Macroeconomic Effects of Sovereign Deficits: Evidence from An Estimated DSGE Model for the Philippines

Aris Zoleta

DLSU Graduate School of Economics

aris.c.zoleta@gmail.com

BSP Research Fair
July 13 -14 2021

The view express in this paper is solely of mine and do not necessarily represent those of DLSU School of Economics or of others.

Motivation

- The recent pandemic brought several uncertainties on economic prospect and growth.
- The government is committed to increase deficit spending on public infrastructure as policy tools for recovery.
- There is public debate on increasing fiscal risk in in expanding the public deficits and increased government borrowing.
- Is public investment on infrastructure yield positive externalities on private investment.
- What is the impact of increased fiscal spending on different macroeconomic variables such as output, employment and inflation.

Literature Review

- Ramey (2020) and Aschauer (1989) highlights the potential increase in long-run output using infrastructure as a policy tool. He attributes this result to the effects of the increased government investment in infrastructure on the stock of public capital
- Lim (2019) show that government spending on infrastructure helps the economy recover after a natural disaster. In Lim's simulation natural disasters, such as storms which are frequent in the Philippines, destroy different infrastructure in the economy.
- Leeper et. al (2010) and Dacuycuy and Sauler (2017) show that implementation delays diminish the immediate effects of public infrastructure investment. Because of the time completing this project. Legal setbacks and other forms of delays impact the timing of infrastructure benefits

Model

Household

$$E_t \sum_{s=0}^{\infty} \beta^{t+s} \chi_{t+s}^{u} \left[\frac{1}{1-\gamma} (C_{t+s} - hC_{t+s-1})^{1-\gamma} - \chi_{t+s}^{l} \frac{L_{t+s}^{1+\kappa}}{1+\kappa} \right] \quad \text{Eq. (1)}$$

$$(1 + \varphi_t^c) P_t C_t + I_t + B_t = (1 - \varphi_t^l) W_t L_t + (1 + \varphi_t^k) R_t^k K_t^p + R_t^b B_{t-1} + \phi_t \quad \text{Eq. (2)}$$

Eq. (1) defines the household objective function to maximize lifetime utility subject to budget constraint Eq. (2)

Firm

The Final good firms used Dixit- Stiglitz (1977) technology in aggregating intermediates good

$$Y_t = \left[\int_0^1 (y_t^j)^{\frac{\varepsilon-1}{\varepsilon}} dj\right]^{\frac{\varepsilon}{\varepsilon-1}} \quad \text{Eq. (3)}$$

Maximizing profit solving Eq.(4) subject to Eq. (3) yields Eq.(5) and (6)

$$\max\left[P_t Y_t - \int_0^1 P_t^j Y_t^j \; dj\right] \quad \text{Eq. (4)}$$

$$y_t^j = \left(\frac{P_t^j}{P_t}\right)^{-\varepsilon} Y_t \; ; \quad \text{Eq. (5)}$$

$$P_t = \left[\int_0^1 (P_t^j)^{1-\varepsilon} \, dj\right]^{\frac{1}{1-\varepsilon}} \quad \text{Eq.(6)}$$

I follow Villaverde and Ramirez (2006) on the exposition of firms' cost minimization problem of the retail firm. Solving Eq. 7 given Eq. 8.

$$y_t^j = A_t\left(k_{jt}^P\right)^{\alpha} l_{jt}^{1-\alpha} \left(k_{t-1}^G\right)^{\alpha_G} \quad \text{Eq. (7)}$$

$$\min_{k_{jt-1}^P, l_{jt}} r_t^P k_{jt}^j + w_t l_{jt}{}' \quad \text{Eq. (8)}$$

Fiscal Authority

The government purchase of consumption and investment, interest payment for bond and transfer shall match by the revenue from taxes in consumption, capital, and labor.

$$\frac{B_{t+1}}{P_{t+1}} = G_t^C + G_t^I + \frac{R_t^G}{\pi_t}\frac{B_t}{P_t} + \phi_t - \left(\varphi_t^c P_t C_t + \varphi_t^k R_t^P K_t^P + \varphi_t^l W_t L_t\right) \quad \text{Eq. (9)}$$

Fiscal Rule

$$G_{1,t} = \gamma_{1,y}(y_t) + \gamma_{1,\tau}\left(\frac{\tau_t}{y_t}\right) + \gamma_{1,b}\left(\frac{b_{t-1}}{y_t}\right) + \psi^G_{1,t} \quad \text{Eq. (10)}$$

$$G_{2,t} = \gamma_{3,y}(y_t) + \gamma_{3,\tau}\left(\frac{\tau_t/y_t}{\bar{\tau}/\bar{y}}\right) + \gamma_{3,b}\left(\frac{b_{t-1}/y_t}{\bar{b}/\bar{y}}\right) + \psi^G_{2,t} \quad \text{Eq. (11)}$$

Monetary Authority

There is a central bank that conducts monetary policy. The monetary authority sets the interest rate as a policy instrument. I assume that the central bank uses a simple Taylor Rule in the below form

$$i_t = \phi_i i_{t-1} + \phi_y(\bar{y} - y_t) + \phi_\pi(\bar{\pi} - \pi_t) + \psi^i_t \quad \text{Eq. (12)}$$

Analysis of the Estimation Results

Table 1 Estimates of Fiscal Rule

Notation	Parameter	prior mean	posterior mean	90% HPD	Interval	Prior	Posterior Deviation
γ_Y	Output	0.5	0.1851	0.0334	0.323	beta	0.2
γ_τ	Deficit to GDP	0.5	0.1316	0.0264	0.2438	beta	0.2
γ_b	Debt to GDP	0.5	0.9197	0.859	0.988	beta	0.2

Table 1 Estimated Coefficient of Fiscal Rule

.

Table 2 Estimates of Monetary Rule

Notation	Parameter	prior mean	posterior mean	90% HPD	Interval	Prior	Posterior Deviation
ϕ_π	Inflation	2	2.2061	1.8859	2.5562	norm	0.25
ϕ_i	Interest smoothing	0.75	0.6712	0.5251	0.8147	beta	0.10
ϕ_Y	Output gap	0.125	0.0847	0.031	0.1445	norm	0.05

Table 2 Estimated Coefficient of Taylor Rule

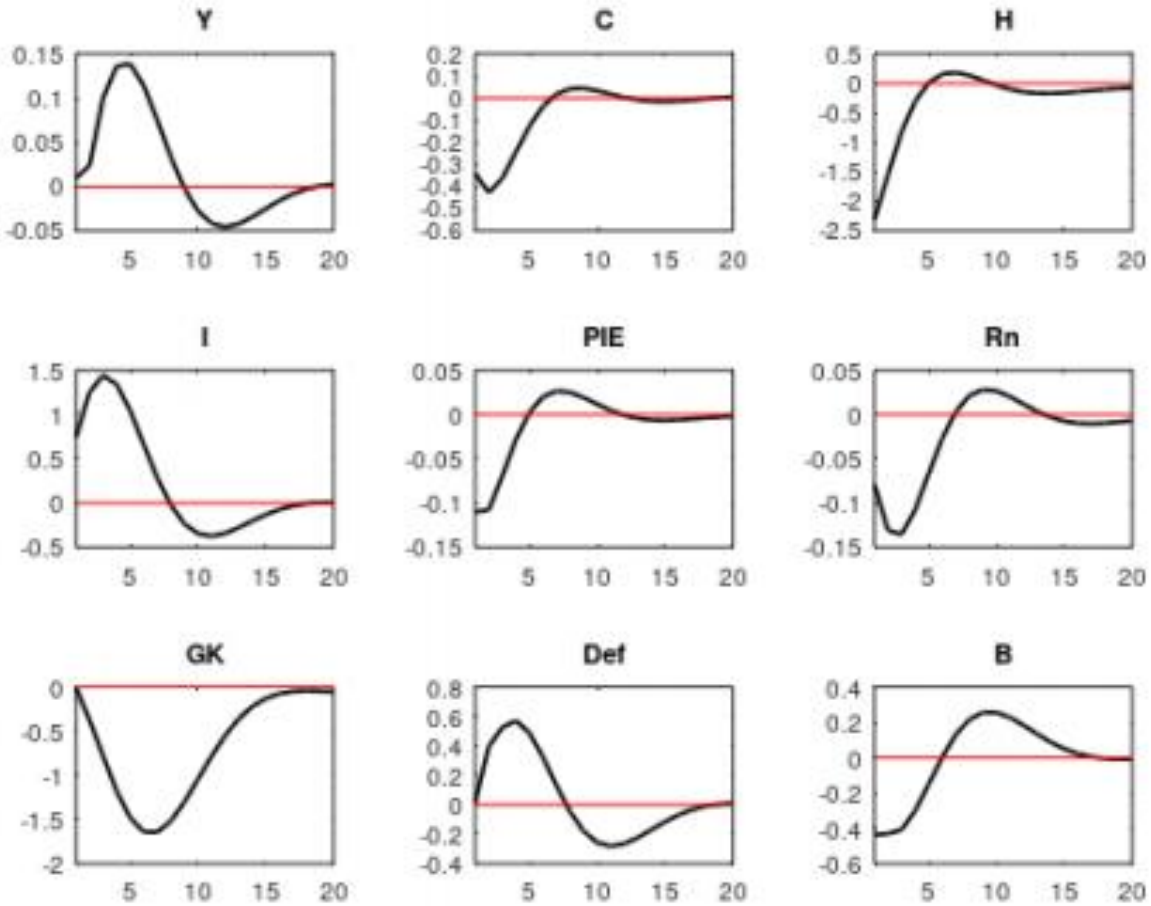

Figure 1 The Effects of Technology Shock on Output (Y), Consumption (C), Labor hours (H), Investment (I), inflation (PIE), BSP rate (Rn), Govt. Capital (GK), Deficit (Def), and Gov.t Debt (B)

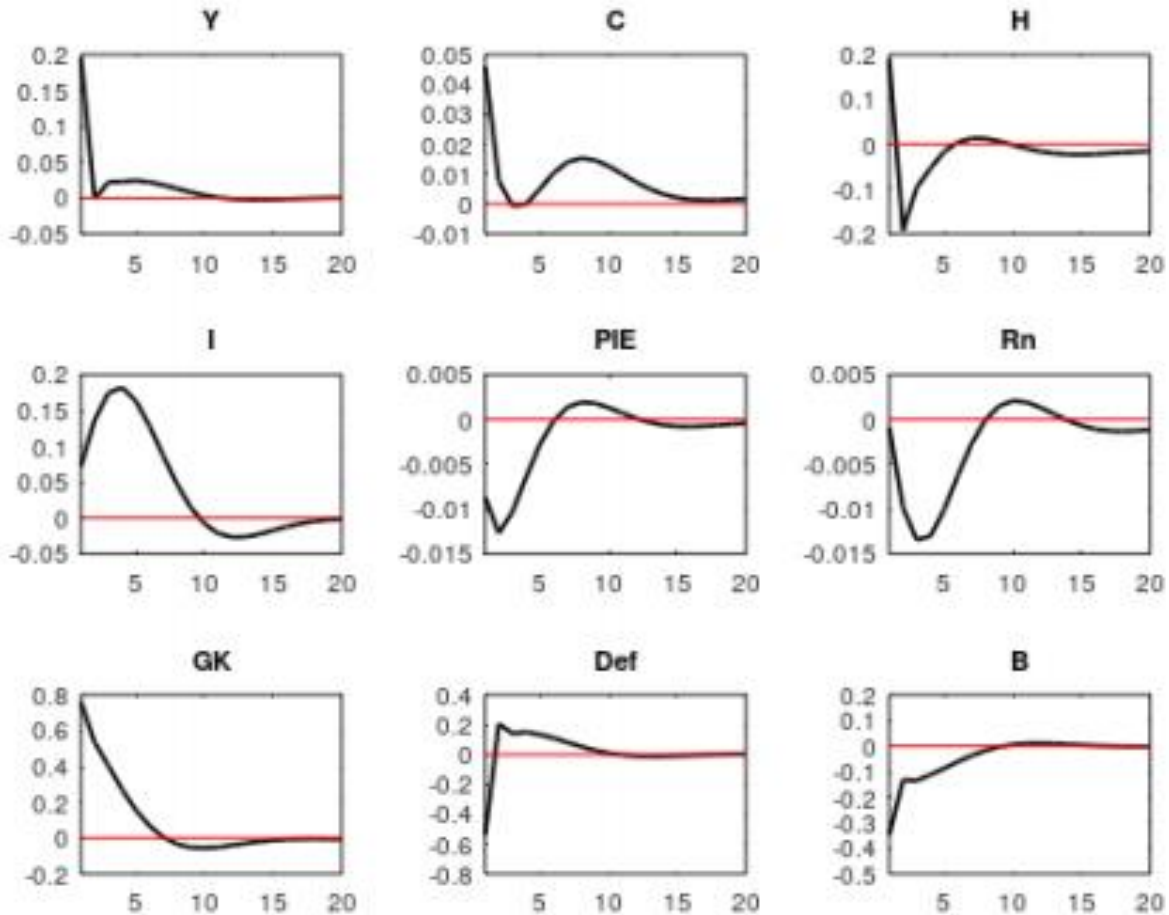

Figure 2 The Effects of Govt. Spending Shock on Output (Y), Consumption (C), Labor hours (H), Investment (I), inflation (PIE), BSP rate (Rn), Govt. Capital (GK), Deficit (Def), and Govt. Debt (B)

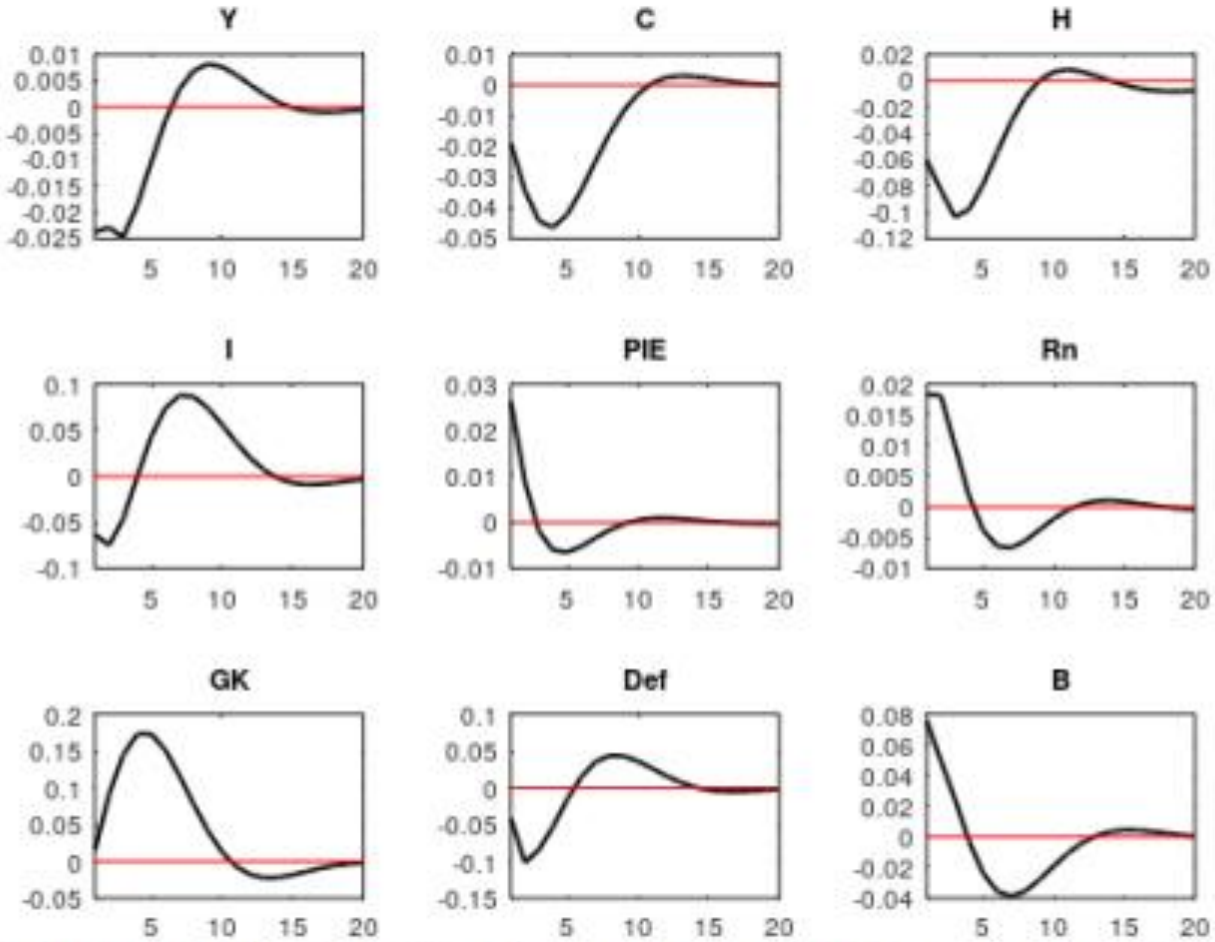

Figure 3 The Effects of Price Mark-Up Shock on Output (Y), Consumption (C), Labor hours (H), Investment (I), inflation (PIE), BSP rate (Rn), Govt. Capital (GK), Deficit (Def), and Govt. Debt (B)

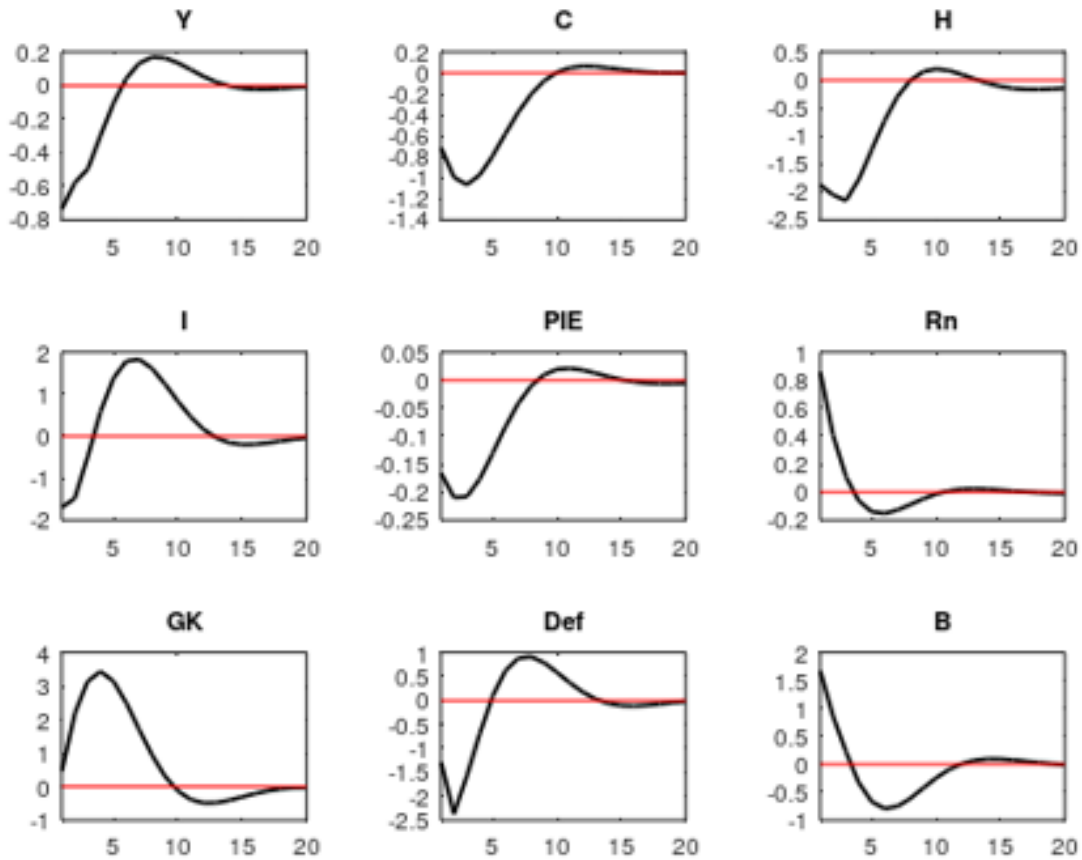

Figure 4 The Effects of Monetary Policy Shock on Output (Y), Consumption (C), Labor hours (H), Investment (I), inflation (PIE), BSP rate (Rn), Govt. Capital (GK), Deficit (Def), and Govt. Debt (B)

Conclusion

Using DSGE models the simulation provides evidence on the ability of government public investment on infrastructure to influence private capital investment. The simulation results suggest that during episodes of increasing government spending private capital responded positively. In addition, both public and private investment exhibits procyclical behaviors in presence of government spending shock. Lastly, the output is more persistent during episodes of technology shocks than on an increase in government spending.

The estimates also show that the national government is more sensitive on debt to GDP than on output or deficits to GDP in presence of government spending shock.