Simulated Method of Moments and Bayesian Estimation for A Two-Agent Household Model

Seminar Paper in
Bayesian Macroeconometrics

by

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December 2025

Abstract

This paper estimates a two-agent New Keynesian DSGE model for the New Zealand economy using a sequential Simulated Method of Moments (SMM) and Bayesian approach. By introducing heterogeneous households with spenders who consume their entire income and optimizing savers, the model aims to better capture consumption dynamics that representative agent models fail to replicate. The SMM estimation reveals that a very high share of hand-to-mouth households ($\omega \approx 0.94$) is required to match the volatility of aggregate consumption observed in New Zealand data. A Bayesian estimation of fiscal shocks identifies a highly persistent government spending process ($\rho_G \approx 0.96$) with significant volatility. Despite these fiscal results, variance decomposition suggests that supply-side constraints limit the ability of government spending to drive output, instead primarily crowding out private consumption and investment.

1 The Model

This paper considers an Galí et al. (2007) inspired New Keynesian DSGE model with three building blocks, consisting of two-agent households, a supply-side representative firm and a public finance component in form of the government - which all are observed on an aggreated level under defined market clearing conditions. The model is underlying for calibration of moments obtained from a Simulated Method of Moments.

The Household building block considers an infinite time horizon problem, in which two types of agents maximise their infinite lifetime consumption subject to two different budget constraints, whose combined consumption shares are the economy's aggregated consumption measure. The firm maximises lifetime discounted profits considering on how much labour to employ and capital to use subject to their budget constraints. The government acts as a public finance institution, financing it's spending through taxes that are levied cross the heterogenous savers.

1.1 The Household Problem

The economy's household decision making is ruled by two consumption maximisation problems.

First, a representative household *(SP)* with "hand-to-mouth" endowments maximises the discounted sum of lifetime utility from consumption of income $w_t l_t^{SP}$ substracted by taxes paid T_t^{SP}, where wages are set at w_t and labour is supplied at l_t^{SP}. Labour provision is inelastic and set to $l_{it}^{SP} = \frac{1}{3}$, which corresponds to an eight hour working day. Their maximisation problem writes as

$$\max_{\{C_t^{SP}\}_{t=0}^{\infty}} \quad \sum_{t=0}^{\infty} \beta^t \log(C_t^{SP})$$

$$\text{s.t.} \quad C_t^{SP} = w_t l_t^{SP} - T_t^{SP}$$

This implies a first property of moderative risk averse household with a relative risk-aversion coeeficient of $\sigma = 1$, resulting a logarithmic utility as a special case of consumption utility from Constant Relative Risk Aversion (CRRA) utility families. Further, the Intertemporal Elasticity of Substitution ($IES = \frac{1}{\sigma}$) equals one. As labor supply is chosen, log utility implies that income and substitution effects cancel out, leading to specific labor supply properties in this case.

The Lagrangian writes as

$$\mathcal{L} = \sum_{t=0}^{\infty} \left[\beta^t \log(C_t^{SP}) - \lambda_t(w_t l_t^{SP} - T_t^{SP} - C_t^{SP})\right]$$

One derives the first order conditions as

$$\frac{\partial \mathcal{L}}{\partial C_t^{SP}} = \beta^t \left(\frac{1}{C_t} - \lambda_t\right) = 0 \qquad \Rightarrow \qquad \lambda_t = \frac{1}{C_t^{SP}}$$

$$\frac{\partial \mathcal{L}}{\partial \lambda_t} = w_t l_t^{SP} - T_t^{SP} - C_t^{SP} = 0 \qquad \Rightarrow \qquad C_t^{SP} = w_t l_t^{SP} - T_t^{SP}$$

$$C_t^{SP*} = w_t l_t^{SP} - T_t^{SP} \tag{1}$$

This optimal consumption solution tells us that the household simply consumes all current net labor income each period, as there is no saving or intertemporal choice in this set-up, showing why this agents endowments can be referred to as "hand-to-mouth" household.

Secondly, a representative household *(SA)* with "wealthy" endowments maximises the discounted sum of lifetime utility from consumption and savings of income $w_t l_t^{SP}$ and asset holdings including safe assets $r_t B_t$ and risky assets $r_t^K K_t$ substracted by taxes paid T_t^{SP} where wages are set at w_t and labour is supplied at l_t^{SP}. Labour provision is also inelastic and set to $l_{it}^{SA} = \frac{1}{3}$. Their maximisation problem writes as

$$\max_{\{C_t^{SA}, B_{t+1}, I_t, K_{t+1}\}_{t=0}^{\infty}} \quad \sum_{t=0}^{\infty} \beta^t \log(C_t^{SA}) \tag{2}$$

$$\text{s.t.} \quad C_t^{SA} + B_{t+1} + I_t = r_t B_t + r_t^K K_t + w_t l_t^{SA} - T_t^{SA} \tag{3}$$

$$\text{and} \quad K_{t+1} = (1-\delta)K_t + I_t \tag{4}$$

with δ as the capital K_t depreciation rate, I_t is the investment in "risky" assets K_t that yield returns r_t^K and B_t as bonds with r_t returns. The Lagrangian writes as

$$\mathcal{L} = \sum_{t=0}^{\infty} \left[\beta^t \log(C_t^{SA}) - \lambda_t \left(r_t B_t + (r_t^K + 1 - \delta)K_t + w_t l_t^{SP} - T_t^{SP} - C_t^{SA} - B_{t+1} - K_{t+1}\right)\right].$$

One derives the first order conditions as

$$\frac{\partial \mathcal{L}}{\partial C_t^{SA}} = \beta^t \left(\frac{1}{C_t^{SA}} - \lambda_t \right) = 0 \qquad \Rightarrow \qquad \boxed{\lambda_t = \frac{1}{C_t^{SA}}} \tag{5}$$

$$\frac{\partial \mathcal{L}}{\partial K_{t+1}^{SA}} = -\beta^t \lambda_t + \beta^{t+1} \lambda_{t+1} (r_{t+1}^K + 1 - \delta) = 0 \qquad \Rightarrow \qquad \boxed{\frac{1}{C_t^{SA}} = \beta (r_{t+1}^K + 1 - \delta) \frac{1}{C_{t+1}^{SA}}} = \lambda_t \tag{6}$$

$$\frac{\partial \mathcal{L}}{\partial B_{t+1}} = -\beta^t \lambda_t + \beta^{t+1} \lambda_{t+1} r_{t+1} = 0 \quad \Rightarrow \quad \boxed{\frac{1}{C_t^{SA}} = \beta r_{t+1} \frac{1}{C_{t+1}^{SA}}} = \lambda_t \tag{7}$$

where (6) and (7) are the Capital and Bond Euler equations. Thus, the household chooses B_{t+1} so that the utility cost of giving up one unit of consumption today equals the discounted utility benefit of consuming r_{t+1} more tomorrow. Further, it chooses K_{t+1} so that the marginal utility loss from investing one more unit today equals the discounted marginal utility gain from the higher capital income and remaining capital tomorrow. This implies that in the optimum, the household equalises the intertemporal trade-off across all assets: bonds and capital must offer the same marginal utility return, otherwise the household would reallocate wealth toward the asset with higher utility payoff.

1.2 The Firm Problem

The representative firm uses labor L_t and capital K_t to produce goods Y_t. The elasticity of labour production $1-\alpha$ is set to $\frac{2}{3}$ and itself the weighted sum of both agent types, "savers" and "spenders" $L = \omega L_t^{SP} + (1-\omega) L_t^{SA}$, while the share of spenders in the economy is set towards $\omega = 0.3$. Each labor category is affected by the same labor augmented technology with growth trend Γ_t such as $L_t^{SP} = \Gamma_t l_t^{SP}$ and $L_t^{SA} = \Gamma_t l_t^{SA}$. The economy trend has an underlying growth rate γ_y, implying $\Gamma_t = \gamma_y \Gamma_{t-1}$.

The firm maximises lifetime periodically discounted profits under a discount rate $\beta \frac{\lambda_{t+1}}{\lambda_t}$, obtained from the marginal utility of savers λ_t. The production is influenced by TFP A, which is subject to shocks introducing idiosyncratic risk, while deciding (i) for how much labour L_t to employ and (ii) how much capital to use. The firms problem writes as

$$\max_{\{d_t, Y_t, L_t, K_t\}_{t=0}^{\infty}} \quad \sum_{t=0}^{\infty} \beta^t \frac{\lambda_t}{\lambda_0} d_t \tag{8}$$

$$\text{s.t.} \quad d_t = Y_t - w_t L_t - r_t^K K_t \tag{9}$$

$$\text{and} \quad Y_t = A_t K_t^{\alpha} L_t^{1-\alpha} \qquad \text{with} \qquad \log(A_t) = \rho_A \log(A_{t-1}) + \eta_A \tag{10}$$

where $\eta_A \sim \mathcal{N}(0, \sigma_A^2)$. Later on in the calibration, I decide for three different values of the persistence term ρ_A, while the standard deviation of the shock is held at 0.01.
Altogether, this writes as

$$\max_{\{L_t, K_t\}_{t=0}^{\infty}} \Pi_t = A_t K_t^{\alpha} L_t^{1-\alpha} - w_t L_t - r_t^K K_t$$

One can then derive the first order conditions for labour and capital

$$\frac{\partial \mathcal{L}}{\partial L_t} = (1-\alpha) A_t K_t^{\alpha} L_t^{-\alpha} - w_t = 0 \qquad \Rightarrow \qquad \boxed{w_t = (1-\alpha) \frac{Y_t}{L_t}}$$

$$\frac{\partial \mathcal{L}}{K_t} = \alpha A_t K_t^{\alpha-1} L_t^{1-\alpha} - r_t^K = 0 \qquad \Rightarrow \qquad \boxed{r_t^K = \alpha \frac{Y_t}{K_t}}$$

1.3 The Government

The government acts as a public finance institution financing its spending trough taxes

$$G_t = T_t$$

where public spending G_t is set at a fixed rate of the economy's output (GDP) (i.e. 20%)

$$G_t = 0.2Y_t \tag{11}$$

1.4 Aggregate Levels and Market Clearing Condition

The economies aggregated consumption is composed by the share of "savers" and "spenders" consumption, resulting in

$$C_t = \omega C_t^{SP} + (1-\omega)C_t^{SA} \tag{12}$$

Further, aggregated labor is composed of the share of "savers" and "spenders" labour supply

$$L_t = \omega L_t^{SP} + (1-\omega)L_t^{SA}$$

Taxes are uniformly levied across the two agent types ($T_t = T_t^{SP}$), implying as well $T_t = T_t^{SA}$, resulting in a tax structure

$$T_t = \omega T_t^{SP} + (1-\omega)T_t^{SA}$$

Furthermore, the bond markets are clearing due to the total amount of bonds supplied in the economy equals the total amount demanded, so aggregate bond holdings sum to zero

$$B_t = 0$$

Lastly, the equilibrium of a closed NK-DSGE model requires a resource constraint such as

$$Y_t = C_t + I_t + G_t \tag{13}$$

indicdating that the economy's output consists of aggregated consumption, investment and government spending. Hence, I introduced assumptions and the economy's set-up, whose maximisation problems have been solved - aggregated terms and closing conditions make it complete. In the next section, the components will be transformed into stationary terms to obtain the models stationary (detrended) equilibrium of the model.

2 Detrended Equilibrium

This section presents an overview over all beforehand presented components which will be detrended towards a stationary steady-state equilibrium.

The model set-up assumes a balanced-growth structure in the sense that output, investment, capital and government spending all share the same deterministic trend Γ_t, growing at gross rate γ_y. Labor L_t, the inerest rates r_t, r_t^K and the share parameter ω are stationary. The TFP follows a stochastic process as in (10). Detrending all variables by Γ_t removes the deterministic growth so that all transformed real variables become stationary. Therefore one detrends all level variables by the trend components:

$$\tilde{C}_t^{SP} = \frac{C_t^{SP}}{\Gamma_t} \qquad \tilde{I}_t = \frac{I_t}{\Gamma_t}$$

$$\tilde{C}_t^{SA} = \frac{C_t^{SA}}{\Gamma_t} \qquad \tilde{K}_t = \frac{K_t}{\Gamma_t}$$

$$\tilde{C}_t = \frac{C_t}{\Gamma_t} \qquad \tilde{G}_t = \frac{G_t}{\Gamma_t}$$

$$\tilde{Y}_t = \frac{Y_t}{\Gamma_t}$$

Here, labor L_t, interest rates r_t and r_t^K, and TFP A_t are already stationary and are not detrended.

Stationary Equilibrium Conditions

This set-up allows us to rewrite the key equilibrium equations in terms of detrended variables and γ_y. For accumulated capital as in (4) this becomes

$$\tilde{K}_{t+1} = \frac{1-\delta}{\gamma_y}\tilde{K}_t + \frac{1}{\gamma_y}\tilde{I}_t$$

For production as in (10) this yields

$$\tilde{Y}_t = A_t \tilde{K}_t^{\alpha} L_t^{1-\alpha}$$

The government and resource constraints in (11) and (13) become

$$\tilde{G} = 0.2\tilde{Y} \quad \text{and} \quad \tilde{Y} = \tilde{C}_t + \tilde{I}_t + \tilde{G}_t$$

The only aggregation measure that changes is aggregated consumption (12) toward

$$\tilde{C}_t = \omega \tilde{C}_t^{SP} + (1-\omega)\tilde{C}_t^{SA}$$

The budget constraints and Euler equations of "saving" and "spenders" households are similiarly expressed in stationary terms. Summarised, The stationary equilibrium of the detrended economy is characterized by the following system of equations:

$$\tilde{C}_t^{SP} = w_t L_t^{SP} - T_t^{SP} \tag{14}$$

$$\tilde{C}_t^{SA} + B_{t+1} + \tilde{I}_t = R_t B_t + r_t^K \tilde{K}_t + w_t L_t^{SA} - T_t^{SA} \tag{15}$$

$$\tilde{K}_{t+1} = \frac{1-\delta}{\gamma_y}\,\tilde{K}_t + \frac{1}{\gamma_y}\,\tilde{I}_t \tag{16}$$

$$\frac{1}{\tilde{C}_t^{SA}} = \frac{\beta}{\gamma_y} R_{t+1} E_t\left[\frac{1}{\tilde{C}_{t+1}^{SA}}\right] \tag{17}$$

$$\frac{1}{\tilde{C}_t^{SA}} = \frac{\beta}{\gamma_y} E_t\left[\left(r_{t+1}^K + 1 - \delta\right)\frac{1}{\tilde{C}_{t+1}^{SA}}\right] \tag{18}$$

$$\tilde{Y}_t = A_t \tilde{K}_t^{\alpha} L_t^{1-\alpha} \tag{19}$$

$$w_t = (1-\alpha)\,\frac{\tilde{Y}_t}{L_t} \tag{20}$$

$$r_t^K = \alpha\,\frac{\tilde{Y}_t}{\tilde{K}_t} \tag{21}$$

$$\log A_t = \rho_A \log A_{t-1} + \eta_{A,t} \tag{22}$$

$$\tilde{G}_t = 0.2\,\tilde{Y}_t \varepsilon_{G,t} \tag{23}$$

$$\log \varepsilon_{G,t} = \rho_G \log \varepsilon_{G,t-1} + \eta_{G,t} \tag{24}$$

$$\tilde{G}_t = \tilde{T}_t \tag{25}$$

$$\tilde{Y}_t = \tilde{C}_t + \tilde{I}_t + \tilde{G}_t \tag{26}$$

$$\tilde{C}_t = \omega \tilde{C}_t^{SP} + (1-\omega)\tilde{C}_t^{SA} \tag{27}$$

$$L_t = \omega L_t^{SP} + (1-\omega) L_t^{SA} \tag{28}$$

$$\tilde{T}_t = \omega T_t^{SP} + (1-\omega) T_t^{SA} \tag{29}$$

$$B_t = 0 \tag{30}$$

While the full detrended equilibrium system contains multiple Euler equations and market-clearing conditions, imposing zero net bond supply makes bond holdings non-dynamic. As a result, the bond Euler is treated as a pricing condition, and only the capital Euler governs intertemporal dynamics. The building blocks in Dynare therefore use a reduced but equivalent system that preserves the underlying economic structure while satisfying the Blanchard–Kahn conditions. While the theoretical model derived above presents the general equilibrium framework, two specific modifications are introduced for the estimation implementation. First, the baseline deterministic government spending rule in eq. 23 is modeled as a stochastic component as defined in eq. 24 to allow for fiscal policy shocks, which are necessary for identifying fiscal transmission mechanisms in the Bayesian analysis. Second, to ensure robust convergence during the estimation routine, the steady-state calculation in the code is solved analytically in a recursive block (finding R, then r^K, then Y, K, I, and C) rather than relying on numerical solving. This should guarantee that the initial values provided to the optimisation are exact.

3 Estimation Analysis

3.1 Calibration (Baseline)

Before turning to estimation, the detrended two-agent model is solved under a baseline calibration to verify that the stationary equilibrium is well-defined and that the linearized dynamics are stable. The calibration follows the project setup, with a share of hand-to-mouth households $\omega = 0.3$, a Cobb–Douglas capital share $\alpha = 1/3$, depreciation $\delta = 0.025$, and gross trend growth $\gamma_y = 1.005$ (approximately 2% annual). Government spending is balanced-budget and set as a constant fraction of output, $G_t/Y_t = 0.2$, implying $T_t = G_t$ and uniform taxes across types. Total factor productivity follows an AR(1) process $\log(A_t) = \rho_A \log(A_{t-1}) + \eta_{A,t}$ with persistence $\rho_A = 0.9$ and innovation standard deviation $\sigma_A = 0.01$. Table 1 reports the implied steady state of the detrended economy.

Table 1: Baseline calibration and implied steady state (detrended model)

Panel A: Baseline calibration (per quarter)			
Parameter	Value	Parameter	Value
β (discount factor)	0.99	ω (share of spenders)	0.30
α (capital share)	$0.\bar{3}$	δ (depreciation)	0.025
γ_y (gross trend growth)	1.005	G/Y (tax share)	0.20
ρ_A (TFP persistence)	0.90	σ_A (TFP shock s.d.)	0.01
L^{SP} (inelastic labor)	$0.\bar{3}$	L^{SA} (inelastic labor)	$0.\bar{3}$
Panel B: Implied steady state			
Variable	Value	Variable	Value
a (TFP level)	1.000000	w (wage)	1.920870
r^K (rental rate of capital)	0.0401515	r (gross risk-free rate)	1.01515
y (output)	0.960433	c (aggregate consumption)	0.529144
i (investment)	0.239202	k (capital)	7.97341
c^{SP} (spenders' consumption)	0.448202	c^{SA} (savers' consumption)	0.563834
g (government spending)	0.192087	t (taxes)	0.192087
t^{SP} (spenders' taxes)	0.192087	t^{SA} (savers' taxes)	0.192087

Dynare reports that the Blanchard–Kahn rank condition is satisfied: there are three eigenvalues outside the unit circle for three forward-looking variables, implying a unique local equilibrium around the steady state for the linearized system. Further, all building block equations have a reported residual of zero.

Impulse responses. Figure A.1 displays impulse responses to a one-standard-deviation positive TFP shock $\eta_{A,t}$. Output y rises on impact and monotonically declines back to steady state, reflecting the persistence of TFP and the gradual adjustment of the capital stock. Wages w co-move positively with output, since labor is fixed and higher productivity increases the marginal product of labor. Investment i increases strongly on impact, creating a hump-shaped response of capital k as capital accumulates and then slowly returns with depreciation.

Consumption responses differ across household types. Hand-to-mouth consumption c^{SP} rises immediately with wages and then declines, consistent with the spender budget constraint that links current consumption to contemporaneous after-tax labor income. Saver consumption c^{SA} responds more smoothly and can display a mild hump as savers reallocate resources intertemporally in response to temporarily higher returns and income. Aggregate consumption c increases and follows an intermediate path because it is a weighted average of the two groups. Fiscal variables (T, T^{SP}, T^{SA} and G) co-move with output in the IRFs because the spending rule fixes G_t as a constant share of Y_t and the government budget constraint implies $T_t = G_t$.

Modified SA budget constraint (model closure). Relative to the original set-up household block the implemented baseline specification effectively uses the aggregate feasibility condition together with the aggregate consumption definition to introduce saver consumption. In particular, the resource constraint $Y_t = C_t + I_t + G_t$ fixes aggregate consumption as a residual, $C_t = Y_t - I_t - G_t$, while the aggregation equation $C_t = \omega C_t^{SP} + (1-\omega)C_t^{SA}$ then implies

$$C_t^{SA} = \frac{C_t - \omega C_t^{SP}}{1-\omega}.$$

This closure ensures goods-market clearing in the detrended economy while preserving heterogeneity in consumption dynamics: spender consumption continues to be determined by current after-tax wage income, whereas saver consumption adjusts endogenously to satisfy feasibility given aggregate investment and government absorption. This results in treating the saver household as a residual in the goods market (conditional on the firm and government blocks), which should be consistent with Walras' law logic in multi-agent DSGE systems but differs from explicitly imposing both household budget constraints next to the aggregate resource constraint.

4 Simulated Method of Moments

Methodology

To calibrate the structural parameters of the model, I employ the Simulated Method of Moments (SMM). This approach aims to minimize the weighted distance between the empirical moments calculated from the data and the theoretical moments generated by the model simulations. Let Ψ_{data} denote the vector of empirical moments and $\Psi_{model}(\theta)$ denote the moments simulated by the model for a parameter vector θ. The estimator $\hat{\theta}_{SMM}$ is defined as:

$$\hat{\theta}_{SMM} = \arg\min_{\theta} [\Psi_{data} - \Psi_{model}(\theta)]' W [\Psi_{data} - \Psi_{model}(\theta)]$$

I employ an optimal weighting matrix W estimated using a Bartlett kernel with 20 lags to account for autocorrelation and heteroskedasticity in the data. The optimization algorithm used is a Newton-type method robust to boundary conditions.

Table 2: SMM Estimation Results and Model Fit

(a) Structural Parameter Estimates

Param	**Sym**	**Est**	**SE**	**t-stat**
Time Pref	β	0.9950	0.0058	171.36
Growth	γ_y	1.0080	0.0975	10.34
TFP Pers	ρ_A	0.9988	1.1208	0.89
H-to-M	ω	0.9361	0.8155	1.15
TFP SD	σ_A	0.0098	0.0032	3.05

(b) Data vs. Model Moments

Moment	**Data**	**Model**
$E[\Delta \log y_t]$	0.0075	0.0079
$E[\Delta \log c_t]$	0.0085	0.0079
$E[R_t]$	1.0126	1.0129
$Var(\Delta \log y_t)$	1.34e-4	1.50e-4
$Var(\Delta \log c_t)$	1.42e-4	1.29e-4

Note: Estimates obtained via SMM using a Bartlett kernel optimal weighting matrix (20 lags).

Data

The estimation targets five key moments of the New Zealand economy: the mean and variance of GDP growth and consumption growth, and the mean risk-free interest rate. All data series are quarterly from 1995Q1 to 2019Q4. I utilize Real Gross Domestic Product data from the OECD (OECD, 2025b) and Real Private Final Consumption Expenditure (OECD, 2025c). Growth rates are computed as logarithmic differences ($\Delta \log(X_t)$). The risk-free rate is proxied by the 3-Month Bank Bill rate for New Zealand (OECD, 2025a), converted to a quarterly gross rate.

SMM Results

Table 2 presents the estimated structural parameters and model fit. The estimation procedure converged successfully, achieving a high fit where the model replicates the first and second moments of the data with high precision.

The discount factor β is estimated at 0.995, implying a quarterly discount rate consistent with the observed mean interest rate of 1.013. The economy's trend growth factor γ_y is estimated at 1.008, reflecting an annualized growth rate of approximately 3.2%.

Notably, the estimated share of hand-to-mouth consumers is high at $\omega = 0.936$. Economically, this suggests that to match the observed consumption volatility in New Zealand data without additional frictions (such as habit formation), the model requires a dominant share of agents to consume their income directly rather than smoothing it via savings. However, we note that the standard error for ω is relatively large (0.81), indicating that this parameter is weakly identified by the selected moments. Similarly, the TFP persistence ρ_A is estimated close to unity (0.999), suggesting shocks have long-lasting effects, though this parameter also exhibits weak identification in this specification.

Despite these identification challenges, the point estimates provide the best available fit for the targeted moments and are adopted for the subsequent Bayesian estimation analysis.

4.1 Bayesian Estimation

Methodology

Following the SMM calibration of the core structural parameters, I estimate the parameters that drive the exogenous public spending shock process (ρ_G, σ_G) using Bayesian techniques. This approach ensures that the preference parameters remain consistent with the long-run moments matched in the previous step, while allowing the data to inform the specific dynamics of fiscal policy.

I employ a Monte-Carlo algorithm with Metropolis-Hastings specification and 2,000 replications across 2 chains to sample from the posterior distribution. The structural parameters $(\beta, \gamma_y, \rho_A, \omega)$ and the TFP shock volatility (σ_A) are fixed at their SMM-estimated values. Further, I assign a beta prior for the persistence parameter ρ_G and an inverted Gamma beforehand for the shock volatility σ_G (mean 0.01, infinite variance). The observables used for estimation are the growth rates of GDP and aggregate consumption.

Bayesian Results

Table 3 presents the posterior estimates for the government spending shock process.

Table 3: Bayesian Estimation Results

	Prior		Posterior		90% HPD Interval	
Parameter	**Dist**	**Mean**	**Mean**	**SD**	**Lower**	**Upper**
Gov. Persistence (ρ_G)	Beta	0.500	**0.9598**	–	0.9293	0.9867
Gov. Shock SD (σ_G)	InvG	0.010	**0.0247**	–	0.0218	0.0277

Note: Estimation based on 2,000 Metropolis-Hastings draws. TFP parameters were fixed at SMM values ($\rho_A = 0.999$, $\sigma_A = 0.0098$).

The estimation reveals that government spending shocks in New Zealand are highly persistent, with an ex-post mean for ρ_G of 0.96, significantly shifting away from the prior mean of 0.5. The 90% Highest Posterior Density (HPD) interval $[0.93, 0.99]$ excludes zero, confirming strong autocorrelation in fiscal policy deviations. The estimated volatility of these shocks is 2.47% ($\sigma_G = 0.0247$), which is considerably larger than the estimated TFP volatility (0.98%), suggesting that fiscal dominance plays a non-negligible role in short-run fluctuations.

Shock Decomposition and Identification. Despite the high volatility of the fiscal shock, the variance decomposition indicates that TFP shocks (η_A) remain the dominant driver of aggregate fluctuations, explaining over 99% of the variance in GDP (y). The historical shock decomposition in A.2 appears to be of no economic interpretation due to persistent initial values after the 50th time lag - a problem that might result from the data cleaning process, resulting in large, persistent deviations that do not reflect genuine structural shocks. However, fiscal shocks (η_G) account for approximately 0.8% of the variance in aggregate consumption (c). This discrepancy arises from the model's supply-side constraints: with inelastic labor and predetermined capital, output is largely supply-determined in the short run. Consequently, government spending shocks primarily crowd out private expenditure rather than expanding output, forcing consumption to absorb the fiscal impulse.

Counterfactual Analysis for ω. To assess how financial friction intensity changes the transmission of fiscal shocks, I simulated the model under alternative calibrations for the share of hand-to-mouth households (ω) for $0.1, 0.3$ and 0.5. The variance decomposition results indicate a counter-intuitive but mechanically consistent finding: Fiscal shocks explain 0.92% of consumption variance, when frictions are low, ($\omega = 0.1$). Otherwise, when the baseline friction is high ($\omega = 0.9$), fiscal shocks explain roughly 0.78% of consumption variance.

This suggests that as the share of hand-to-mouth agents increases, aggregate consumption actually becomes *less* sensitive to government spending shocks relative to TFP shocks. This occurs because investment bears the brunt of the crowding-out effect. Optimizing "saver" households, who own the capital stock, react to fiscal expansion by sharply cutting investment. "Spender" households, who simply consume their wage, are insulated from intertemporal substitution effects. Thus, in a high-ω economy, the volatility burden of fiscal shocks is shifted from consumption toward investment.

5 Conclusion

This paper has developed and estimated a two-agent New Keynesian model to analyse drivers behind aggregated fluctuations in New Zealand. The model therefore relied explicity the interaction between credit constrained "hand-to-mouth" and households that are able to save, departing from a sole representative agent approach. The empirical analysis finds three main conclusions.

First, the SMM estimation indicates that a high fraction of households ($\omega \approx 0.94$) must be modeled to replicate the observed volatility of consumption relative to output. This suggests significant financial frictions in the New Zealand household sector.

Second, Bayesian estimates reveal that fiscal policy shocks are both volatile and highly persistent, but play a minor role behind aggregated output fluctuations. Instead, output is highly determined by TFP shocks which comes from the models supply-side constraints on labour and capital.

Thirdly, the counterfactual analysis provides an insight into transition mechanisms, depending on the different household specialisation shares: in an economy with a high share of hand-to-mouth agents, fiscal expansions crowd out investment rather than consumption, as optimizing savers bear the burden of intertemporal adjustment. Future research could extend this framework by introducing nominal rigidities to allow for a stronger demand-side channel of fiscal policy.

References

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Datasets

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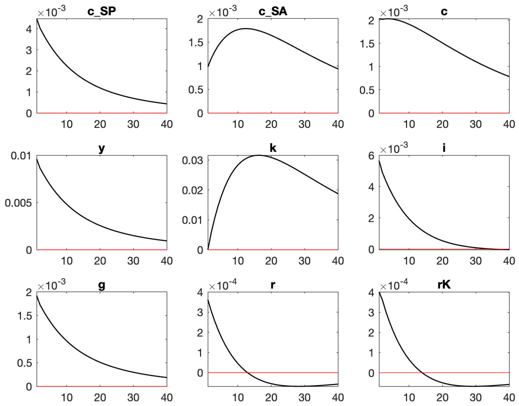
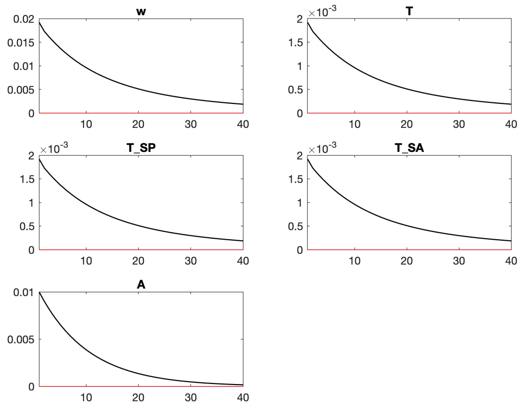
A Figures

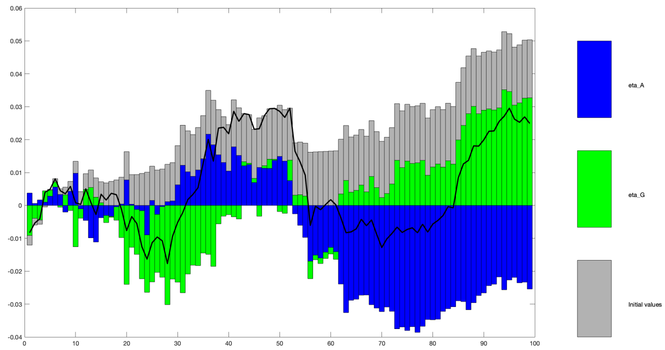


(a) Baseline IRFs for private aggregates

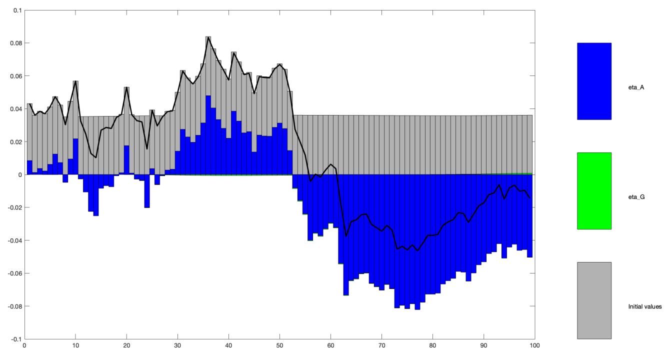


(b) Baseline IRFs for fiscal variables

Figure A.1: Baseline impulse responses to a one-standard-deviation TFP shock.



(a) Shock Decomposition: Consumption (c)



(b) Shock Decomposition: GDP (y)

Figure A.2: Historical shock decomposition of aggregate variables. *Note:* Blue bars represent TFP shocks (η_A), green bars represent government spending shocks (η_G), and grey bars indicate the contribution of initial values.