The Active and Passive Fiscal-Monetary Policy Regimes and India's Government Expenditure Shocks: Which Stand Matters the Most?

Paras Sachdeva[*] *Wasim Ahmad*[†]

Abstract

This paper employs the DSGE model with rich fiscal block to examine the asymmetries in the transmission and effectiveness of the government expenditure shock across the active fiscal and passive monetary policy (AFPM) regime and the active monetary and passive fiscal policy (AMPF) regime in the Indian economy. In the AMPF regime, the central bank actively targets inflation, and the fiscal authority ensures public debt sustainability. On the other hand, in the AFPM regime, the central bank weakly targets inflation and stabilizes public debt in the economy. With higher multipliers and debt rollover, the government expenditure stimulus has been more beneficial in the AFPM regime than in the AMPF regime. In the AMPF regime, the central bank has effectively neutralized the inflationary effects of the government expenditure shock. However, this neutralization has weakened the effect of the government expenditure shock on consumption, investment, and output. Based on the findings, the paper suggests the monetary authority to keep its stance accommodative when the fiscal authority injects government expenditure stimulus into the economy.

JEL Classification: E32, E62, C32, C11

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[*]Department of Economic Sciences, Indian Institute of Technology Kanpur, Uttar Pradesh, India parassachdevaeco@gmail.com

[†]Department of Economic Sciences, Indian Institute of Technology Kanpur, Uttar Pradesh, India ahmadwasimdu@gmail.com

1 Introduction

Governments have aggressively infused fiscal stimuli during the global financial crisis and the COVID-19 pandemic to counter the contractionary effects of these crises. Along with this, the central banks have also kept their stance accommodative in response to these crises by maintaining interest rates at low levels. This coordinated move by monetary and fiscal authorities has gathered the attention of macroeconomists and raised some key questions. Is the fiscal stimulus combined with an accommodative monetary policy stance effective in uplifting economic activity? What will be the impact of these expansionary policies on inflation? Does this kind of policy intervention keep the debt-GDP ratio stable in the future? In this study, we attempt to answer these questions in the context of the Indian economy.

Numerous studies have examined how the transmission of fiscal stimulus is conditioned on the monetary policy stance (see Leeper, 1991; Davig & Leeper, 2011; Traum & Yang, 2011; Zubairy, 2014; Leeper et al., 2017; Beck-Friis & Willems, 2017; Bianchi & Melosi, 2019; Ascari et al., 2023; Kim et al., 2023). These studies describe fiscal and monetary policy mix stances in the form of active fiscal and passive monetary policy stance (AFPM) and active monetary and passive fiscal policy stance (AMPF). The passive policy adjusts its instrument to stabilize the public debt, whereas the active policy keeps its instrument free from public debt. In the AMPF stance, the fiscal instruments respond to public debt, and the central bank actively targets inflation. On the contrary, in the AFPM stance, fiscal instruments do not respond to debt, and the central bank weakly targets inflation. The public expenditure stimulus under the AMPF regime results in higher interest rates and smaller public expenditure multiplier values. The rise in public debt under this regime gets stabilized by future primary surpluses. On the other hand, in the AFPM regime, the public expenditure stimulus results in higher inflation and larger multiplier values[1] . Higher inflation in this regime stabilizes the initial rise in public debt. The stabalization of public debt via inflation in the AFPM regime is stated as the Fiscal Theory of Price Level (FTPL) or Fiscal Dominance in the literature (see Woodford, 1994; Cochrane, 1998; Cochrane, 2001; Cochrane, 2005).

The aforementioned studies discussing non-linearities in the transmission of fiscal shocks have been confined to advanced economies. In the case of emerging market economies (EMEs), few studies discuss the transmission and effectiveness of public expenditure stimulus in AMPF and AFPM regimes (see Nandi, 2019; Liu et al., 2021). These studies define the AMPF and AFPM regimes in line with studies on developed economies. However, EMEs differ from advanced economies in terms of structural characteristics like fiscal space, degree of fiscal dominance, fiscal policy transmission mechanism, inflation volatility, interest rate structure, growth rate, etc. Therefore, fiscal and monetary policy rules governing the AFPM and AMPF regimes will differ in EMEs compared to what is prevailing in developed economies. Withal, the transmission of public expenditure stimulus in these regimes in EMEs will also vary with the existing macroeconomic literature. In this regard, this paper redefines the fiscal and monetary policy rules in the AFPM and AMPF regimes, and examines the asymmetries in transmission and effectiveness of the government expenditure shock across these regimes in an EME (the Indian case).

In contrast to developed economies, in the AFPM regime, debt stabilization via inflation without a reduction in the nominal interest rate stands infeasible in EMEs like India. This is because the public expenditure stimulus doesn't always lead to inflationary effects. Food subsidies, aimed at inducing price rigidity, have been one of the biggest components of the Indian budget (see Anand et al., 2016). The fiscal stimulus, injected via food subsidies, stabilizes

[1]Alongside, the studies have also found the efficacy of fiscal stimulus to be high in a zero lower-bound environment (see Eggertsson, 2011; Woodford, 2011; Christiano et al., 2011; Erceg & Lindé, 2014)

inflation instead of spiking it (see Ginn & Pourroy, 2019 and Ginn & Pourroy, 2022[3]). The government expenditure shock, without causing inflationary scenarios, can result in high public debt levels in the economy. However, the increase in public debt with fiscal stimulus can be neutralized if the central bank lowers its interest rate in response to the increased public debt (see Kumhof et al., 2010). The reduction in interest rates cuts down nominal debt servicing cost and raises inflation in the economy. The rise in inflation further cuts down the real cost of debt and, subsequently, the public debt levels in the economy. In this regard, our study, in line with Kumhof et al. (2010), considers the interest rate to depend on public debt along with other macroeconomic variables in the AFPM regime.

In the AMPF regime, debt stabilization through a fiscal consolidation drive becomes difficult in EMEs, which have limited fiscal space. Fiscal policy in EMEs is classified as non-Ricardian, i.e., changes in the present primary deficit will affect the discounted future value of the government budget. Furthermore, the EMEs exhibit a weak tax revenue base, a rudimentary tax system with incidences of tax evasion, and a high share of revenue expenditure in total government expenditure. Therefore, it becomes strenuous for the fiscal authorities to generate primary surpluses for stabilizing public debt in this regime. In order to incorporate the aforementioned fiscal rigidities into the AMPF regime, we have considered tax rates to be independent of public debt, and public expenditures to respond negatively to the increasing public debt.

In a nutshell, this paper considers the central bank to actively target inflation and the fiscal authorities to cut down public expenditure to stabilize debt in the AMPF regime. On the other hand, in the AFPM regime, the paper considers the central bank to weakly target inflation and stabilize debt by reducing nominal interest rates.

[3]The insignificant impact of the fiscal stimulus on inflation in the Indian economy has also been found in Sachdeva et al. (2023a) and Sachdeva et al. (2023b).

In this paper, we examine the asymmetries in the transmission of public expenditure shocks across the AMPF and AFPM regimes by using the Dynamic Stochastic General Equilibrium (DSGE) model of Leeper et al. (2017). Our study augments the Leeper et al. (2017) model by incorporating the debt-GDP ratio into the Taylor rule. The AMPF and AFPM regimes are classified through the Taylor rule and fiscal reaction function parameters. We estimate the DSGE model with Bayesian methods on Indian data. Furthermore, our study examines the sensitivity of the transmission and effectiveness of the government expenditure shocks subject to changes in the parameters describing wage and price rigidities, habit formation, the share of non-Ricardian consumers, public consumption in utility, and the persistence of the government expenditure shocks.

The estimation of the DSGE model reveals the effect of the government expenditure shock on output, consumption, and investment to be substantially higher in the AFPM regime than in the AMPF regime. Moreover, the Ricardian consumption, and investment multipliers are positive and negative in the AFPM regime and AMPF regime, respectively. The positive value of the investment multiplier found in the AFPM regime contrasts with the existing DSGE literature. The accommodative response of interest rates to the government expenditure shock and the resulting high inflation have led to debt rollover, i.e., the negative impact of the government expenditure shock on the debt-GDP ratio in the AFPM regime. This contrasts with studies on developed economies, which find a larger impact of the government expenditure shock on the debt-GDP ratio in the AFPM regime. Moreover, the debt-rollover doesn't come at the cost of uncontrolled inflation, as the impact of the government expenditure shock on inflation has converged to zero over longer horizons in the AFPM regime.

Besides, the paper finds the transmission and effectiveness of the government expenditure shock in the AMPF regime to stand robust with changes in non-policy parameters. Whereas, in the AFPM regime, the transmission and effectiveness of the government expenditure shock have been found sensitive to changes in parameters governing wage and price rigidity, the share of non-Ricardian consumers, habit formation, and the persistence of the government expenditure shock. However, the asymmetries in transmission and the effectiveness of the government expenditure shock across the AMPF and AFPM regimes still stand insensitive to changes in key non-policy parameters.

Our study contributes to the existing macroeconomic literature by identifying the AFPM and AMPF regimes that reflect EMEs. It further adds to the literature by revealing: i) the zero convergence of inflation and public debt responses to the government expenditure shock in the AFPM regime; ii) the presence of debt-rollovers in the AFPM regime; iii) the positive and negative impact of the government expenditure shock on Ricardian consumption and private investment in the AFPM and AMPF regimes, respectively; and iv) the larger values of government expenditure multipliers in the AFPM regime than in the AMPF regime. These revelations have key policy implications for policymakers in EMEs like India. The government expenditure stimulus, if injected with an accomodative monetary policy stance, can uplift economic activity without causing inflationary and public debt spikes in the economy.

The rest of the paper is structured as follows. The DSGE model is discussed in the second section. The third section details the priors and posterior estimates of the DSGE model. The transmission of the government expenditure shock across the AMPF and AFPM regimes has been discussed in the fourth section. The fifth section checks the sensitivity of the transmission and effectiveness of the government expenditure shock across the AFPM and AMPF regimes, subject to the non-policy parameters. The last section concludes the study.

2 Dynamic Stochastic General Equilibrium Model

The paper employs the DSGE model of Leeper et al. (2017) to examine asymmetries in the transmission of the government expenditure shock across the AFPM and AMPF regimes. The Leeper et al. (2017) model features (i) Ricardian consumers who can participate in credit markets and non-Ricardian consumers who are bounded by their labor income in each period; (ii) government expenditure in consumers' utility, i.e., households derive utility from leisure, consumption, and government spending; (iii) producers who employ labor and capital to produce goods; (iv) imperfect competition in labor and goods markets; (v) frictions in agents' decision making; (vi) fiscal authority setting its instruments through feedback rules; and (vii) monetary authority following the Taylor rule to determine policy rates. Our study augments the model by introducing the debt-GDP ratio in the Taylor rule, as suggested by Kumhof et al. (2010). The details of the DSGE model are as follows:

Consumers

The economy comprises of a continuum of consumers, out of which $1-\mu$ proportion of consumers are Ricardian and μ proportion of consumers are non-Ricardian. The Ricardian consumer gets utility from leisure and consumption.

Ricardian Consumers

The lifetime utility function of a Ricardian consumer is as follows:

$$E_t \sum_{t=0}^{\infty} \beta^t \mu_t^b \left(\ln \left(\mathrm{C}_t^R(j) - \theta \mathrm{C}_{t-1}^R \right) - \left(\frac{H_t^R(j)^{1+\xi}}{1+\xi} \right) \right) \tag{2.1}$$

Here, $C_t^R\,(j)$ refers to the consumption of j^{th} Ricardian consumer. $C_t^R\,(j)$ is a composite good comprising the consumption of public goods (G_t) and private goods $C_t^{*R}\,(j)$. The relation between $C_t^R(j)$, G_t and $C_t^{*R}(j)$ is defined as $C_t^R(j) = C_t^{*R}(j) + \alpha_G G_t$, where α_G refers to the degree of substitutability between public good and private good [4]. The Ricardian consumer obtains utility from consumption relative to habit shock, i.e., $(C_t^R(j) - \theta C_{t-1}^R)$. Habit persistence is defined via lagged consumption (θC_{t-1}^R, where $\theta \epsilon [0, 1)$). Each of the Ricardian consumers supplies differentiated labor services $H_t^R(j, h)$, where $h\, \epsilon [0, 1]$. The aggregation of the labor services provided by the Ricadian household is given as, $H_t^R(j) = \int_0^1 H_t^R(j, h)\ dh$. β, ξ and μ_t^b in the lifetime utility function are the discount rate, the inverse of Frisch labor elasticity, and exogenous shock to preferences, respectively. The flow budget constraint of the Ricardian consumer is given in equation (2.2).

$$\begin{aligned} P_t\left(1+\tau_t^C\right) \mathrm{C}_t^{*R}(j) + P_t I_t^R(j) + P_t^B B_t(j) + R_t^{-1} B_{R,t}(j) \\ = \left(1+\rho P_t^B\right) B_{t-1}(j) + B_{R,t-1}(j) \\ + \left(1-\tau_t^H\right) \int_0^1 W_t^h H_t^R(j,h) dh + \left(1-\tau_t^K\right) R_t^k v_t(j) \bar{K}_{t-1}^R(j) \\ - \psi\left(v_t\right) \bar{K}_{t-1}^R + P_t Z_t^R + D_t(j) \end{aligned} \tag{2.2}$$

The Ricardian consumer participates in the credit market via one-period nominal private bonds $(B_{R,t}(j))$ and long-term nominal government bonds $(B_t(j))$. The Ricardian consumer buys $B_{R,t}(j)$ at price R_t^{-1} in period t and sells it at one currency unit in period t+1. These bonds have a net zero supply. On the other hand, the Ricardian consumer transacts $B_t(j)$ at price P_t^B in the market. The maturity of $B_t(j)$ decreases at the rate of $\rho \epsilon [0, 1]$, to get the duration of $(1 - \beta\rho)^{-1}$.

The Ricardian consumers get the after-tax labor income $\left((1 - \tau_t^H) \int_0^1 W_t^h H_t^R(j, h)\ dh\right)$, lump-sum government transfers $\left(P_t Z_t^R\right)$, firms' profit $(D_t(j))$, return on capital $((1 - \tau_t^K) R_t^k$

[4] If $\alpha_G < 0$, then $C_t^{*R}(j)$ and G_t are compliments, and if $\alpha_G > 0$, then $C_t^{*R}(j)$ and G_t are substitutes.

$v_t \bar{K}^R_{t-1}(j) - \psi(v_t) \bar{K}^R_{t-1})$, and value of bond holding $\left(\left(1+\rho P^B_t\right) B_{t-1}(j) + B_{R,t-1}(j)\right)$. Here, τ^H_t and τ^K_t are tax rates on labor income and rental income of capital, respectively. They spend the received income on consumption, which is subject to sales tax $(P_t \left(1+\tau^C_t\right)$ $C^{*R}_t(j))$, and invest in bonds $\left(P^B_t B_t(j) + R^{-1}_t B_{R,t}(j)\right)$ and capital $(P_t I^R_t(j))$. The physical capital $(\bar{K}^R_{t-1}(j))$ in the budget constraint is related to effective capital $(K^R_t(j))$ via $K^R_t(j) = v_t(j) \bar{K}^R_{t-1}(j)$, where $v_t(j)$ is the proportion of capital utilized. The utilization of capital comes at the per unit cost $(\Psi(v_t))$ of physical capital. In the steady state, the capital stock is fully utilized without incurring any cost, i.e., $v_t = 1$ and $\Psi(v_t) = 0$. The evolution of capital stock is defined in equation 2.3.

$$\bar{K}^R_t(j) = (1-\delta)\bar{K}^R_{t-1}(j) + u^i_t \left[1 - S\left(\frac{I^R_t(j)}{I^R_{t-1}(j)}\right)\right] I^R_t(j) \tag{2.3}$$

In line with Smets & Wouters (2003) and Christiano et al. (2005), the capital evolution equation comprises of an investment adjustment cost S(.), which satisfies $S'(e^\gamma) = 0$ and $S''(e^\gamma) \equiv s > 0$. The investment adjustment cost is subject to an investment efficiency shock u^i_t.

Non-Ricardian Consumers

The utility function of a non-Ricardian consumer is in line with Ricardian consumer. However, the non-Ricardian consumer doesn't participate in the credit market and spends their disposable income in each period on consumption $P_t \left(1+\tau^C_t\right) C^{*NR}_t(j)$. The disposable income of non-Ricardian consumers comprises of government transfers and after-tax wage income. In line with Ricardian consumers, the labor income and consumption expenditure of non-Ricardian consumers are taxed at the rates of τ^H_t and τ^C_t, respectively. The budget constraint of non-Ricardian consumers is given in equation (2.4).

$$P_t\left(1+\tau_t^C\right)\mathrm{C}_t^{*NR}(j)=\left(1-\tau_t^H\right)\int_0^1 W_t^h H_t^{NR}(j,h)dh+P_t Z_t^{NR}(j) \tag{2.4}$$

Producers

The production sector of the economy comprises firms producing intermediate goods and final goods. The final goods producing firm operating in a competitive market uses intermediate goods $Y_t(i),\ i\in\ [0,1]$, to produce the final good Y_t. The production function of a firm producing a final good exhibit a constant return to scale and is given in equation (2.5).

$$Y_t=\left(\int_0^1 Y_t(i)^{\frac{1}{1+\eta_t^p}}di\right)^{1+\eta_t^p} \tag{2.5}$$

Here, η_t^p refers to the time-varying markup on the prices of intermediate goods. The intermediate and final goods are priced at $\bar{P}_t(i)$ and $\bar{P}_t$, respectively. The final good producing firm maximizes $\bar{P}_t Y_t$ subject to the production technology given in equation (2.5). Profit maximization yields the demand function for intermediate goods, which is given in equation (2.6).

$$Y_t(i)=Y_t\left(\frac{\bar{P}_t(i)}{\bar{P}_t}\right)^{-\left(1+\eta_t^p\right)/\eta_t^p} \tag{2.6}$$

The firms producing intermediate goods are monopolistic and they use labor and capital as inputs. The production function of these firms exhibits constant returns to scale and is given in equation (2.7).

$$Y_t(i)=K_t(i)^\alpha\left(A_t H_t\right)^{1-\alpha}-A_t\Omega \tag{2.7}$$

Here, $\alpha \in [0, 1]$ and $\Omega > 0$ is the fixed cost incurred in producing the intermediate goods. Ω grows at a constant rate of technological progress (A_t), which is defined as, $u_t^a = lnA_t - lnA_{t-1}$. The term u_t^a follows the stationary first-order autoregressive process given in equation (2.8).

$$u_t^a = (1 - \rho_a)\,\gamma + \rho_{\mathrm{a}} u_{t-1}^a \tag{2.8}$$

Here, γ refers to the steady state value of u_t^a. The intermediate firms hire labor and capital in a perfectly competitive market at prices W_t and R_t. These firms minimize the cost, $W_tH_t{+}R_tK_t$ subject to the production function given in equation (2.7). The cost minimization yields the marginal cost (MC_t) given in equation (2.9).

$$MC_t = (1 - \alpha)^{\alpha - 1}\alpha^{-\alpha}\left(\mathrm{R}_{\mathrm{t}}^{\mathrm{K}}\right)^a W_t^{1-a} A_t^{\alpha - 1} \tag{2.9}$$

The price of output produced by intermediate firms $(\bar{P}_t\,(i))$ evolves according to the Calvo mechanism (see Calvo, 1983). The intermediate firm in period t reoptimizes its price with probability $(1 - \omega_P)$ and sets its price subject to past inflation with probability (ω_P). The firm reoptimizes its price by maximizing the expected discounted nominal profits given in equation (2.10) subject to the demand function given in equation (2.6), and it sets its price according to past inflation by following the rule given in equation (2.11).

$$E_t \sum_{s=0}^{\infty} (\beta\omega_P)^s \frac{\lambda_{t+s}}{\lambda_t}\left[\left(\prod_{k=1}^{s} \pi_{t+k-1}^{\chi_{\mathrm{P}}} \pi^{1-\chi_{\mathrm{P}}}\right) P_t(i) Y_{t+s}(i) - MC_{t+s} Y_{t+s}(i)\right] \tag{2.10}$$

$$P_t(i) = \pi_{t-1}^{\chi_{\mathrm{P}}} \pi^{1-\chi_{\mathrm{P}} P_{t-1}}(i) \text{ where } \pi_{t-1} \equiv \frac{P_{t-1}}{P_{t-2}} \tag{2.11}$$

Labor Market

The Ricardian consumers optimize their wages by maximizing utility in each period with probability $(1-\omega_w)$ and set their wages according to past inflation by the rule given in equation (2.12) with probability (ω_w). The non-Ricardian consumer sets their wages according to the optimization carried out by Ricardian consumers. At the determined wages, households supply differentiated labor to labor agency. The labor agency combines the differentiated labor input supplied by the households into a homogeneous labor input using the technology given in equation (2.13) and sells it to intermediate firms in a competitive market.

$$W_t(h) = W_{t-1}(h)\left(\pi_{t-1}e^{u^a_{t-1}}\right)^{\chi_w}\left(\pi e^{\gamma}\right)^{1-\chi_w} \tag{2.12}$$

$$H_t = \left(\int_0^1 H_t(h)^{\frac{1}{1+\eta_t^w}}\, dh\right)^{1+\eta_t^w} \tag{2.13}$$

$$H_t(h) = H_t^d\left(\frac{W_t(h)}{W_t}\right)^{\frac{-(1+\eta_t^w)}{\eta_t^W}} \tag{2.14}$$

Here, η_t^w refers to the time-varying markup over wages. The labor agency maximizes its profit function subject to production technology in equation (2.13). The profit maximization yields demand for differentiated labor given in equation (2.14). Here, H_t^d and W_t is the demand for homogeneous labor by the intermediate firms and the aggregate wage, which satisfies $W_t = \left(\int_0^1 W_t\,(h)^{\frac{1}{\eta_t^w}}\, dh\right)^{\eta_t^w}$.

Fiscal and Monetary Policy

The fiscal authority levies taxes on consumption, capital, and labor. It also receives money by selling nominal bonds. The government uses this money to finance their consumption expenditures and transfers made to Ricardian and non-Ricardian consumers. The transfers made by the government are identical across Ricardian and non-Ricardian households. The budget constraint faced by the government is given in equation (2.15). Fiscal instruments (government expenditure, transfers, and taxes) behave according to the rules given in equations (2.16), (2.17), and (2.18).

$$P_t G_t + P_t Z_t + \left(1 + \rho P_t^B\right) B_{t-1} = P_t^B B_t + \tau_t^K \mathrm{R}_\mathrm{t}^\mathrm{K} + \tau_t^H W_t H_t + P_t \tau_t^C C_t \tag{2.15}$$

$$\hat{g}_t = \rho_G \hat{g}_{t-1} - (1 - \rho_G)\, \gamma_G \hat{s}_{t-1}^b + u_t^G \tag{2.16}$$

$$\hat{z}_t = \rho_Z \hat{z}_{t-1} - (1 - \rho_Z)\, \gamma_Z \hat{s}_{t-1}^b + u_t^Z \tag{2.17}$$

$$\hat{\tau}_t^J = \rho_J \hat{\tau}_t^J - (1 - \rho_J)\, \gamma_J \hat{s}_{t-1}^b \tag{2.18}$$

$$u_t^G = \rho_{es} u_{t-1}^G + \epsilon_t^G; \epsilon_t^G \sim N\left(0, \sigma_G^2\right) \tag{2.19}$$

$$u_t^Z = \rho_{es} u_{t-1}^Z + \epsilon_t^Z; \epsilon_t^Z \sim N\left(0, \sigma_Z^2\right) \tag{2.20}$$

Here $J = K, H; g_t = \frac{G_t}{A_t}$, and $s_{t-1}^b = \frac{P_{t-1}^B B_{t-1}}{P_{t-1} Y_{t-1}}$. The shock term in fiscal rules follows the first-order autoregressive process given in equations (2.19) and (2.20). The central bank sets nominal interest rates by following the Taylor rule given in equation (2.21). The nominal interest rate in the Taylor rule is conditioned on its lagged value, debt-GDP ratio, the ratio of current output and technology ($y_t = \frac{Y_t}{A_t}$), and current inflation. The term u_t in the Taylor rule is a monetary policy shock that follows the autoregressive process of order one as given in equation (2.22). The terms with the hat are percentage deviations from their steady states.

$$\hat{R}_t = \rho_r \hat{R}_{t-1} + (1 - \rho_r) \left[\phi_\pi \hat{\pi}_t + \phi_y \hat{y}_t - {\phi_s}^b \hat{s}_t^b\right] \tag{2.21}$$

$$u_t^m = \rho_{em} u_{t-1}^m + \epsilon_t^m ; \epsilon_t^m \sim N\left(0, \sigma_m^2\right) \tag{2.22}$$

Aggregation

The market clearing conditions for consumption, bonds, capital, investment, profit, and output are in equations (2.23), (2.24), and (2.25).

$$C_t^* = \int_0^1 C_t^*(j) dj = (1-\mu) C_t^{*R} + \mu C_t^{*NR} \tag{2.23}$$

$$\Gamma_t = \int_0^{1-\mu} \Gamma_t(j) dj ; \Gamma = \{K, I, B, D\} \tag{2.24}$$

$$Y_t = C_t + I_t + G_t + \psi\left(v_t\right) \bar{K}_{t-1} \tag{2.25}$$

Given that the model consists of a permanent shock to technology, several variables are transformed to get stationarity

$$\left(\left(q_t = \frac{Q_t}{A_t} \text{ where } Q_t = Y_t, \mathrm{C}_t^{*R}, \mathrm{C}_t^{*NR}, \mathrm{C}_t^{R}, K_t, \bar{K}_t, I_t, G_t, Z_t\right), b_t = \frac{P_t^B B_t}{P_t A_t}, w_t = \frac{W_t}{P_t A_t}\right)$$

The equilibrium of the DSGE model comprises of the optimality conditions of Ricardian and non-Ricardian consumers, intermediate and final goods firms, fiscal and monetary policy rules, the government budget constraint, market clearing conditions, and shock processes. In order to estimate the model, equilibrium conditions are log-linearized around the steady state and solved using the Sims (2001) method. The equilibrium conditions, steady state, and log-linearized equations are given in the Appendix.

3 Data and Model Estimation

The paper estimates the DSGE model by using Bayesian methods on an Indian quarterly dataset spanning the period 1997Q1 TO 2022Q1. The paper has used six observables (government expenditure, government debt, private consumption expenditure, private investment, wholesale price index, and T-bill rate) to estimate the model. The data for these variables are taken from the RBI Handbook of the Indian Economy. Inflation is calculated by taking the log difference of the wholesale price index and multiplying it by 100. All the variables except inflation and T-bill rates are deflated using the WPI, seasonally adjusted using the Census-XII method, and transformed into per capita terms using the population index[5]. The data for observable variables have been linked with the model variables by the measurement equations (3.1) to (3.6).

$$dlGovspend_t = 100e^{\gamma} + 100\left(\hat{g}_t - \hat{g}_{t-1} + \hat{u}_t^a\right) \tag{3.1}$$

$$dlGovDebt_t = 100e^{\gamma} + 100\left(\hat{b}_t - \hat{b}_{t-1} + \hat{u}_t^a\right) \tag{3.2}$$

$$dlCons_t = 100e^{\gamma} + 100\left(\hat{c}_t - \hat{c}_{t-1} + \hat{u}_t^a\right) \tag{3.3}$$

$$dlInv_t = 100e^{\gamma} + 100\left(\hat{\imath}_t - \hat{\imath}_{t-1} + \hat{u}_t^a\right) \tag{3.4}$$

$$Inflt_t = \bar{\pi} + 100\hat{\pi}_t \tag{3.5}$$

$$Tbill_t = \bar{R} + 400\hat{R}_t \tag{3.6}$$

Here dl stands for 100 times the log difference of the variable and $\bar{R} = \bar{\pi} + \left(\frac{e^{\gamma}}{\beta} - 1\right)100$. The variables with hats are in their log-linearized forms. The solution of the log-linearized equations leads us to the state transition equations, which, along with the measurement equa-

[5]The population index (POP_t) is constructed by dividing the population at period t by the population in 2011Q1.

tions (3.1 to 3.6) form the state space system. The likelihood function, computed via the Kalman filter, along with the prior distribution of parameters, gives the posterior distribution. The random walk metropolis-hastings algorithm is employed to get 15,00,000 parameters draws from the posterior distribution. Out of the 15,00,000 draws, the initial 5,00,000 draws are discarded, and every 50th draw is picked from the remaining 10,00,000 draws to avoid autocorrelation in the chain.

The paper fixes certain parameters in the DSGE model. In the Indian context, 10-year government bonds have been the most traded government security (Das & Ghate, 2022); therefore, the paper set the average duration of long-term debt to 40 quarters. In line with Nandi (2019), the paper set the discount factor (β) to 0.9863 and the depreciation of private capital (δ) to 0.025. The share of capital in the production function (α) is fixed at 0.33 (see Ginn & Pourroy, 2019). The paper follows Gabriel et al. (2011) and Gabriel et al. (2016) and fix price and wage markups $(\eta_t^p,\ \eta_t^w)$ to 0.14. The calvo parameters (ω_P, ω_w) in line with existing literature, have been set to to 0.75. The price and wage partial indexation (χ_p, χ_w) have been set equal to 0.1. The steady-state values of tax rates $\tau_H,\ \tau_k,\ \tau_c$ are calibrated to 0.2, 0.1, and 0.12, respectively (see Nandi, 2019). The steady-state values of the government expenditure-GDP ratio and debt-GDP ratio have been set to 0.15 and 1.8[6], respectively. The paper follows existing macroeconomic literature[7] to set priors for the non-calibrated parameters. The summary of the prior distribution of these parameters given in Table 1.

[6]The government expenditure-GDP ratio and debt-GDP has been calibrated to the sample averages. In this calibration, the GDP in line with model is defined as the sum of consumption, investment and government expenditure.

[7]$100\gamma, \psi, \alpha_G$, is in line with Leeper et al. (2017). ii) $\xi, \rho_a, \rho_b, \rho_w, \rho_p, \rho_G, \rho_R, \rho_{eg}, \rho_{ez}, 100\sigma_a, 100\sigma_b, 100\sigma_m, 100\sigma_i, 100\sigma_P, 100\sigma_W, 100\sigma_G, 100\sigma_Z$ are set in line with Ginn & Pourroy (2022). iii) $\theta, \bar{\pi}, \mu$ aligns with Batini et al. (2023), Kumar (2023), and Nandi (2019), respectively. iv.) $\phi_\pi, \gamma_G,\ and\ \gamma_z$ across AFPM and the AMPF is in line Nandi (2019) and Leeper et al. (2017). v.) ϕ_{s^b} aligns with Kumhof et al. (2010).

Table 1: Prior Distribution of Parameters

Parameter	Prior Distribution	Prior Mean	Prior Standard Deviation
100γ, ss growth rate	Normal	0.4	0.05
ξ, Inverse Frisch elasticity	Gamma	1	0.1
ψ, Capital utilization	Beta	0.6	0.15
s, Investment adjustment cost	Normal	4	1
μ, share of non-ricardian consumers	Normal	0.6	0.01
θ, habit formation	Normal	0.6	0.2
α_G, substitutability of public, private consumption	Uniform	0	1.01
ϕ_π, Taylor rule inflation coefficient in AMPF regime	Normal	1.5	0.2
ϕ_π, Taylor rule inflation coefficient in AFPM regime	Beta	0.25	0.01
ϕ_y, Taylor rule output parameter	Normal	0.115	0.03
ϕ_{s^b}, Taylor rule debt-GDP coefficient in AFPM regime	Normal	0.6	0.01
ρ_r, lagged response of interest rates	Beta	0.75	0.1
γ_G, Response of Government consumption to debt in AMPF regime in AFPM regime	Normal	0.15	0.1
γ_Z, Response of Government transfer to debt in AMPF regime	Normal	0.15	0.1
ρ_G, lagged response of Government expenditure	Beta	0.75	0.15
ρ_Z, lagged response of Government transfer	Beta	0.6	0.2
ρ_a, technology shock	Beta	0.75	0.1
ρ_b, preference shock	Beta	0.75	0.1
ρ_i, investment shock	Beta	0.8	0.2
ρ_w, wage markup shock	Beta	0.75	0.1
ρ_p, price markup shock	Beta	0.75	0.1
ρ_{em}, monetary policy shock	Beta	0.5	0.05
ρ_{eg}, government consumption shock	Beta	0.75	0.1
ρ_{ez}, government transfer shock	Beta	0.75	0.1
$100\sigma_a$, technology	Inverse Gamma	0.1	1
$100\sigma_b$, preference	Inverse Gamma	0.1	1
$100\sigma_m$, monetary policy	Inverse Gamma	0.1	1
$100\sigma_i$, investment	Inverse Gamma	0.1	1
$100\sigma_p$, price markup	Inverse Gamma	0.1	1
$100\sigma_w$, wage markup	Inverse Gamma	0.1	1
$100\sigma_G$, government consumption markup	Inverse Gamma	0.1	1

Table 2: Posterior Estimates of Parameters

Parameter	AFPM Regime		AMPF Regime	
	Mean	90%CI	Mean	90%CI
100γ, ss growth rate	0.4247	$(0.3438, 0.5066)$	0.3842	$(0.3052, 0.4653)$
ξ, Inverse Frisch elasticity	1.0471	$(0.8882, 1.2047)$	1.0067	$(0.8413, 1.1611)$
ψ, Capital utilization	0.5138	$(0.2350, 0.7954)$	0.7754	$(0.6182, 0.9311)$
s, Investment adjustment cost	3.5381	$(0.2013, 5.6262)$	4.9875	$(3.7365, 6.2449)$
μ, share of non-ricardian consumers	0.6097	$(0.5940, 0.6256)$	0.5997	$(0.5826, 0.6148)$
θ, habit formation	0.8351	$(0.6786, 0.9938)$	0.4705	$(0.3253, 0.6286)$
α_G, substitutability of public and private consumption	0.8340	$(0.5123, 1.1658)$	0.5248	$(0.2700, 0.78876)$
ϕ_π, Taylor rule inflation coefficient	0.6950	$(0.6135, 0.7756)$	1.4405	$(1.0155, 1.7201)$
ϕ_y, Taylor rule output parameter	0.1193	$(0.0758, 0.1602)$	-0.0053	$(-0.0119, 0.0027)$
ϕ_{s^b}, Taylor rule debt-GDP coefficient	0.5993	$(0.5831, 0.61577)$	NA	NA
ρ_r, lagged response of interest rates	0.9693	$(0.9568, 0.9803)$	0.9158	$(0.8985, 0.9360)$
γ_G, Response of Government consumption to debt	NA	NA	0.18862	$(0.0714, 0.2916)$
γ_Z, Response of Government transfer to debt	NA	NA	0.2273	$(0.0727, 0.3734)$
ρ_G, lagged response of Government expenditure	0.2407	$(0.0740, 0.4080)$	0.1732	$(0.0677, 0.2838)$
ρ_Z, lagged response of Government transfer	0.9690	$(0.9519, 0.99871)$	0.9055	$(0.7857, 0.9885)$
ρ_a, technology shock	0.4110	$(0.30745, 0.5137)$	0.6420	$(0.5368, 0.7586)$
ρ_b, preference shock	0.9738	$(0.9566, 0.9922)$	0.7781	$(0.6247, 0.9635)$
ρ_i, investment shock	0.1119	$(0.0029, 0.2202)$	0.1994	$(0.0204, 0.3697)$
ρ_w, wage markup shock	0.7482	$(0.5843, 0.9134)$	0.9827	$(0.9730, 0.9930)$
ρ_p, price markup shock	0.3598	$(0.2558, 0.4620)$	0.4104	$(0.2948, 0.5178)$
ρ_{em}, monetary policy shock	0.3933	$(0.3085, 0.4799)$	0.3556	$(0.2785, 0.4262)$
ρ_{eg}, government consumption shock	0.7564	$(0.6380, 0.8831)$	0.4091	$(0.2395, 0.5873)$
ρ_{ez}, government transfer shock	0.9320	$(0.8896, 0.98244)$	0.8565	$(0.7466, 0.9654)$
$100\sigma_a$, technology	4.1527	$(3.1240, 5.2151)$	2.4314	$(1.1282, 3.6656)$
$100\sigma_b$, preference	11.1121	$(6.7165, 15.9228)$	0.4597	$(0.0210, 1.6993)$
$100\sigma_m$, monetary policy	0.1971	$(0.1701, 0.2223)$	0.2391	$(0.2020, 0.2777)$
$100\sigma_i$, investment	4.7063	$(3.9418, 5.3615)$	3.6725	$(3.0000, 4.3745)$
$100\sigma_p$, price markup	0.8215	$(0.6641, 0.9834)$	0.9111	$(0.7699, 1.0596)$
$100\sigma_w$, wage markup	0.1279	$(0.0206, 0.3183)$	0.0785	$(0.0513, 0.1228)$
$100\sigma_G$, government consumption	16.0307	$(13.8862, 18.5024)$	12.5720	$(10.5285, 14.3947)$
$100\sigma_z$, government transfer	1.3225	$(0.8571, 1.8249)$	2.7267	$(0.7839, 4.4453)$
$\bar{\pi}$, steady state of inflation	1.0896	$(0.7829, 1.417)$	1.0757	$(0.6836, 1.4601)$

The posterior estimates of the parameters are given in the Table 2. The posterior mean of interest rate response to inflation (ϕ_π) has been found larger than one in the AMPF regime and smaller than one in the AFPM regime. The posterior mean of the response of government consumption and transfers to debt-GDP ratio (γ_G and γ_z) has been found to be around 0.2 in AMPF regime. Whereas the response of interest rate to debt-GDP ratio (ϕ_{s^b}) has been found to be 0.5993 in AFPM regime. Along with policy parameters, the posterior estimates of habit formation (θ), capital utilization (ψ), investment adjustment cost (s), the autocorrelation of government consumption shock (ρ_{eg}), the standard deviation of preference shock and government expenditure shock (σ_b and σ_G) also substantially vary across the AFPM and AMPF regimes. The posterior means of ψ and s are larger in the AMPF regime, whereas the posterior means of θ, σ_b and σ_G are larger in the AFPM regime.

4 Transmission and Effectiveness of the Government Expenditure Shocks across AMPF and AFPM Regimes

4.1 Transmission of Government Expenditure Shocks

The impulse responses of government expenditure shock are reported in Figure 1 and have been utilized to examine asymmetries in the transmission of government expenditure stimulus across the AMPF and AFPM regimes. The transmission of the government expenditure shock in the AMPF regime is in line with the existing macroeconomic literature. However, in the AFPM regime, with the interest rate in the Taylor rule being conditioned on the debt-GDP ratio, the transmission of government expenditure stimulus differs from the prevailing literature.

In the AMPF regime, with the central bank actively targeting inflation and the fiscal authority stabilizing the debt, the government expenditure stimulus has a positive impact on output and non-Ricardian consumption, and a negative impact on investment and Ricardian consumption. As discussed above, the government's expenditure stimulus boosts aggregate demand and raises price levels in the economy. This increase in aggregate demand and price levels can be observed from the positive responses of output, consumption, and inflation to the government expenditure shock in the initial quarters. With $\phi_\pi > 1$ in the AMPF regime, the monetary authority raises the interest rate in a larger proportion than the increase in inflation. The larger increase in the interest rate can be seen as the positive response of the real interest rate to government expenditure shocks. The higher real interest rate raises the borrowing cost of money, which crowds out private investment. This crowding out is reflected in the negative response of investment to government expenditure stimulus. The increase in borrowing costs also raises the price of present consumption. With this, Ricardian consumers substitute future consumption with present consumption, as seen from the negative response of Ricardian consumption to government expenditure shock.

The positive impact of public expenditure stimulus on economic activity decreases the debt-GDP ratio, as seen from the negative impact of the government expenditure shock on the debt-GDP ratio in the initial quarters. However, the government's expenditure stimulus leads to a rise in budgetary deficits and public debt, which increases the debt-GDP ratio. Furthermore, the increase in interest rates in the AMPF regime raises the debt-servicing cost, which in turn increases the public debt and debt-GDP ratio. The net impact of the government expenditure shock on the debt-GDP ratio stands positive, as seen in the impulse responses.

With the increase in budgetary deficits and public debt, the Ricardian consumer expects future deductions in government transfers, as seen in the negative response of the transfers to the government expenditure shock. In this regard, the Ricardian consumer smoothens lifetime consumption by reducing present consumption. This also adds to the negative response of Ricardian consumption to the government expenditure shock. Given $\phi_\pi > 1$, the magnitude of the wage-price spiral stands close to zero in the AMPF regime. This can be observed from the close to zero response of the real wage to the government expenditure shock.

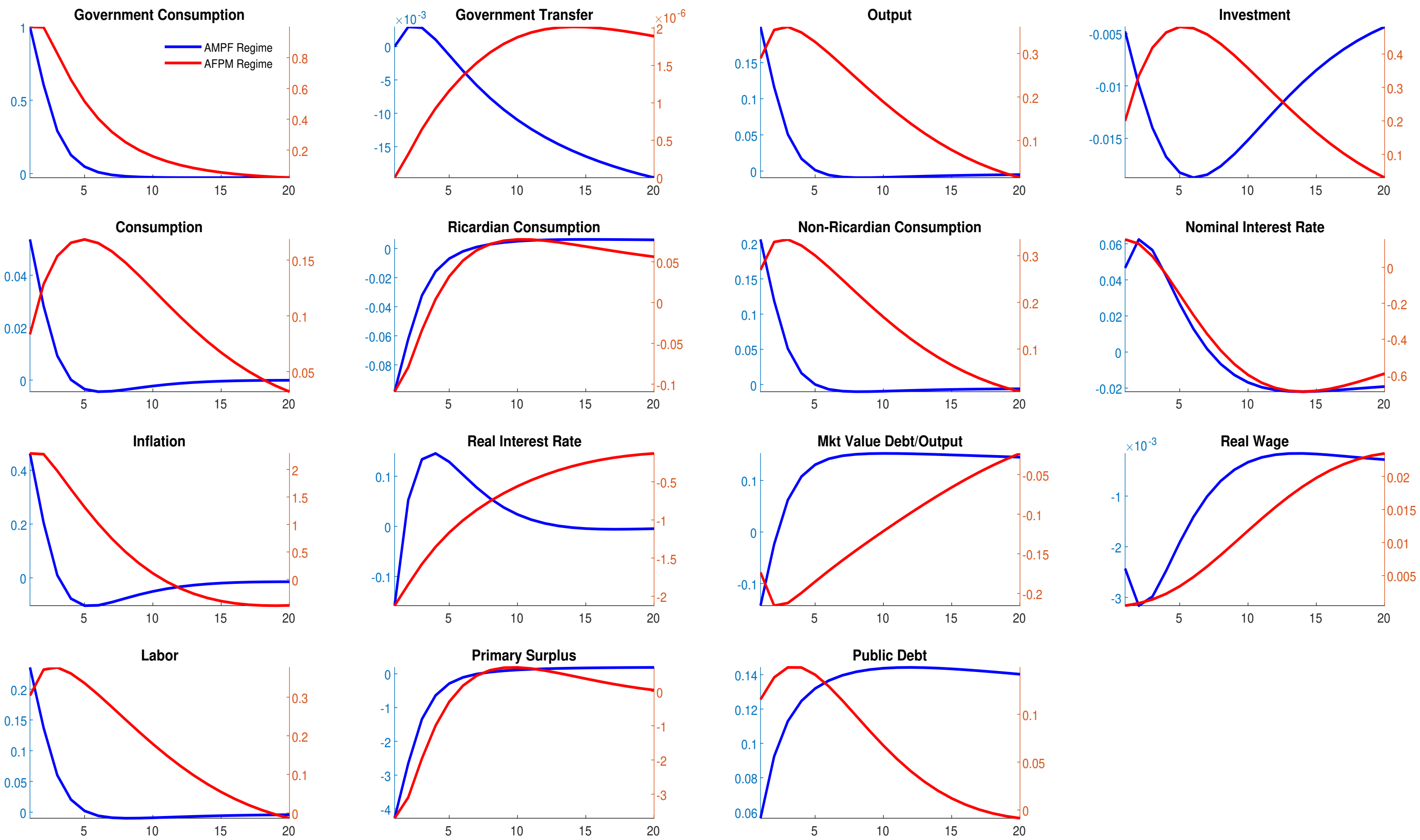
The response of government expenditure to its own shock is substantially larger in the AFPM regime than in the AMPF regime. The larger response can be attributed to: i) the large value of the standard deviation of government expenditure shock (σ_G) in the AFPM regime compared to the AMPF regime; ii) the close to zero values of government expenditure and transfer responses to public debt (γ_G, and γ_Z) in the AFPM regime. The impact of government expenditure stimulus on output, Ricardian consumption, non-Ricardian consumption, aggregate consumption, and private investment in the AFPM regime is positive and substantially larger compared to the AMPF regime.

The government expenditure stimulus in the AFPM regime, as in the AMPF regime, boosts aggregate demand and leads to wage-price spiral movements in the economy. However, in the AFPM regime, with $\phi_\pi < 1$, the central bank weakly targets inflation and doesn't raise interest in a proportion larger than inflation. This results in a negative response of the real interest rate to the government expenditure shock. The downward movement of real interest rates in the AFPM regime cuts down the real borrowing cost of money. The reduction in borrowing costs crowds in private investment, as depicted in the positive response of private investment to the government expenditure shock. Furthermore, with a decrease in borrowing costs, Ricardian consumers substitute present consumption with future consumption, as reflected in the positive response of Ricardian consumption to government expenditure stimulus.

As in the AMPF regime, the government's expenditure stimulus leads to budgetary deficits and a rise in public debt in the AFPM regime. Although, a larger response of the government expenditure shock on output results in a negative response of the debt-GDP ratio in the initial quarters. However, in contrast with the AMPF regime, the negative response of the debt-GDP ratio doesn't turn positive in subsequent quarters in the AFPM regime. In the AFPM regime, with $\phi_{s^b} > 0$, the monetary authority cuts down the interest rates to stabilize the public debt. The reduction in interest rate, as observed in the negative response of the nominal interest rate to the government expenditure shock, decreases the debt servicing cost, which aids in debt stabilization in subsequent quarters. The debt stabilization in the AFPM regime can be seen through the convergence of the response of public debt to the government expenditure shock to zero in later quarters. The lower nominal and real interest rates further crowd in Ricardian consumption and private investment and intensify the positive impact of the government expenditure shock on aggregate demand. The increase in aggregate demand spikes inflation and cuts down the real value of public debt. The government expenditure stimulus leads to the debt rollover in the AFPM regime as observed from the negative response of debt-GDP ratio.

In summary, the impact of government expenditure stimulus on consumption, investment, output, and inflation is substantially larger in the AFPM regime than in the AMPF regime. The response of interest rates in the AFPM and AMPF regimes is negative and positive, respectively. In contrast to the positive response of the debt-GDP ratio in the AMPF regime, the persistent negative response of the debt-GDP ratio in the AFPM regime is due to the negative response of interest rates and the larger positive response of output and inflation in this regime.

Figure 1: Transmission of the Government Expenditure Shocks across the AFPM and AMPF Regimes



Note: This Figure shows the impulse responses of the government expenditure shocks across the AFPM and AMPF regime. The impulse responses reported are the mean of the impulse responses computed at each of the 20000 parameter draws. The 90 percent confidence intervals of the impulse responses of the government expenditure shocks across the AFPM and AMPF regimes are reported in Figures A.1 and A.2 in the Appendix.

4.2 Effectiveness of Government Expenditure Shocks

The paper quantifies the effectiveness of government expenditure shocks via multiplier values. The multiplier, as in Auerbach & Gorodnichenko (2012), is calculated as $\frac{\sum_{i=1}^{n} \Delta Y_{t+i}}{\sum_{i=1}^{n} \Delta G_{t+i}} \frac{Y}{G}$, where ΔY_{t+i} represents the response of economic activity (i.e., output, consumption, investment) to government expenditure shock at the i^{th} horizon and ΔG_{t+i} represents the response of government expenditure to its own shock at the i^{th} horizon. $\frac{Y}{G}$ refers to the ratio of steady-state values of Y and G. The government expenditure multipliers across the AMPF and AFPM regimes are reported in Table 3.

The output multiplier value in the AFPM regime is found to be greater than two, whereas in the AMPF regime, it hovers around one. Similarly, the consumption and non-Ricardian consumption multiplier values are also substantially larger in the AFPM regime compared to the AMPF regime. The Ricardian consumption and investment multiplier values are positive and negative in the AFPM and AMPF regimes, respectively.The asymmetries in the government expenditure multipliers across the AFPM and AMPF regimes arise due to differences in the posterior estimates of the central bank and fiscal authority policy parameters across regimes. As discussed above, in the AMPF regime with the central bank actively targeting inflation, the increase in the real interest rate to curb inflation crowds out Ricardian consumption and investment, which dampens the effectiveness of government expenditure stimulus on economic activity. Withal, the fall in government transfers and government expenditure to stabilize public debt in the AMPF regime also weakens the government expenditure multiplier. On the other hand, in the AFPM regime, the monetary authority weakly targets inflation and reduces the interest rate to stabilize public debt, which crowds in consumption and investment and amplifies the government expenditure multipliers.

Table 3: Government Expenditure Multipliers across the AFPM and AMPF Regimes

	AMPF Regime				
	4 Quarters	8 Quarters	12 Quarters	16 Quarters	20 Quarters
Output	1.264	1.177	1.125	1.101	1.091
	(1.072,1.462)	(0.969,1.388)	(0.905,1.359)	(0.875,1.365)	(0.821,1.368)
Investment	-0.030	-0.077	-0.120	-0.154	-0.1803
	(-0.045,-0.018)	(-0.114,-0.051)	(-0.172,-0.078)	(-0.220,-0.102)	(-0.258,-0.121)
Consumption	0.197	0.162	0.153	0.158	0.168
	(0.042,0.357)	(-0.006,0.325)	(-0.022,0.334)	(-0.020,0.368)	(-0.025,0.395)
Ricardian	-0.557	-0.561	-0.532	-0.489	-0.442
Consumption	(-0.814,-0.295)	(-0.823,-0.297)	(-0.826,-0.277)	(-0.784,-0.205)	(-0.760,-0.137)
Non-Ricardian	9.603	8.845	8.390	8.125	7.932
Consumption	(7.761,11.405)	(6.998,10.790)	(6.169,10.357)	(5.632,10.350)	(5.028,10.384)
	AFPM Regime				
	4 Quarters	8 Quarters	12 Quarters	16 Quarters	20 Quarters
Output	2.586	3.375	3.909	4.173	4.232
	(2.145,3.198)	(2.641,4.134)	(2.941,4.889)	(3.234,5.233)	(3.398,5.113)
Investment	0.545	0.893	1.144	1.276	1.311
	(0.3028,0.8638)	(0.491,1.293)	(0.645,1.631)	(0.781,1.775)	(0.880,1.742)
Consumption	0.661	1.035	1.315	1.490	1.586
	(0.507,0.820)	(0.687,1.364)	(0.806,1.817)	(0.953,2.093)	(1.048,2.151)
Ricardian	-0.339	0.016	0.339	0.608	0.830
Consumption	(-0.609,-0.062)	(-0.435,0.403)	(-0.234,0.941)	(-0.078,1.315)	(0.082,1.577)
Non-Ricardian	11.569	15.014	17.269	18.294	18.432
Consumption	(9.551,13.527)	(11.467,18.722)	(12.470,22.192)	(13.284,23.309)	(14.02,22.83)

Note: This table reports the government expenditure multipliers across the AFPM and AMPF regimes. The non-bracketed values are the mean values of the government expenditure multipliers computed at each of the 20,000 parameter draws. The bracketed values are the 90 percent confidence interval of multiplier draws.

4.3 Counterfactual Analysis

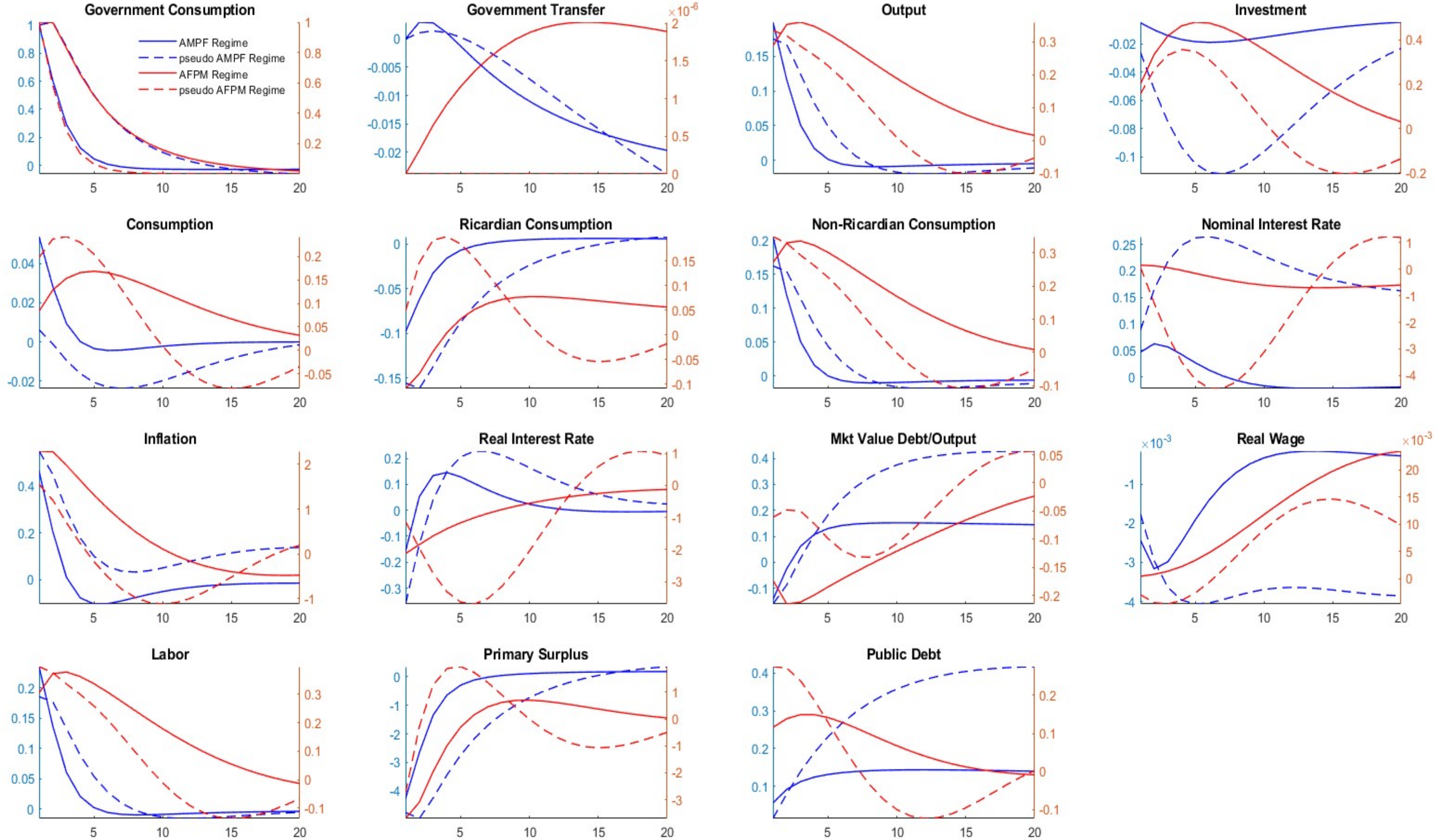
The asymmetries in the transmission and effectiveness of government expenditure shocks across the AMPF and AFPM regimes can arise due to the difference in posterior estimates of non-policy parameters along with the policy parameters across the regimes. Therefore, it becomes imperative to enquire into the asymmetries in the transmission mechanism, which arise solely out of variations in policy parameters across the AMPF and AFPM regimes. In this regard, the paper defines the pseudo-AMPF regime by calibrating the policy parameters (ϕ_π, ϕ_{s^b}, γ_G, and γ_Z to the posterior estimates of the AMPF regime and the non-policy parameters to the posterior estimates of the AFPM regime. Similarly, the paper defines the pseudo-AFPM regime by calibrating the policy parameters (ϕ_π, ϕ_{s^b}, γ_G, and γ_Z) to the posterior estimates of the AFPM regime and the non-policy parameters to the posterior estimates of the AMPF regime.

The impulse responses of the government expenditure shock in the pseudo-AMPF and pseudo-AFPM regimes, along with the AMPF and AFPM regimes, are reported in Figure 2. The asymmetries in the transmission of government expenditure shocks across AFPM and AMPF regimes arising solely due to differences in the policy parameters can be examined by comparing transmission mechanism across i) the pseudo AMPF regime and the AFPM regime and ii) the pseudo AFPM regime and the AMPF regime. The asymmetries in these two comparisons align with the asymmetries prevailing in the transmission mechanism of the government expenditure shock across the AMPF and AFPM regimes. The response of economic activity to the government expenditure shock is larger in the pseudo-AFPM regime compared to the AMPF regime and is smaller in the pseudo-AMPF regime than the AFPM regime. The interest rate responds negatively and positively to the government expenditure shock in the pseudo-AFPM and pseudo-AMPF regimes, respectively. With this, the positive impact of the government expenditure shock on inflation is larger in the pseudo-AFPM regime than the AMPF regime and smaller in the pseudo-AMPF regime than the AFPM regime. In line with the AFPM regime, debt rollover has been observed in the pseudo-AFPM regime, contrasting with the positive response of debt-GDP ratio to government expenditure shock in the pseudo-AMPF and the AMPF regimes.

Nevertheless, the effects of the government expenditure shock on output consumption and investment are smaller in the pseudo-AFPM regime than in the AFPM regime. On the other hand, the absolute magnitude of the response of these variables is larger in the pseudo-AMPF than in the AMPF regime. These differences in the response of economic activity can be attributed to the larger values of σ_G and ρ_{eg} in the AFPM regime. With the posterior mean of ρ_r being larger in the AFPM regime than in the AMPF regime, the response of the real interest rate in the pseudo-AMPF regime is more dominant than in the AMPF regime. Contrarily, the real interest rate response is more accommodative in the pseudo-AFPM regime than in the AFPM regime. In the fiscal sector, the debt rollover has been found to be smaller in the pseudo-AFPM regime than in the AFPM regime. Whereas the positive impact of government expenditure shock on debt-GDP has been larger in the pseudo-AMPF regime than in the AMPF regime itself.

The multiplier effect of government expenditure on output, consumption, and investment in the pseudo-AFPM and pseudo-AMPF regimes has been reported in Table 4. In line with the transmission mechanism, government expenditure multiplier values are larger in the pseudo-AFPM regime compared to the AMPF regime and smaller in the pseudo-AMPF regime compared to the AFPM regime. Besides, the government expenditure multiplier in the pseudo-AMPF and pseudo-AFPM regimes stands higher than the AFPM and AMPF regimes, respectively.

Figure 2: Transmission of the Government Expenditure Shocks across the pseudo-AFPM and pseudo-AMPF Regimes



Note: This Figure reports the impulse responses of the government expenditure shock across the pseudo-AFPM and pseudo-AMPF regimes. In the pseudo-AFPM regime, policy parameters are calibrated to the posterior means of the AFPM regime and then the impulse responses are computed at each of the 20000 non-policy parameter draws of the AMPF regime. Similarly, in the pseudo-AMPF regime, policy parameters are calibrated to the posterior means of the AMPF regime and then the impulse responses are computed at each of the 20000 non-policy parameter draws of the AFPM regime. The impulse responses reported in the Figure are the mean values of the impulse responses computed at each of the 20,000 parameter draws.

Table 4: Government Expenditure Multipliers across the pseudo-AFPM and pseudo-AMPF regimes

	pseudo-AMPF Regime				
	4 Quarters	8 Quarters	12 Quarters	16 Quarters	20 Quarters
Output	1.039	0.851	0.710	0.628	0.588
	(0.8428,1.229)	(0.631,1.058)	(0.485,0.911)	(0.444,0.820)	(0.416,0.751)
Investment	-0.092	-0.186	-0.269	-0.331	-0.377
	(-0.200,-0.029)	(-0.369,-0.076)	(-0.487,-0.129)	(-0.561,-0.174)	(-0.613,-0.206)
Consumption	-0.023	-0.096	-0.152	-0.185	-0.203
	(-0.194,0.145)	(-0.258,0.0623)	(-0.306,0.002)	(-0.333,-0.030)	(-0.354,-0.052)
Ricardian	-0.874	-0.911	-0.942	-0.962	-0.975
Consumption	(-1.194,-0.543)	(-1.247,-0.592)	(-1.279,-0.626)	(-1.303,-0.659)	(-1.295,-0.666)
Non-Ricardian	3.959	3.243	2.702	2.377	2.200
Consumption	(1.172,6.092)	(0.924,5.139)	(0.629,4.246)	(0.552,3.730)	(0.502,3.427)
	pseudo-AFPM Regime				
	4 Quarters	8 Quarters	12 Quarters	16 Quarters	20 Quarters
Output	4.012	5.892	5.754	4.5134	3.5499
	(3.032,4.070)	(3.871,5.164)	(5.225,6.224)	(5.388,6.403)	(3.674,4.335)
Investment	0.724	1.398	1.384	0.941	0.480
	(0.6094,0.869)	(1.163,1.611)	(1.098,1.642)	(0.560,1.265)	(0.1536,0.776)
Consumption	1.969	3.093	3.038	2.401	1.955
	(1.780,2.139)	(2.849,3.410)	(2.780,3.307)	(2.063,2.729)	(1.705,2.172)
Ricardian	1.592	2.938	3.012	2.480	2.132
Consumption	(1.292,1.869)	(2.541,3.382)	(2.666,3.475)	(2.129,2.864)	(1.856,2.390)
Non-Ricardian	30.522	43.878	41.955	32.308	39.524
Consumption	(25.039,35.448)	(36.745,49.835)	(34.013,47.656)	(24.867,39.524)	(18.765,30.724)

Note: Note: This Table reports the multipliers of the government expenditure shock across the pseudo-AFPM and pseudo-AMPF regimes. In the pseudo-AFPM regime, policy parameters are calibrated to the posterior means of the AFPM regime and then the multipliers are computed at each of the 20000 non-policy parameter draws of the AMPF regime. Similarly, in the pseudo-AMPF regime, policy parameters are calibrated to the posterior means of the AMPF regime and then the multipliers are computed at each of the 20000 non-policy parameter draws of the AFPM regime. The bracketed and non-bracketed values in the table are the mean and 90 percent confidence intervals of the multipliers.

4.4 Transmission Mechanism's Contingency on Regime Determining Parameters

In the wake of asymmetries in the transmission of government expenditure shock across AFPM and AMPF regimes arising from different values of policy parameters in these regimes, it becomes important to examine the dependency of the transmission of the government expenditure shock on the values of policy parameters. The paper in this sub-section calibrates the two key regime-determining policy parameters ϕ_π and ϕ_{s^b} to values between (0.7, 2.0) and (0, 1), respectively, to examine the contingency of the transmission mechanism on these parameter values. The impulse responses of the government expenditure shock conditioned on different values of ϕ_π and ϕ_{s^b} are reported in the Figures 3 and 4, respectively.

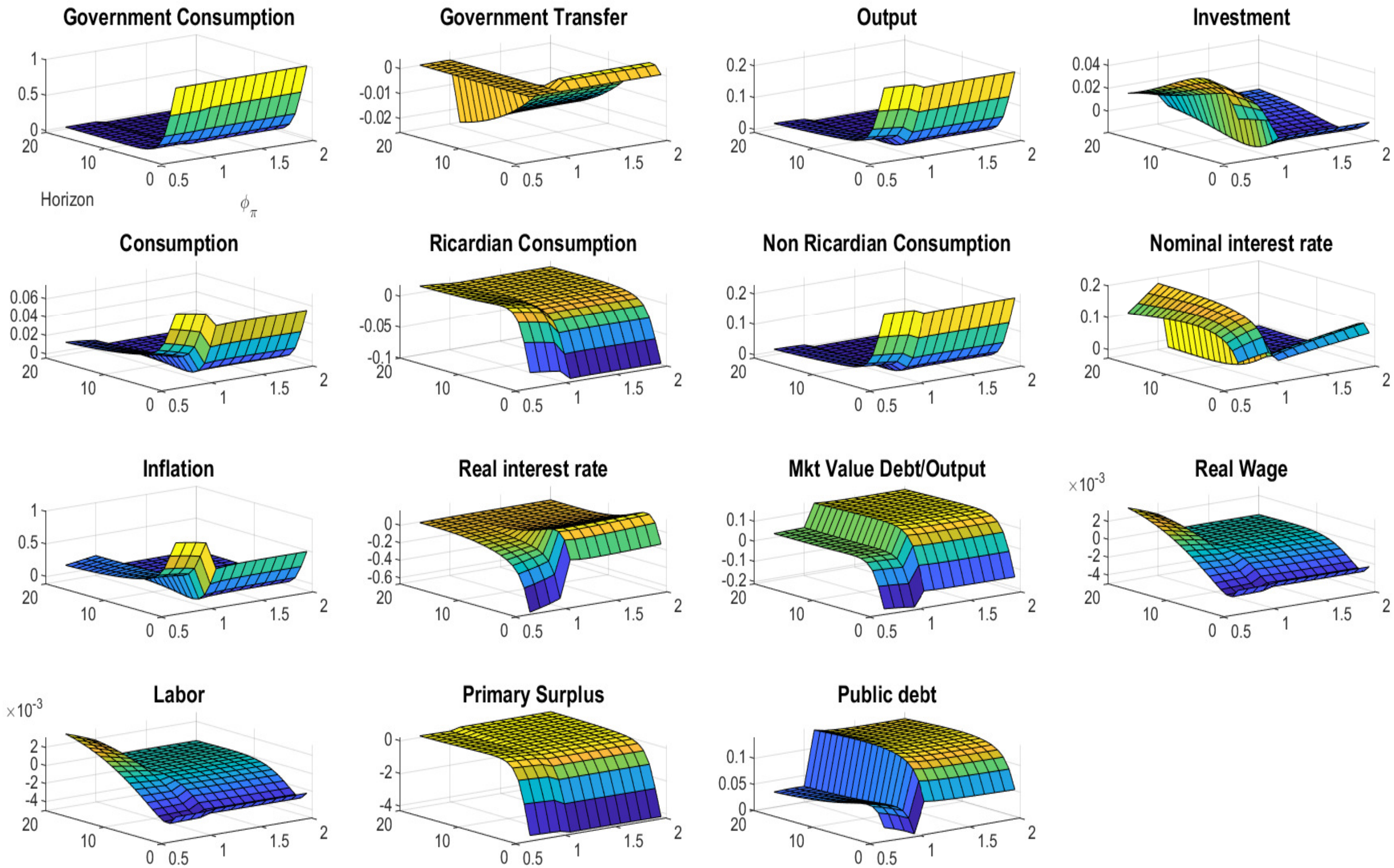
The ϕ_π value equals one acts as a threshold at which the transmission mechanism of government expenditure shock marks the substantial change. At the other values of ϕ_π i.e., (0.7,0.9) and (1.1, 2), the transmission of government expenditure shock stands unchanged. When the value of ϕ_π remains less than one, i.e., the monetary authority weakly targets inflation, the real interest rate responds negatively to the government expenditure shock, which crowds in private investment. Alongside the response of the debt-GDP ratio to the government expenditure shock stays negative over a longer horizon as well. Withal, the response of government transfers remains close to zero, and the larger response of inflation carries out debt stabilization.

On the other hand, as ϕ_π becomes greater than one, i.e., the central bank actively targets inflation, the real interest rate starts responding positively to the government expenditure shock, and private investment starts crowding out. The crowding out of private investment weakens the positive impact of the government expenditure shock on output and consumption. Furthermore, the response of public debt to government expenditure shock increases substantially as the value of ϕ_π goes beyond one. As a result of the large response of public debt and the weak response of output, the debt-GDP ratio starts responding positively over longer horizons. Besides, the debt stabilization, in this case, is carried out by a fall in government transfers, contrasting with the case where ϕ_π is less than one. In the labor market, the response of labor and real wages falls significantly as ϕ_π crosses the value 1.

Along with ϕ_π, the transmission of government expenditure shock also changes with the value of ϕ_{s^b}. With an increase in the value of ϕ_{s^b}, i) the positive impact of government expenditure shock on output, consumption, and investment increases substantially, ii) the negative response of the real interest rate becomes larger, iii) the incidence of debt rollover intensifies, iv) the labor and real wage responds more positively.

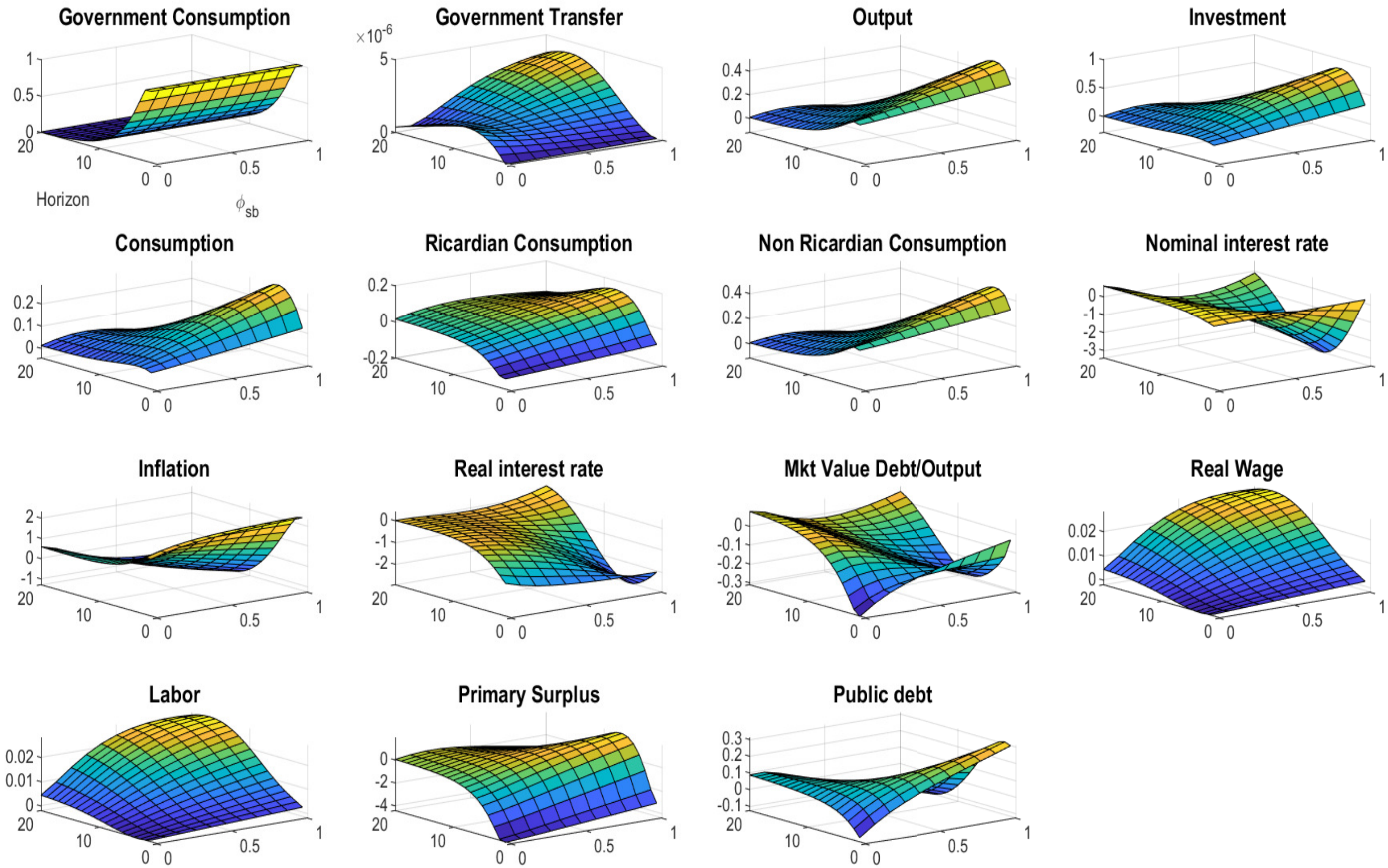
The government expenditure multipliers computed at different values of ϕ_π and ϕ_{s^b} have been reported in the Table 5. The multipliers decrease and increase with the increase in values of ϕ_π and ϕ_{s^b}, respectively. As ϕ_π crosses the value one, i.e., the threshold where monetary policy turns from being passive to active, the investment multiplier turns from being positive to negative. Alongside that, the output and consumption multipliers also fall substantially. Withal the values of ϕ_π at (0.7, 0.9) and (1.1, 1.9), the government expenditure multipliers remain almost constant.

Figure 3: Transmission of the Government Expenditure Shocks at Different Values of ϕ_π



Note: This Figure reports the mean value of impulse responses of the government expenditure shock computed at each of 20,000 parameter draws of the AMPF regime with ϕ_π calibrated to different values between 0.7 and 2. The x-axis reports horizon, y-axis reports the values of ϕ_π, and z-axis reports the values of impulse responses.

Figure 4: Transmission of the Government Expenditure Shocks at Different Values of ϕ_{s^b}



Note: This Figure reports the mean value of impulse responses of the government expenditure shock computed at each of 20,000 parameter draws of the AFPM regime with ϕ_{s^b} calibrated to different values between 0 and 1. The x-axis reports horizon, y-axis reports the values of ϕ_{s^b}, and z-axis reports the values of impulse responses.

Table 5: Government expenditure multipliers at different values of ϕ_π and ϕ_{sb}

Government expenditure multipliers at different values of ϕ_π					
ϕ_π	Output	Investment	Consumption	Ricardian Consumption	Non-Ricardian Consumption
0.7	1.924	0.197	0.586	-0.100	14.412
0.9	1.780	0.1487	0.501	-0.197	13.344
1.1	1.174	-0.080	0.162	-0.557	8.867
1.3	1.202	-0.069	0.178	-0.542	9.08
1.5	1.204	-0.068	0.178	-0.542	9.095
1.7	1.200	-0.069	0.176	-0.545	9.069
1.9	1.195	-0.070	0.172	-0.549	9.033
Government expenditure multipliers at different values of ϕ_{sb}					
ϕ_{sb}	Output	Investment	Consumption	Ricardian Consumption	Non-Ricardian Consumption
0.1	1.975	0.294	0.402	-0.509	7.995
0.3	2.671	0.597	0.707	-0.272	10.831
0.5	3.358	0.898	1.007	-0.042	13.619
0.7	3.994	1.171	1.291	0.189	16.194
0.9	4.586	1.416	1.565	0.431	18.589

Note: This table reports the government expenditure multipliers computed at different values of ϕ_π and ϕ_{sb}. The multipliers reported are the mean values and computed in the fashion like impulse responses in the Figure 3 and 4.

5 Sensitivity Analysis

In this section, the paper examines the sensitivity of the transmission and effectiveness of government expenditure stimulus across AFPM and AMPF regimes to changes in the values of non-policy parameters.

5.1 Wage and Price Stickiness Parameters

In the macroeconomic literature, standard business cycle models with flexible prices have revealed the negative effects of public expenditure shocks on consumption (see Aiyagari et al., 1992; Christiano & Eichenbaum, 1992; Baxter & King, 1993). On the contrary, empirical studies like Blanchard & Perotti (2002) have found positive effects of government expenditure shocks on consumption. The inclusion of nominal wage and price rigidities in the theoretical model has shed light on this puzzle and led to the positive impact of the government expenditure shock on consumption (see Linnemann & Schabert, 2003; Galí et al., 2007; Bilbiie, 2011; Colciago, 2011; Woodford, 2011).). As per the general New Keynesian framework, the government's expenditure stimulus boosts the aggregate demand for goods produced by monopolistic intermediate firms at given prices. With the increase in demand for intermediate goods, firms producing them raise the demand for labor at given wages. The government's expenditure stimulus also drives up consumption expenditure in the economy. The increase in consumption expenditure and labor raises the marginal rate of substitution and cuts down the wage markups from their initial levels. The fall in wage markups increases real wages, which in turn raises the marginal cost of firms producing intermediate goods. The intermediate firms, which can revise their prices following the rise in marginal costs, increase the prices of their goods. The revaluation of prices reduces the initial increase in real wages and crowds out consumption through substitution and income effects. The net effect of government expenditure stimulus is conditioned on the degree of wage and price rigidity. The higher the wage and price rigidity, the lower will be the wage and price adjustment, and the higher will be the effect of government expenditure stimulus on economic activity.

The paper in the benchmark model[8] has calibrated the wage and price rigidity parameters (ω_w and ω_P) to 0.75. In line with the macroeconomic literature, wage and price rigidities have led to positive consumption multipliers across the AMPF and AFPM regimes. However, the role of these rigidities in explaining the transmission and effectiveness of government expenditure across the AMPF and AFPM regimes is yet to be examined. Therefore, the paper calibrates ω_w

[8]The benchmark model refers to the model with parameter values as posterior estimates given in Table 2.

and ω_P to different values: 0.5, 0.6, 0.7, 0.9 and analyze the transmission and effectiveness of government expenditure shock across AMPF and AFPM regimes. The impulse responses of the government expenditure shocks across the AMPF and AFPM regimes at different values of ω_w and ω_P have been reported in the Appendix in Figures A.3 and A.4.

Along with ω_w and ω_P, the price and wage rigidities in the model are also induced by the parameter ϕ_π. In the AMPF regime, with ϕ_π greater than one, the central bank actively targets inflation and controls price movements. Therefore, the decrease in values of ω_w and ω_P don't have much effect on the transmission and effectiveness of government expenditure shock, as seen in the Figures A.4 and A.6. On the contrary, in the AFPM regime, the central bank weakly targets inflation and hence doesn't regulate the price movements in the economic system. Therefore, in this case, the increase in wage and price flexibility, i.e., a decrease in ω_w and ω_P intensifies the impact of the government expenditure shock on inflation. As a result, the response of real wages to the government expenditure shock decreases with the decrease in the values of ω_w and ω_P. The impact of the government expenditure shock on output, consumption, investment, labor, and real wages stays positive until the values of ω_w and ω_P stand above 0.7. As the values of ω_w and ω_P fall below 0.7, the government expenditure shocks impact on inflation tremendously increases. With this, the response of real wages to the government expenditure shock turns negative. Alongside this, the interest rate response also turns positive, which crowds out private consumption and investment, and results in the negative impact of the government expenditure shock on output.

In line with the transmission mechanism, the government expenditure multipliers in the AMPF regime reported in the Figure A.5 don't change much with the changes in values of ω_w and ω_P. Whereas the government expenditure multipliers in the AFPM regime reported in the Figure A.6 turn from being positive to negative as values of ω_w and ω_P fall below 0.7. Given that the transmission mechanism and effectiveness of the government expenditure shock in the AFPM regime substantially change with the fall in values of ω_w and ω_P, the asymmetries in transmission and effectiveness of the government expenditure shock across the AFPM and AMPF regimes found in the benchmark model don't hold for values of ω_w and ω_P less than 0.7.

5.2 Share of Non- Ricardian Consumers

Along with wage and price rigidities, the inclusion of non-Ricardian consumers in DSGE models has also contributed to solving the puzzle between the government expenditure shock and the response of private consumption (see Mankiw, 2000; Galí et al., 2007; Coenen & Straub, 2005). Non-Ricardian consumers don't smoothen consumption and spend their entire income each period. Therefore, with government expenditure stimulus, non-ricardian consumers drive up their consumption, which counterbalances the negative wealth effects and increases aggregate consumption. The paper in the benchmark model has found the posterior estimate of the share of non-Ricardian households (μ) approximately equal to 0.6 in the AFPM and AMPF regimes. At this value of μ, the impact of the government expenditure shock on consumption is positive in both regimes. However, the positive impact is substantially larger in the AFPM regime.

The positive impact of the government expenditure shock on consumption in the AMPF regime arises solely due to non-Ricardian consumption. Whereas in the AFPM regime, the positive impact of the government expenditure shock on consumption arises due to both Ricardian and non-Ricardian consumption. Therefore, with the increase in the share of non-Ricardian consumers, the positive response of consumption to the government expenditure shock in the AMPF regime may increase. However, in the case of the AFPM regime, it is ambiguous. In this regard, it becomes imperative to examine whether the asymmetries found in the transmission and effectiveness of government expenditure shock across the AMPF and AFPM regimes in the benchmark model will hold at different values of μ or not.

The paper examines the transmission and effectiveness of government expenditure shock across AMPF and AFPM regimes at μ calibrated to 0, 0.3, and 0.9, along with the benchmark value of 0.6. The impulse responses of government expenditure shock across AMPF and AFPM regimes at different values of μ have been reported in the Figures A.7 and A.8. The effect of the government expenditure shock on consumption and output in the AMPF regime decreases with the decrease in the share of non-Ricardian consumers. Due to the lesser positive response of non-Ricardian consumption, inflation responds relatively weakly to the government expenditure shock at low values of μ. As a result, interest rates respond less aggressively to the government expenditure shock, leading to less crowding out of private investment.

The interest rates and inflation respond more accommodatively to the government expenditure shock, with a smaller share of non-Ricardian consumers in the AFPM regime. This leads to a larger crowding in of Ricardian consumption and private investment in the AFPM regime. As a result, with a lesser share of non-Ricardian consumers, the government expenditure shock has a more accelerating impact on output, consumption, and investment in the AFPM regime.

The Figures A.9 and A.10 reports the government expenditure multipliers across the AFPM and AMPF regimes at different values of μ. The government expenditure multiplier increases and decreases with the increase in the share of non-Ricardian households in the AMPF and AFPM regimes, respectively. Despite the uneven changes in the transmission mechanism and the government expenditure multipliers with changes in the value of μ across AMPF and AFPM regimes, the asymmetries found in the transmission and effectiveness of government expenditure shock across AMPF and AFPM regimes hold for the different values of μ.

5.3 Substitutability Between Government and Private Consumption

The transmission and effectiveness of the government expenditure shock are also conditioned on substitutability between private and public consumption (see Aschauer, 1985; Feldstein & Elmendorf, 1990; Bouakez & Rebei, 2007; Coenen et al., 2013). The higher the substitutability between private and government consumption, the higher will be the crowding out of private consumption with government expenditure stimulus, and the lesser will be the consumption multiplier. In the benchmark model, the parameter α_G governs the degree of substitutability between private consumption and government consumption. The paper finds the posterior estimate of α_G to be equal to 0.8340 in the AFPM regime and 0.5248 in the AMPF regime. The positive values of α_G reflect the partial degree of substitutability between private and public consumption in the model.

In light of existing macroeconomic literature, it becomes crucial to examine the role of α_G in explaining the transmission and effectiveness of government expenditure shocks across the AFPM and AMPF regimes. Further, it becomes imperative to check whether the asymmetries in transmission and effectiveness of government expenditure shocks across the AFPM and AMPF regimes found in the benchmark model will hold in the following cases: i) α_G is zero, i.e., private consumption is independent of public consumption. ii) α_G is less than zero, i.e., private and public consumption are complementary to each other. In this regard, the paper calibrates α_G to 0 and -0.3 and then examines the transmission and effectiveness of government expenditure shocks across the AMPF and AFPM regimes. The impulse responses and multipliers of the government expenditure shocks across the AFPM and AMPF regimes in the cases where private and public expenditures are independent of each other and complementary to each other have been reported in the Figures A.11, A.12, A.13 and A.14.

The response of inflation to the government expenditure shock in the AMPF and AFPM regimes is larger in the case of α_G less than zero compared to the case where α_G is greater than zero. This is due to the larger impact of the government expenditure shock on private consumption in the initial quarters in the case of α_G less than zero. The larger response of inflation to the public expenditure shock in the case of α_G less than zero leads to a more aggressive response of the interest rate in the AMPF regime and a less accommodative response of the interest rates in the AFPM regime. As a result, a larger crowding out and a smaller crowding in of private investment with the government expenditure shock have been observed in the AFPM and AMPF regimes, respectively.

In totality, the impact of government expenditure on output in the AFPM regime stands larger in the benchmark model (α_G greater than zero) whereas in the AMPF regime, it stands larger in the case of α_G less than zero. Although, in both regimes, the difference in the impact of government expenditure shock on output, consumption, and investment between the cases when α_G is less than zero, and when it is greater than zero is substantially small and close to zero. Further, in contrast with existing macroeconomic literature, the value of α_G doesn't play a significant role in explaining the transmission and effectiveness of the government expenditure shocks in both regimes. With this, the asymmetries found in the transmission mechanism of government expenditure shocks across AFPM and AMPF regimes in the benchmark model also hold in the cases where α_G is less than zero and where α_G is equal to zero.

5.4 Habit Formation

Habit persistence plays an important role in directing the transmission and effectiveness of government expenditure shocks (see Furlanetto & Seneca, 2009; Bhattarai & Trzeciakiewicz, 2017). The presence of habit formation weakens the sensitivity of Ricardian consumption to interest rates (see Fuhrer, 2000; Bhattarai & Trzeciakiewicz, 2017). Therefore, if the government consumption shock crowds out and crowds in private consumption, then the increase in degree of habit persistence will increase and decrease the consumption multipliers, respectively. The paper in the benchmark model finds the posterior estimate of the parameter governing habit formation (θ) to be equal to 0.8351 in the AFPM regime and 0.4705 in the AMPF regime. Given the effectiveness of the government expenditure shock on consumption being sensitive to habit persistence and the posterior estimate of the parameter governing habit persistence is found to be different in the AFPM and AMPF regimes. The paper, as a sensitivity check, examines the asymmetries in transmission and effectiveness of government expenditure across the AFPM and AMPF regimes in the absence of habit formation.

The impulse responses and multipliers of government expenditure shock across the AFPM and AMPF regimes in the absence of habit formation, i.e., θ equals zero, have been reported in the Figures A.15 and A.16. In the AMPF regime, the difference in transmission of the government expenditure shock on different economic variables between the benchmark model and the model with no habit formation is infinitesimal and close to zero. Given that Ricardian consumption is more sensitive to the interest rate in a model with no habit formation, the impact of the government expenditure shock on Ricardian consumption and aggregate consumption in the AFPM regime is larger in a model with no habit formation compared with the benchmark model until the seventh quarter. The accommodative response of the interest rate and subsequent crowding in of private investment in the AFPM regime is relatively small in the model with no habit formation compared to the benchmark model.

In line with the transmission mechanism, the government expenditure multipliers in the AMPF regime are approximately equal in the benchmark model and the model with no habit formation. Whereas in the AFPM regime, the Ricardian and non-Ricardian consumption multipliers are relatively larger in the model with no habit formation, and the investment multiplier is relatively larger in the benchmark model. The asymmetries in the transmission and effectiveness of government expenditure shock across AFPM and AMPF regimes in the model with no habit formation align with the benchmark model.

5.5 Persistence of Government Expenditure Shocks

The studies have found the transmission mechanism of the government expenditure shock to be contingent on whether the shock is transitory or permanent (see Aiyagari et al., 1992; Baxter & King, 1993; Campbell, 1994; Dupaigne & Fève, 2016). These studies reveal the improvement in the efficacy of the government expenditure shock with the rise in the persistence of government expenditure shocks. This improvement has been found to come from an increase in the impact of the government expenditure shock on private investment. In this paper, the persistence of government expenditure shock has been captured through the parameter ρ_G. The persistence of government expenditure shock rises with the increase in the value of ρ_G. The paper finds the posterior estimate of ρ_G to be around 0.1 in both regimes. This is in contrast with the studies by Smets & Wouters (2007), Leeper et al. (2010), and Leeper et al. (2017), which have found ρ_G to be around 0.9 in the U.S. As per Leeper et al. (2017), ρ_G plays a vital role in explaining the changes in the government expenditure multiplier. In this regard, the paper examines how the transmission and effectiveness of government expenditure shocks in the AFPM and AMPF regimes change with the changes in values of ρ_G.

The impulse responses and multipliers of the government expenditure shocks across the AFPM and AMPF regimes at different values of ρ_G has been reported in the Figures A.17, A.18, A.19 and A.20. In the AFPM regime, the response of government expenditure to shock itself increases with the rise in the persistence of government expenditure shocks. The inflationary impact of the government expenditure shock also intensifies with the increase in the value of ρ_G. With monetary authority weakly targeting inflation in the AFPM regime, the response of nominal interest rates to the government expenditure shock doesn't change substantially with the increase in value of ρ_G from 0 to 0.7. As a result, the response of the real interest rate gets more accommodative, which leads to more crowding in of Ricardian consumption and private investment at higher values of ρ_G. This larger crowding in of Ricardian consumption and private investment further leads to the larger response of aggregate consumption and output to the government expenditure shock.

At ρ_G equal to 0.9, the response of inflation to the government expenditure shock gets very large. With this, the response of the real wage to the government expenditure shock turns out to be negative from being positive in the benchmark model. Alongside this, the nominal interest rate has responded very aggressively to the government expenditure shock in this case. This aggressive response of the interest rate was even larger than what is prevailing in the AMPF regime in the benchmark model. Because of the negative response of the real wage and the aggressive response of the real interest rate, consumption, investment, and output have responded relatively weakly to the government expenditure shock.

Given that the response of government expenditure to shock itself has changed substantially with the changes in the value of ρ_G, the efficacy of government expenditure shock in accelerating economic activity at different values of ρ_G can be better examined by government expenditure multipliers. In contrast with the existing macroeconomic literature, the paper doesn't find a substantial increase in government expenditure multipliers with an increase in the value of ρ_G in both regimes. Furthermore, in the AFPM regime at ρ_G equals to 0.9, the public expenditure becomes smaller than what is prevailing in the benchmark AFPM regime.

In the AMPF regime, with monetary authority actively targeting inflation, the response of inflation to the government expenditure shock doesn't change substantially with the increase in values of ρ_G. In line with inflation, the impact of the government expenditure shock on the real interest rate, investment, consumption, and output also stands invariant with different values of ρ_G. This can also be observed from the government expenditure multipliers in AMPF regimes computed at different values of ρ_G. Besides the asymmetries in the transmission and effectiveness of government expenditure across AFPM and AMPF regimes prevailing in the benchmark model also holds for different values of ρ_G between 0 and 0.7. At ρ_G equals to 0.9, the public expenditure multiplier in the AFPM regime becomes equivalent to the AMPF regime.

6 Conclusion

The contingency of the transmission and effectiveness of the government expenditure shock on the monetary policy stance have been very well investigated in the case of advanced economies (see Davig & Leeper, 2011; Traum & Yang, 2011; Zubairy, 2014; Leeper et al., 2017; Beck-Friis & Willems, 2017; Bianchi & Melosi, 2019; Ascari et al., 2023; Kim et al., 2023). However, the non-linearities in the transmission and effectiveness of the government expenditure shock across different monetary policy regimes are still a matter of query in EMEs. In this regard, the paper adds to the macroeconomic literature by studying the transmission and effectiveness of the government expenditure shock across the AFPM and AMPF regimes in the Indian context. The paper defines the AFPM regime as the regime where the central bank weakly targets inflation and reduces policy rates to stabilize public debt, and the AMPF regime as the regime where the central bank actively targets inflation and the fiscal authority carries out consolidation drives to stabilize public debt. Leeper et al. (2017) DSGE model, comprising rich fiscal block and non-Ricardian consumers, has been used to examine the asymmetries in the transmission and effectiveness of the government expenditure shock across the AMPF and AFPM regimes. The paper augments Leeper et al. (2017) model by allowing the interest rate in the Taylor rule to depend on the debt-GDP ratio.

We find the impact of the government expenditure shock on inflation substantially higher in the AFPM regime than in the AMPF regime. With the central bank weakly targeting inflation and stabilizing debt in the AFPM regime and actively targeting inflation in the AMPF regime, the nominal interest rate responds negatively and positively in the AFPM and AMPF regimes, respectively. Following the nominal interest rate and inflation responses, the real interest rates also respond positively and negatively to the government expenditure shock in the AFPM and AMPF regimes, respectively. The asymmetric response of the real interest rate has resulted in the crowding in and crowding out of Ricardian consumption and private investment in the AFPM and AMPF regimes, respectively. Besides, the lower nominal and real interest rate responses have led to a lower response of public debt to the government expenditure shock in the AFPM regime than in the AMPF regime.

The higher persistence of the government expenditure shock and the larger labor response in the AFPM regime led to the positive and negative impact of the government expenditure shock on the real wage in the AFPM and AMPF regimes, respectively. As a result, the government expenditure shock has a more accelerating impact on non-Ricardian consumption in the AFPM regime than in the AMPF regime. Following the consumption and investment responses, the output response to the government expenditure shock is substantially larger in the AFPM regime than in the AMPF regime. In line with the transmission mechanism, the government expenditure multipliers are also larger in the AFPM regime than in the AMPF regime. With low public debt response and high government expenditure multipliers, debt rollover has been observed in the AFPM regime.

Overall, the government expenditure stimulus has been more fruitful in the AFPM regime than in the AMPF regime. Therefore, the paper suggests the monetary authority to respond accommodatively to the fiscal stimulus. The accommodative stance will make the public debt sustainable and enhance the efficacy of the government expenditure shock.

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A Appendix

A.1 Equilibrium Conditions

A.1.1 Household First Order Conditions

The paper defines langrange multipliers linked with Ricardian consumers budget equation and capital accumulation equation as Λ_t^R and $\Lambda_t^R q_t$, respectively. $r_t^k = \frac{R_t^k}{A_t}$.

$$c_t^R = \alpha_g g_t + c_t^{*R} \tag{A.1}$$

Ricardian households first order conditon for consumption

$$\frac{\mu_t^b}{c_t^R - \theta c_{t-1}^R e^{-\mu_t^a}} = \lambda_t^R \left(1 + \tau_t^c\right) \tag{A.2}$$

First order condition for capital

$$q_t = \beta E_t \frac{\lambda_{t+1}^R e^{-\mu_{t+1}^a}}{\lambda_t^R} \left\{ \left(1 - \tau_{t+1}^K\right) r_{t+1}^K v_{t+1} - \psi\left(v_{t+1}\right) + (1-\delta) q_{t+1} \right\} \tag{A.3}$$

Here q_t is the Tobin's Q.

First order condition for investment

$$\begin{aligned} 1 = {} & q_t \mu_t^i \left[1 - s\left(\frac{i_t e^{\mu_t^a}}{i_{t-1}}\right) - s'\left(\frac{i_t e^{\mu_t^a}}{i_{t-1}}\right) \frac{i_t e^{\mu_t^a}}{i_{t-1}} \right] \\ & + \beta E_t \left[q_{t+1} \frac{\lambda_{t+1}^R e^{-\mu_{t+1}^a}}{\lambda_t^R} \mu_{t+1}^i s'\left(\frac{i_{t+1} e^{\mu_{t+1}^a}}{i_t}\right) \left(\frac{i_{t+1} e^{\mu_{t+1}^a}}{i_t}\right)^2 \right] \end{aligned} \tag{A.4}$$

First order conditions for capacity utilization

$$\left(1 - \tau_t^k\right) r_t^k = \psi'\left(v_t\right) \tag{A.5}$$

Effective capital

$$k_t = \upsilon_t e^{-\mu_t^a} \bar{k}_{t-1} \tag{A.6}$$

Evolution of capital

$$\bar{k}_t = (1-\delta) e^{-\mu_t^a} \bar{k}_{t-1} + \mu_t^i i_t \left[1 - s\left(\frac{e^{\mu_t^a} i_t}{i_{t-1}} \right) \right] \tag{A.7}$$

Non-Ricardian household budget constraint

$$(1+\tau_t^c)\, c_t^{NR} = \left(1+\tau_t^H\right) w_t H_t + z_t^{NR} \tag{A.8}$$

Euler condition for the one period private bond

$$\lambda_t^R = \beta R_t E_t \frac{\lambda_{t+1}^R e^{-\mu_{t+1}^a}}{\pi_{t+1}} \tag{A.9}$$

Price relation between the long run and short run private bonds

$$P_t^B = E_t \left(\frac{1}{R_t} \left(1 + \rho P_{t+1}^B\right) \right) \tag{A.10}$$

A.1.2 Wage First Order Conditions

$$0 = E_t \left\{ \sum_{s=0}^{\infty} \lambda_{t+s}^R (\beta \omega_w)^R \overline{H}_{t+s} \left[\widetilde{w}_t \prod_{k=1}^{s} \left\{ \left(\frac{\pi e^{\gamma}}{\pi_{t+k} e^{\mu_{t+k}^a}} \right) \left(\frac{\pi_{t+k-1} e^{\mu_{t+k-1}^a}}{\pi e^{\gamma}} \right)^{\chi^w} \right\} - \frac{\bar{L}_{t+s}^{\xi} \left(1+\eta_{t+s}^w\right) \mu_{t+s}^b}{\left(1-\tau_{t+s}^L\right) \lambda_{t+s}^R} \right] \right\} \tag{A.11}$$

Here

$$\bar{H}_{t+s} = \left(\widetilde{w}_t \prod_{k=1}^{s} \left\{ \left(\frac{\pi e^{\gamma}}{\pi_{t+k} e^{\mu_{t+k}^a}} \right) \left(\frac{\pi_{t+k-1} e^{\mu_{t+k-1}^a}}{\pi e^{\gamma}} \right)^{\chi^w} \right\} \right)^{-\left(\frac{1+\eta \eta_{t+s}^w}{\eta_{t+s}^w} \right)} H_{t+s} \tag{A.102}$$

The evolution of aggregate wage is

$$w_t^{\frac{1}{\eta_t^w}} = \omega_{\mathrm{w}} \left[\left(\frac{\pi_{t-1} e^{\mu_{t-1}^a}}{\pi e^\gamma} \right)^{\chi^w} \left(\frac{\pi e^\gamma}{\pi_t e^{\mu_t^a}} \right) w_{t-1} \right]^{\frac{1}{\eta_t^w}} + (1-\omega_{\mathrm{w}})\, \widetilde{w}_t^{\frac{1}{\eta_t^w}} \tag{A.13}$$

A.1.3 First order conditions of firm producing intermediate goods

Production function

$$y_t pd_t = k_t^\alpha H_t^{1-\alpha} - \Omega \tag{A.14}$$

Capital labor ratio

$$\frac{k_t}{H_t} = \frac{w_t}{r_t^k} \frac{\alpha}{1-\alpha} \tag{A.15}$$

Real Marginal Cost

$$mc_t = \frac{Mc_t}{P_t} = (1-\alpha)^{\alpha-1} \alpha^{-\alpha} r_t^{k\alpha} w_t^{1-\alpha} \tag{A.16}$$

Intermediate firms first order conditions for price

$$0 = E_t \left\{ \sum_{s=0}^{\infty} \lambda_{t+s}^R (\beta\omega_{\mathrm{p}})^R \bar{y}_{t+s} \left[\tilde{p}_t \prod_{k=1}^{s} \left\{ \left(\frac{\pi_{t+k-1}}{\pi} \right)^{\chi^p} \left(\frac{\pi}{\pi_{t+k}} \right) \right\} - \left(1+\eta_{t+s}^{\mathrm{w}}\right) mc_{t+s} \right] \right\} \tag{A.17}$$

Here

$$\bar{y}_{t+s} = \left(\tilde{p}_t \prod_{k=1}^{s} \left\{ \left(\frac{\pi_{t+k-1}}{\pi} \right)^{\chi^p} \left(\frac{\pi}{\pi_{t+k}} \right) \right\} \right)^{-\left(\frac{1+\eta_{t+s}^{\mathrm{p}}}{\eta_{t+s}^{p}} \right)} y_{t+s} \tag{A.18}$$

Aggregate price index

$$1 = \left[(1-\omega_{\mathrm{p}})\, \tilde{p}_t^{\frac{1}{\eta_t^p}} + \omega_{\mathrm{p}} \left[\left(\frac{\pi_{t-1}}{\pi} \right)^{\chi^p} \left(\frac{\pi}{\pi_t} \right) \right]^{\frac{1}{\eta_t^p}} \right]^{\eta_t^{\mathrm{p}}} \tag{A.19}$$

Government budget contraint

$$\tau_t^C C_t + b_t + \tau_t^K r_t^k k_t + \tau_t^H w_t H_t = g_t + z_t \frac{1 + \rho P_t^B}{P_{t-1}^B} \frac{b_{t-1}}{\pi_t e^{\mu_t^a}} \tag{1}$$

Consumption aggregation

$$c_t = \mu c_t^R + (1-\mu) c_t^{NR} \tag{A.21}$$

Aggregate resource equation

$$y_t = c_t + i_t + g_t + \psi\left(v_t\right) k_{t-1} e^{-\mu_t^u} \tag{A.22}$$

A.2 steadystate

At steady state, $v = 1,\ \pi = 1,\ s\left(e^{\gamma}\right) = s'\left(e^{\gamma}\right) = 0$. With this $R = \frac{e^{\gamma}}{\beta}$.

$$\rho = \left(1 - \frac{1}{AD}\right) \frac{1}{\beta} \tag{A.23}$$

$$P^B = \frac{\beta}{e^{\gamma - \rho\beta}} \tag{A.24}$$

$$r^k = \frac{\frac{e^{\gamma}}{\beta} - 1 + \delta}{1 - \tau^k} \tag{A.25}$$

$$\psi'(1) = r^k \left(1 - \tau^k\right) \tag{A.26}$$

$$mc = \frac{1}{1 + \eta^p} \tag{A.27}$$

$$w = \left[mc(1-\alpha)^{1-\alpha} \alpha^{\alpha}\right) \left(r^k\right)^{-\alpha}\Big]^{\frac{1}{1-\alpha}} \tag{A.28}$$

$$\frac{k}{H} = \frac{w}{r^k} \frac{\alpha}{1-\alpha} \tag{A.29}$$

$$\frac{\Omega}{H} = \left(\frac{k}{H}\right)^{\alpha} - r^k \frac{k}{H} - w \tag{A.30}$$

$$\frac{y}{L} = \left(\frac{k}{H}\right)^{\alpha} - \frac{\Omega}{H} \tag{A.31}$$

$$\frac{i}{H} = \left(1 - (1-\delta)e^{-\gamma}\right) e^{\gamma} \frac{k}{H} \tag{A.32}$$

$$\frac{c}{H} = \frac{y}{H}\left(1 - \frac{g}{y}\right) - \frac{i}{H} \tag{A.33}$$

$$\frac{z}{H} = \left[\left(1 - Re^{-\gamma}\right)\frac{b}{y} - \frac{g}{y}\right]\frac{y}{H} + \tau^c \frac{c}{H} + \tau^H w + \tau^k r^k \frac{k}{H} \tag{A.34}$$

$$\frac{c^{NR}}{H} = \frac{\left(1 - \tau^H\right) w + \frac{z}{H}}{1 + \tau^c} \tag{A.35}$$

$$\frac{c^{*R}}{H} = \frac{\frac{c}{H} - \mu \frac{c^{NR}}{H}}{1 - \mu} \tag{A.36}$$

$$\frac{c^R}{H} = \frac{c^{*R}}{H} + \alpha_g \frac{g}{y}\frac{y}{H} \tag{A.37}$$

$$H = \left[\frac{\left(1 - \tau^l\right) w}{\left(1 + \tau^c\right)\left(1 + \eta^w\right)} \frac{1}{\left(1 - \theta\right)e^{-\gamma}\right) \frac{c^R}{H}}\right]^{\frac{1}{\xi+1}} \tag{A.38}$$

A.3 Log-Linearized Equations

Household first order condition for consumption

$$\hat{\lambda}_t^R = \hat{u}_t^b + \hat{u}_t^{\alpha} - \frac{e^{\gamma}}{e^{\gamma-\theta}}\left(\hat{c}_t^R + \hat{u}_t^{\alpha}\right) + \frac{\theta}{e^{\gamma-\theta}}\hat{c}_{t-1}^R - \frac{\tau^{\mathrm{C}}}{1 + \tau^{\mathrm{C}}}\widehat{\tau}_t^C \tag{A.39}$$

Private and public consumption in utility function

$$\hat{c}_t^R = \frac{c^{*R}}{c^{*R} + \alpha_g g}\hat{c}_t^{*R} + \frac{\alpha_g g}{c^{*R} + \alpha_g g}\hat{g}_t \tag{A.40}$$

Euler condition

$$\hat{\lambda}_t^R = \hat{R}_t + E_t\hat{\lambda}_{t+1}^R - E_t\hat{\pi}_t - E_t\hat{u}_{t+1}^\alpha \tag{A.41}$$

Debt Maturity structure

$$\hat{R}_t + \hat{P}_t^B = \frac{\rho P^B}{1+\rho P^B} E_t\hat{P}_{t+1}^B \tag{A.40}$$

Household first order condition for capacity utilization

$$\hat{r}_t^k - \frac{\tau^k}{1-\tau^k}\widehat{\tau}_t^k = \frac{\psi}{1-\psi}\hat{v}_t \tag{A.43}$$

Household first order condirtion for capital

$$\begin{aligned}\hat{q}_t = {} & E_t\hat{\lambda}_{t+1}^R - \hat{\lambda}_t^R - E_t\hat{u}_{t+1}^\alpha + \beta e^{-\gamma}\left(1-\tau^k\right)\mathrm{r}^k E_t\hat{r}_{t+1}^k - \beta e^{-\gamma}\left(\tau^k\right)\mathrm{r}^k E_t\hat{\tau}_{t+1}^k + \\ & \beta e^{-\gamma}(1-\delta)E_t\hat{q}_{t+1}\end{aligned} \tag{A.44}$$

Household first order condition for investment

$$\hat{\imath}_t + \frac{1}{1+\beta}\hat{u}_t^\alpha + \frac{1}{(1+\beta)se^{2\gamma}}\hat{q}_t - \hat{u}_t^i - \frac{\beta}{1+\beta}E_t\hat{\imath}_{t+1} - \frac{\beta}{1+\beta}E_t\hat{u}_{t+1}^\alpha = \frac{1}{1+\beta}\hat{\imath}_{t-1} \tag{A.45}$$

Here

$$\widehat{u}_t^i = \frac{1}{(1+\beta)se^{2\gamma}}\widehat{\tilde{u}}_t^i \tag{A.46}$$

$$\widehat{\tilde{u}}_t^i = \rho_i\hat{\tilde{u}}_{t-1}^i + \epsilon_{\mathrm{t}}^i \quad \epsilon_{\mathrm{t}}^i \sim N\left(0, \sigma_i^2\right) \tag{A.47}$$

Effective capital equation

$$\hat{k}_t = \hat{v}_t + \hat{\bar{k}}_{t-1} - \hat{u}_t^\alpha \tag{A.48}$$

Evolution of capital

$$\hat{\bar{k}}_t = (1-\delta)e^{-\gamma}\left(\hat{\bar{k}}_{t-1} - \hat{u}_t^{\alpha}\right) + \left[1-(1-\delta)e^{-\gamma}\right]\left((1+\beta)se^{2\gamma}\widehat{u}_t^{i} + \hat{\imath}_t\right) \tag{A.49}$$

Non Ricardian budget equation

$$\tau^C c^{NR}\hat{\tau}_t^C + \left(1+\tau^C\right)c^{NR}\hat{c}_t^{NR} = \left(1+\tau^H\right)wL\left[\widehat{w}_t + \widehat{H}_t\right] - \tau^H wH\hat{\tau}_t^H + z\hat{z}_t \tag{A.50}$$

Consumption aggregation

$$c\hat{c}_t = C^R(1-\mu)\hat{c}_t^{*R} + C^{NR}\mu\hat{c}_t^{NR} \tag{A.51}$$

Wage equation

$$\widehat{w}_t = \frac{1}{1+\beta}\widehat{w}_{t-1} + \frac{\beta}{1+\beta}E_t\widehat{w}_{t+1} - k_w\left[\widehat{w}_t - \xi\widehat{H}_t - \widehat{u}_t^b + \hat{\lambda}_t^R - \frac{\tau^H}{1-\tau^H}\hat{\tau}_t^H\right] + \frac{\chi^w}{1+\beta}\widehat{\pi}_{t-1} - \frac{1+\beta\chi^w}{1+\beta}\widehat{\pi}_t + \frac{\beta}{1+\beta}E_t\widehat{\pi}_{t+1} + \frac{\chi^w}{1+\beta}\widehat{u}_{t-1}^{\alpha} + \frac{1+\beta\chi^w - \rho^a\beta}{1+\beta}\hat{u}_t^{\alpha} + \hat{u}_t^w \tag{A.52}$$

Here

$$k_w = \frac{\left(1-\beta\omega^w\right)\left(1-\omega^w\right)}{\omega^w(1+\beta)\left(1+\frac{(1+\eta^w)\xi}{\eta^w}\right)} \tag{A.53}$$

$$\widehat{u}_t^w = k_w\widehat{\eta}_t^w \tag{A.54}$$

$$\widehat{u}_t^w = \rho_{\mathrm{w}}\hat{u}_{t-1}^w + \epsilon_t^w \quad \epsilon_t^w \sim N\left(0, \sigma_w^2\right) \tag{A.55}$$

Production function

$$\hat{y}_t = \frac{y+\Omega}{y}\left[(1-\alpha)\widehat{H}_t + \alpha\hat{k}_t\right] \tag{A.56}$$

Capital labor ratio

$$\widehat{H}_t - \hat{k}_t = \hat{r}_t^k - \widehat{w}_t \tag{2}$$

Phillips equation

$$\hat{\pi}_t = \frac{\beta}{1+\chi^p\beta} E_t \hat{\pi}_{t+1} + \frac{\chi^p}{1+\chi^p\beta} \widehat{\pi}_{t-1} + k_p \widehat{mc_t} + \hat{u}_t^p \tag{A.58}$$

Here

$$k_p = \frac{\left[\left(1-\beta\omega^p\right)\left(1-\omega^p\right)\right]}{\left[\omega^p\left(1+\beta\chi^p\right)\right]} \tag{A.59}$$

$$\widehat{u}_t^p = k_p \widehat{\eta}_t^p \tag{A.60}$$

$$\hat{u}_t^p = \rho_p \hat{u}_{t-1}^p + \epsilon_{\mathrm{t}}^p \quad \epsilon_{\mathrm{t}}^p \sim N\left(0, \sigma_p^2\right) \tag{A.61}$$

Marginal cost

$$\widehat{mc}_t = \alpha \hat{r}_t^k + (1-\alpha)\widehat{w}_t \tag{A.62}$$

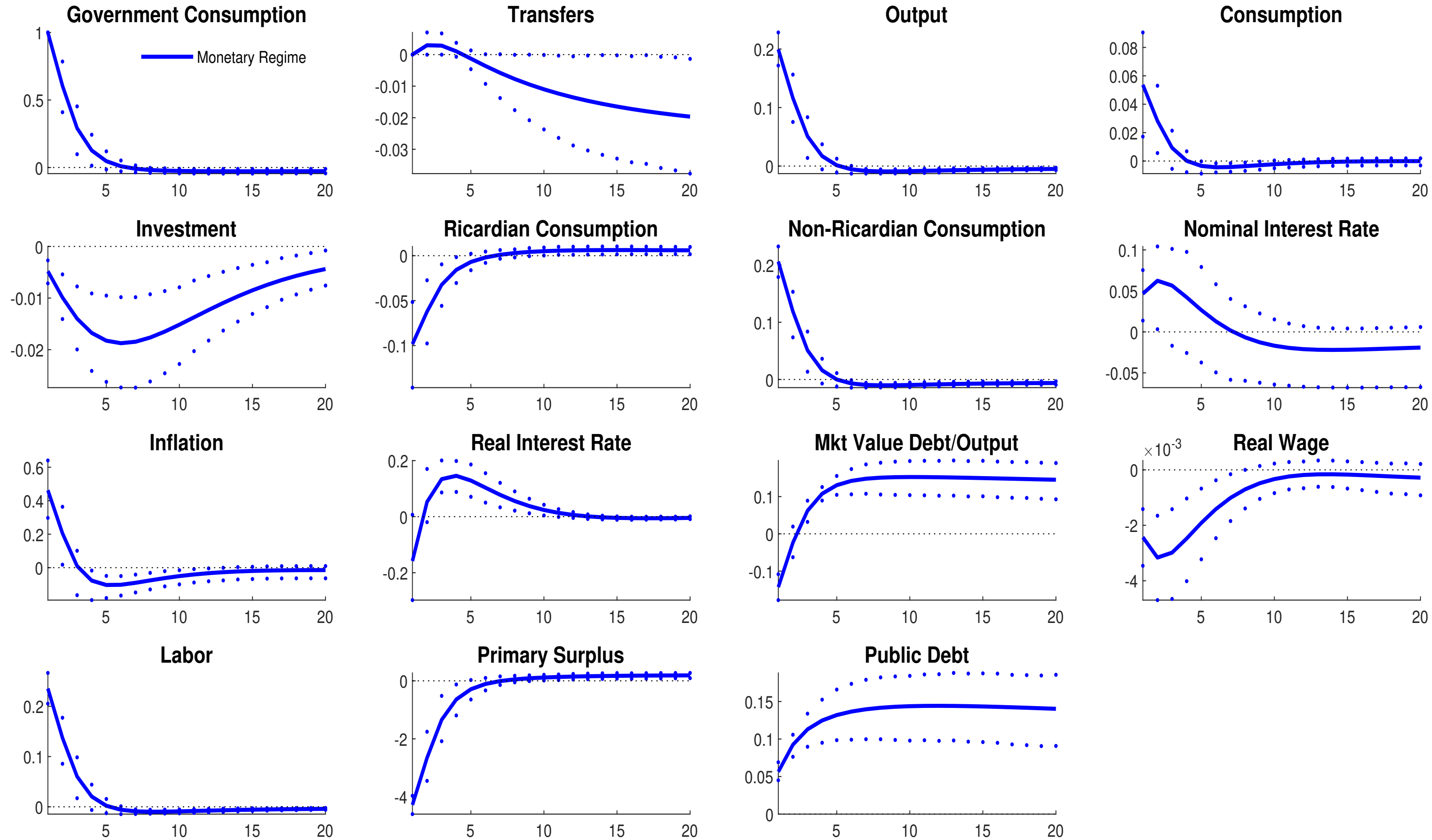
Government budget constraint

$$\begin{aligned} &\frac{b}{y}\hat{b}_t + \frac{k}{y} r^k \tau^k \left[\hat{\tau}_t^k + \hat{r}_t^k + \hat{k}_t\right] + \frac{H}{y} W \tau^H \left[\hat{\tau}_t^H + \widehat{w}_t + \widehat{H}_t\right] + \frac{c}{y}\tau^C \left[\hat{\tau}_t^C + \hat{c}_t\right] = \\ &\frac{1}{\beta}\frac{b}{y}\left[\hat{b}_{t-1} - \hat{\pi}_t - \hat{P}_{t-1}^B - \hat{u}_t^\alpha\right] + \frac{b}{y}\rho e^{-\gamma}\hat{P}_t^B + \frac{g}{y}\hat{g}_t + \frac{z}{y}\hat{z}_t \widehat{mc}_t + \alpha \hat{r}_t^k + (1-\alpha)\widehat{w}_t \end{aligned} \tag{A.63}$$

Resource constraint

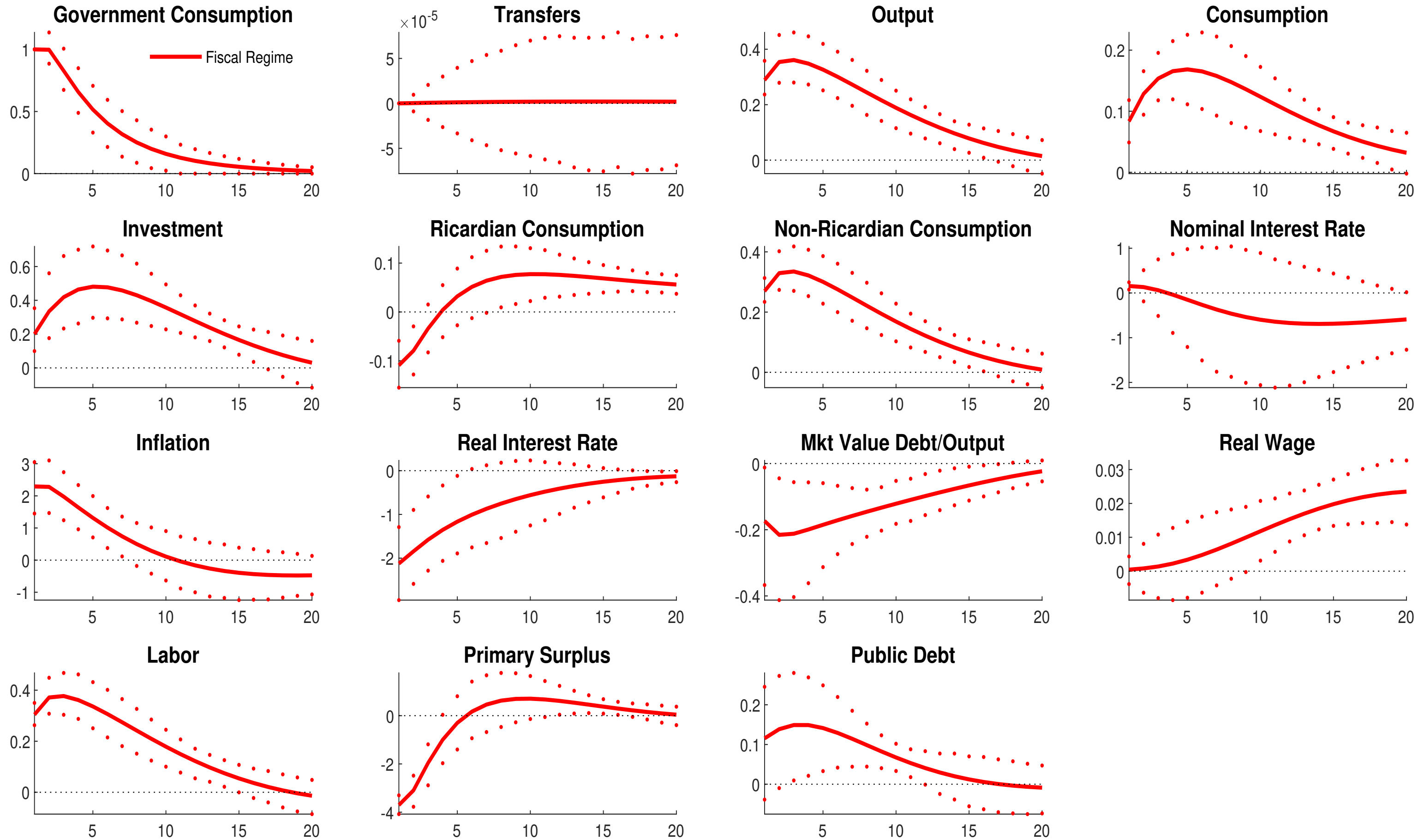
$$y\hat{y}_t = c\hat{c}_t + g\hat{g}_t + i\hat{\imath}_t + k\hat{v}_t \Psi'(1) \tag{A.64}$$

Figure A.1: Transmission of the Government Expenditure Shock in the AMPF Regime



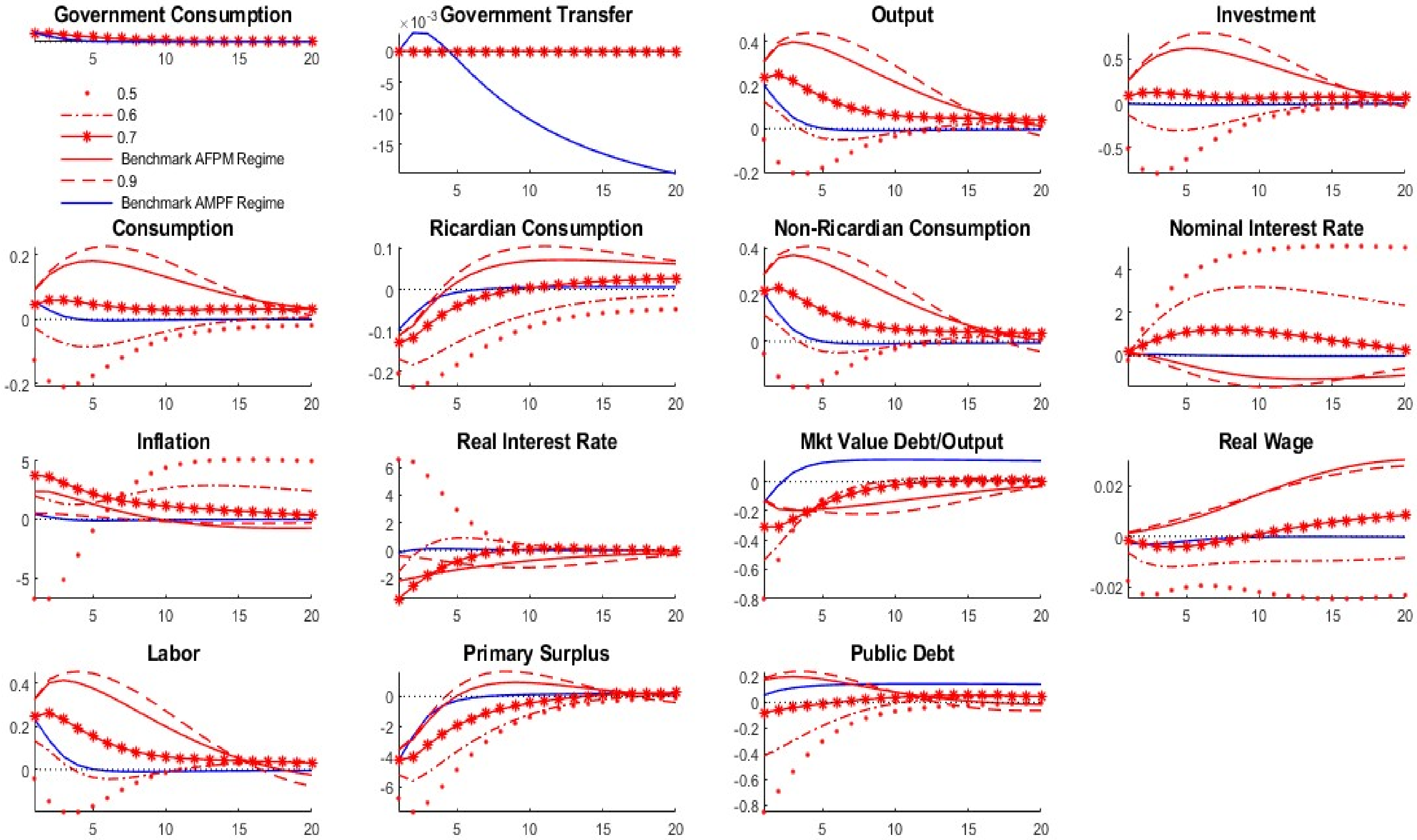
Note: This Figure shows the impulse responses of the government expenditure shock in the AMPF regime. The impulse responses represented by blue lines are the mean of the impulse responses computed at each of the 20000 parameter draws. The blue dotted lines represent the 90 percent confidence intervals of the impulse responses of the government expenditure shock.

Figure A.2: Transmission of the Government Expenditure Shock in the AFPM Regime



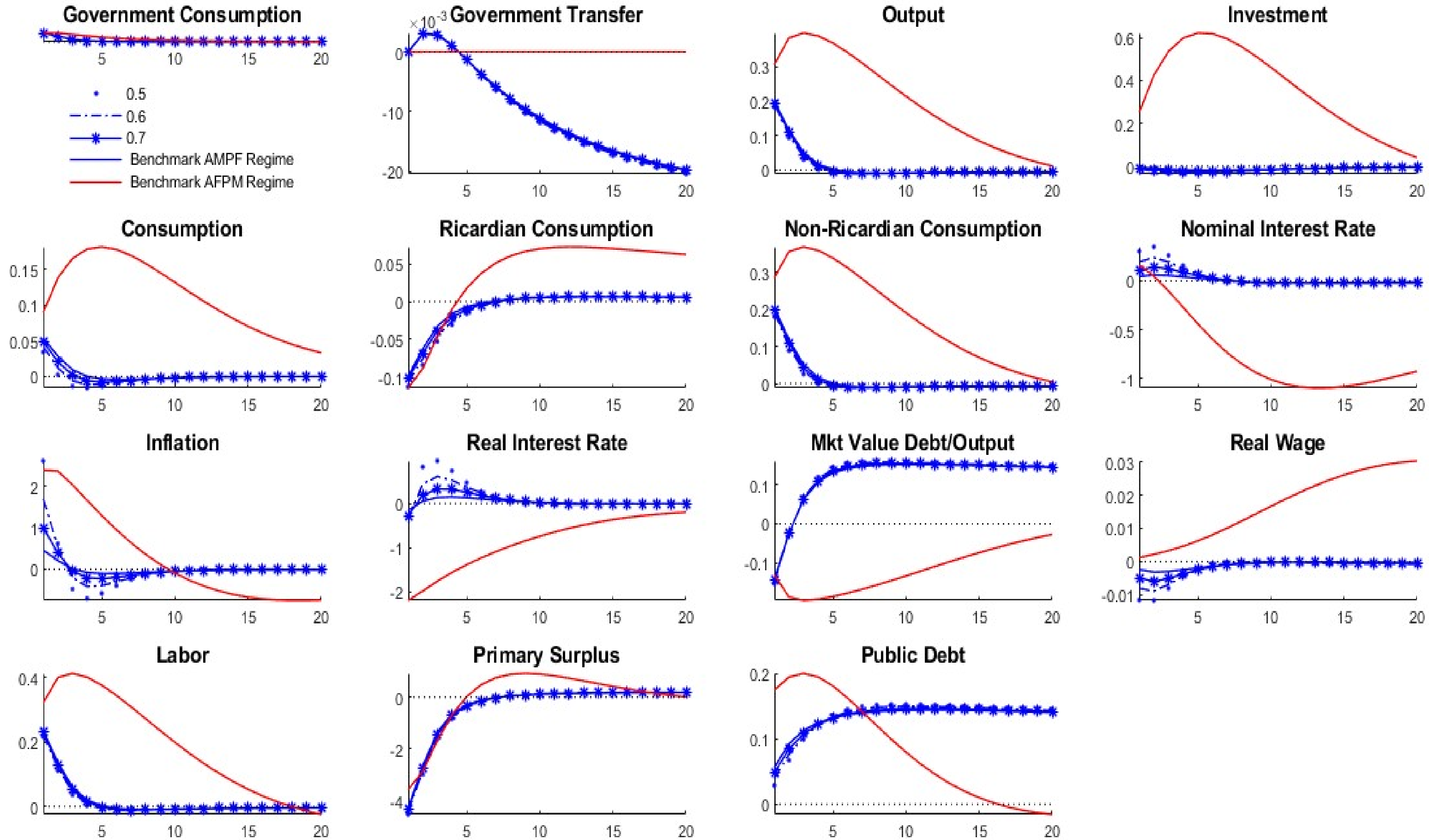
Note: This Figure shows the impulse responses of the government expenditure shock in the AFPM regime. The impulse responses represented by blue lines are the mean of the impulse responses computed at each of the 20000 parameter draws. The blue dotted lines represent the 90 percent confidence intervals of the impulse responses of the government expenditure shock.

Figure A.3: Transmission of the Government Expenditure Shock with Low Wage and Price Rigidity in the AFPM Regime



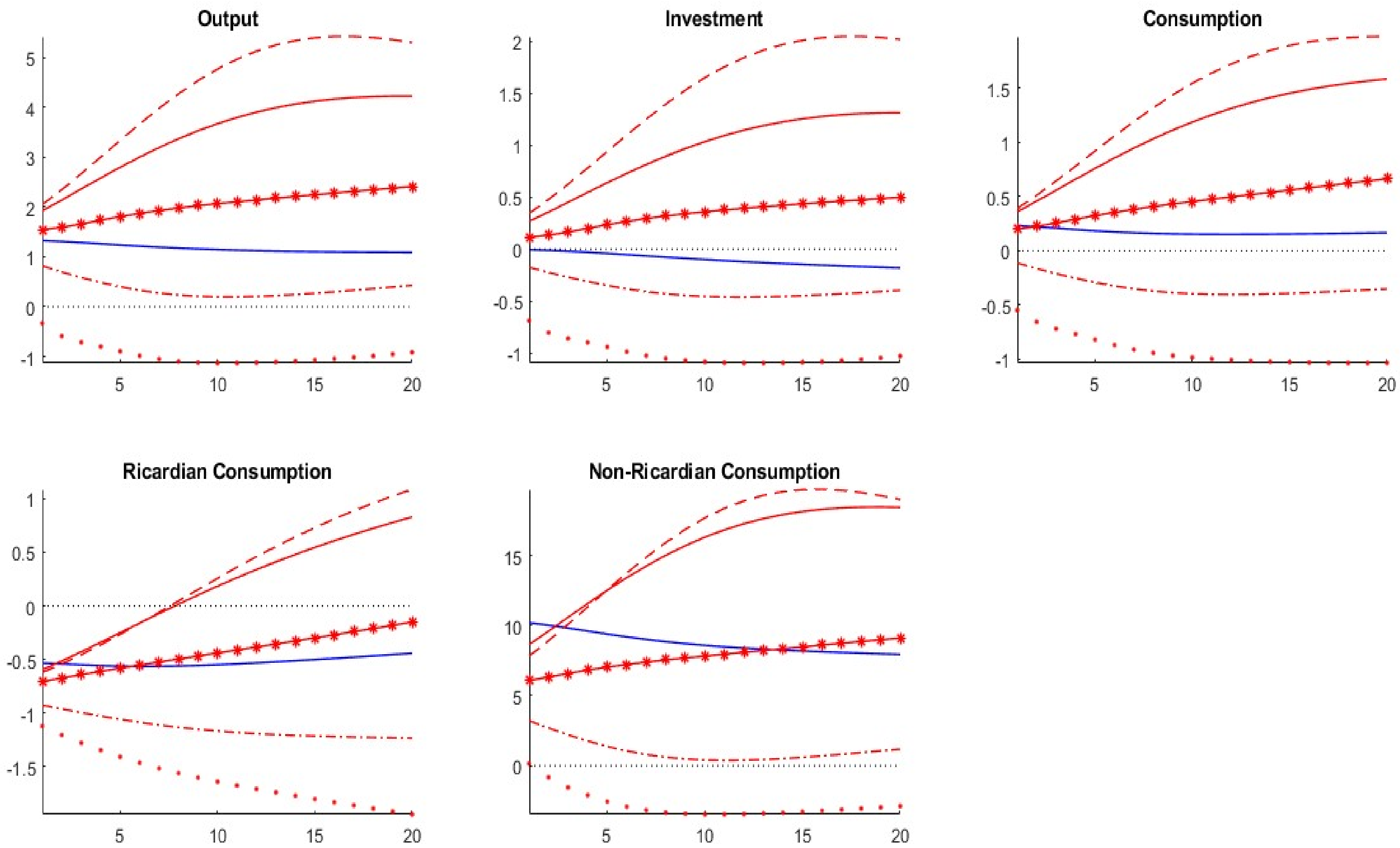
Note: This Figure reports the mean value of impulse responses of the government expenditure shock computed at each of 20,000 parameter draws of the AFPM regime with ω_w and ω_P calibrated to 0.5, 0.6, 0.7, and 0.9.

Figure A.4: Transmission of the Government Expenditure Shock with Low Wage and Price Rigidity in the AMPF Regime



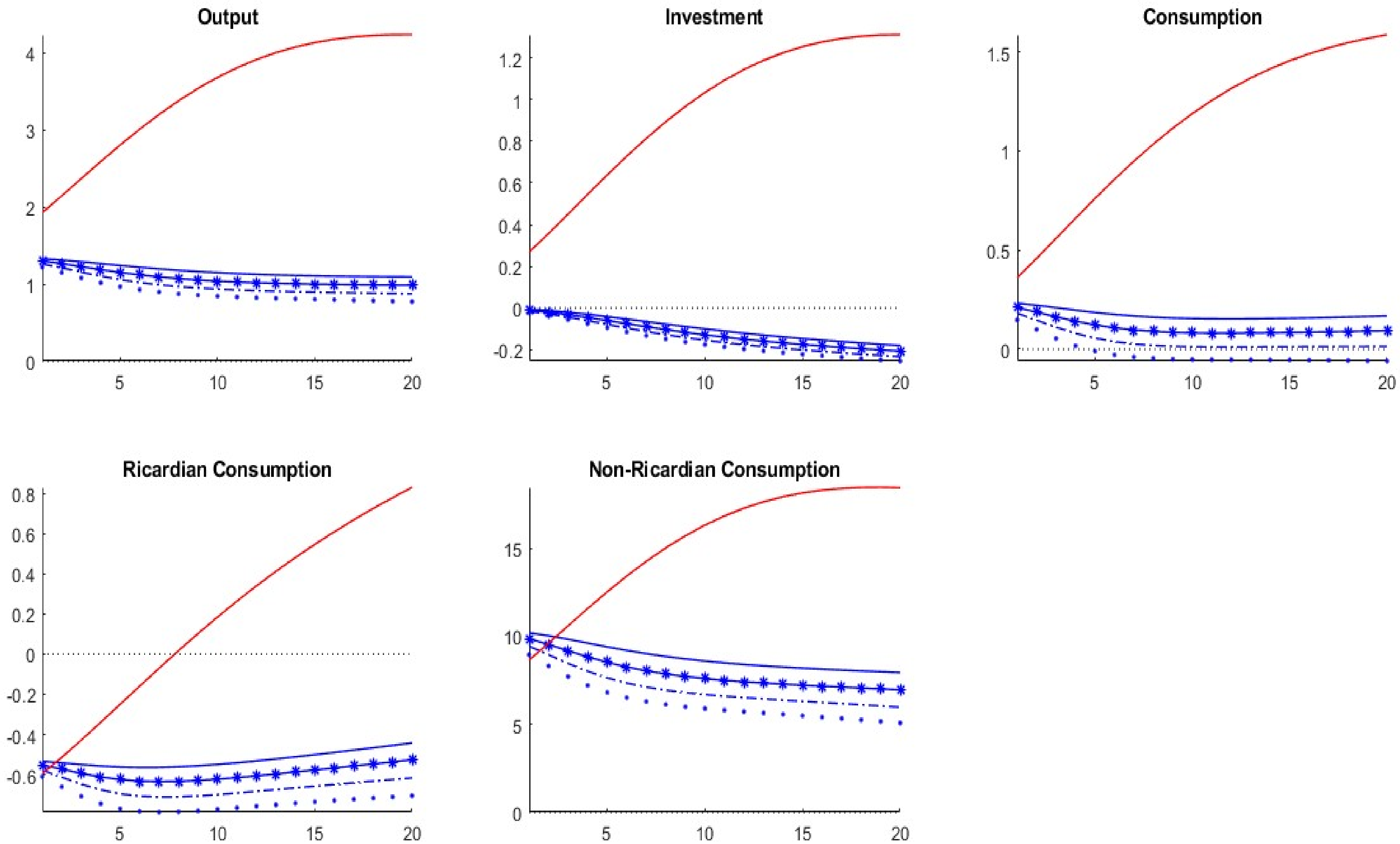
Note: This Figure reports the mean value of impulse responses of the government expenditure shock computed at each of 20,000 parameter draws of the AMPF regime with ω_w and ω_P calibrated to 0.5, 0.6, 0.7, and 0.9.

Figure A.5: Government Expenditure Multiplier at Low Wage and Price Rigidity in the AFPM Regime



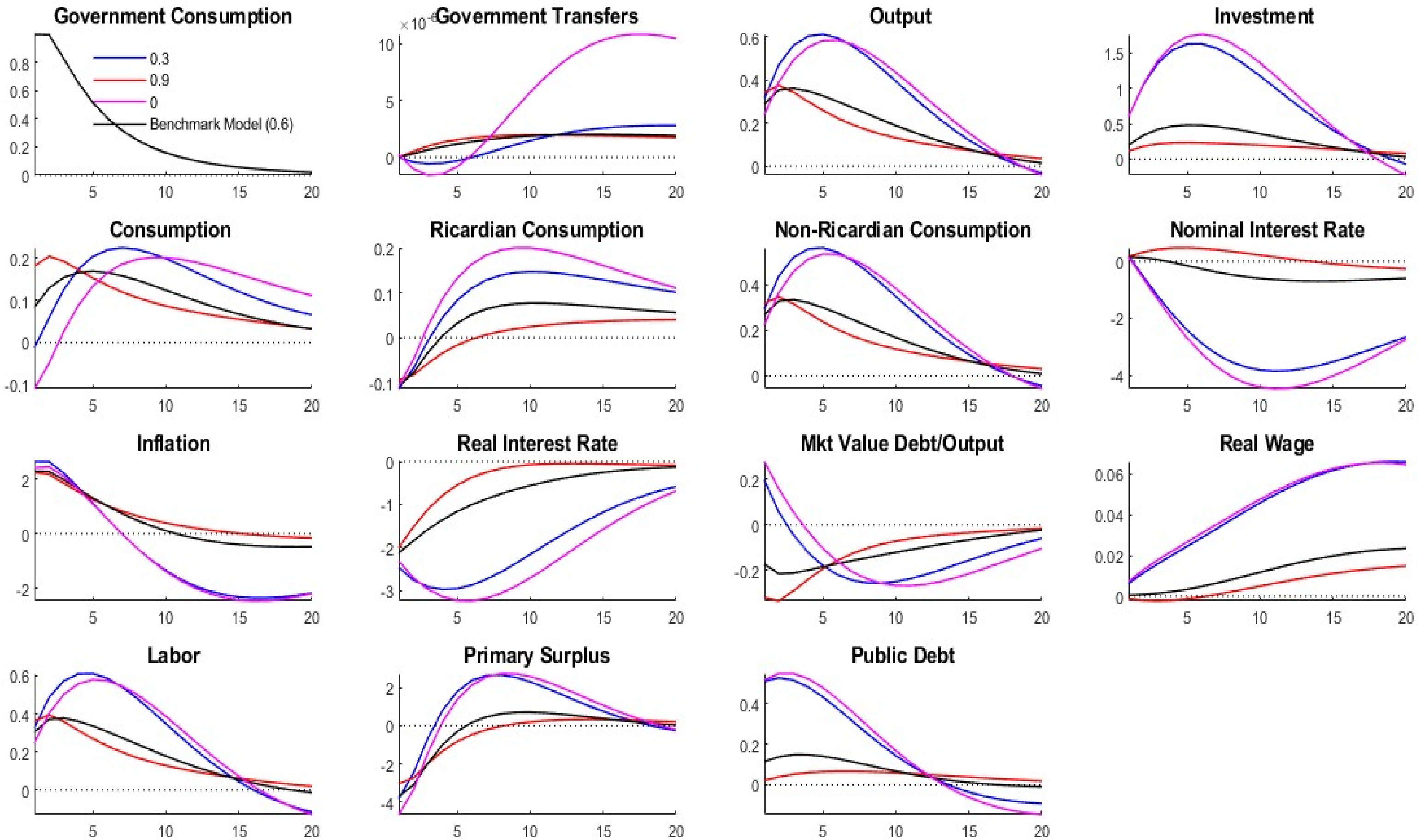
Note: This Figure reports the mean value of the government expenditure multipliers computed at each of 20,000 parameter draws of the AFPM regime with ω_w and ω_P calibrated to 0.5, 0.6, 0.7, and 0.9..

Figure A.6: Government Expenditure Multiplier at Low Wage and Price Rigidity in the AMPF Regime



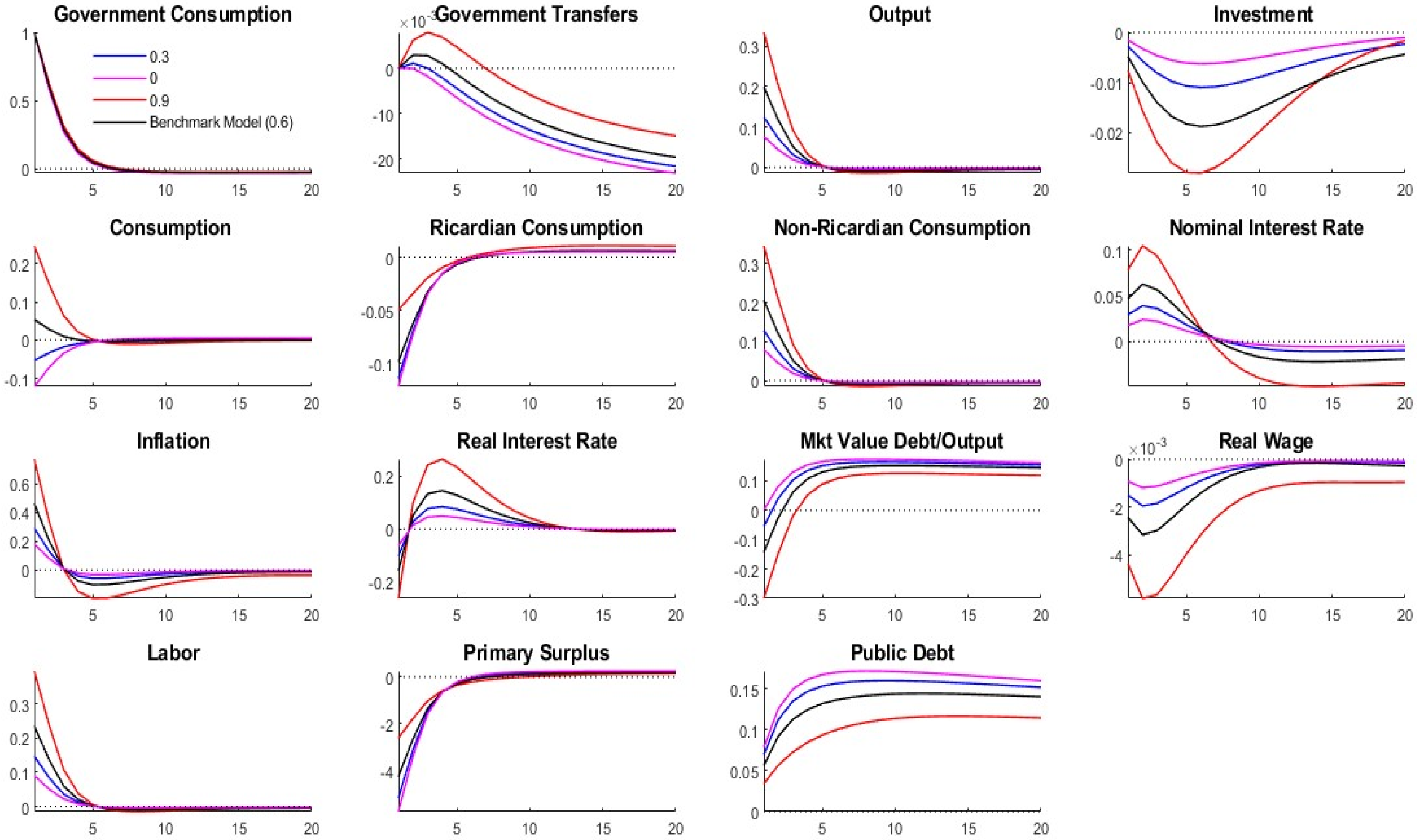
Note: This Figure reports the mean value of the government expenditure multipliers computed at each of 20,000 parameter draws of the AMPF regime with ω_w and ω_P calibrated to 0.5, 0.6, 0.7, and 0.9..

Figure A.7: Transmission of Government Expenditure Shocks Conditioned on the Share of Non-Ricardian Consumers in the AFPM Regime



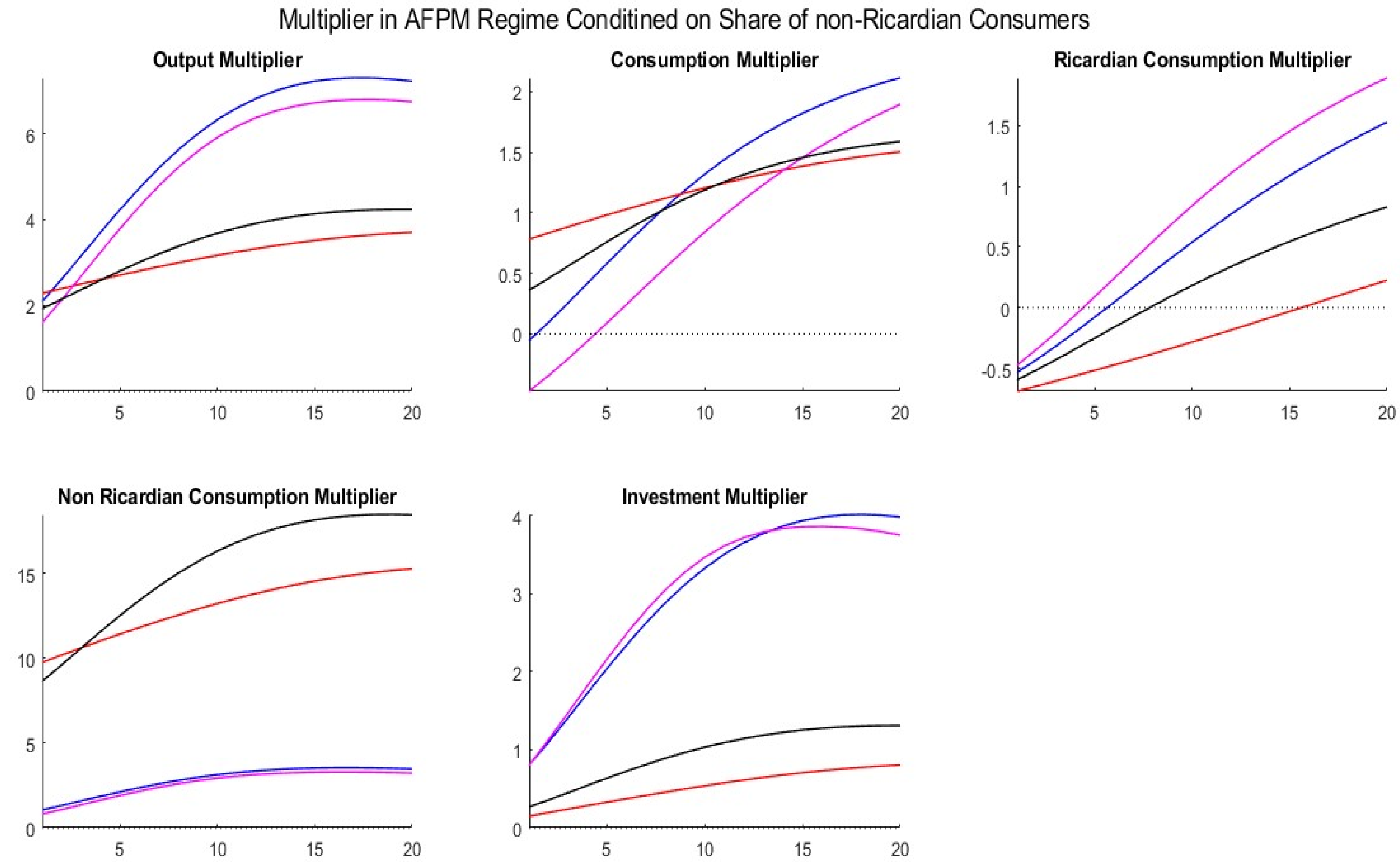
*Note:*This Figure reports the mean value of impulse responses of the government expenditure shock computed at each of 20,000 parameter draws of the AFPM regime with μ calibrated to 0, 0.3, and 0.9.

Figure A.8: Transmission of Government Expenditure Shocks Conditioned on the Share of Non-Ricardian Consumers in the AMPF Regime



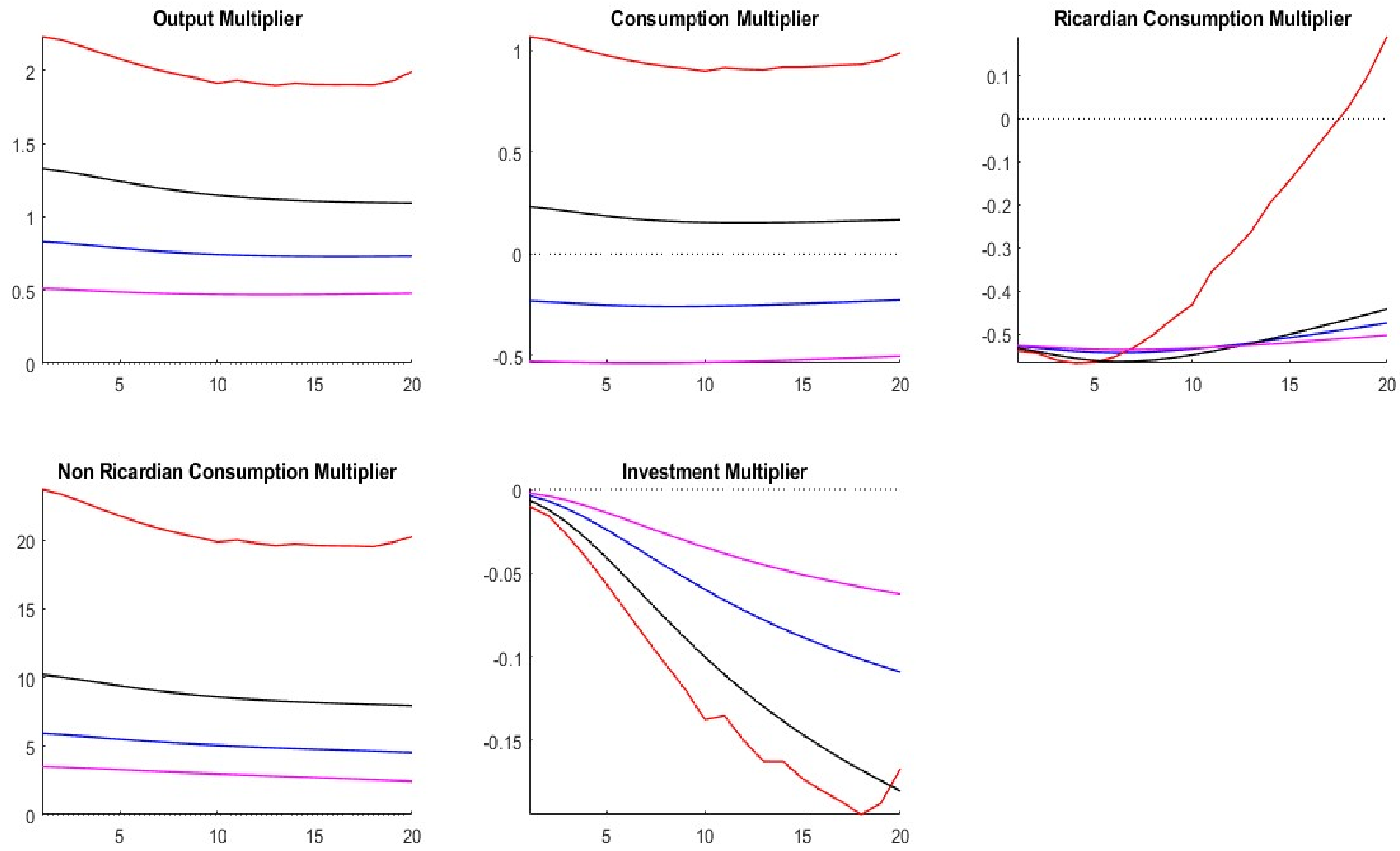
*Note:*This Figure reports the mean value of impulse responses of the government expenditure shock computed at each of 20,000 parameter draws of the AMPF regime with μ calibrated to 0, 0.3, and 0.9.

Figure A.9: Government Expenditure Multipliers Conditioned on the Share of Non-Ricardian Consumers in the AFPM Regime



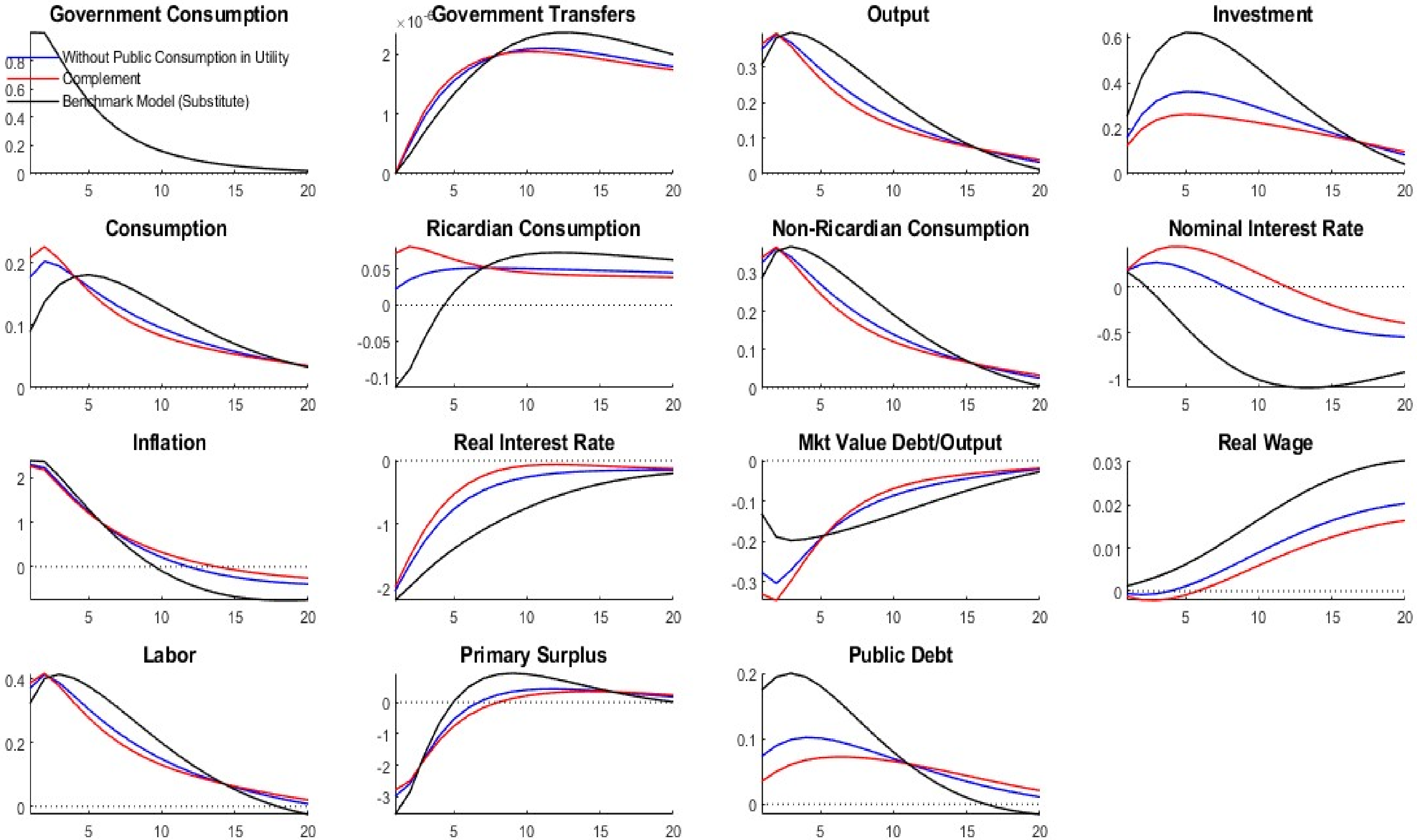
*Note:*This Figure reports the mean value of the government expenditure multipliers computed at each of 20,000 parameter draws of the AFPM regime with μ calibrated to 0, 0.3, and 0.9.

Figure A.10: Government Expenditure Multipliers Conditioned on the Share of Non-Ricardian Consumers in the AMPF Regime



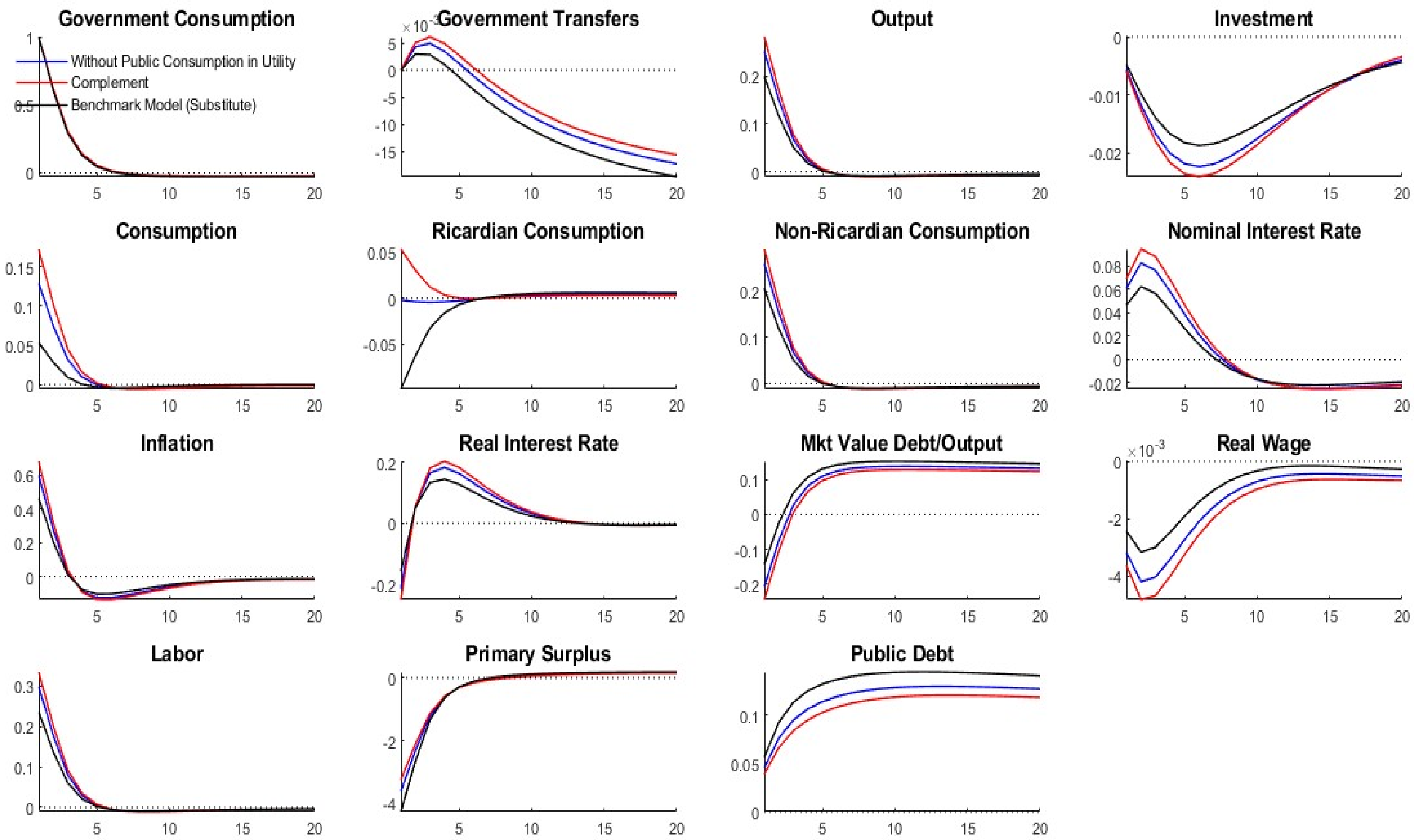
*Note:*This Figure reports the mean value of the government expenditure multipliers computed at each of 20,000 parameter draws of the AMPF regime with μ calibrated to 0, 0.3, and 0.9.

Figure A.11: Transmission of the Government Expenditure Shock Conditioned on Relation between Private and Public Consumption in the AFPM Regime



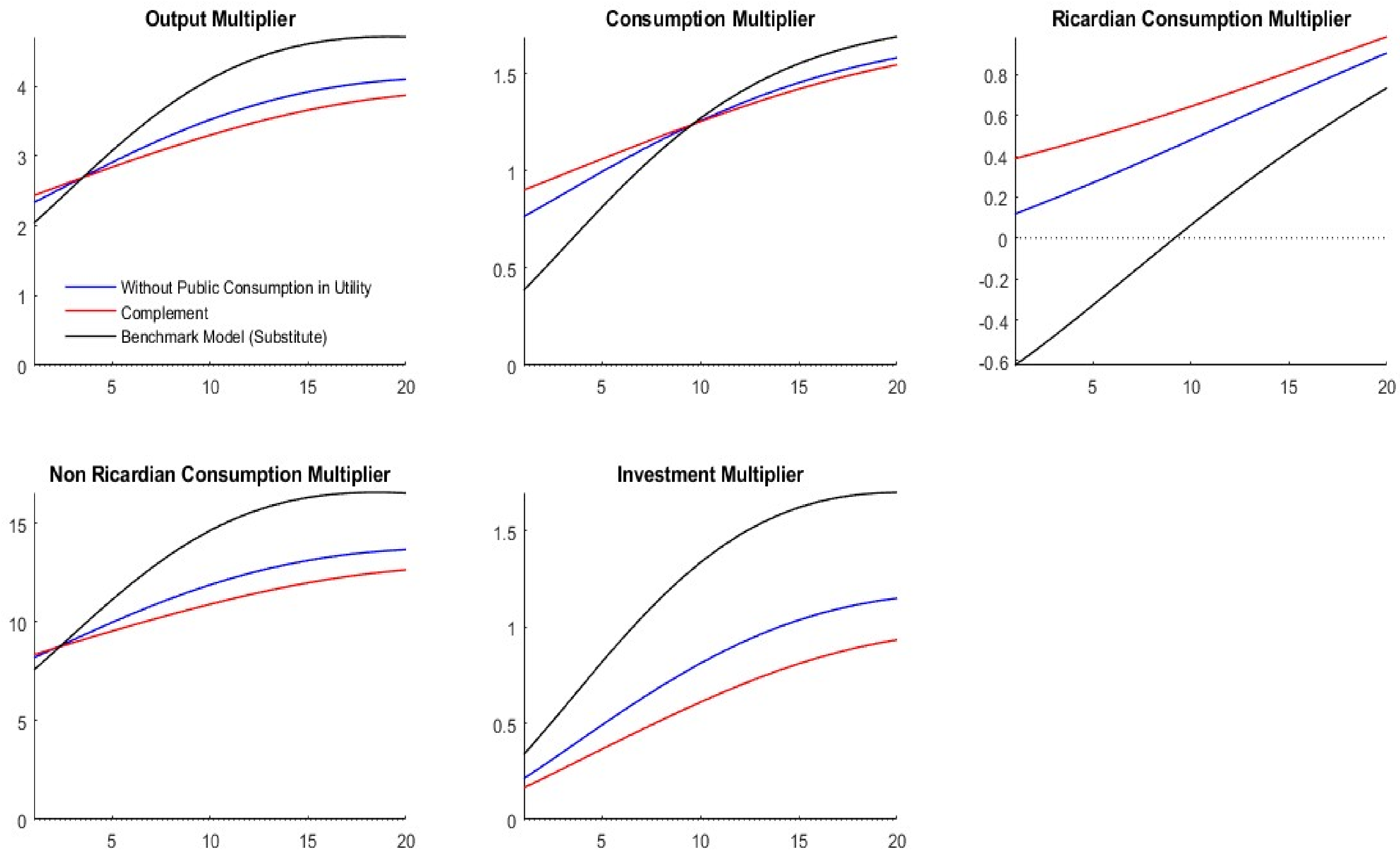
Note: This Figure reports the mean value of impulse responses of the government expenditure shock computed at each of 20,000 parameter draws of the AFPM regime with α_G calibrated to 0 ,0.3, and -0.3.

Figure A.12: Transmission of the Government Expenditure Shock Conditioned on Relation between Private and Public Consumption in the AMPF Regime



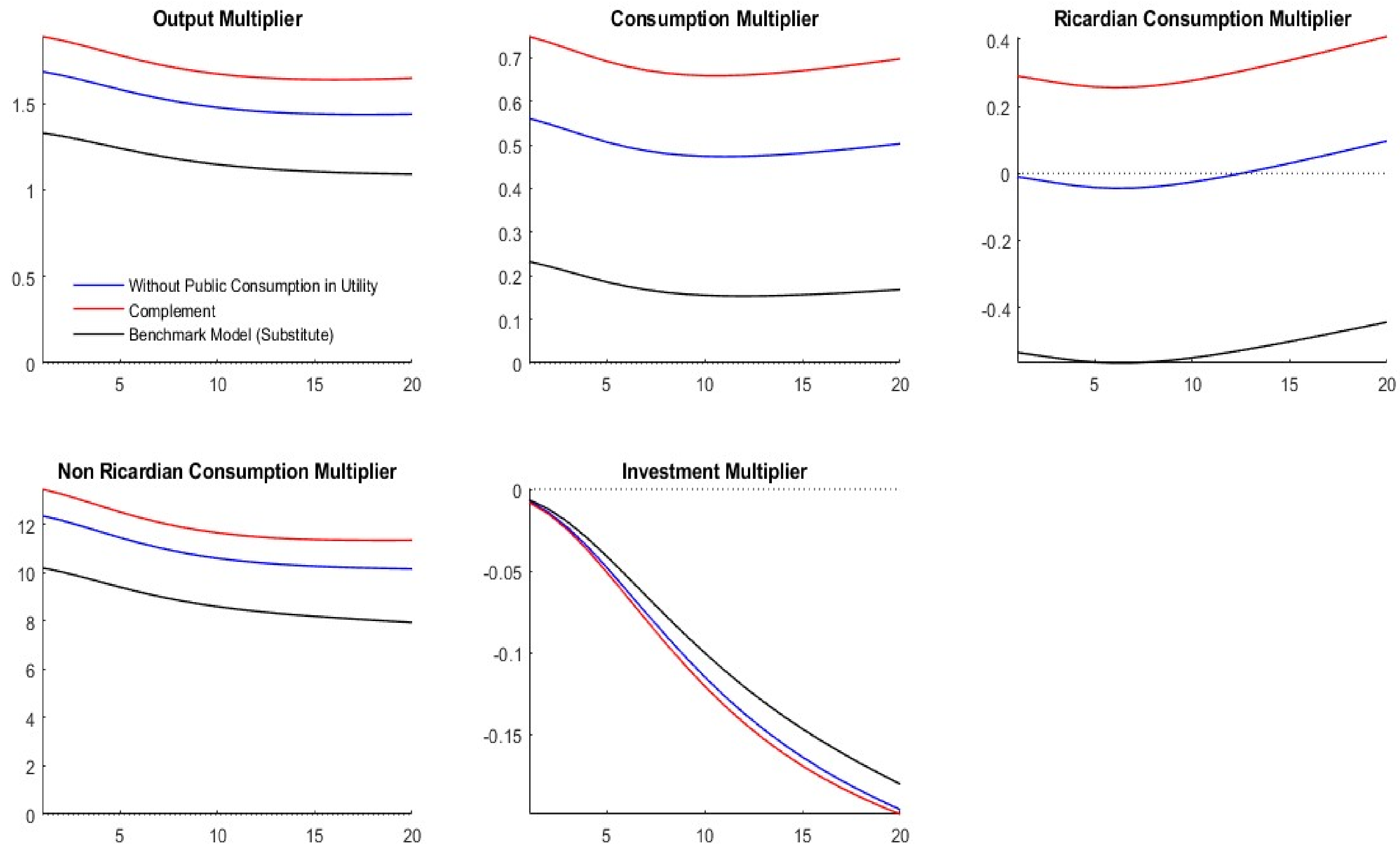
Note: This Figure reports the mean value of impulse responses of the government expenditure shock computed at each of 20,000 parameter draws of the AMPF regime with α_G calibrated to 0 ,0.3, and -0.3.

Figure A.13: Government Expenditure Multipliers Conditioned on Relation between Private and Public Consumption in the AFPM



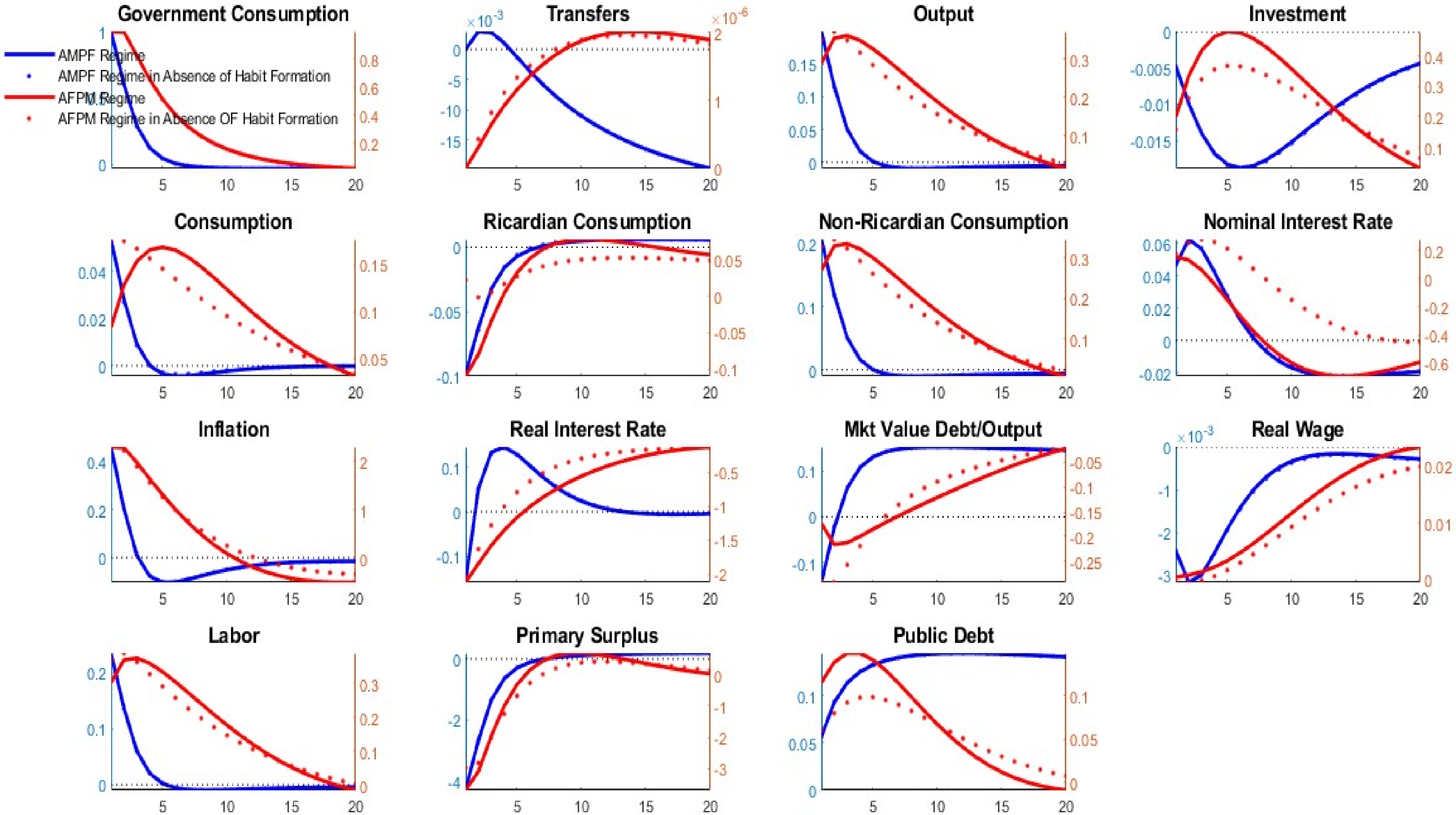
Note: This Figure reports the mean value of the government expenditure multipliers computed at each of 20,000 parameter draws of the AFPM regime with α_G calibrated to 0 ,0.3, and -0.3.

Figure A.14: Government Expenditure Multipliers Conditioned on Relation between Private and Public Consumption in the AMPF



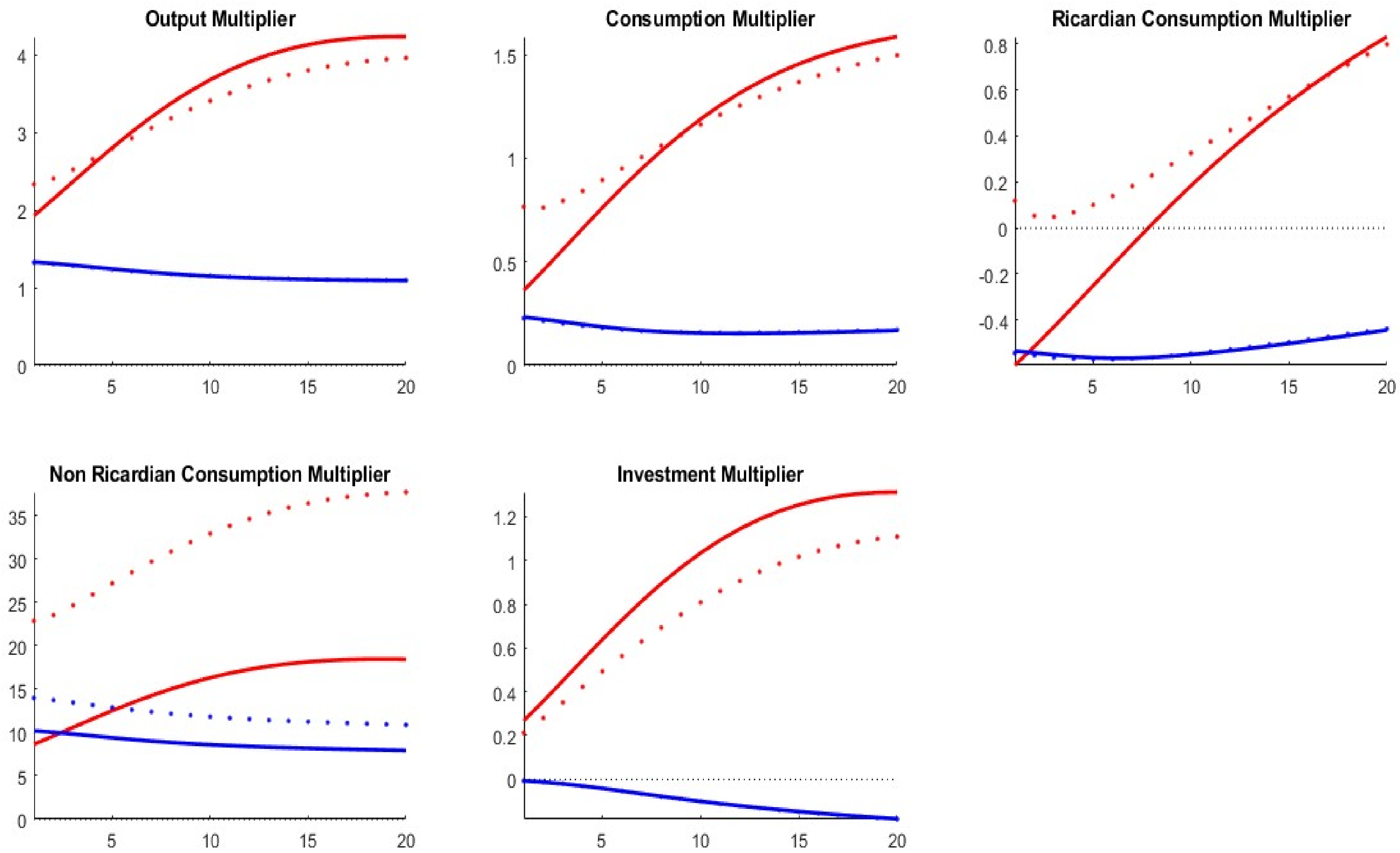
Note: This Figure reports the mean value of the government expenditure multipliers computed at each of 20,000 parameter draws of the AMPF regime with α_G calibrated to 0 ,0.3, and -0.3.

Figure A.15: Transmission of the Government Expenditure Shock in Absence of Habit Formation across the AFPM and AMPF Regimes



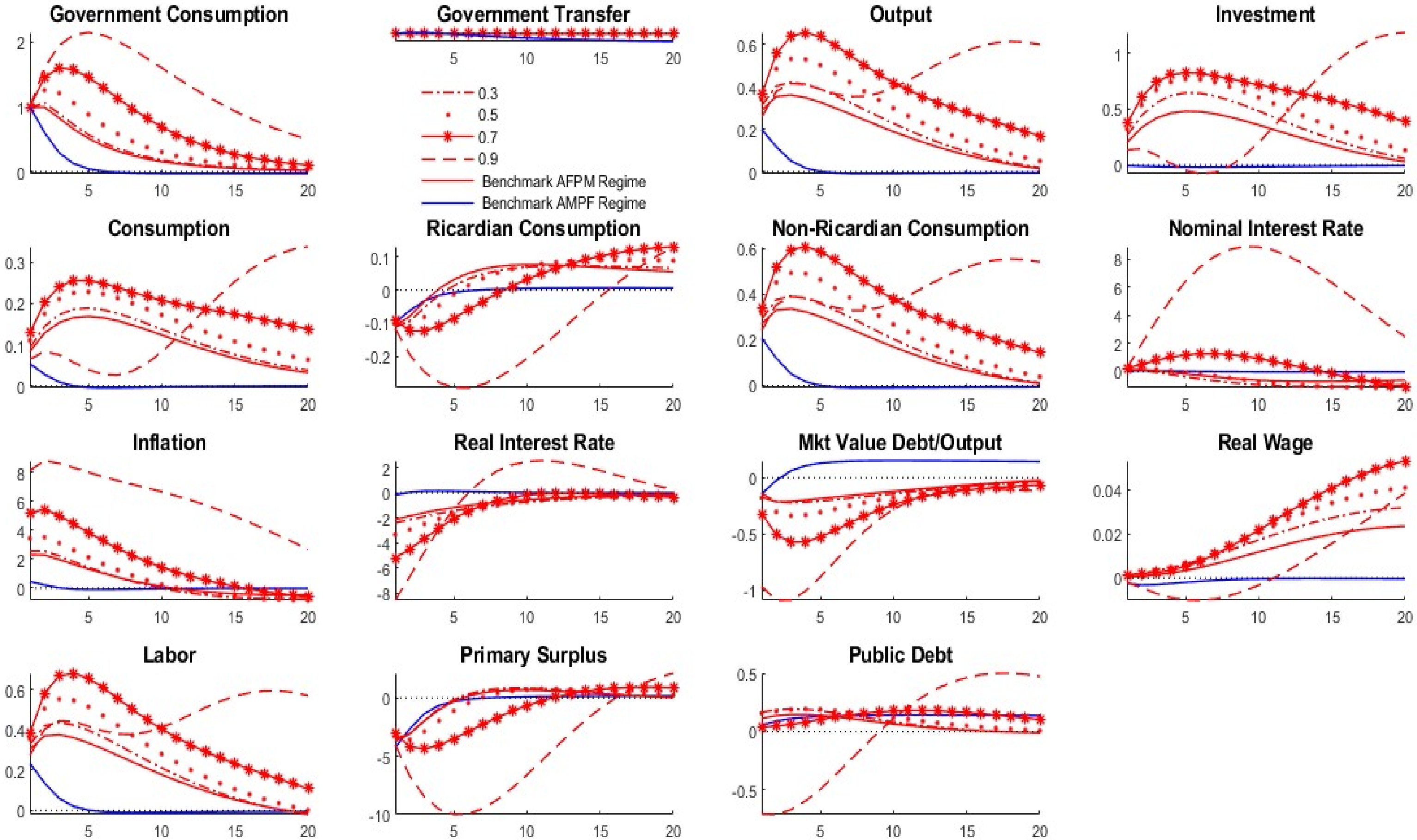
Note: This Figure reports the mean value of impulse responses of the government expenditure shock computed at each of 20,000 parameter draws of the AFPM and AMPF regime with θ calibrated to 0.

Figure A.16: Government Expenditure Multiplier in Absence of Habit Formation across the AFPM and AMPF Regimes



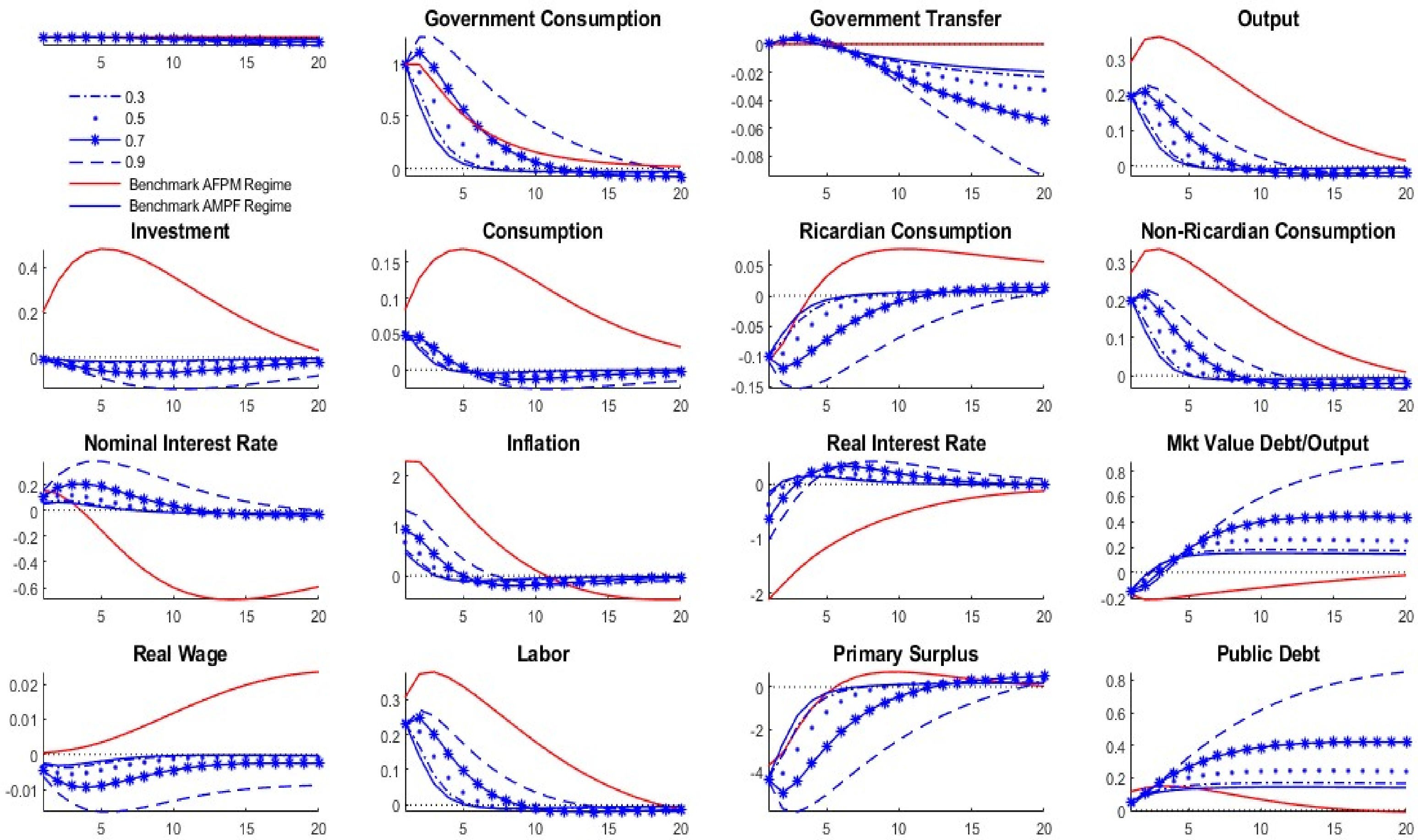
Note: This Figure reports the mean value of the government expenditure multipliers computed at each of 20,000 parameter draws of the AFPM and AMPF regime with θ calibrated to 0.

Figure A.17: Transmission of the Government Expenditure Shock Conditioned on the Government Expenditure Persistency in the AFPM Regime



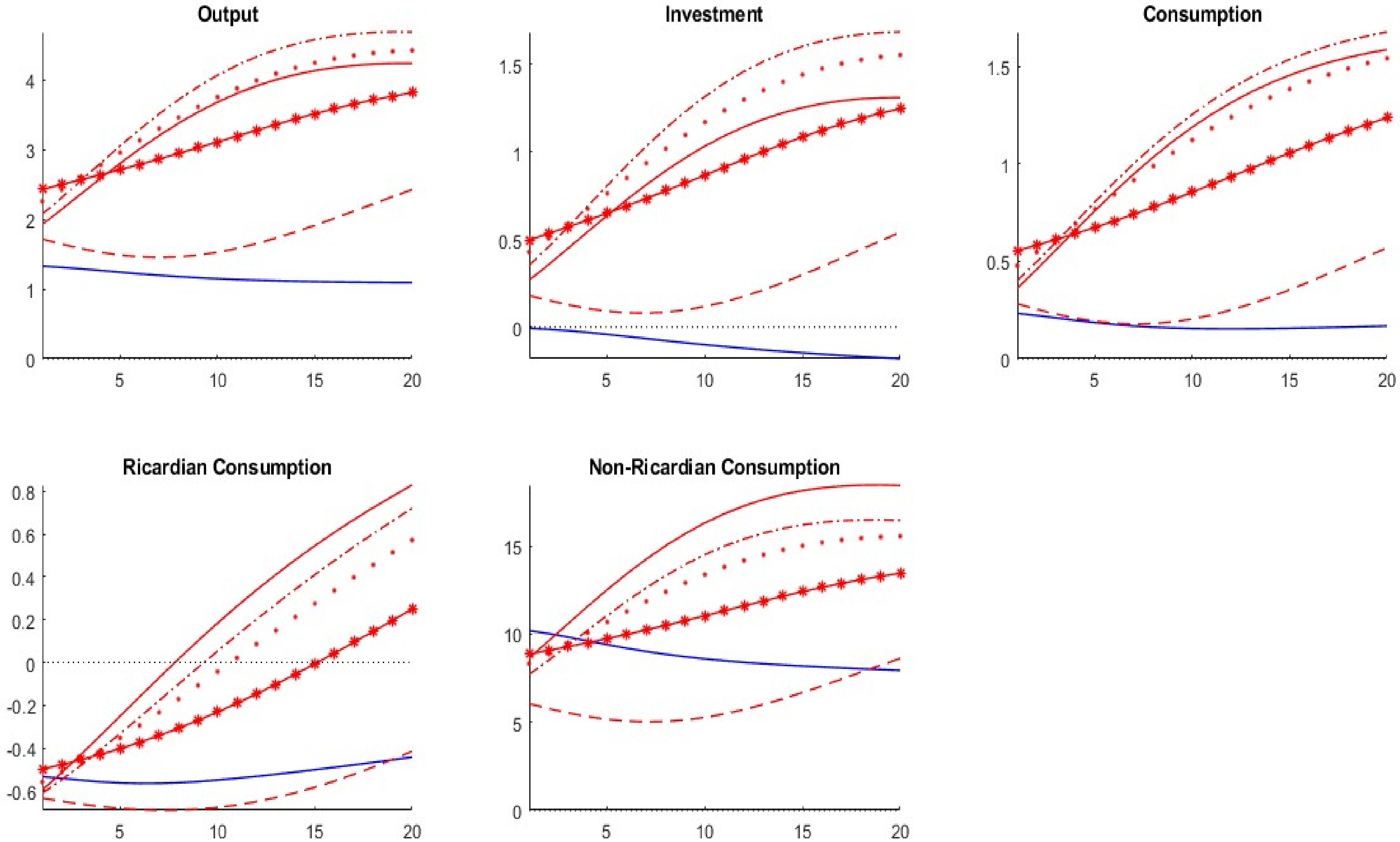
Note: This Figure reports the mean value of impulse responses of the government expenditure shock computed at each of 20,000 parameter draws of the AFPM regime with ρ_G calibrated to 0.3, 0.5, 0.7, and 0.9.

Figure A.18: Transmission of the Government Expenditure Shock Conditioned on the Government Expenditure Persistency in the AMPF Regime



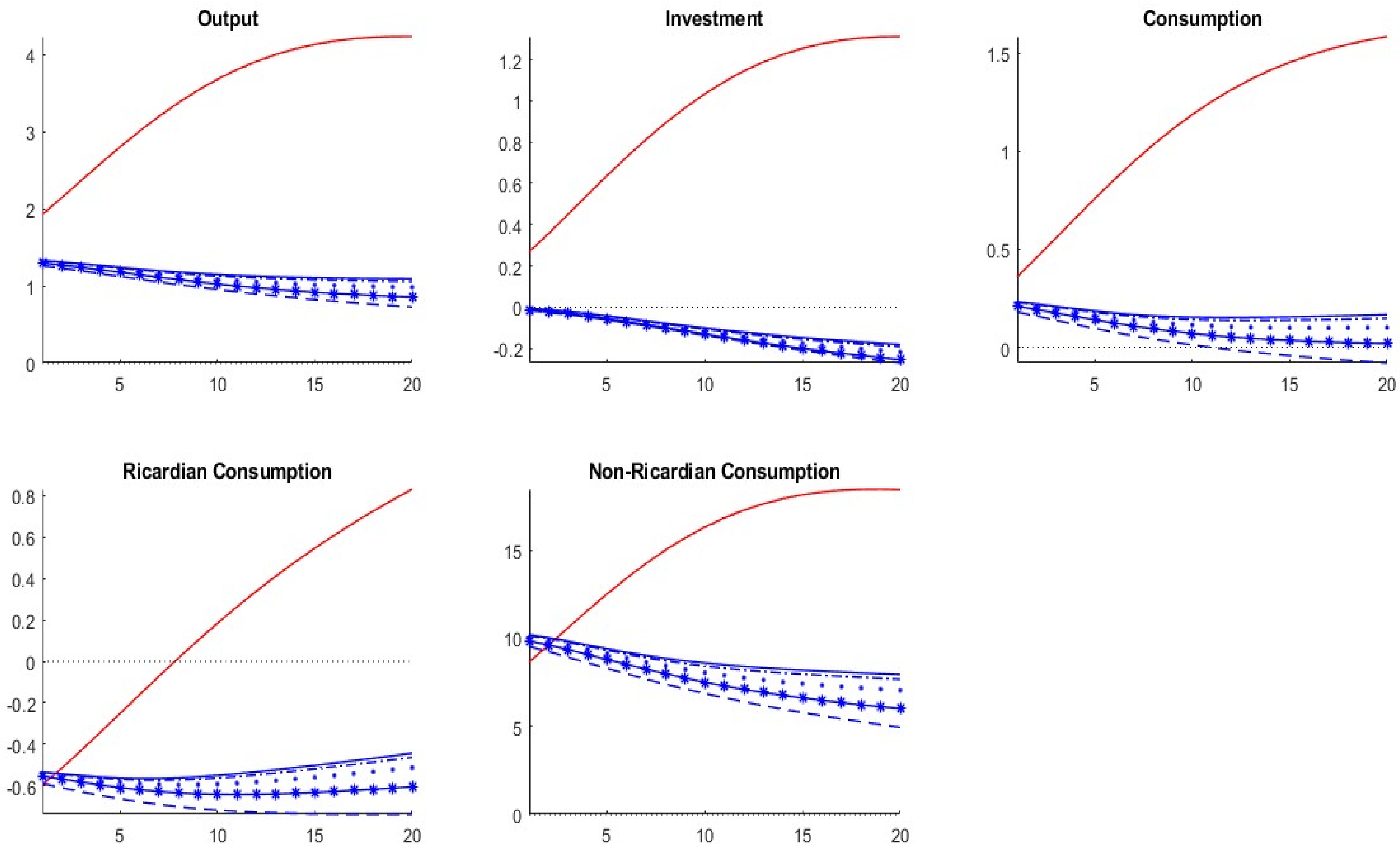
Note: This Figure reports the mean value of impulse responses of the government expenditure shock computed at each of 20,000 parameter draws of the AMPF regime with ρ_G calibrated to 0.3, 0.5, 0.7, and 0.9.

Figure A.19: Government Expenditure Multiplier Conditioned on the Government Expenditure Persistency in the AFPM Regime



Note: This Figure reports the mean value of the government expenditure multipliers computed at each of 20,000 parameter draws of the AFPM regime with ρ_G calibrated to 0.3, 0.5, 0.7, and 0.9.

Figure A.20: Government Expenditure Multiplier Conditioned on the Government Expenditure Persistency in the AMPF Regime



Note: This Figure reports the mean value of the government expenditure multipliers computed at each of 20,000 parameter draws of the AMPF regime with ρ_G calibrated to 0.3, 0.5, 0.7, and 0.9.