with the passive case (2.91%).

The debt-to-GDP ratio exhibits much less volatility when fiscal policy is active. This is mostly due to the fact that, under active fiscal policy, real debt remains closer to its long-run level and avoids the sharp increases typically induced by deflation.

Overall, the counterfactual analysis suggests that a shift toward a more aggressive fiscal stance could have generated important macroeconomic gains. Had the Japanese government adopted an active fiscal stance, the protracted deflationary episode would have been substantially mitigated, without significant repercussions for output volatility, provided it did not resort excessively to fiscal policy shocks. The absence of a pronounced output-inflation trade-off can be related to the relatively low degree of price rigidity estimated under passive fiscal policy, implying a relatively steep Phillips curve.

To complement our counterfactual exercise, we also compute a counterfactual variance decomposition of inflation. Table 4 reports the contribution of the different shocks (grouped by type) to the forecast error variance of inflation at different horizons. The decomposition is evaluated at the posterior mean of the estimated parameters under passive fiscal policy (columns PF). To construct the counterfactual under active fiscal policy (columns AF), we keep all structural parameters and shock standard deviations fixed at the posterior mean of the passive specification, but replace the fiscal

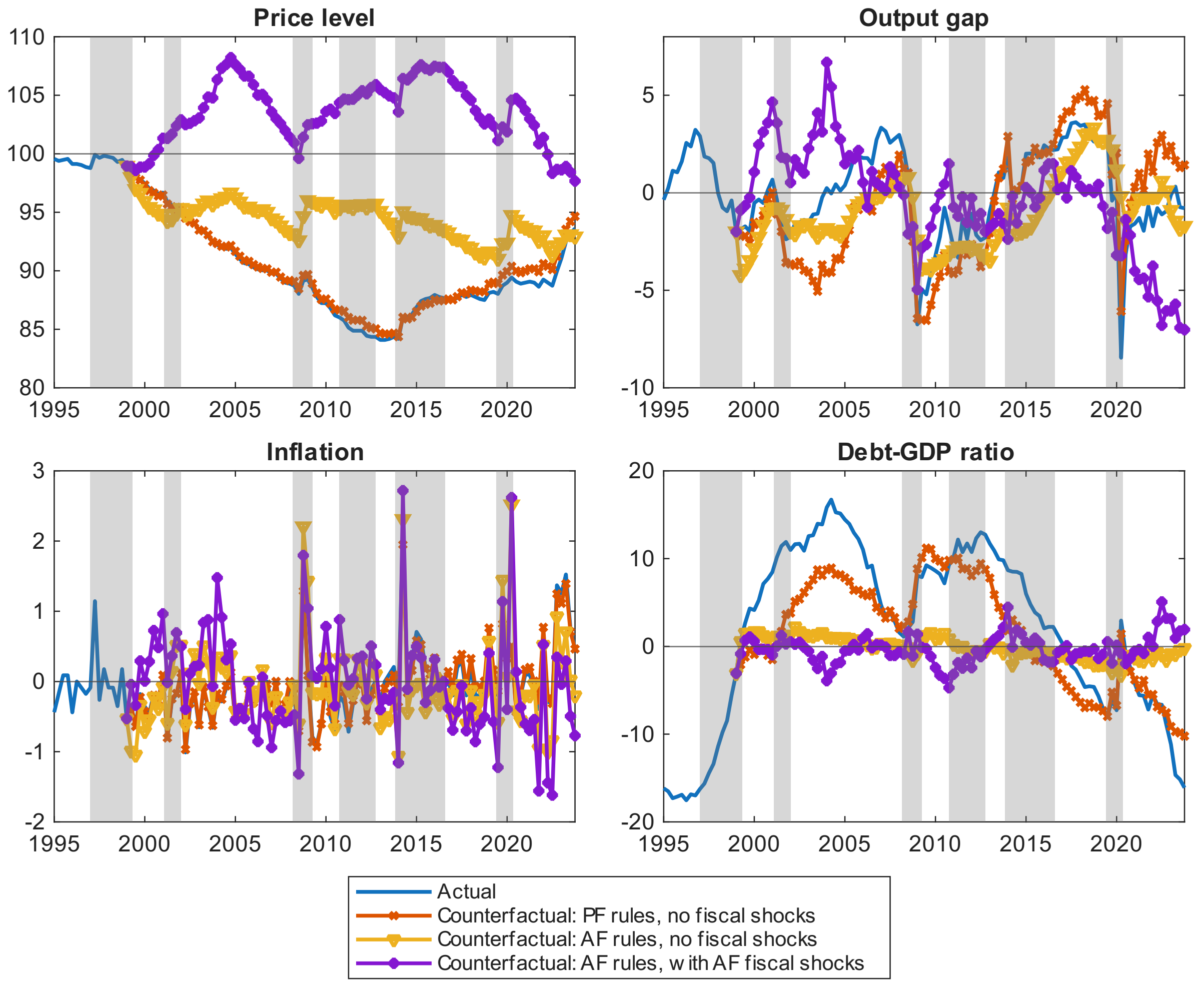

Figure 8: Actual vs. counterfactual evolution of macroeconomic variables.

Notes: Actual and counterfactual paths of key macroeconomic variables for Japan over the 1995Q1-2023Q4 period. Counterfactual simulations are computed by fixing the non-policy parameters at the posterior means associated with the passive fiscal regime (see Table 2). Policy parameters and fiscal shocks are specified as follows. For the red lines with crosses, the systematic components of the policy rules are set to the passive fiscal values and fiscal shocks (government spending and tax shocks) are shut down. For the yellow lines with triangles, the systematic components of the policy rules are set to the active fiscal values, while fiscal shocks are shut down. For the violet lines with diamonds, the systematic components of the policy rules are set to the active fiscal values and the smoothed fiscal shocks estimated under the active fiscal regime are included.

feedback coefficients with those corresponding to the active regime.

This exercise provides additional insight into the relative importance of different sources of inflation fluctuations across regimes. Under passive fiscal policy, a substantial share of inflation variability (between 18 and 22 percent) is attributed to the sunspot shock, reflecting the role of non-fundamental expectation-driven dynamics under indeterminacy. Fiscal shocks explain about 13-16% of inflation variance, while the contribution of other demand shocks remains lower.

Under the counterfactual active fiscal regime, the variance decomposition changes significantly. The sunspot component disappears by construction, and the share of fiscal shocks rises to roughly 27% across horizons. This suggests that if fiscal policy had been active, fiscal shocks would have played a much stronger role in shaping inflation dynamics.

Interpreting these results in light of Japan's experience, if fiscal disturbances during this period were mostly expansionary (e.g., higher public spending or tax cuts), an active fiscal regime would have amplified their inflationary impact, consistent with our counterfactual findings. Conversely, the limited role of fiscal shocks under the passive regime helps explain the persistently weak inflation observed in Japan between 1995 and 2023.

Table 4: Variance decomposition of inflation

	4 quarters		8 quarters		40 quarters	
	Active fiscal	Passive fiscal	Active fiscal	Passive fiscal	Active fiscal	Passive fiscal
Supply shocks	72.26	56.58	69.91	61.56	68.42	60.06
Demand shocks	0.62	6.06	2.86	6.63	4.87	9.38
Fiscal shocks	27.12	15.73	27.23	13.25	26.71	12.81
Sunspot shock	–	21.63	–	18.56	–	17.75

6 Conclusions

This paper investigates the role of fiscal policy in Japan during its period of a permanent liquidity trap, emphasizing the distinction between active and passive fiscal policy regimes. The results strongly indicate that passive fiscal policy better explains Japan's economic dynamics during this period. The estimates comparison reveals a clear preference for the passive fiscal policy specification, with a Bayes factor of approximately 110, suggesting that fiscal policy was passive during the period considered.

Our findings show that under passive fiscal policy, government spending multipliers are lower than one, and tax cuts can have contractionary effects. In contrast, active fiscal policy results in higher multipliers, which is consistent with the literature on Fiscal Theory of the Price Level. Notably, the impulse response functions reveal that fiscal expansions under passive fiscal policy are often associated with deflationary pressures, which may help explain the subdued inflation observed in Japan despite fiscal stimulus measures.

Additionally, robustness exercises confirm the preference for the passive fiscal policy model. Even when altering assumptions regarding shock correlations or introducing a Taylor rule, the passive fiscal policy specification consistently outperforms the active fiscal policy regime, further validating its explanatory power for Japan's economic experience during the liquidity trap period.

Finally, through a counterfactual analysis, we explore the potential effects of an active fiscal policy. The simulation results indicate that had Japan adopted an active fiscal policy stance, the price level would have likely risen, potentially helping to move the economy out of deflation. Moreover, this shift would not have significantly affected output volatility, suggesting that while active fiscal policy might have addressed deflation, it may not have significantly altered the broader macroeconomic stability.

In conclusion, our analysis highlights the critical role that the fiscal policy regime plays in shaping the effects of fiscal interventions, especially during the ZLB. Our findings suggest that, for Japan, a passive fiscal policy is more consistent with the observed economic outcomes, explaining the persistence of low inflation despite fiscal expansion.

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A Appendix

A.1 System of log-linear equations

$$-\sigma\frac{1}{1-\zeta}\hat{c}_t+\sigma\frac{\zeta}{1-\zeta}\hat{c}_{t-1}=\hat{\lambda}_t+\frac{\tau^c}{1+\tau^c}\hat{\tau}_t^c \tag{A1}$$

$$\hat{R}_t=-\hat{\varepsilon}_t^b+\hat{\pi}_{t+1}+\hat{\lambda}_t-\hat{\lambda}_{t+1} \tag{A2}$$

$$\hat{\imath}_t=\frac{1}{\gamma_I\left(1+\beta\right)}\left(\hat{Q}_t+\hat{\varepsilon}_t^i\right)+\frac{1}{1+\beta}\hat{\imath}_{t-1}+\frac{\beta}{1+\beta}\hat{\imath}_{t+1} \tag{A3}$$

$$\hat{\lambda}_{t+1}-\hat{\lambda}_t+\beta r^k\hat{r}_{t+1}^k+\beta\left(1-\delta\right)\hat{Q}_{t+1}=\hat{Q}_t \tag{A4}$$

$$\hat{r}_t^k=\frac{\gamma_{u2}}{r^k}\hat{u}_t \tag{A5}$$

$$\hat{k}_{t+1}=\left(1-\delta\right)\hat{k}_t+\frac{i}{k}\hat{\imath}_t+\frac{i}{k}\hat{\varepsilon}_t^i \tag{A6}$$

$$\begin{aligned} & y\tilde{g}_t+\frac{bR}{\pi}\hat{R}_{t-1}+\frac{R}{\pi}y\tilde{b}_t-\frac{Rb}{\pi}\hat{\pi}_t \\ = & y\tilde{b}_{t+1}+y\tilde{t}_t+c\tau^c\left(\hat{\tau}_t^c+\hat{c}_t\right) \\ & +wh\tau^w\left(\hat{\tau}_t^w+\hat{w}_t+\hat{h}_t\right)\end{aligned} \tag{A7}$$

$$0=\frac{c}{y}\hat{c}_t+\tilde{g}_t+\frac{i}{y}\hat{\imath}_t-\hat{y}_t+\frac{\gamma_{u1}k}{yg_z}\hat{u}_t \tag{A8}$$

$$\begin{aligned}\left(1+\beta\chi_p\right)\hat{\pi}_t = & \chi_p\hat{\pi}_{t-1}+\beta\hat{\pi}_{t+1}-\beta\left(1-\chi_p\right)\hat{\overline{\pi}}_{t+1}+\left(1-\chi_p\right)\hat{\overline{\pi}}_t \\ & +A\frac{\left(1-\beta\xi_p\right)\left(1-\xi_p\right)}{\xi_p}\left(\widehat{mc}_t+\hat{\lambda}_t^p\right)\end{aligned} \tag{A9}$$

$$\begin{aligned} & \hat{w}_t \\ = & -\frac{\left(1-\xi_w\right)\left(1-\xi_w\beta\right)}{\left(1+\beta\right)\xi_w}\left(\begin{array}{c}\hat{w}_t-\widehat{MRS}_t-\frac{\lambda^w}{1+\lambda^w}\hat{\lambda}_t^w-\frac{\tau^l}{1-\tau^l}\hat{\tau}_t^l \\ -\frac{\tau^c}{1+\tau^c}\hat{\tau}_t^c\end{array}\right) \\ & +\frac{\beta}{1+\beta}\hat{w}_{t+1}+\frac{1}{1+\beta}\hat{w}_{t-1}+\frac{\chi_w}{1+\beta}\hat{\pi}_{t-1}-\frac{1+\beta\chi_w}{1+\beta}\hat{\pi}_t \\ & +\frac{\beta}{1+\beta}\hat{\pi}_{t+1}\end{aligned} \tag{A10}$$

$$\widehat{MRS}_t=\frac{\sigma}{1-b}\hat{c}_t-\frac{\zeta\sigma}{1-\zeta}\hat{c}_{t-1}+\phi_l\hat{h}_t \tag{A11}$$

$$\hat{u}_t+\hat{k}_t-\hat{h}_t-\hat{g}_{z,t}=\hat{w}_t-\hat{r}_t^k \tag{A12}$$

$$\widehat{mc}_t=-\hat{\varepsilon}_t^a+\alpha\hat{r}_t^k+\left(1-\alpha\right)\hat{w}_t \tag{A13}$$

$$\hat{y}_t=\frac{y+\Phi}{y}\hat{\varepsilon}_t^a+\frac{\alpha\left(y+\Phi\right)}{y}\hat{k}_t+\frac{\alpha\left(y+\Phi\right)}{y}\hat{u}_t+\frac{\left(1-\alpha\right)\left(y+\Phi\right)}{y}\hat{h}_t \tag{A14}$$

$$\hat{R}_t=0 \tag{A15}$$

$$\tilde{t}_t = \rho_t \tilde{t}_{t-1} + (1-\rho_t)\,\phi_{tb}\tilde{b}_{t-1} + \upsilon_t^t \tag{A16}$$

$$\hat{\tau}_t^w = \rho_w \hat{\tau}_{t-1}^w + (1-\rho_w)\,\phi_{\tau wb}\tilde{b}_{t-1} + \upsilon_t^{\tau w} \tag{A17}$$

$$\hat{\tau}_t^c = \rho_c \hat{\tau}_{t-1}^c + (1-\rho_c)\,\phi_{\tau cb}\tilde{b}_{t-1} + \upsilon_t^{\tau c} \tag{A18}$$

$$\tilde{g}_t = \rho_g \tilde{g}_{t-1} + \upsilon_t^g \tag{A19}$$

$$\hat{\varepsilon}_t^a = \rho_a \hat{\varepsilon}_{t-1}^a + \upsilon_t^a \tag{A20}$$

$$\hat{\varepsilon}_t^b = \rho_b \hat{\varepsilon}_{t-1}^b + \upsilon_t^b \tag{A21}$$

$$\hat{\varepsilon}_t^i = \rho_b \hat{\varepsilon}_{t-1}^i + \upsilon_t^i \tag{A22}$$

$$\hat{\lambda}_t^p = \rho_p \hat{\lambda}_{t-1}^p + \upsilon_t^p \tag{A23}$$

$$\hat{\lambda}_t^w = \rho_w \hat{\lambda}_{t-1}^w + \upsilon_t^w \tag{A24}$$

Definition of total tax revenues:

$$\widetilde{trev}_t = \tilde{t}_t + \frac{c}{y}\tau^c\left(\hat{\tau}_t^c + \hat{c}_t\right) + \frac{\tau^w wh}{y}\left(\hat{\tau}_t^w + \hat{w}_t + \hat{h}_t\right) \tag{A25}$$

A.2 Data

Definition of observable variables

- $gy\_obs = 100 * \Delta LN(RGDP/LFWindex)$
- $gc\_obs = 100 * \Delta LN((CONS/GDPDEF)/LFWindex)$
- $gi\_obs = 100 * \Delta LN((INV/GDPDEF)/LFWindex)$
- $gb\_obs = 100 * \Delta LN((DEBT/GDPDEF)/LFWindex)$
- $h\_obs = 100 * (LN(HOURS) - HP\_trend)$
- $gw\_obs = 100 * \Delta LN(WAGE/GDPDEF)$
- $\pi\_obs = 100 * \Delta LN(GDPDEF)$
- $grev_l = 100 * \Delta LN((REV_l/GDPDEF)/LFWindex)$
- $grev_c = 100 * \Delta LN((REV_c/GDPDEF)/LFWindex)$
- $R\_obs = INT\_RATE/4$

Source of data

- RGDP: Real Gross domestic product, Quarterly, Billions of Chained (2015) Yen, Seasonally adjusted.

  Source: National Accounts of Japan, Cabinet Office.
- HOURS=HW*EMPLindex/LFWindex
- LFW: Working-Age Population Total: From 15 to 64 Years for Japan, Persons, Quarterly, Seasonally Adjusted.

  Source: LFWA64TTJPQ647S, Federal Reserve Bank of St. Louis.
- LFWindex: Index for LFW (2015=100)

  Note: average quarterly index for tax revenues.
- EMPL: Employment Total: 15 Years or over for Japan, Persons, Quarterly, Seasonally Adjusted.

  Source: LFEMTTTTJPM647S, Federal Reserve Bank of St. Louis.
- EMPLindex: Index for EMPL (2015=100)
- HW: Hours Worked: Manufacturing: Monthly for Japan, Index 2015=100, Quarterly, Seasonally Adjusted.

  Source: HOHWMN03JPM661S, Federal Reserve Bank of St. Louis.
- GDPDEF: GDP deflator, Quarterly, Seasonally adjusted, Index, 2015=100.

  Source: National Accounts of Japan, Cabinet Office.

  Note: average quarterly index for tax revenues.
- CONS: Private Consumption, Quarterly, Billion Yen, Seasonally adjusted.

  Source: National Accounts of Japan, Cabinet Office.
- INV: Gross fixed capital formation, Quarterly, Billion Yen, Seasonally adjusted.

  Source: National Accounts of Japan, Cabinet Office.
- DEBT: Nominal Total Credit to General Government, Adjusted for Breaks, for Japan, Japanese Yen (Billions), Quarterly, Not Seasonally Adjusted.

  Source: QJPGANXDCA, Federal Reserve Bank of St. Louis.

  Authors' computations: Seasonally adjusted with Census X-13, missing observations rebuilt backwards with Tramo-Seats.
- WAGE: Labour compensation per employee, Quarterly, Index, Current prices, 2015=100, Seasonally adjusted.

  Source: OECD Productivity and unit labour costs Database.

- REV_I: Taxes on income and profits of individuals, General government, Billions Yen, annual. Source: 1110, Japan - Tax revenues, OECD.
- REV_c: Taxes on goods and services, General government, Billions Yen, annual. Source: 5000, Japan - Tax revenues, OECD.
- INT_RATE: Shadow rate by Krippner (download at: https://www.ljkmfa.com/visitors/)

A.3 Robustness

A.3.1 Passive fiscal with no correlations

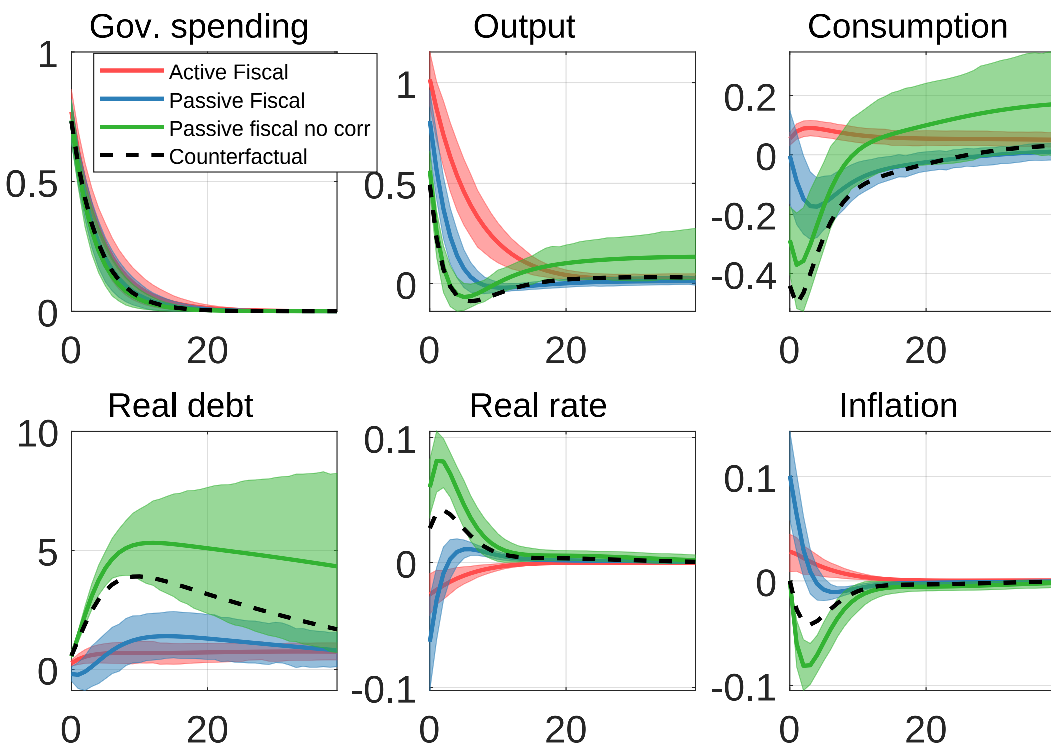

Figure A1: Posterior impulse responses to a one standard deviation government spending shock.
Notes: Red = Active Fiscal, Blue = Passive Fiscal. Solid lines are mean responses, shaded areas indicate 90% bands. Counterfactual (dotted black lines) = passive fiscal with zero correlation with sunspot.

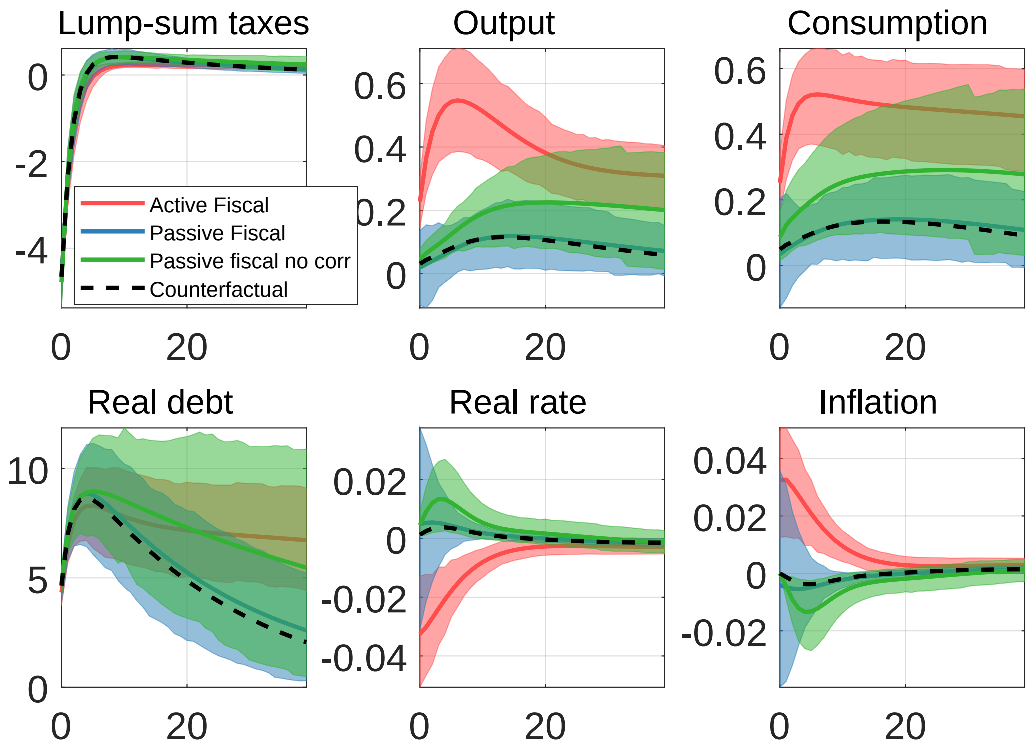

Figure A2: Posterior impulse responses to a one standard deviation lump-sum tax shock.
Notes: Red = Active Fiscal, Blue = Passive Fiscal. Solid lines are mean responses, shaded areas indicate 90% bands. Counterfactual (dotted black lines) = passive fiscal with zero correlation with sunspot.

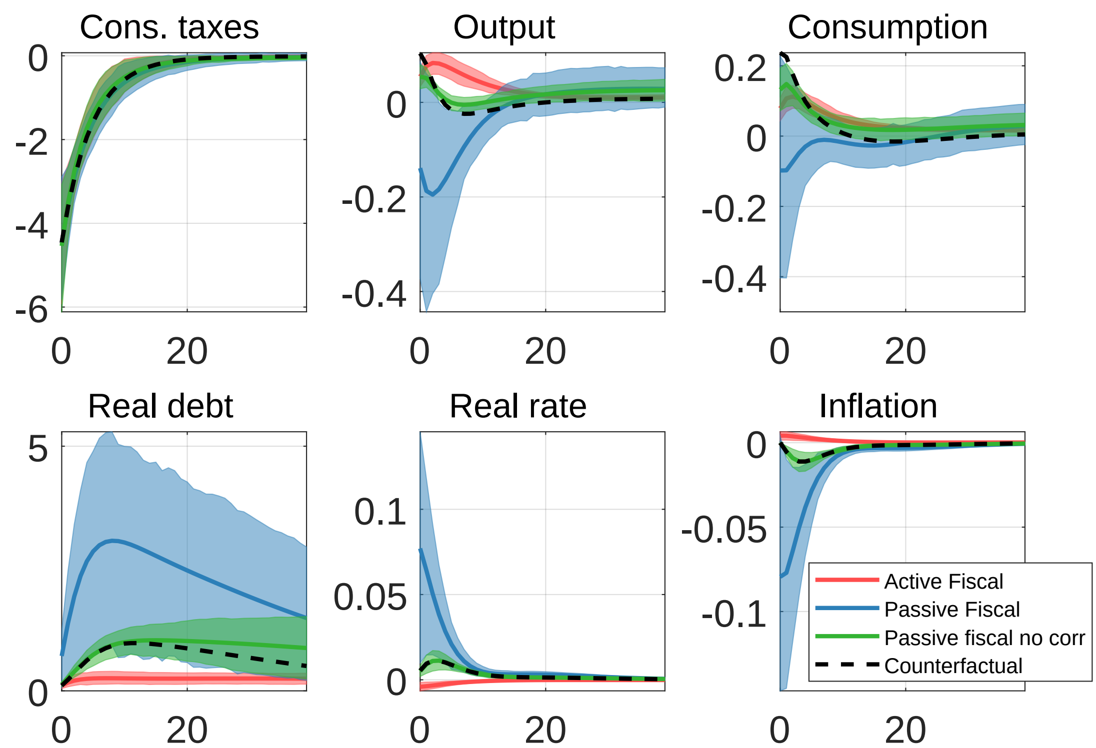

Figure A3: Posterior impulse responses to a one standard deviation consumption tax shock.
Notes: Red = Active Fiscal, Blue = Passive Fiscal. Solid lines are mean responses, shaded areas indicate 90% bands. Counterfactual (dotted black lines) = passive fiscal with zero correlation with sunspot.

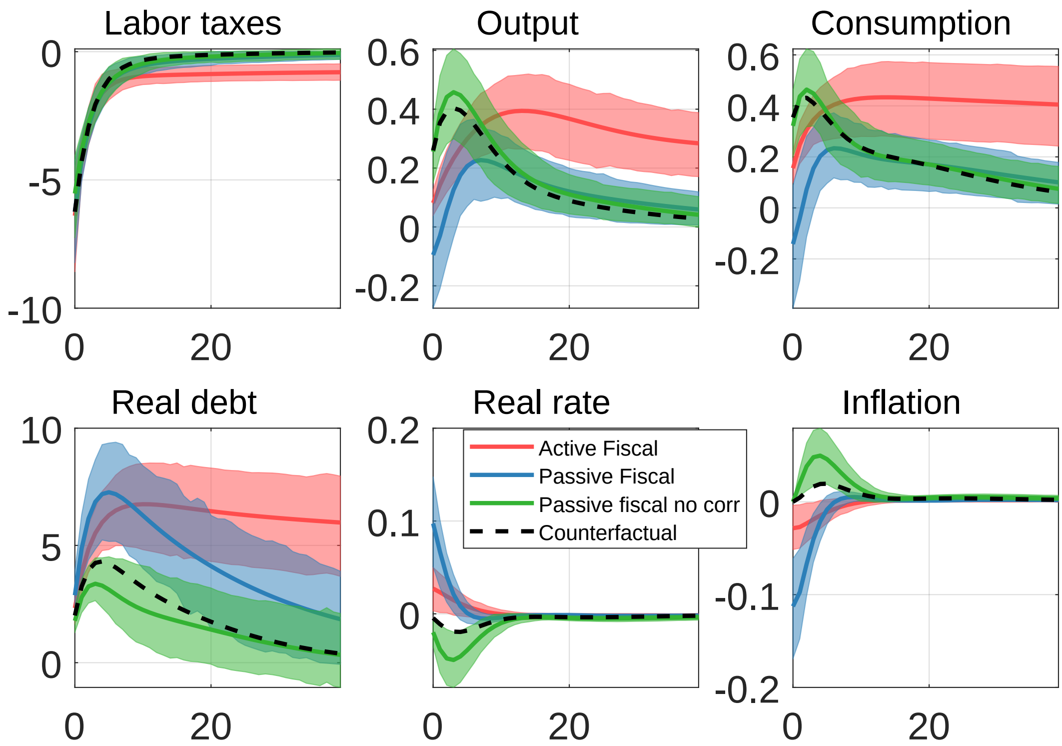

Figure A4: Posterior impulse responses to a one standard deviation labor tax shock.
Notes: Red = Active Fiscal, Blue = Passive Fiscal. Solid lines are mean responses, shaded areas indicate 90% bands. Counterfactual (dotted black lines) = passive fiscal with zero correlation with sunspot.

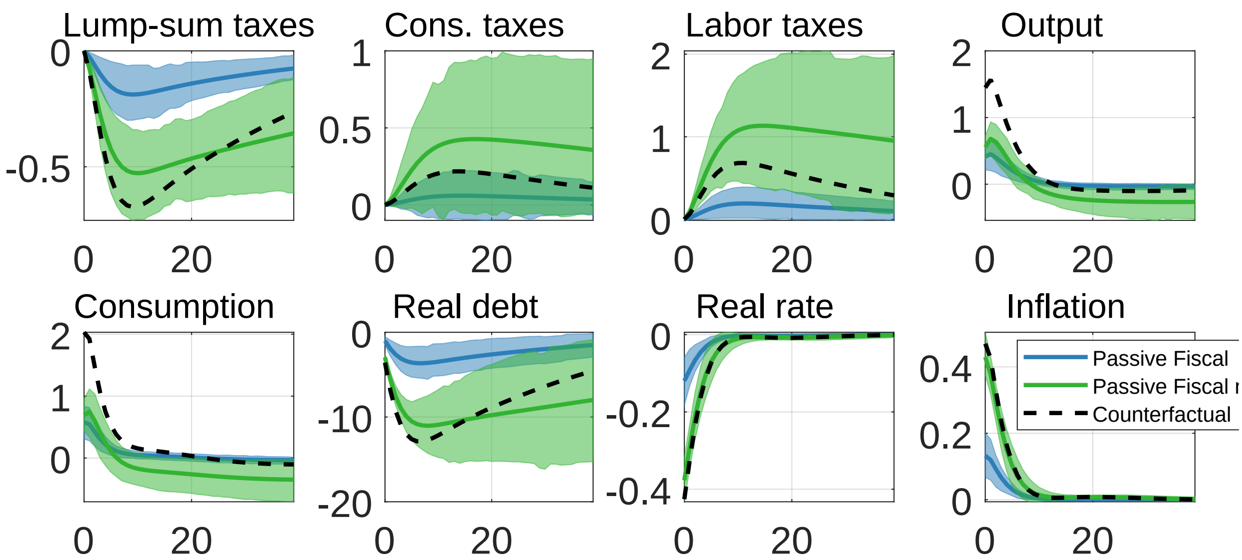

Figure A5: Posterior impulse responses to a one standard deviation sunspot shock.
Notes: Blue = Passive Fiscal. Solid lines are mean responses, shaded areas indicate 90% bands.

A.3.2 Passive monetary policy with Taylor rule

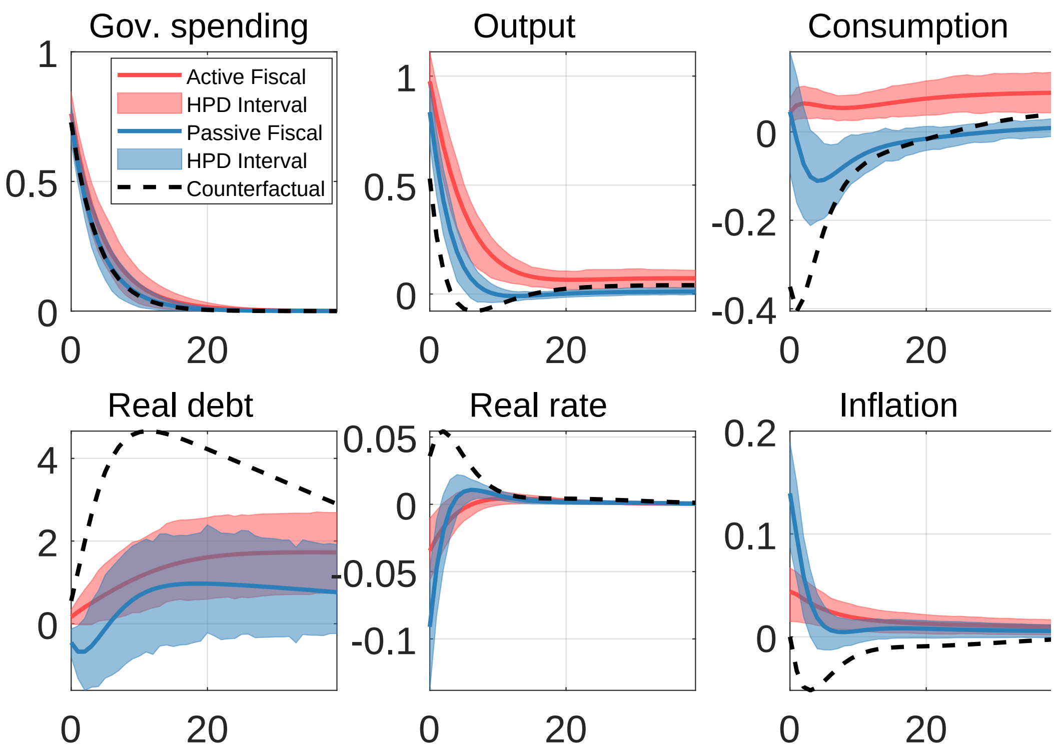

Figure A6: Posterior impulse responses to a one standard deviation government spending shock.
Notes: Red = Active Fiscal, Blue = Passive Fiscal. Solid lines are mean responses, shaded areas indicate 90% bands. Counterfactual (dotted black lines) = passive fiscal with zero correlation with sunspot.

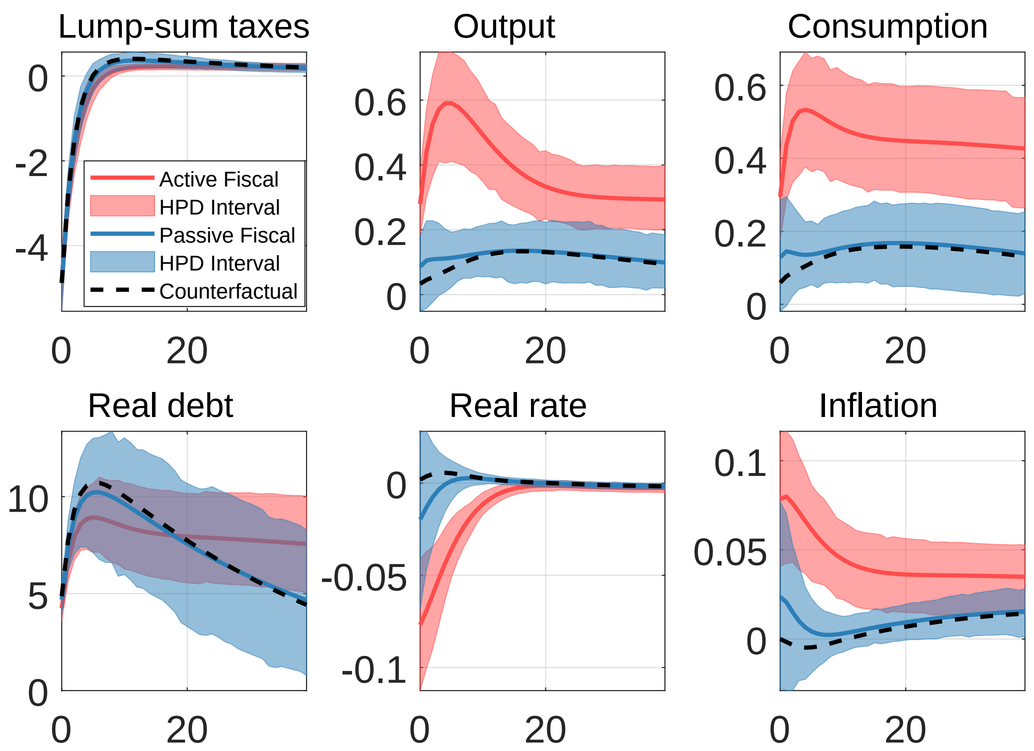

Figure A7: Posterior impulse responses to a one standard deviation lump-sum tax shock.
Notes: Red = Active Fiscal, Blue = Passive Fiscal. Solid lines are mean responses, shaded areas indicate 90% bands. Counterfactual (dotted black lines) = passive fiscal with zero correlation with sunspot.

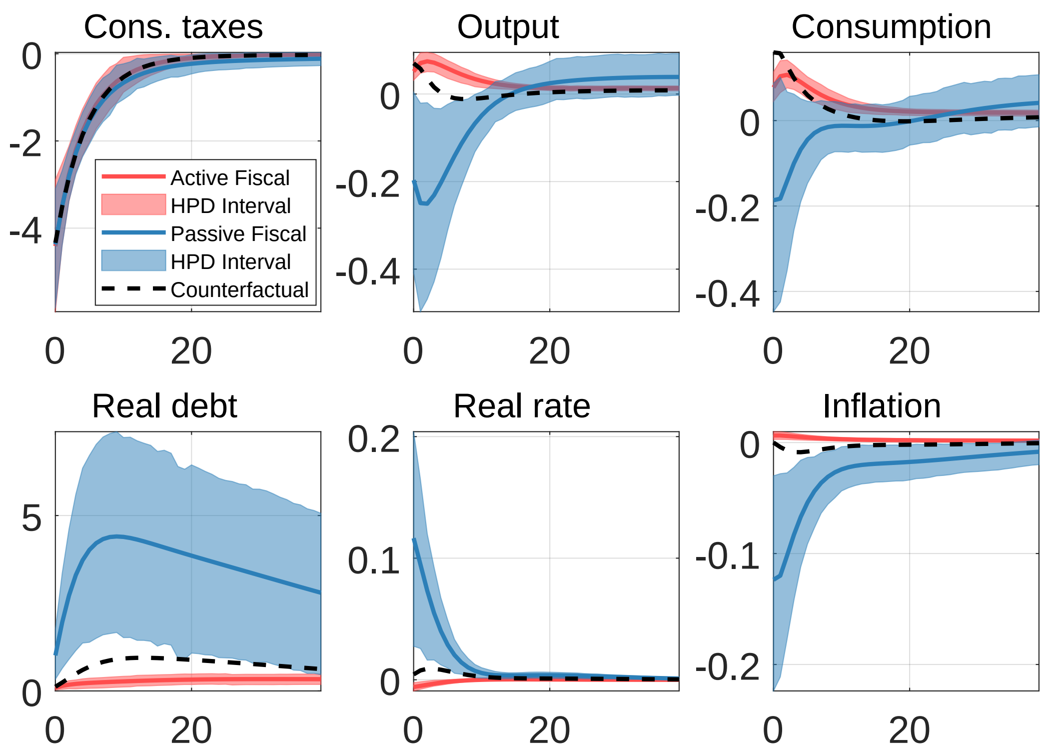

Figure A8: Posterior impulse responses to a one standard deviation consumption tax shock.
Notes: Red = Active Fiscal, Blue = Passive Fiscal. Solid lines are mean responses, shaded areas indicate 90% bands. Counterfactual (dotted black lines) = passive fiscal with zero correlation with sunspot.

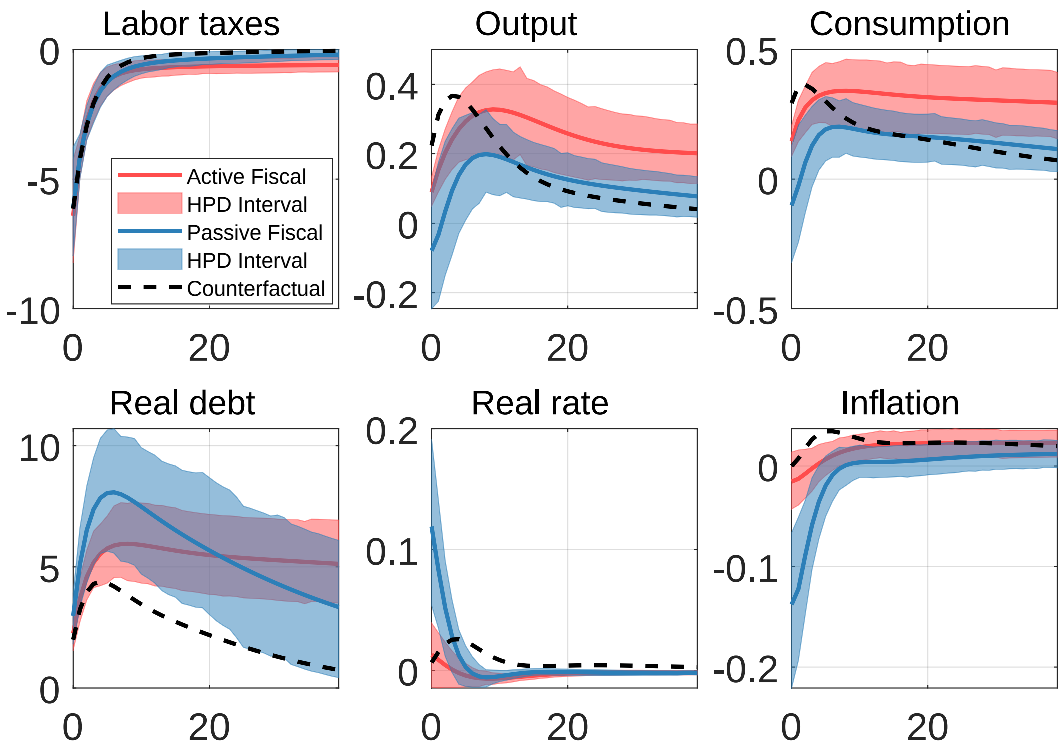

Figure A9: Posterior impulse responses to a one standard deviation labor tax shock.

Notes: Red = Active Fiscal, Blue = Passive Fiscal. Solid lines are mean responses, shaded areas indicate 90% bands. Counterfactual (dotted black lines) = passive fiscal with zero correlation with sunspot.