Online Appendix to

"Uncertain Policy Regimes and Government Spending Effects"

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This online appendix contains additional sensitivity simulations of government spending effects in the uncertain money regime, as well as the simulations using a model with regimes $\mathcal{F}$ and $\mathcal{M}$, which are similar to our money and debt regimes in the paper.

1 More Sensitivity analysis

The two sensitivity simulations presented here are 1) the exogenous regime switching mechanism and 2) a big government spending shock.

1.1 Exogenous Policy Regime Switching

We model policy regime uncertainty as endogenous in the paper, depending on economic states. As most work with macro policy regime switching assumes exogenous switching (e.g., Davig and Leeper, 2006; Bianchi, 2013), we also simulate money-financed spending effects with an exogenous switching mechanism—assuming that the switching probability to the debt regime is constant.

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We set the switching probability to the debt regime (1-$p_{\mathbf{M},t}$) to be 0.04 for all t, matching the estimated mean switching probability of regime $\mathcal{F}$ in Bianchi and Ilut (2017). With an initial debt ratio of 100%, the impact output multiplier, 1.14, is almost the same as that under the fixed money regime (see Table 1 under exogenous switching and row (2) of Table 2 for output multipliers in the paper).

The simulation under the exogenous switching mechanism shows the importance of modeling regime switching as endogenous. Setting the switching probability to a small, constant value underestimates the impact of regime uncertainty on money-financed spending effects. Our modeling of endogenous regime switching also highlights the role of observed inflation in shaping agents' expectations about future policy regimes, quantitatively important in money-financed spending multipliers.

1.2 A Bigger Government Spending Shock

All simulations in the paper are based on a government spending shock equal to 1% of steady-state output. Since the fiscal support provided in the last two recessions is sizable, we explore whether multipliers depend on the size of the shock, taking the advantage of our nonlinear model.[1] Table 2 compares the output multipliers for a 1% shock to those of a 10% shock under fixed and uncertain regime assumptions. The output multipliers are very similar between the two spending shocks, whether the policy regime is fixed or uncertain.

Since the spending shocks are persistent ($\rho_g = 0.8$), the bigger 10% shock leads to higher expected and current inflation. Higher inflation enhances intertemporal substitution effects to support private demand, but it also leads agents to place a higher probability of switching to the debt regime. These two channels have opposing effects on government spending effects, explaining

[1] The American Recovery and Reinvestment Act in 2009 is estimated to have a budgetary cost of 5.4% of GDP (Congressional Budget Office, 2009). A sequence of legislation in response to the COVID-19 pandemic as of March 2021 is estimated to have a budgetary cost of 25.5% of GDP (International Monetary Fund, 2021).

the little differences between the two sets of multipliers.

2 Spending Multipliers under Regimes $\mathcal{F}$ vs. $\mathcal{M}$

In the literature of monetary and fiscal policy interactions, the mechanisms that government spending is more expansionary in regime $\mathcal{F}$ than regime $\mathcal{M}$ are the same as those making spending multipliers bigger in the fixed money than in the fixed debt regime (see Section 4.1 in the paper). In this section, we simulate an extended model of Mao and Yang (2020) with seigniorage to show that regime uncertainty can substantially lower spending multipliers in the uncertain regime $\mathcal{F}$, relative to those in the fixed regime $\mathcal{F}$.

The model description here shares the same variable definitions as those described in Section 2 of the paper, and the model has the same agents' and firms' optimization problems described by equations (2.1) and (2.3). The government budget constraint and the government purchase process are also the same as equations (2.9) and (2.10). Policy regimes $\mathcal{F}$ and $\mathcal{M}$ are characterized by different response magnitudes of the income tax rate to debt deviation in the tax rule and the magnitude of the nominal interest rate to inflation in the monetary policy rule, following Leeper (1991) and Leeper et al. (2017).

$$\tau_t = \tau + \gamma^{\mathcal{J}}(b_{t-1} - b), \qquad \gamma^{\mathcal{J}} \in \{\gamma^F, \gamma^M\}, \tag{2.1}$$

where $\gamma^{\mathcal{M}} > \gamma^{\mathcal{F}} \geq 0$.

$$R_t = \max\left\{1, R \cdot \left(\frac{\pi_t}{\pi^*}\right)^{\alpha^{\mathcal{J}}}\right\}, \qquad \alpha^{\mathcal{J}} \in \{\alpha^{\mathcal{F}}, \alpha^{\mathcal{M}}\}, \tag{2.2}$$

where $\alpha^{\mathcal{F}} < 1$ and $\alpha^{\mathcal{M}} > 1$. For the demonstrative purpose, the calibration of the structural parameters and steady-state fiscal values follow those listed in Table 1. In regime $\mathcal{F}$, we set $\alpha^{\mathcal{F}} = \gamma^{\mathcal{F}} = 0$, and in regime $\mathcal{M}$, $\alpha^{\mathcal{M}} = 1.5$ and $\gamma^{\mathcal{M}} = 0.05$. Both sets of parameters ensure that the model has determinacy.

To model policy regime uncertainty in regime $\mathcal{F}$, we adopt the same logistic function as specified in equation (2.17), where $p_{\mathcal{F},t}$ (replacing $p_{\mathbf{M},t}$) is the probability of continuing to stay in regime $\mathcal{F}$, which depends on last-period inflation as specified in equation (2.18) in the paper. The simulations confirm that the fixed regime assumption produces much bigger multipliers in regime $\mathcal{F}$ than in regime $\mathcal{M}$, and the short-run multipliers in regime $\mathcal{F}$ is bigger than 1 (see Table 3). These findings are consistent with Kim (2003), Davig and Leeper (2011), Dupor and Li (2015), Beck-Friis and Willems (2017), and Leeper et al. (2017). Also like Mao and Yang (2020), the simulations under the initial debt ratio has a negative effect on output multipliers in regime $\mathcal{F}$, but not in regime $\mathcal{M}$.

As in the baseline model with the money and debt regimes, policy regime uncertainty in regime $\mathcal{F}$ plays a similar role in decreasing output multipliers. Comparing row (2) in Table 3 to row (1) under regime $\mathcal{F}$ in Table 4, we see that the spending multipliers decrease substantially in the uncertain regime $\mathcal{F}$. Conditional on an initial debt ratio of 100%, the impact multiplier is 1.12 in the fixed regime $\mathcal{F}$, compared to 0.70 in the uncertain regime $\mathcal{F}$. Also, a smaller degree of regime uncertainty—as represented by a flatter regime switching function—only has a minor effect in increasing spending multiplier in regime $\mathcal{F}$, as shown in row (2) of Table 4.

	impact	4Q	20Q
	output multiplier		
Baseline regime switching function	0.70	0.73	0.77
Exogenous switching	1.14	1.03	0.80

Table 1: **Sensitivity analysis: exogenous switching mechanism.** The initial debt ratio is 100%. Multipliers are calculated based on equation (4.1) in the paper.

Initial Shock Size	1% of Output			10% of Output		
	impact	4Q	20Q	impact	4Q	20Q
			output multiplier			
Fixed money regime	1.13	1.00	0.80	1.13	0.99	0.81
Uncertain money regime	0.70	0.73	0.77	0.69	0.70	0.74

Table 2: **Sensitivity analysis: the size of government spending shocks.** Cumulative multipliers in the money regime. Multipliers are calculated based on equation (4.1) in the paper.

Policy Regime	Regime $\mathcal{M}$			Regime $\mathcal{F}$		
	impact	4Q	20Q	impact	4Q	20Q
			output multiplier			
(1) $\frac{b_0}{4y_0} = 0.6$	0.59	0.57	0.50	1.19	1.03	0.84
(2) $\frac{b_0}{4y_0} = 1.0$	0.59	0.57	0.49	1.12	0.95	0.78

Table 3: **Cumulative multipliers in the model with regimes $\mathcal{M}$ and $\mathcal{F}$: fixed policy regime.** Multipliers are calculated based on equation (4.1) in the paper.

	impact	4Q	20Q
(1) *Baseline regime switching function*	0.66	0.66	0.65
(2) *Flatter regime switching function*	0.67	0.67	0.65

Table 4: **Cumulative spending multipliers in regime $\mathcal{F}$: uncertain policy regime.** The initial debt ratio is 100% of annual output. The baseline (flatter) regime switching function is the solid (dashed) line in Figure 2 in the paper. Multipliers are calculated based on equation (4.1) in the paper.

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