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Are transfers expansionary? A DSGE approach

Lawrence B. Dacuycuy[1]
[1] *School of Economics, De La Salle University*
**Corresponding Author: lawrence.dacuycuy@dlsu.edu.ph*

Abstract: Does an unanticipated shock to government transfers have real effects? Do transfer shocks increase the consumption of vulnerable households? These questions matter because of the documented governmental actions to ameliorate unfavorable market adjustments due to crises and other economic downturns. To answer these questions, we estimated, using Bayesian approaches, a medium-scale dynamic stochastic general equilibrium (DSGE) model with rich fiscal properties using quarterly Philippine data series from 2002Q3 to 2021Q3. The DSGE model incorporates optimizing and vulnerable households, making it suitable for measuring the real effects of government transfers. While the estimated model yields other results of empirical importance, we zero in on government transfers. The paper addresses the following issues related to (a) the magnitude of vulnerable households, (b) the reaction of output and consumption growth to unanticipated transfer shocks, and (c) the stability of the fiscal transfer rule. Posterior estimates show that 63% of households are vulnerable to shocks because of their relative inability to respond to shocks. Unanticipated transfer shocks have transitory positive effects on consumption and output growth that last 1 quarter. Such shocks also improve the consumption of vulnerable households. Finally, transfers react negatively to increasing debt-to-GDP ratio but exhibit procyclicality with respect to the aggregate cycle – clear signs that mechanisms are in place to discourage transfers during periods of increasing indebtedness.

Key Words: DSGE, government transfers, Philippines, Ricardian and non-Ricardian households

1. INTRODUCTION

Expansionary fiscal policy remains a potent part of policymakers' toolkit. During recessions, fiscal authorities increase government purchases of consumption goods, reduce taxes, and facilitate transfers.

Transfers such as social security benefits, unconditional dole-outs, and conditional cash assistance represent government interventions to blunt the effects of sudden downgrades in economic activity or welfare. Economic theory predicts that income deteriorates in the face of adverse aggregate demand shocks. As a result, private consumption possibilities narrow, and welfare deteriorates. To address potential welfare downgrades, resources are transferred to households with a higher marginal propensity to consume.

The size of transfers and consumption dynamics depend on the proportion of vulnerable households (Coenen, Straub, & Trabandt, 2010).

During the pandemic, fiscal authorities spent large sums of money to mitigate the effects of shutdowns and quarantines. Transfer payments from the government may have increased consumption among vulnerable households.

Evaluating the macroeconomic effects of transfers is worthwhile and informative. Recent evidence suggests that government transfer effects are conditioned by the stage of development a country is in (Churchill & Yew, 2017).

However, much research has largely focused on the effect of government consumption spending and investment shocks on output and consumption. However, the literature remains scant on establishing the expansionary impact of transfers (Oh & Reis, 2012).

We are interested in answering the following questions: How large are the vulnerable households? Are transfers expansionary? Do transfers benefit the vulnerable dynamically more than optimizing households? As a fiscal rule, do transfers react to changes in output and debt?

To answer the questions, we use an estimated medium-scale DSGE model developed for the Philippines to investigate the effects of transfers on output growth and private consumption (Dacuycuy, 2024). This model, summarized succinctly, incorporates Ricardian and non-Ricardian (vulnerable) households to ensure that transfers with real effects.[1] It also has a rich fiscal block and encompasses usual components such as the production sector, labor market, and open economy.

The paper follows the usual organizational design. Section 2 details the model, focusing on decisions of households and firms, fiscal and monetary policies. Section 3 discusses the estimation methodology. Section 4 shows and interprets the results, and the last section concludes.

2. THE MODEL

2.1 Households

Christoffel, Coenen, & Warne (2006) and Coenen, Straub, & Trabandt (2010) developed open economy DSGE models, with the latter emphasizing household heterogeneity and richer fiscal processes[2]. In theory, optimizing households can smooth consumption in the face of adverse shocks, purchase domestic or international bonds, invest in new capital, and own firms.

The utility function of optimizing households (indexed by h) is specified as

Where β is the discount factor, κ the habit formation parameter, and ζ is the inverse

[1] A variable has real effects if it can actually influence output and other variables such as investments and consumption.

[2] The estimated DSGE model is materially based on these two papers.

of the Frisch elasticity of substitution. $\tilde{C}_{h,t}$ consists of private and public consumption. Composite consumption, $\tilde{C}_{h,t}$ is aggregated using the constant elasticity of substitution function. $L_{i,t}$ is labor supply.

$$\tilde{C}_{h,t} = \left(\theta_G^{\frac{1}{\nu_G}} \left(C_{h,t}\right)^{\left(1-\frac{1}{\nu_G}\right)} + (1-\theta_G)^{\frac{1}{\nu_G}} \left(G_t\right)^{\left(1-\frac{1}{\nu_G}\right)} \right)^{\left(\frac{\nu_G}{\nu_G - 1}\right)}$$

The objective function is represented by

$$E_t \left[\sum_{\tau=0}^{\infty} \beta^{\tau} \left(ln\left(\tilde{C}_{h,t+\tau} - \kappa \tilde{C}_{h+\tau-1}\right) - \frac{1}{1+\zeta} \left(L_{h,t+\tau}\right)^{1+\zeta} \right) \right] \quad (1)$$

The household's budget constraint is given by

$$\begin{aligned} &(1+\tau_t^C) P_t^C C_{h,t} + P_t^I I_{h,t} + \frac{B_{h,t}}{\epsilon_t^{RP} R_t} + \\ &\frac{ER_t B_{h,t+1}^*}{\left(1-\Gamma_{B^*}\left(B_{t+1}^*; \epsilon_t^{RP,*}\right)\right) R_t^*} + LSTax_{h,t} = \\ &\left(1-\tau_t^N - \tau_t^{W_h}\right) W_{h,t} L_{h,t} + (1- \\ &\tau_t^K)\left[R_t^K u_{h,t} - \Gamma_u\left(u_t^i\right) P_t^I\right] K_{h,t} + \\ &\tau_t^K \delta P_t^I K_{h,t} + (1-\tau_t^D) D_{h,t} + TR_{i,t} + \\ &B_{h,t} + ER_t B_{h,t}^* \\ &\quad + \tau_t^c \left(R_{K,t} - \delta P_{I,t}\right) K_{h,t} + \tau_t^K K_{h,t} \\ &\qquad + \frac{B_{h,t+1}}{R_t} + T_t \end{aligned} \quad (2)$$

Control variables include consumption, investment, domestic bonds, international bonds, labor supply, and capital. These are denoted in the model by the variables $C_{h,t}, I_{h,t}, B_{h,t}, B_{h,t+1}^*, L_{h,t}, K_{h,t}$, respectively. P_t^C and P_t^I are the respective prices of consumption and investment goods.

The variables $\tau_t^C, \tau_t^N, \tau_t^{W_N}, \tau_t^D, \tau_t^K$ represent the various tax rates imposed on consumption, labor earnings, social security taxes, dividends, and capital, paid by Ricardian consumers. In the model, only Ricardian households pay lump-sum taxes $LSTax_{i,t}$. Risk premia are differentiated domestically and internationally. Interest rates and wage rates are given by R_t, R_t^*, W_t^h. Transfers TR_t^h and dividends go to both types of households as well.

In contrast to Ricardian households, vulnerable households (indexed by j) do not optimize but rather use a rule of thumb to determine consumption and labor supply. They face the same tax rate on consumption and may even be asked to pay labor earnings taxes, but they do not pay lump-sum taxes. They are unable to access to international and domestic financial markets, making them unable to purchase bonds. Equation (3) shows the vulnerable household's budget constraint.

$$\begin{aligned} &(1+\tau_t^C) P_t^C C_{j,t} \\ &\quad = \left(1-\tau_t^N - \tau_t^{W_h}\right) W_{j,t} L_{j,t} \\ &\quad + TR_{j,t} \end{aligned} \quad (3)$$

Following Coenen et al, we use a functional rule that determines the distribution of transfers.

$$\varpi\left(\frac{TR_{h,t}}{TR_{h,t}\ -1}\right)=(1-\varpi)\left(\frac{TR_{j,t}}{TR_{j,t}\ -1}\right) \qquad (4)$$

Where ϖ is an estimable parameter associated with the above transfer rule.

2.2. Firms

In the model's productive sector, there are 2 categories of firms: intermediate goods firms and final goods firms[3]. Intermediate goods firms produce differentiated goods for domestic and foreign demand. These are firms that rent capital and hire labor services. Final goods firms are price-taking firms that combine intermediate goods purchased from abroad or domestic markets. They produce final consumption, investment, and government goods.

2.3 Fiscal Policymakers

As noted in Coenen et al, the fiscal authority generates tax revenues and incurs public debt to finance public consumption and investment final goods purchases. It also provides transfers to Ricardian and non-Ricardian households, thereby augmenting financial resources. Transfers are deemed distinct from government spending because they are not spent on specific goods and services.

To sustain public consumption and investment spending, the government strategically constitutes a budget that may be balanced if tax revenues are adequate to finance expenditure programs.

Our fiscal rule on transfers $\widehat{tr}_t$ is given in log-linearized form[4].

$$\begin{aligned}\widehat{tr}_t = (1-\mathrm{I}_{TR})\big[&\rho_G\widehat{tr}_{t-1}+\theta_{Tr,B}\hat{b}_t\\ &+\theta_{Tr,Y}\hat{y}_t\big]\\ &+(1-\psi_{TR})\hat{\eta}_t^{G}\\ &+\psi_{TR}\hat{\eta}_{t-1}^{tr}\end{aligned} \qquad (5)$$

Where $\hat{b}_t$ is debt to GDP ratio and $\hat{y}_t$is output. $\hat{\eta}_t^{TR}$ is a fiscal innovation. $\mathrm{I}_{TR}$is an indicator variable associated with a policy switch. Note that all variables are expressed in terms of percentage deviation from the steady state.

2.4 Monetary policy makers

We will use a typical specification of the Taylor rule to explain how short-term interest rates are determined.

$$\begin{aligned}\hat{r}_t = {}&\phi_R\hat{r}_{t-1}+(1-\phi_R)\left(\phi_\pi\pi_{C,t}+\phi_Y\hat{y}_t\right)\\ &+\phi_{\Delta\pi}\left(\pi_{C,t}-\pi_{C,t-1}\right)+\phi_{\Delta\mathrm{Y}}(\hat{y}_t-\hat{y}_{t-1})\\ &+\sigma_R\hat{\eta}_{R,t}\end{aligned} \qquad (6)$$

[3] Including both types of firms is a standard treatment in the literature. The modeling approach by Christoffel, Coenen, & Warne (2006) is used.

[4] Note that there are fiscal rules that pertain to expenditures (government consumption and investment) and revenues (taxes).

ϕ_R represents interest smoothing. $\phi_{\Delta\pi}$captures the impact of inflation growth; $\phi_{\Delta Y}$ captures the role of output growth. $(1-\phi_R)\phi_Y$ is the effect of output gap, where it is measured by the deviation of output from trend productivity growth.

3. ESTIMATION METHODOLOGY

In DSGE modeling, the most important structure is the state-space representation of the equilibrium laws of motion (Z_t) and the observables (Y_t). The solution of the DSGE model is represented by two equations:

$$Z_t = \Theta Z_{t-1} + \Phi\epsilon_t \qquad (7)$$
$$Y_t = \mathrm{H}Z_t$$

ϵ_t is the vector of structural innovations and Θ and Φ are functions of structural parameters.

To ensure that solutions exist, the model must first satisfy the Blanchard-Khan conditions, which technically require that the number of jumpers (or forward-looking variables) be equal to the number of eigenvalues greater than 1 in modulus[5].

Data on macroeconomic series span the period 2002Q1-2021Q3. We obtained quarterly macroeconomic data from the OpenStats of the Philippine Statistics Authority (PSA), the Department of Finance's Statistical Database, the International Monetary Fund's International Financial Statistics database, OECD.Stat, Federal Reserve Bank at St. Louis Database and Bangko Sentral ng Pilipinas[6].

Following Bayesian methodologies, we iteratively construct the posterior, which consists of the sum of two parts, namely: the log likelihood and the log prior. The value of the parameters at which the log posterior is maximized is known as the posterior mode. We use the Metropolis-Hastings Markov Chain Monte Carlo (MHMCMC), which specifies the posterior distribution as the target distribution, from which Markov Chains are formed.

For the model, the number of replications (or iterations) for Metropolis-Hastings algorithm is 300000 with 25% of the draws used during the burn-in phase discarded. The number of parallel chains for Metropolis-Hastings algorithm was set to 2. The solution algorithm is the Monte-Carlo based optimization routine.

4. RESULTS AND DISCUSSION

3.1 Are government transfers expansionary?

[5] See Dacuycuy (2024)

[6] For complete details, please see the methodology section of Dacuycuy (2024).

Using the Kalman smoother, we verified the behavior of government transfers (see Figure 1). The smoothed government transfer shock shows wide swings during the pandemic period, plausibly in response to the behavior of the aggregate cycle.

We document the impulse response functions computed for 8 quarters (See Figures 2 and 3). A 1% increase in unanticipated transfer shocks would only increase output growth for 1 quarter before contributing

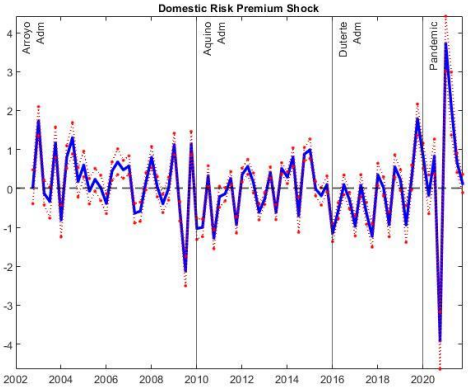

Fig.1. Smoothed fiscal transfer shocks: 2002Q3-2021Q3

negatively for the next 7 quarters. This finding supports the prediction that transfers have real effects. While transfers have real effects on output, the effects are immediate but short-lived or lack persistence.

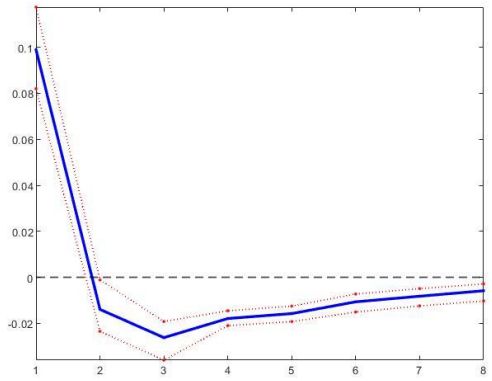

Fig. 2. Dynamic effects of unanticipated transfer shocks on observed output growth

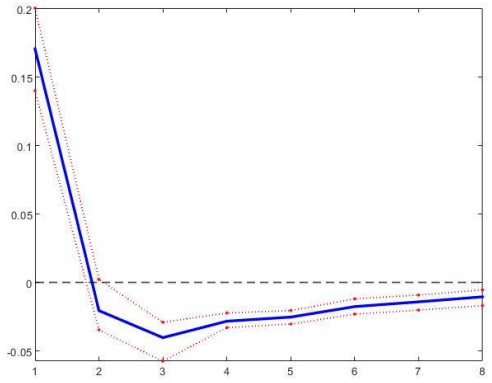

Fig. 3. Dynamic effects of unanticipated transfer shocks on observed consumption growth

3.2 Do transfers benefit the vulnerable dynamically more than optimizing households?

A comparison between the effects of shocks on the consumption of Ricardian and vulnerable households reveals that the latter benefit more when transfers increase unexpectedly.

This result bolsters the belief that while transfers have momentary effects on output growth, they tend to benefit those who cannot adjust to adverse shocks more than those who can smooth their consumption and optimally respond to such adverse shocks.

3.3. How large is the size of the vulnerable households?

With the introduction of household heterogeneity, the model allows us to estimate the parameter associated with the proportion of households considered non-optimizing or vulnerable.

Posterior estimates show that 63% of households are vulnerable to shocks because of their relative inability to respond to shocks. This finding is way above estimates computed for developed economies, and it is considered the first time that an estimate on the size of vulnerable households has been offered.

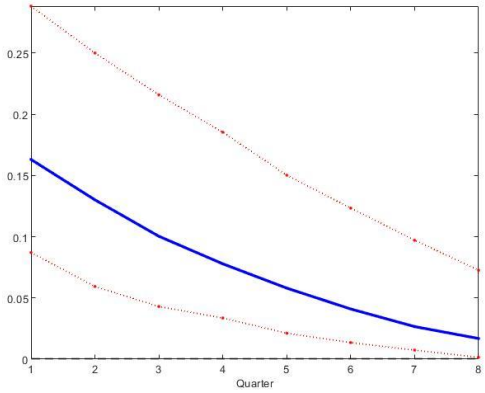

Fig. 4. Dynamic effects of unanticipated transfer shocks on consumption: Ricardian Households

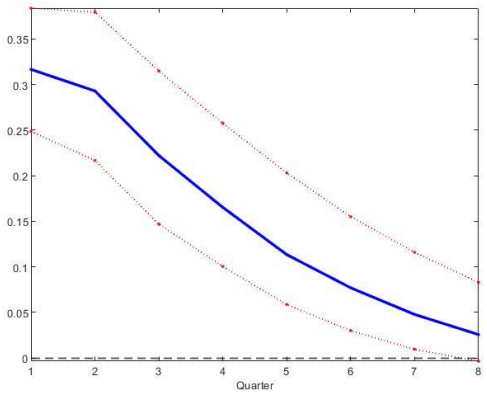

Fig. 5. Dynamic effects of unanticipated transfer shocks on consumption: Vulnerable Households

3.4. On the estimated fiscal rule

One key finding shows that transfers respond strongly and positively to output growth but negatively to lagged debt-to-GDP ratio. While the latter seems to conform with fiscal management initiatives, the former is typically evident in developing economies.

4. CONCLUSIONS

Using an estimated open economy DSGE model with a rich fiscal block, this study established several stylized facts or takeaways about government transfers.

First, the proportion of vulnerable households is significantly high.

Second, vulnerable households tend to benefit more from unanticipated increases in transfers compared with

those who can optimally respond to adverse economic shocks.

Third, unanticipated increases in transfers are only effective in increasing output in the short run.

Fourth, transfers react negatively to increases in debt to GDP ratio but remain procyclical with the aggregate cycle.

We must admit that the problem is narrow and many details about the estimated DSGE model have not been discussed. However, the fiscal-centric nature of the model opens doors to several empirical investigations that may shed light on the structural adjustments, degree of effectiveness, and relevance of fiscal policies.

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