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Evaluating the Effectiveness of Fiscal and Monetary Policy in the Bangladeshi Economy: A HANK-DSGE Analysis

- Sakib Bin Amin*
- Mainul Islam Chowdhury**
- Javed Hossain***

Abstract

This paper assesses the efficacy of fiscal and monetary policies in the context of the Bangladeshi economy, which is currently experiencing significant changes in the aftermath of its recent regime shift. The study employs a closed economy HANK-DSGE framework to analyze these policies. The results indicate that both fiscal and monetary measures stimulate growth through demand- and supply-side channels, though monetary policy exerts a stronger influence. We argue for an optimal, coordinated policy mix to reinvigorate the economy while containing inflationary pressures.

Keywords: HANK-DSGE Model, Fiscal Policy, Monetary Policy, Bangladeshi Economy.
JEL Classification: C32, C68, E52, E62

1. Introduction

Macroeconomic stabilization programs worldwide aim to achieve high, stable, and sustainable development. A wealth of literature outlines how fiscal and monetary policies can boost the economy and achieve macroeconomic stability (Younus, 2017; Leith & Von Thadden, 2008; El Husseiny, 2023). However, there remains ambiguity regarding the findings of the relative effectiveness of these policies on both the theoretical and empirical fronts. The ideological distinction between Keynesian and monetarist approaches can be used to understand the core of this ambiguity.

While monetarists emphasize the need for significant increases in the money supply to boost the economy, Keynesians raise concerns regarding the

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* Sakib Bin Amin is a Professor, Department of Economics, North South University, Dhaka, Email: sakib.amin@northsouth.edu; **Mainul Islam Chowdhury, Ph.D., Associate Professor, Department of Economics, North South University, Dhaka, Email: mainul.chowdhury@ northsouth.edu, and ***Javed Hossain, Assistant Professor, Department of Economics, North South University, Dhaka, Email: javed.hossain01@northsouth.edu. The views expressed in this paper are the authors' own.

effectiveness of a higher monetary supply to stimulate the economy. They instead argue that governments should rely on fiscal policy to stimulate the economy because of the liquidity trap effect.

This debate becomes more prominent in Bangladesh, where the newly formed interim government is committed to boosting the economy by stabilizing the banking sector, reestablishing trust, instituting transparency and accountability, and combating inflation through monetary and fiscal policies. Sound economic research is expected to guide policymakers in finding the most optimal macroeconomic policies. A fundamental prerequisite for the effective conduct of macroeconomic policy is a rigorous understanding of the monetary and fiscal transmission mechanisms through which policy actions influence the aggregate economic performance (Kaplan, Moll, & Violante, 2018). During ousted prime minister Sheikh Hasina’s regime (2009-2024), Bangladesh's economy was fragile, as shown by high inflation, diminishing foreign exchange reserves, mounting debt, ineffective tax collection, poor development project implementation, and inadequate financial sector governance. Therefore, repairing the fractures within the economy will require persistent and arduous efforts by the interim and the future elected governance over an extended period. However, the right strategies and sustained efforts can improve the economy.

Dynamic Stochastic General Equilibrium (DSGE) models have advanced significantly in recent years for macroeconomic policy research because policymakers find them particularly significant because they offer insights into trade prices and quantities while generating more comprehensive and sophisticated data relevant to the economy. The DSGE model also makes it easier to predict how market conditions, including new government policies or technological advancements, will alter the degree of welfare. Moreover, the New Keynesian (NK) model has gained momentum in monetary policy analysis throughout the past decade. This model is based on the Rational Expectations (REs) hypothesis and presumes a representative agent structure (Massaro, 2013).

A detailed household consumption and investment model is necessary to assess the relative strength of fiscal and monetary policy. There are growing concerns regarding the Representative Agent New Keynesian (RANK) model, as the aggregate consumption response to a change in interest rates is driven entirely by the Euler equation of the representative household. Therefore, monetary policy in RANK models operates almost solely through intertemporal substitution for any plausible parameterization: indirect effects are minimal, and direct effects account for the macroeconomic impact of interest rate changes. Thus, to evaluate the efficacy of Bangladesh's macroeconomic policies across the significant macroeconomic variables, we create a Heterogeneous Agent New Keynesian (HANK) model.

Following Galí, López-Salido, & Vallés (2007), our model considers two different types of households: Ricardian and Non-Ricardian. While Non-Ricardian households do not have access to financial and capital markets, the Ricardian household has unlimited access to the capital and financial markets. Both households must pay taxes on their income. Both households are subjected to tax on their earnings. As in Rotemberg (1982), we employ the conventional New Keynesian model on the supply side, assuming that monopolistically competitive producers set prices in the face of nominal rigidities through quadratic price adjustment costs.

Model calibration is required before examining the model's performance to evaluate the empirical data. For example, Cooley (1995) calibrates the model by choosing parameter values consistent with long-run historical averages and microeconomic evidence. However, we have generally adopted three approaches in calibrating parameters for our DSGE model. Some parameters are picked from the existing DSGE literature for developing and developed countries. Some parameter values are chosen using the model's steady-state conditions. The Bangladesh Bureau of Statistics, Bangladesh Household Income and Expenditure Survey, Bangladesh Bank, and Bangladesh Economic Review directly consider the rest of the parameter values. All model parameters are calibrated at a quarterly frequency.

The main contribution of this paper is twofold. First, we develop a novel HANK-DSGE model tailored to the Bangladeshi economy, integrating heterogeneous household behavior into a micro-founded New Keynesian framework. Second, we calibrate the model to evaluate the performances of monetary and fiscal policy towards Bangladesh's economy in a heterogeneous framework.

The paper is organized as follows. Section 2 reviews the literature. The DSGE model is presented in Section 3, which is followed by a discussion on the calibration of the parameters in Section 4. Section 5 discusses the results. Finally, conclusions and policy implications are presented in Section 6.

2. Literature Review

Senbeta (2011) examined the applicability of the New Keynesian DSGE model to low-income economies in Sub-Saharan Africa, excluding South Africa. The study reviewed developments, criticisms, and recent advancements in DSGE modeling, highlighting persistent challenges, particularly in incorporating structural specifications relevant to low-income economies. The findings underscore the necessity of modifying standard NK DSGE assumptions to address pressing issues such as labor market dynamics and unemployment.

Amiri, Sayadi, and Mamipour (2021) analyzed the impact of oil price shocks on macroeconomic variables in oil-exporting economies using a DSGE model calibrated for Iran. Their framework included households, firms, the central bank, and government sectors, integrating balance-of-payments and government budget constraints. The results indicate that increases in oil revenue expand the monetary base, leading to inflation, real exchange rate depreciation, and weakened competitiveness. The authors suggest that sovereign wealth funds could help stabilize the economy against external oil price shocks.

Nguyen (2021) investigated the sources of business cycle fluctuations in Vietnam using a small open-economy NK-DSGE model with habit formation, staggered pricing, and incomplete exchange rate pass-through. To improve the model’s accuracy in capturing international spillovers, additional foreign shocks were incorporated. Impulse response functions and historical decompositions revealed insights into Vietnam’s economic fluctuations, and the study recommends integrating the banking sector to better capture nominal frictions.

Zhang, Zhang, and Zhu (2021) explored the effects of the COVID-19 pandemic on China's economic sustainability, income inequality, and government debt using an NK DSGE framework. The study found that pandemic-induced demand and supply shocks hindered sustainable development and exacerbated social inequality. The authors recommend that monetary policy focus on price stability during demand-driven recessions and prioritize economic growth when labor demand declines. Targeted interventions that stimulate consumption are suggested to sustain economic activity.

Fornero (2010) examined fiscal and monetary policy interactions in the EU and US, evaluating the relevance of the Ricardian Equivalence Proposition in economies with liquidity-constrained consumers. Using a DSGE model estimated via vector autoregression, the study found that expansionary fiscal policy increases private consumption, contradicting the permanent income hypothesis, whereas monetary policy has limited effects on consumption. The findings suggest that incorporating capital dynamics and alternative tax regimes could refine policy implications.

Steinbach, Mathuloe, and Smit (2009) applied an open-economy NK DSGE model to South Africa, incorporating external habit formation, wage and price indexation, and staggered price-setting mechanisms. Bayesian estimation using data from 1990Q1 to 2007Q4 showed that the DSGE model outperformed Reuters consensus forecasts in predicting GDP growth over a seven-quarter horizon and provided more accurate medium- to long-term inflation forecasts.

Bukhari and Khan (2008) evaluated a small open-economy DSGE model representing Pakistan's economy, including price rigidity, habit formation, and monetary policy transmission mechanisms. Their analysis revealed that high inflation had minimal impact on domestic consumption, while a policy rate hike of 100–200 basis points effectively reduced inflation. Exchange rate pass-through to domestic prices was limited, and 24% of firms did not re-optimize prices, suggesting an average contract duration of roughly two quarters.

Bangara (2019) investigated the role of foreign exchange constraints in import-dependent, low-income economies using a four-sector NK DSGE model calibrated to Malawi. The study found that increased imports, although vital for production, could reduce output and consumption while depreciating the currency. The severity of foreign exchange constraints influenced the magnitude of economic shocks, and contractionary monetary policy was found to stabilize output and consumption despite these constraints.

Kumar (2023) developed a closed-economy DSGE model to examine the effects of monetary policy on economic activity in India. Incorporating price rigidities and an inflation-targeting framework based on the Taylor rule, the simulations showed that positive productivity shocks enhance output, while expansionary monetary policy temporarily boosts output but does not sustain long-term growth.

While several studies have applied NK-DSGE models to emerging and low-income economies (e.g., Bukhari & Khan, 2008; Senbeta, 2011; Nguyen, 2021), little attention has been given to the relative effectiveness of fiscal and monetary policy in the context of Bangladesh. Moreover, existing models predominantly employ representative-agent frameworks, overlooking household heterogeneity. This paper addresses these gaps by analyzing fiscal–monetary policy effectiveness in Bangladesh using a heterogeneous-agent NK-DSGE model.

3. The Model

A heterogeneous agent New Keynesian DSGE framework is employed to analyze fluctuations in macroeconomic variables caused by fiscal and monetary policy shocks. The model incorporates heterogeneity by classifying households based on their access to financial markets and ownership of capital. Additionally, imperfect competition is included, allowing firms to produce differentiated goods using distinct labor and capital inputs. The effectiveness of various fiscal policies is assessed through government intervention within the model. A monetary authority is also incorporated to implement monetary policy. Finally, the general equilibrium framework is completed through the market-clearing condition.

3.1 The Household Problem

We consider two types of agents based on the framework presented by Galí, López-Salido, and Vallés (2007). A continuum of infinitely lived representative households is indexed by $j \in [0,1]$. A fraction (ω) of households, denoted as Ricardian (R), have unrestricted access to financial and capital markets. By contrast, the remaining $(1-\omega)$ fraction, referred to as Non-Ricardian (NR), are excluded from both markets. Ricardian households are subject to a lump-sum tax, τ. The respective households $j \in \{R, NR\}$ maximize their welfare through the following CRRA utility function[1]:

$$U(C_{j,t}, L_{j,t}) = E_t \sum_{t=0}^{\infty} \beta^t \left(\frac{C_{j,t}^{1-\sigma_j}}{1-\sigma_j} - \frac{L_{j,t}^{1+\phi_j}}{1+\phi_j} \right) \ldots\ldots\ldots(1)$$

where E denotes the expectation parameter β is the intertemporal discounting factor; C_j is the consumption of the household $j \in \{R, NR\}$. σ_j is the relative risk aversion coefficient. L_j is the quantity of labor supplied by household $j \in \{R, NR\}$ that creates negative utility for the household. ϕ_j is the inverse of Frisch elasticity due to labor supply. The following sections provide the budget constraints of the respective households with the necessary first-order conditions.

3.1.1 Ricardian Households, *R*

The representative Ricardian household chooses the level of consumption, labor supply, capital formation, and government-issued bond to maximize the utility function, equation (1) , subject to the following budget constraint:

$$P_t C_{R,t} + P_t I_t + \frac{B_{t+1}}{R_{B,t}} = P_t W_t L_{R,t} + P_t R_t K_t + B_t + P_t \Pi_t - P_t \tau_t \ldots\ldots\ldots(2)$$

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[1] This specification is referred to as the constant relative risk aversion (CRRA) utility function. Under this formulation, the marginal utility of consumption declines at a constant rate determined by the coefficient of relative risk aversion. The curvature of the utility function depends on the sign and magnitude of this coefficient: a positive value implies concavity and risk-averse behavior, a negative value implies convexity and risk-loving preferences, and a value of zero corresponds to risk neutrality. In parallel, the Frisch elasticity captures the responsiveness of labor supply to changes in wages, isolating the substitution effect while holding wealth constant.

At the beginning of the period t, the Ricardian household earns labor income $P_t W_t L_{R,t}$ where P_t is the price level, W_t is the real wage, and $L_{R,t}$ denotes the labor supply by the Ricardian household. Due to the ownership of capital, this type of household earns an income from capital holdings, $P_t R_t K_t$ where R_t denotes the real return to the capital. B_t is the quantity of the nominally riskless bond carried over from the period $t-1$. $R_{B,t}$ is the nominal return on this bond. $\frac{B_{t+1}}{R_{B,t}}$ measures the expenditure on the nominally riskless bond at period t , which will give a return $R_{B,t+1}$ at period $t+1$. Π_t is a dividend to the Ricardian household by the firm. It has to be mentioned that the representative household is paying a lump-sum tax, τ_t. Capital adjustment costs are introduced in the law of motion of capital following Christiano, Eichenbaum, and Evans (2005) as shown below

$$K_{t+1} = (1-\delta)K_t + I_t\left(1 - \frac{\chi}{2}\left(\frac{I_t}{I_{t-1}} - 1\right)^2\right) \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where $\delta \in (0,1)$ is the rate of depreciation, and $\chi > 0$ is an investment cost parameter. However, the cost of adjusting investments is described in a manner that meets the criteria outlined in Christiano, Eichenbaum, and Evans (2005). This convex cost faced by the representative household is included to avoid the excessive investment volatility due to interest rate differentials. Maximizing the Ricardian household's utility function with respect to the budget constraint (equation(2)) and law of motion of capital stock (equation (3)) provides the following conditions:

$$W_t = C_{R,t}^{\sigma_R} L_{R,t}^{\phi_R} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$$Q_t = \beta E_t\left(\frac{C_{R,t+1}}{C_{R,t}}\right)^{-\sigma_R}\left(\frac{P_t}{P_{t+1}}\right)(P_{t+1}R_{t+1} + (1-\delta)Q_{t+1}) \ldots\ldots\ldots (5)$$

$$\Rightarrow q_t = \beta E_t\left(\frac{C_{R,t+1}}{C_{R,t}}\right)^{-\sigma_R}(R_{t+1} + (1-\delta)q_{t+1})$$

$$P_t = Q_t\left(1 - \frac{\chi}{2}\left(\frac{I_t}{I_{t-1}} - 1\right)^2 - \chi\left(\frac{I_t}{I_{t-1}} - 1\right)\left(\frac{I_t}{I_{t-1}}\right)\right) +$$

$$\beta\chi E_t\left(\frac{C_{R,t+1}}{C_{R,t}}\right)^{-\sigma_R}\left(\frac{P_t}{P_{t+1}}\right)Q_{t+1}\left(\frac{I_{t+1}}{I_t} - 1\right)\left(\frac{I_{t+1}}{I_t}\right)^2 \ldots\ldots\ldots (6)$$

$$\Rightarrow 1 = q_t\left(1 - \frac{\chi}{2}\left(\frac{I_t}{I_{t-1}} - 1\right)^2 - \chi\left(\frac{I_t}{I_{t-1}} - 1\right)\left(\frac{I_t}{I_{t-1}}\right)\right) + \beta\chi E_t\left(\frac{C_{R,t+1}}{C_{R,t}}\right)^{-\sigma_R} q_{t+1}\left(\frac{I_{t+1}}{I_t} - 1\right)\left(\frac{I_{t+1}}{I_t}\right)^2$$

$$1 = \beta R_{B,t}E_t\left(\frac{C_{R,t+1}}{C_{R,t}}\right)^{-\sigma_R}\left(\frac{P_t}{P_{t+1}}\right) \text{..............................} (7)$$

Here, Q_t plays the role of Tobin's Q showing the ratio between the installed capital's market value and the installed capital's replacement cost. Here, $q_t = \frac{Q_t}{P_t}$. Euler equations relate the expected marginal utility of consumption today with the expected marginal utility of consumption tomorrow, considering the effects of interest rate and time preferences.

3.1.2 Non-Ricardian Households, *NR*

Unlike the Ricardian households, the representative non-Ricardian household has access to neither the financial market nor the bond market. The budget constraint for the non-Ricardian household can be written as

$$C_{NR,t} = W_t L_{NR,t} \text{..} (8)$$

The non-Ricardian household maximizes its utility function specific to the type (equation (1)) within the aforementioned budget constraint. The first-order conditions, along with appropriate algebraic substitutions, yield

$$W_t = C_{NR,t}^{\sigma_{NR}} L_{NR,t}^{\phi_{NR}} \text{...} (9)$$

3.1.3 Aggregation

Aggregate consumption and labor can be calculated using the weighted average of the respective variables for each consumer type as follows:

$$C_t \equiv \omega C_{R,t} + (1-\omega)C_{NR,t} \text{....................................} (10)$$
$$L_t \equiv \omega L_{R,t} + (1-\omega)L_{NR,t} \text{....................................} (11)$$

Similarly, aggregate investment and capital stock are given by

$$I_t \equiv \omega I_{R,t}$$
$$K_t \equiv \omega K_{R,t}$$

3.2 The Firm Problems

One important novelty of the NK-DSGE model is that it incorporates imperfect competition in the framework by assuming a continuum of monopolistically competitive firms (indexed by j) producing differentiated intermediate goods. However, a final good-producing firm assembles all these intermediate goods to produce the final good in a perfectly competitive environment.

3.2.1 Final Good Producer

The perfectly competitive representative final good producer produces the final good by assembling a continuum of intermediate goods ($j \in [0,1]$) as per the following aggregator function (Dixit & Stiglitz, 1977):

$$Y_t = \left(\int_0^1 Y_{j,t}^{1-\frac{1}{\rho}} dj \right)^{\frac{\rho}{\rho-1}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(12)$$

where $Y_{j,t}$the amount of intermediate is good j used as input for final good production, $\rho > 1$ is the elasticity of substitution among intermediate goods[2]. Taking the price of final good P_t and the price of intermediate good $P_{j,t}$ $\forall\ j$ as given, profit maximization problem yields the following demand for the intermediate good j

$$Y_{j,t} = \left(\frac{P_{j,t}}{P_t} \right)^{-\rho} Y_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(13)$$

As the final good producing firm is perfectly competitive, the zero-profit condition provides the following general price index

$$P_t = \left(\int_0^1 P_{j,t}^{1-\rho} dj \right)^{\frac{1}{1-\rho}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(14)$$

[2] It will be a Cobb-Douglas production function if the elasticity of substitution is equal to 1.

3.2.2 Intermediate Good Producers

A continuum of intermediate good producers is producing differentiated intermediate products employing capital and labor as follows.

$$Y_{j,t} = A_t K_{j,t}^{\alpha} L_{j,t}^{1-\alpha} \text{.................................}(15)$$

where $K_{j,t}$ and $L_{j,t}$ depict the demand for capital and labor by the intermediate good producer firm j. α measures the contribution of capital in the production process. A_t measures the productivity shock, which is common to all firms. Taking the factor prices as given, the cost minimization problem provides the relative factor demand as follows

$$\frac{K_{j,t}}{L_{j,t}} = \frac{\alpha}{1-\alpha}\frac{W_t}{R_t} \text{..}(16)$$

The constant returns to technology and common productivity shock make the marginal cost the same for all firms.

$$MC_t = \frac{1}{A_t}\left(\frac{R_t}{\alpha}\right)^{\alpha}\left(\frac{W_t}{1-\alpha}\right)^{1-\alpha} \text{...}(17)$$

However, the total factor productivity follows a $AR(1)$ process which is written in the logarithmic form

$$\log A_t = (1-\zeta_A)\log A + \zeta_A \log A_{t-1} + \epsilon_{A,t} \text{ ....}(18)$$

where $|\zeta_A| < 1$ is the autoregressive parameter confirming its stationary property. $\epsilon_{A,t}$ captures the productivity shock, which is assumed to be normally distributed, i.e., $\epsilon_{A,t} \sim N(0, \sigma_A)$.

3.2.3 Price Setting

Intermediate firms are assumed to adjust prices in a staggered manner, following the stochastic, time-dependent pricing rule introduced by Calvo (1983). Each firm resets its price with a probability $(1-\theta)$ each period. Hence, a fraction $(1-\theta)$ of producers reset their prices each period while the remaining fraction

θ of producers stick with the same price. A price resetting firm will solve the following problem in a period t:

$$E_t \sum_{\kappa=0}^{\infty} (\beta\theta)^{\kappa} \left(\tilde{P}_{j,t} Y_{j,t+\kappa} - MC_{j,t+\kappa} Y_{j,t+\kappa} \right)$$

subject to the following demand constraint

$$Y_{j,t+\kappa} = \left(\frac{\tilde{P}_{j,t}}{P_{t+\kappa}} \right)^{-\rho} Y_{t+\kappa}$$

After having the first order condition with respect to $\tilde{P}_{j,t}$, we can get

$$\tilde{P}_{j,t} = \frac{\rho}{\rho-1} E_t \sum_{\kappa=0}^{\infty} (\beta\theta)^{\kappa} MC_{j,t+\kappa} \qquad (19)$$

where $\frac{\rho}{\rho-1}$ is the frictionless price markup in the steady state. However, the price index can be rewritten as

$$P_t = \left((1-\theta)\tilde{P}_t^{1-\rho} + \theta P_{t-1}^{1-\rho} \right)^{\frac{1}{1-\rho}} \qquad (20)$$

An inflationary situation is generated due to the markup created by the product differentiation and price stickiness. Log-linearizing the above two equations provide the New Keynesian Phillips curve equation as follow

$$\hat{\pi}_t = \beta E_t \hat{\pi}_{t+1} + \frac{(1-\theta)(1-\beta\theta)}{\theta} (\widehat{MC}_t - \hat{P}_t)$$

3.3 Fiscal Policy

The government budget constraint is

$$\frac{B_{t+1}}{R_{B,t}} + P_t \tau_t = B_t + P_t G_t \qquad (21)$$

The government is generating revenue through imposing a lump-sum tax and issuing government bonds. The expenditure side of the government budget constraint contains public expenditure (G_t), and return to the government issued bonds $\left(\frac{B_{t+1}}{R_{B,t}}\right)$. The exogenous fiscal policy variable τ_t follows $AR(1)$ process

$$log\ \tau_t = (1 - \zeta_\tau) log\ \tau\ + \zeta_\tau log\ \tau_{t-1} + \epsilon_{\tau,t} \text{ ....(22)}$$

where ζ_τ is the persistent autoregressive parameter associated with the respective fiscal policy shock $\epsilon_{\tau,t} \sim\ N(0, \sigma_\tau)$. Following the fiscal policy rule (Galí, López-Salido, & Vallés, 2007), lump-sum tax imposed on the Ricardian is set as follows

$$\tau_t = B_t^{\phi_B} G_t^{\phi_G} \text{ ....(23)}$$

where ϕ_B and ϕ_G\$ represent the smoothing parameter.

3.4 Monetary Policy

The central bank is assumed to set the nominal interest rate according to a simple Taylor rule (Taylor, 1993), aiming to simultaneously stabilize inflation and the output gap. The targeted inflation rate, corresponding to a threshold level of output, serves as an anchor for implementing the monetary policy rule. Following this, the Taylor rule can be written as

$$\frac{R_{B,t}}{R_B} = \left(\frac{R_{B,t-1}}{R_B}\right)^{\phi_R} \left(\left(\frac{\pi_t}{\pi}\right)^{\phi_\pi} \left(\frac{Y_t}{Y}\right)^{\phi_Y}\right)^{1-\phi_R} M_t \text{ ....(24)}$$

where ϕ_Y and ϕ_π measure the interest rate sensitivity in relation to output and inflation, respectively. $\phi_R > 0$ is the interest rate smoothing parameter, and to satisfy Taylor rule, we have to maintain that $\phi_R > 1$. M_t captures the monetary policy shock following an $AR(1)$ process:

$$log\ M_t = (1 - \zeta_M) log\ M\ + \zeta_M log\ M_{t-1} + \epsilon_{M,t} \text{ ....(25)}$$

where $|\zeta_M| < 1$ is the autoregressive parameter ensuring its stationary property, and M is the money supply at the steady state. The exogenous monetary policy shock is captured by $\epsilon_{M,t}$ which follows a normal distribution ($\epsilon_{M,t} \sim N(0, \sigma_M)$).

3.5 Market Clearing Condition

The definition of the national income accounting for a closed economy represents the goods market clearing condition as follows

$$Y_t = C_t + I_t + G_t \text{ ....(26)}$$

The above equation ensures that all the macroeconomic variables and agents attain the point of stable equilibrium.

4. Data and Parameters

The economic variables used in the calibration of the are drawn from several sources- Bangladesh Bureau of Statistics, Bangladesh Bank, and Bangladesh Economic Review. Standard parameter values are employed in line with the macroeconomic literature.

We set discount factor β equal to 0.99. The rate of depreciation δ is set equal to 0.025 as per the standard literature. For Ricardian households, coefficient of relative risk aversion σ_R is 1.50, and inverse of Frisch elasticity of labor supply ϕ_R is 2.00 as per the calibrated result of Rotemberg and Woodford (1997), while $\sigma_{NR} = 3.00$ and $\phi_{NR} = 0.5$ for the non-Ricardian household. Investment sensitivity in relation to adjustment cost, χ is 2.00 following (Banerjee, Basu, & Ghate (2020).

According to the World Bank Global Findex data of 2021, which is also refenced in Bangladesh Bank Financial Inclusion Report, 38 percent of Bangladeshi adult population reported having an account at a financial institution, such as bank, microfinance institution, or credit union. Accordingly, the share of Ricardian household is set to $\omega = 0.38$.

Taking the size of Bangladeshi GDP reported in the Bangladesh Economic Review, and gross capital formation as a percentage of GDP (collected from the World Bank website), it is found that the contribution of capital to output, α is 0.3, which is supported by Rahman and Yusuf (2010). Gabriel, Levine, Pearlman, and Yang (2012) estimated the elasticity of substitution (ρ) between intermediate good using the data of the Indian economy. Their estimated value of ρ is 7.02. Smets and Wouters (2007) take the price stickiness parameter, θ value 0.75. Using the concept of Solow residual, we create a series for the total factor productivity. The estimated autoregressive parameter for the total factor productivity is $\zeta_A = 0.9$.

Fiscal policy rule parameters are drawn from Galí, López-Salido, and Vallés (2007) who estimate the dynamic responses of government spending and deficits using a vector autoregressive (VAR) method. We adopt their estimated values of $\phi_G = 0.10$ and $\phi_B = 0.33$. The autoregressive coefficient of tax revenue is estimated at $\zeta_\tau = 0.84$, based on quarterly data from the World Bank's *World Development Indicators* (2002Q1–2023Q1).

For monetary policy, Younus (2017) estimated the relevant coefficients of Taylor rule for the Bangladeshi economy. The estimated interest rate smoothing parameter ϕ_R is 0.89. The estimated sensitivity of interest in relation to inflation, ϕ_π is 1.77 which is 1.50 in the standard macroeconomic literature. The estimated sensitivity of interest rate in relation to GDP, ϕ_Y is 0.45, which is slightly lower than the standard value of 0.5. Using the money supply data over the period 2002Q1-2023Q1 (collected from Bangladesh Bank website), the estimated autoregressive parameter for the monetary policy shock is $\zeta_M = 0.97$.

Table 1: List of Parameters

Parameter	Value	Description
Households		
β	0.99	Discount factor
δ	0.025	Rate of depreciation
σ_R	1.50	Relative risk aversion coefficient of Ricardian household
σ_{NR}	3.00	Relative risk aversion coefficient of non-Ricardian household
ϕ_R	2.00	Inverse of Frisch elasticity of labor supply of Ricardian household
ϕ_{NR}	0.50	Inverse of Frisch elasticity of labor supply of non-Ricardian household
χ	2.00	Investment sensitivity in relation to adjustment cost
ω	0.38	Fraction of Ricardian households
Firms		
α	0.30	Share of capital to output
ρ	7.02	Elasticity of substitution between intermediate goods
θ	0.75	Price stickiness parameter
ζ_A	0.90	AR coefficient of the productivity shock
Fiscal Policy		
ϕ_B	0.33	Persistence of government debt
ϕ_G	0.10	Persistence of government expenditure
ζ_τ	0.84	AR coefficient of the tax revenue shock
Monetary Policy		

Parameter	Value	Description
ϕ_R	0.89	Interest rate smoothing parameter
ϕ_π	1.25	Interest rate sensitivity of inflation
ϕ_Y	0.3	Interest rate sensitivity of output
ζ_M	0.97	AR coefficient of the monetary policy shock

5. Results

After log-linearizing the key equations of the model, we simulate the economic variables considering two types of shock: fiscal policy shock, and monetary policy shock. We discuss the results of the impulse response shock to one standard deviation to the all types of shocks. Responses are simulated for 40 periods.

5.1 Fiscal Policy Shock

We introduce a fiscal policy shock in the form of a temporary tax cut, as illustrated in Figure 5, panel (c). The primary objective of this policy is to stimulate the goods market. The responses of Ricardian and non-Ricardian households, however, differ significantly due to their distinct consumption and saving behaviors.

The response of Ricardian households is relatively muted. Since they are forward-looking, Ricardian households internalize the intertemporal budget constraint: a tax cut today implies higher taxation in the future. As a result, they increase savings to offset the expected future tax burden, leading to only a modest increase in consumption (Figure-1, panel(c)). In contrast, non-Ricardian households exhibit a stronger consumption response. Because they neither pay taxes nor smooth consumption intertemporally, they do not anticipate future tax hikes. Their disposable income rises immediately after the shock, which translates into a larger increase in consumption.

Both types of households contribute to a positive impact on employment, which raises labor demand and real wages (Figure 4, panel (e)). Nevertheless, the adjustment mechanisms differ. For Ricardian households, the income effect from higher disposable income reduces their incentive to work, while the wealth effect—arising from anticipated future taxation—further dampens their labor supply response. Non-Ricardian households, by contrast, increase their labor supply, as they do not anticipate future tax obligations. The increase in labor demand, driven by higher consumption and output, reinforces the rise in real wages. The impulse response of real wages following the fiscal policy shock is consistent with this mechanism.

Investment rises in response to the tax cut, as higher disposable income stimulates aggregate demand. Firms increase investment to expand capacity, although the magnitude of this response is moderate due to expectations of higher future taxation, which may crowd out investment over time. The initial surge in investment raises borrowing demand, resulting in a sharp increase in the real interest rate (Figure 4, panel (a)), which subsequently declines as firms adjust to the anticipated fiscal tightening. Capital accumulation follows a similar trajectory: the demand for capital increases, as reflected in higher real returns to capital (Figure 4, panel (c)), but the effect is limited by the temporary nature of the tax cut.

The combined increase in consumption, investment, and labor demand contributes to higher output. However, this expansion is short-lived, as the temporary nature of the policy limits its persistence. Inflation exhibits a parallel response. The increase in aggregate demand exerts upward pressure on prices, generating demand-pull inflation. This effect is particularly pronounced if supply constraints are present.

In summary, the fiscal policy shock produces heterogeneous effects across household types. While non-Ricardian households drive stronger short-run responses in consumption and labor supply, Ricardian households exhibit more muted adjustments due to intertemporal considerations. The overall effects on output, wages, and inflation are positive but transitory, reflecting the temporary nature of the tax cut.

5.2 Monetary Policy Shock

A monetary policy shock is introduced into the economy through an exogenous increase in the money supply, as illustrated in Figure-4, panel (d). Our analysis shows that a one standard deviation monetary expansion reduces the nominal interest rate, consistent with established theoretical predictions regarding the negative relationship between money supply and nominal interest rates (Figure-4, panel (b)). The decline in the real interest rate stimulates Ricardian consumption through the wealth effect: lower borrowing costs increase the present value of future wealth, thereby encouraging higher consumption (Figure- 1, panel (d)). In contrast, non-Ricardian households do not benefit from this wealth effect due to liquidity constraints. Instead, their initial consumption declines (Figure-1, panel (f)), driven by the immediate increase in inflation (Figure-5, panel (d)).

The wealth effect from monetary expansion also induces Ricardian households to reduce their labor supply, as higher effective wealth allows them to work less without reducing consumption. In this case, the intertemporal substitution effect dominates the income effect. Conversely, non-Ricardian households increase their labor supply, as the absence of intertemporal smoothing requires them to offset higher prices by supplying more labor. Figure-4, panel (f) demonstrates that the real wage declines initially, reflecting the early dominance of inflationary pressures.

Investment initially falls following the monetary expansion, reflecting the crowding-out effect of higher aggregate consumption. When the central bank increases the money supply, disposable income rises, which directly boosts consumption. Firms respond to this consumption surge primarily by increasing current output rather than expanding capital investment. However, as the real interest rate continues to decline, investment gradually recovers. Capital accumulation follows a similar pattern: demand for capital weakens at first, then increases as lower borrowing costs stimulate both consumption and investment. As a result, aggregate output rises (Figure 3, panel (f)), with the effect being larger and more immediate than that observed under fiscal expansion.

A comparison of the left and right columns of Figures 1–5 indicates that both expansionary fiscal and monetary policies play important roles in stimulating consumption, employment, investment, and output, thereby strengthening aggregate demand and aggregate supply in the Bangladeshi economy. However, the results also show that the effects of monetary policy are more pronounced than those of fiscal policy. This suggests that a coordinated policy mix, rather than reliance on a single instrument, would be more effective in promoting sustainable economic growth.

6. Conclusion

By developing a HANK-DSGE framework, we evaluate the impacts of fiscal policy and monetary policy shocks on the Bangladesh economy in this paper. Our model takes into consideration a monetary authority, the government, intermediate and final producers, and heterogeneous agents (both Ricardian and non-Ricardian). We calibrate the simulated responses of various macroeconomic variables to monetary, and fiscal policy shocks. The impulse response functions produced in response to various shocks are briefly examined. It is important to note that IRF displays the endogenous variables' anticipated future trajectory conditional on a shock of one standard deviation in Period-1.

Figure 1: Simulated Responses of Aggregate, Ricardian, and Non-Ricardian Consumption. The Left Column Reports the Effects of Fiscal Expansion, While the Right Column Reports the Effects of Monetary Expansion

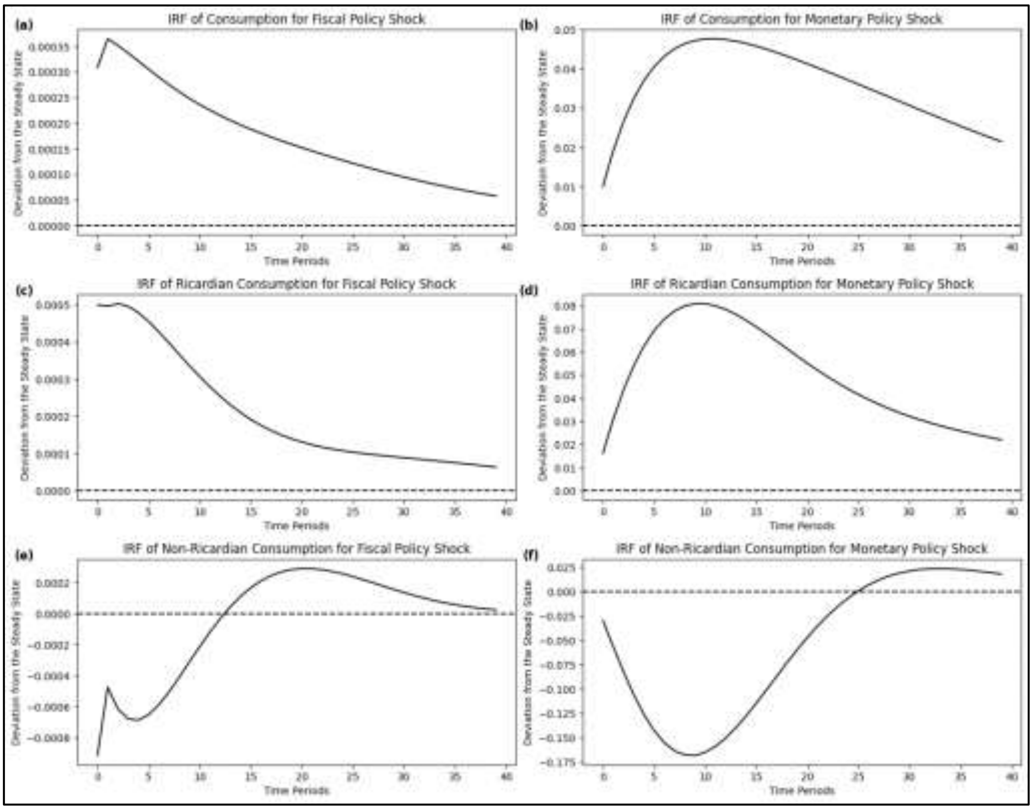


Figure 2: Simulated Responses of Aggregate, Ricardian, and Non-Ricardian Labor Supply. The Left Column Reports the Effects of Fiscal Expansion, While the Right Column Reports the Effects of Monetary Expansion

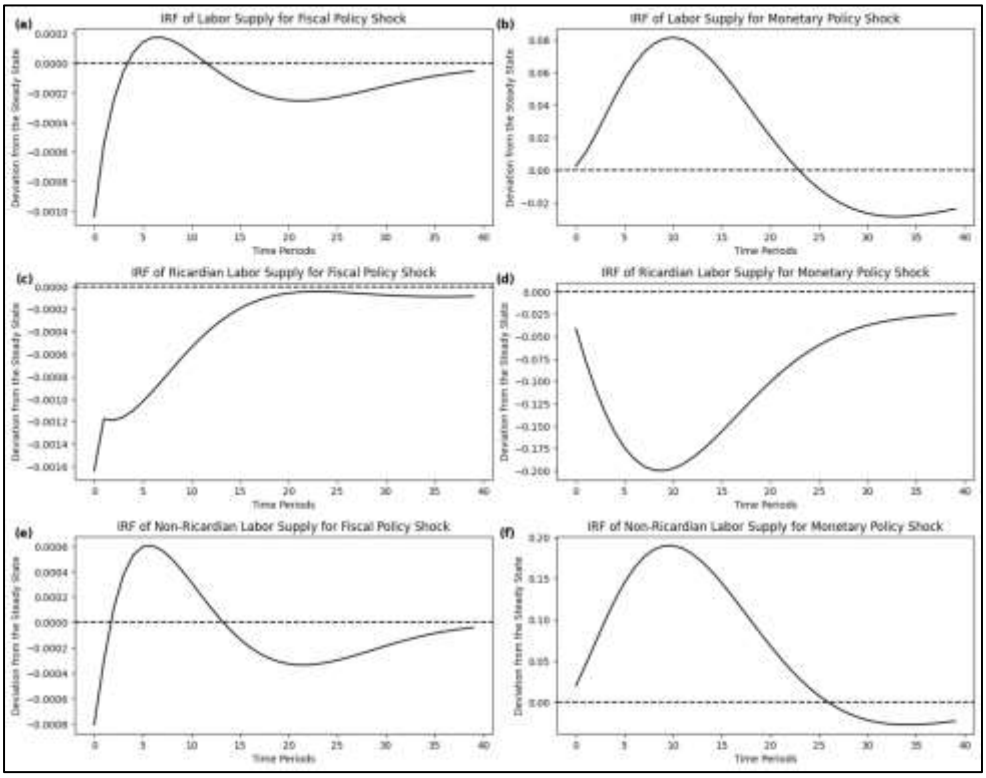


Figure 3: Simulated Responses of Investment, Capital, and Output. The Left Column Reports the Effects of Fiscal Expansion, While the Right Column Reports the Effects of Monetary Expansion

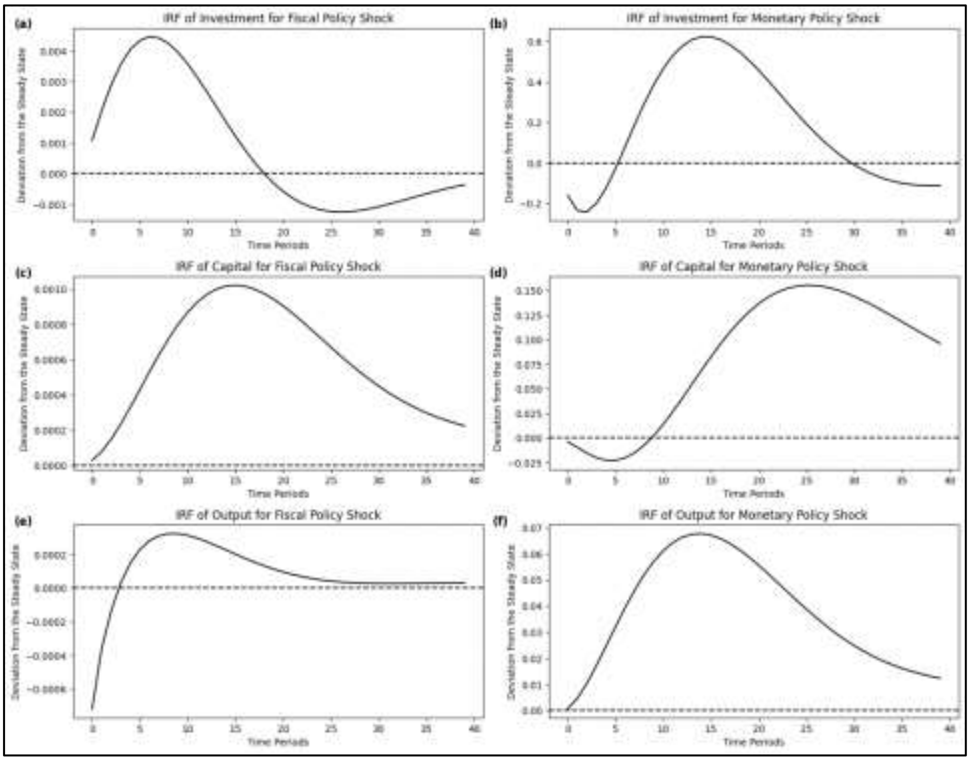


Figure 4: Simulated Responses of Real Interest Rate, Real Return to the Capital, and Real Wage. The Left Column Reports the Effects of Fiscal Expansion, While the Right Column Reports the Effects of Monetary Expansion

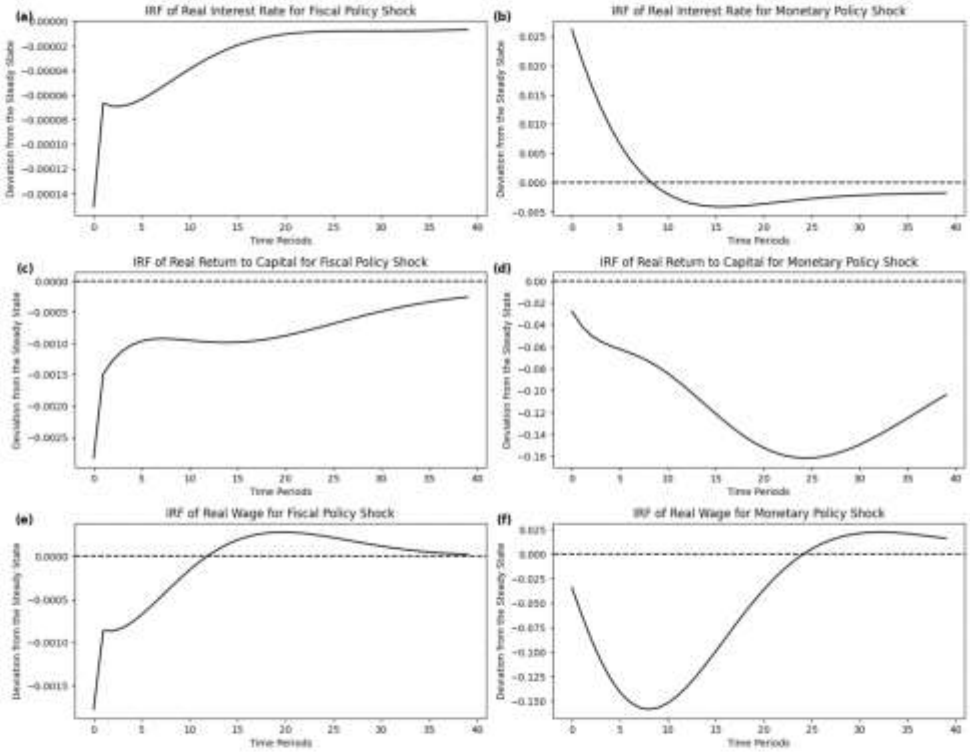
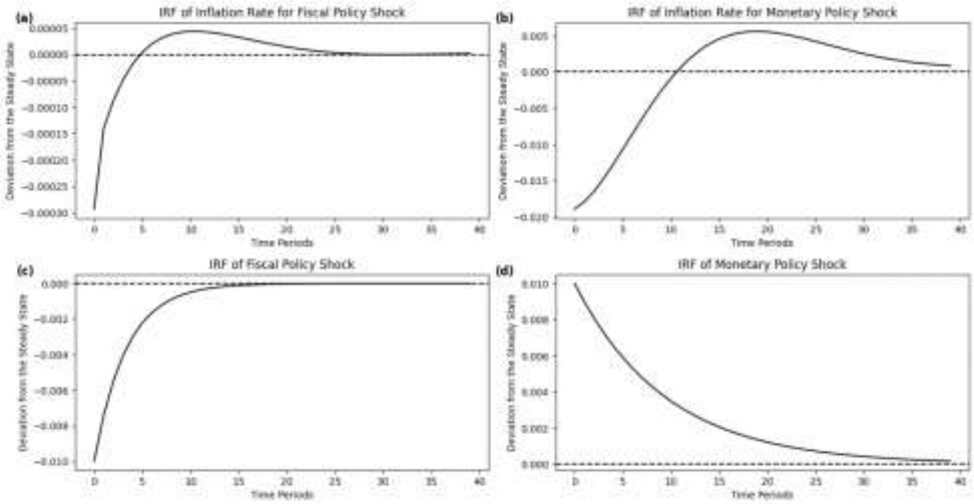


Figure 5: Simulated Responses of Inflation. The Left Column Reports the Effects of Fiscal Expansion, While the Right Column Reports the Effects of Monetary Expansion. Panel (c) Illustrates the Fiscal Policy Shock While Panel (d) Exhibits Monetary Policy Shock



Our findings carry several important policy implications. The analysis indicates that monetary and fiscal policy shocks produce similar responses in key macroeconomic variables, including aggregate consumption, investment, output, and inflation. However, the magnitude of quantitative changes is higher in monetary than fiscal policies. The sharpness of the initial response makes it more pronounced in terms of the immediate effects compared to fiscal policy. Fiscal expansion has significant effects, but these are more transient as the economy quickly returns to the steady state. The main indicators, such as output, inflation, interest rates, and investment, all show anticipated changes when seen through the prism of fiscal and monetary policy. Our policy prescriptions warrant using monetary policy over fiscal policy to stabilize Bangladesh's economy. In addition, we advise against concentrating on fiscal policy in any other setting, which is ultimately an unwise move.

One of the main limitations of the model is the closed economy framework. Hence, one possible avenue for extending the recent work is to reinvestigate the impact of shocks incorporating open economy considerations through the dynamism of the exchange rates. We further aim to estimate our HANK-DSGE model using a Bayesian framework.

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Appendices

Appendix A: Steady State

Taking the variables without time subscripts and solving the equations provide the steady state solution. We start to calculate the steady state by normalizing $Y = 1$. We use $L = \frac{1}{3}$. Equation (4), (9), and (11) at the steady state provide

$$L_R = L_{NR} = L$$

As inflation is defined as $\pi_t = \frac{P_{t+1}}{P_t}$, inflation at the steady state should be $\pi = 1$. Equation (7) yields

$$R_B = \frac{1}{\beta}$$

Equation (6) at the steady state provides $q = 1$, which gives according to equation (5)

$$R = \frac{1}{\beta} - (1 - \delta)$$

The general price level is normalized at 1 (i.e., $P = 1$). With $E_t \sum_{\kappa=0}^{\infty} (\beta\theta)^{\kappa} = \frac{1}{1-\beta\theta}$, equation (19) at the steady state can be written as

$$MC = (1 - \beta\theta)(\frac{\rho - 1}{\rho})$$

The demand for capital at the steady state can be written and

$$K = \alpha(1 - \beta\theta)\left(\frac{\rho - 1}{\rho}\right)\frac{Y}{R}$$

The law of motion of capital at the steady state (equation (3)) provides

$$I = \delta K$$

The demand for labor at the steady state provide the steady stat6eb real wage

$$W = (1 - \alpha)(1 - \beta\theta)\left(\frac{\rho - 1}{\rho}\right)\frac{Y}{L}$$

The steady state level of non-Ricardian consumption is

$$C_{NR} = WL_{NR}$$

The steady state level of aggregate consumption is

$$C = Y - I - G$$

The steady state level of Ricardian consumption can be written as

$$C_R = \frac{1}{\omega}(C - (1 - \omega)C_{NR})$$

The ratio of government expenditure to output is $\Lambda_G = \frac{G}{Y}$ which yields the steady state level of government expenditure.

A can be calibrated by using equation (15) at the steady state

$$A = \frac{Y}{K^{\alpha}L^{1-\alpha}}$$

Government debt is assumed to be zero at the steady state. Hence the government budget constraint yields

$$\tau = G$$

Appendix B: Log-Linearization

We log-linearize the model around the steady states as it is easy to get intuition from a linear model rather than a non-linear model. Uhlig's method is used to conduct the log-linearization process: a variable X_t is replaced by $X\exp(\hat{X}_t)$ where $\hat{X}_t = \log\left(\frac{X_t}{X}\right)$.

Log-linearizing the budget constraint fo9r the Ricardian household

$$PC_R(\hat{P}_t + \hat{C}_{R,t}) + PI(\hat{P}_t + \hat{I}_t) + \frac{B}{R_B}(\hat{B}_{t+1} - \hat{R}_{B,t}) = PWL_R(\hat{P}_t + \hat{W}_t + \hat{L}_{R,t}) + PRK(\hat{P}_t + \hat{R}_t + \hat{K}_t) + B\hat{B}_t - P\tau_R(\hat{P}_t + \hat{\tau}_t)$$

Log-linearizing the law of motion of capital is

$$K\hat{K}_{t+1} = I\hat{I}_t + (1 - \delta)K\hat{K}_t$$

Log-linearizing labor supply condition for the Ricardian household is

$$\widehat{W}_t = \sigma_R \hat{C}_{R,t} + \phi_R \hat{L}_{R,t}$$

Log-linearized demand for capital is

$$\hat{q}_t = -\sigma_R\left(\hat{C}_{R,t+1} - \hat{C}_{R,t}\right) + \frac{R\hat{R}_{t+1} + (1-\delta)q\hat{q}_{t+1}}{R + (1-\delta)q}$$

Log-linearized demand for investment equation can be written as

$$\hat{q}_t = \chi\left(\hat{I}_t - \hat{I}_{t-1}\right) - \beta\chi(\hat{I}_{t+1} - \hat{I}_t)$$

Log-linearized Euler equation for bond is

$$\sigma_R\left(\hat{C}_{R,t+1} - \hat{C}_{R,t}\right) = \hat{R}_{B,t} - \hat{\pi}_{t+1}$$

Log-linearizing labor supply condition for the non-Ricardian household is

$$\widehat{W}_t = \sigma_{NR} \hat{C}_{NR,t} + \phi_{NR} \hat{L}_{NR,t}$$

Aggregate consumption and labor after log-linearization

$$C\hat{C}_t = \omega C_R \hat{C}_{R,t} + (1-\omega) C_{NR} \hat{C}_{NR,t}$$

$$L\hat{L}_t = \omega L_R \hat{L}_{R,t} + (1-\omega) L_{NR} \hat{L}_{NR,t}$$

Log-linearizing the production function around the steady state

$$\hat{Y}_t = \hat{A}_t + \alpha\widehat{K}_t + (1-\alpha)\hat{L}_t$$

Log-linearized version of the relative factor demand is

$$\widehat{K}_t - \hat{L}_t = \widehat{W}_t - \hat{R}_t$$

Log-linearizing the marginal cost yields

$$\widehat{MC}_t = \alpha\hat{R}_t + (1-\alpha)\widehat{W}_t - \hat{A}_t$$

Inflation after log-linearization

$$\hat{\pi}_t = \hat{P}_t - \hat{P}_{t-1}$$

Log-linearized NKPC equation is

$$\hat{\pi}_t = \beta E_t \hat{\pi}_{t+1} + \frac{(1-\theta)(1-\beta\theta)}{\theta}(\widehat{MC}_t - \hat{P}_t)$$

Log-linearized government budget constraint is

$$\frac{B}{R_B}\left(\hat{B}_{t+1} - \hat{R}_{B,t}\right) + P\tau\left(\hat{P}_t + \hat{\tau}_t\right) = B\hat{B}_t + PG\left(\hat{P}_t + \hat{G}_t\right)$$

Log-linearized fiscal policy rules provide

$$\hat{\tau}_t = \phi_B \hat{B}_t + \phi_G \hat{G}_t$$

Log-linearized Taylor rule equation is

$$\hat{R}_{B,t} = \phi_R \hat{R}_{B,t-1} + (1 - \phi_R)\left(\phi_\pi \hat{\pi}_t + \phi_Y \hat{Y}_t\right) + \hat{M}_t$$

Market clearing condition after log-linearization

$$Y\hat{Y}_t = C\hat{C}_t + I\hat{I}_t + G\hat{G}_t$$

The economy absorbs the following shocks

$$\hat{A}_t = \zeta_A \hat{A}_{t-1} + \epsilon_{A,t}$$

$$\hat{\tau}_t = \zeta_\tau \hat{\tau}_{t-1} + \epsilon_{\tau,t}$$

$$\hat{M}_t = \zeta_M \hat{M}_{t-1} + \epsilon_{M,t}$$

List of the endogenous variables

$$\hat{X}_t \equiv [\hat{C}_{R,t}, \hat{C}_{NR,t}, \hat{C}_t, \hat{L}_{R,t}, \hat{L}_{NR,t}, \hat{L}_t, \hat{I}_t, \hat{K}_{t+1}, \hat{B}_{t+1}, \hat{q}_t, \hat{Y}_t, \hat{\tau}_t, \hat{P}_t, \hat{R}_{B,t}, \hat{W}_t, \hat{R}_t, \widehat{MC}_t, \hat{\pi}_t, \hat{A}_t, \hat{\tau}_t, \hat{M}_t]$$

The system consists of 21 equations for 21 endogenous variables. The economy absorbs 3 exogenous shocks

$$\epsilon_t = [\epsilon_{A,t}, \epsilon_{\tau,t}, \epsilon_{M,t}]$$