RESEARCH ARTICLE

Deep Habits and Taxes: A Simulation Study

Lawrence B. Dacuycuy[1]
De La Salle University, Manila, Philippines
lawrence.dacuycuy@dlsu.edu.ph

Abstract: Using a calibrated dynamic model that embeds endogenous fiscal policy tools, this note provides simulation evidence on the effectiveness of tax and fiscal spending policies in determining key macroeconomic outcomes. The model was chosen because newly imposed taxes in the Philippines have affected the prices of consumption varieties and plausibly because of deep habits, the pricing policies of firms have become dynamic. Building upon the seminal model of Ravn, Schmitt-Grohe, and Uribe (2006), this note shows that preference structures do have a key role to play in determining the response of private consumption to endogenous fiscal policy. Results show that lowering labor earnings taxes stimulates the economy through a higher level of output and private consumption. Mark-ups remain countercyclical, replicating a key result associated with an increase in fiscal spending. In contrast, a 1% increase in consumption taxes will exacerbate markups, resulting in lower private consumption. Wages also increase, and output reacts negatively.

Keywords: Deep habits, endogenous fiscal policy, stochastic simulation

JEL Classifications: E32, E62, H31

Assessing the impact of tax reforms has always been an interesting endeavor, given their intertemporal effects. This year, the Philippines implemented the tax reform called Tax Reform for Acceleration and Inclusion Act (TRAIN, 2018), which contained provisions on earnings and consumption tax adjustments. Given this as a background, I am interested in determining how agents with deep habits would respond.

In the macroeconomics literature, deep habits pertain to a behavior within an environment where agents form habits over consumption varieties instead of a consumption aggregate. Researchers from the Bangko Sentral ng Pilipinas have indicated that the degree of habit formation is moderate due to income uncertainty.[2]

It has been shown that fiscal multipliers in models with deep habits tend to be above unity (Ravn et al., 2006; Zubairy, 2014; Cantore, Levine, Melina, & Yang, 2012; Leith, Moldovan,&Rossi, 2015). Under such habits, government spending shocks could induce countercyclical markups, leading to increases in aggregate demand and wages. As Zubairy (2014) and Leith et al. (2015) have noted, this empirical regularity has generated robust support for the integration of deep habits in dynamic stochastic general equilibrium (DSGE) models that focus on fiscal policy.

In terms of multiplier estimates, tax shocks do not generally fare well compared with spending increases or fiscal stimulus in the short run(Coenen, Straub, & Trabandt, 2013; Villaverde, 2010; Uhlig, 2010) but effects tend to accumulate over time, indicating that when policymakers desire a quick macroeconomic response to any fiscal stimulus, fiscal spending remains a viable choice.

This note contributes to the literature by investigating the impact of taxes on key macroeconomic outcomes. It embeds endogenous fiscal policy tools within a model of deep habits. Such policy tools are designed to respond to public debt, which may, to a certain extent, capture the propensity of the current government to enter into debt contracting. I believe that it is an appropriate modeling alternative, given that households have already developed habits over a variety of goods prior to the implementation of higher taxes. For this paper, I will address two interesting research questions. First, in terms of effects on key macroeconomic outcomes, how do labor earnings and consumption tax shocks compare with government spending in a deep habits model? Second, will the dynamics of tax policies still yield or replicate countercyclical markups?

Using a model with calibrated parameter values from the United States and the Philippines, this paper attempts to analyze how deep habits influence the dynamic effects of taxes on earnings and consumption. Just like in Dacuycuy (2016), I also paid close attention to structures associated with private and public consumption goods since a growing body in the fiscal literature emphasizes the key role of complementarities in consumption (Ganelli & Tervala, 2009; Coenen et al., 2013; Linnemann & Schabert, 2004).To achieve comparability, results from models with superficial habits will also be generated. To my knowledge, no dynamic study assessing the impact of taxes on a model of deep habits has been undertaken in the Philippines.

A clear limitation of this study is that a subset of calibrated values was borrowed from Ravn et al. (2006), who used US data. Ido, however, attempted to use calibrated values for important parameters such as the respective shares of investment, consumption, government to output, and steady state values of labor earnings and consumption tax rates. Other parameters were calibrated using values taken from McNelis, Glindro, Co, and Dakila (2009) who estimated an open economy DSGE model for the Philippines.

The Model[3]

Households

A continuum of price-taking households, monopolistically competitive firms that face nominal inertia, and government that sets fiscal policy populate the economy. Household preferences are assumed to exhibit deep habits, implying that habits are formed with respect to the level of individual goods.[4] Following Ravn et al. (2006) and Leith et al. (2015), I define the habit–adjusted consumption commodity composite x_t^j consumed by household j as

$$x_t^j = \left[\int_0^1 \left(c_{it}^j - \theta s_{it-1}\right)^{1-\frac{1}{\eta}} di\right]^{\frac{1}{1-\frac{1}{\eta}}} \quad (1)$$

where c_{it}^j refers to the level of the ith variety consumed by household j; s_{it} is the stock of habits of private consumption up to t – 1; and η is the intertemporal elasticity of substitution which is assumed to be time-invariant. The stock of habits evolves in the following way:

$$s_{it} = \rho s_{it-1} + (1-\rho)c_{it}^j \quad (2)$$

where ρ is a persistence parameter. Using (1) as the constraint, the optimal level of c_{it}^j after minimizing expenditures $\int_0^1 P_{it}^c c_{it}^j di + \int_0^1 \tau_{it}^c P_{it}^c c_{it}^j di$ is

$$c_{it}^j = (P_{it}^c/P_t^c)^{-\eta} x_t^j + \theta s_{it-1} \quad (3)$$

The price index is given by $P_t^c = \left[\int_0^1 \left((1+\tau_{it}^c)P_{it}^c\right)^{1-\eta} di\right]^{\frac{1}{1-\eta_t}}$, where $\tau_{it}^c = \tau_t^c \; \forall i$ represent the variety-specific tax rate. As explained in Ravn et al. (2006), Cantore et al. (2012), Leith et al. (2015), and Zubairy (2014), the optimal demand has two components, an elastic part consisting of $\left(\frac{P_{it}^c}{P_t^c}\right)^{-\eta_t} x_t^j$ and an inelastic portion θs_{it-1}, which depends on the stock of past private consumption habits. The presence of the lagged component implies that when such is taken as a constraint, a firm's pricing policy will consider lagged habits, thereby rendering its pricing policy dynamic.

As always, government spending hike leads to an increase in aggregate demand. Since firms use optimal household demand as a constraint, this may lead to countercyclical markups, thereby explaining the crowding-in effect on private consumption and the rise in wages.

In this economy, households own physical capital, which evolves in the following way:

$$k_{t+1}^j = (1-\delta)k_t^j + i_t^j \tag{4}$$

Investment decisions rest on households. The level of investment i_t^j is specified as a composite good consisting of differentiated investment goods:

$$i_t^j = \left[\int_0^1 \left(i_{it}^j\right)^{1-\frac{1}{\eta}} di\right]^{\frac{1}{1-\frac{1}{\eta}}} \tag{5}$$

Without accounting for investment adjustment costs, the optimal level is given by

$$i_{it}^j = (P_{it}^c/P_t^c)^{-\eta}\left(i_t^j\right) \tag{6}$$

Aside from investing and consuming, households enter the labor market and receive wages, but they also make decisions on how much bonds to purchase. Following Ravn et al. (2006) and Leith et al. (2015), the constraint is given by

$$(1+\tau_t^c)x_t^j + i_t^j + (1+\tau_t^c)\omega_t + B_t^j$$
$$= R_{t-1}B_{t-1}^j + \left(1-\tau_t^h\right)w_t h_t^j + \Phi_t + r_t^j k_t^j \tag{7}$$

where τ_t^c and τ_t^h represent consumption and labor earnings tax rates, $x_t^j + \omega_t$ is the aggregate consumption of all households, Φ_t refers to the amount of dividend payments, and B_{t+1}^j represents bonds bought by the household. Following Ravn et al. (2006), ω_t is equal to $\theta \int_0^1 P_{it}^c/P_t^c\, c_{it}^j di$.

Government

As modeled in Ravn et al. (2006), Leith et al. (2015), and Cantore et al. (2012), private consumption exhibits deep habit formation. Maintaining symmetry, habits are also formed over a continuum of government consumption goods. The consideration of public consumption reflects the acknowledgement of the degree of complementarity between public and private consumption, which is important since government policy may interact with optimal consumption decisions of the household.

The optimization problem seeks to maximize the amount of habit adjusted government consumption goods.

$$\max_{g_{it}^j} x_t^G = \left[\int_0^1 \left(g_{it} - \theta^G s_{t-1}^g\right)^{1-\frac{1}{\eta}} di\right]^{\frac{1}{1-\frac{1}{\eta}}}$$

$$s.t. \int_0^1 P_{it}^G g_{it}^j\, di \leq P_t^G g_t^j \tag{8}$$

The stock of public consumption habits evolves as

$$s_t^g = \rho s_{t-1}^g + (1-\rho)g_t \tag{9}$$

The optimal amount is given by

$$g_{it} = \left(P_{it}^C/P_t^C\right)^{-\eta_t} x_t^G + \theta^G s_{it-1}^g \tag{10}$$

Since the government levies taxes on labor income $w_t h_t^j$, total tax revenue from labor earnings amounts to $\tau_t^h w_t h_t^j$. Like Leith et al. (2015), I assumed that the portfolio of households consists of government bonds.[5] The flow budget constraint gives us

$$B_t = R_{t-1}B_{t-1} + g_t - \tau_t^h w_t h_t^j - (1+\tau_t^c)x_t^j \tag{11}$$

Following Villaverde (2010), the simple laws of motion for labor income and consumption tax rates are:

$$\log\left(\frac{\tau_t^h}{\bar{\tau}^h}\right) = \rho_\tau^h \log\left(\frac{\tau_{t-1}^h}{\bar{\tau}^h}\right) + d_g \frac{B_{t+1}}{y_t} + \epsilon_t^h, \epsilon_t^h \sim N(0,1) \tag{12}$$

$$\log\left(\frac{\tau_t^c}{\bar{\tau}^c}\right) = \rho_\tau^c \log\left(\frac{\tau_{t-1}^c}{\bar{\tau}^c}\right) + d_g \frac{B_{t+1}}{y_t} + \epsilon_t^c, \epsilon_t^c \sim N(0,1) \tag{13}$$

where d_g represents the sensitivity of tax rates to changes in the debt-output ratio; ϵ_t^h and ϵ_t^c represent identically and independently distributed (i.i.d.) innovations to earnings and consumption tax rates, respectively. The role of d_g is to highlight the sensitivity of tax instruments to changes in debt, something that is important given the high propensity to finance government investments through public debt.

As shown in Villaverde (2010), it is also possible to allow a form of stabilization policy involving government spending by integrating the debt–output ratio. Thus, variation ingovernment spending's law of motion would be:

$$\log\left(\frac{g_t}{\bar{g}}\right) = \rho_g \log\left(\frac{g_{t-1}}{\bar{g}}\right) + d_g\, B_{t+1}/y_t + \epsilon_t^g, \epsilon_t^g \sim N(0,1) \tag{14}$$

where $\bar{g}$ is steady state government expenditures and ϵ_t^g is the innovation to government spending.

Optimization Problem

The objective function of households can be generically written as

$$\max_{\{(x_{t+1})^j, K_{t+1}^j, B_{t+1}^j, I_t^j, h_{t+1}^j\}} E_t \sum_{s=0}^{\infty} \beta^{t+s} U^{\mathcal{M}}\left((x_{t+s})^j, 1 - h_{t+s}^j\right) \tag{15}$$

Based on Ravn et al. (2006), Leith et al. (2015), and Cantore et al. (2012), $U^{\mathcal{M}}(\cdot)$, is modeled with additive CRRA components but public consumption does not affect the marginal utility of private consumption.

$$U^A = E_0 \sum_{t=0}^{\infty} \beta^t \left\{ \left(\frac{(x_t - \nu_t)^{1-\sigma} - 1}{1-\sigma} + \gamma \frac{(1-h_t)^{1-\chi} - 1}{1-\chi} \right) \right\} \tag{16.1}$$

Following Ravn et al. (2006), ν_t is a local preference shock that captures innovations to the level of non-business absorption. The process is specified as:

$$\nu_t = \rho_\nu \nu_{t-1} + \epsilon_t^\nu$$

As mentioned, the structure discounts heavily the presence of consumption complementarities. Following Ganelli and Tervala (2009), I specify (16.2) such that private and public consumption are complementary depending on the sign and magnitude of the parameter ω.[6] The sub-utility functions follow the CRRA specification with representing the inverse of the relative risk aversion parameter and χ is the inverse of the Frisch substitution elasticity.

The following utility specification shows that government consumption is now complementary with respect to private consumption.

$$U^B = E_0 \sum_{t=0}^{\infty} \beta^t \left\{ \frac{\left((x_t - \nu_t) + \omega g_t\right)^{1-\sigma}}{1-\sigma} + \gamma \frac{(1-h_t)^{1-\chi} - 1}{1-\chi} \right\} \tag{16.2}$$

Using the logic of Linnermann and Schabert (2004), Ican specify the CES functional form.[7] Based on their theoretical model, private consumption is predicted to rise after a fiscal spending shock if the elasticity of substitution between public and private spending is sufficiently low.

$$U^C = E_0 \sum_{t=0}^{\infty} \beta^t \left\{ \frac{\left((\kappa(x_t - \nu_t)^\iota + (1-\kappa) g_t^\iota)^{1/\iota}\right)^{1-\sigma}}{1-\vartheta} + \gamma \frac{(1-h_t)^{1-\chi} - 1}{1-\chi} \right\} \tag{16.3}$$

Since the Lagrangian multiplier is equal to the marginal utility of consumption, the first order condition with respect to h_{t+s}^j is

$$-\frac{MU_{h,t}^{\mathcal{M}}}{MU_{x,t}^{\mathcal{M}}} = \frac{\left(1 - \tau_t^h\right)}{\left(1 + \tau_t^c\right)} W_t, \mathcal{M} = A, B, C \tag{17}$$

Conditional on the model considered, it is clear in (17) that the tax rates affect the marginal rates of substitution between labor supply and habit adjusted consumption. Households also decide on the optimal B_{t+1}^{j} and the first order condition is

$$MU_{x,t}^{\mathcal{M}}\Omega_{t,t+1} = \beta E_t MU_{x,t+1}^{\mathcal{M}}, \mathcal{M} = A, B, C \quad (18)$$

where $\Omega_{t,t+1}$ is a one – period stochastic discount factor.

The Euler equation is given by

$$MU_{x,t}^{\mathcal{M}} = \beta E_t MU_{x,t+1}^{\mathcal{M}}(r_{t+1}), \mathcal{M} = A, B, C$$

Firms

Monopolistically competitive firms supply goods to both private and public final goods producers. Following Ravn et al. (2006), let the nominal profits be specified as

$$\varphi_{it} = (P_{it}^{c}/P_t^{c})(c_{its} + i_{it} + g_{it}) - w_{it}h_{it} - r_{it}k_{it} \quad (19)$$

Equation (19) does not incorporate price adjustment mechanisms as specified in Zubairy (2014), Cantore et al. (2012), and Leith et al. (2015). The present discounted value of profits is given by

$$\Phi_{it} = E_t\left\{\sum_{s=0}^{\infty}\Omega_{t,t+s}\varphi_{it}\right\}$$

where $\Omega_{t,t+s}$ is the one period stochastic discount factor.

The maximization of $\Phi_{it} = E_t\{\sum_{s=0}^{\infty}\Omega_{t,t+s}\varphi_{it}\}$ is subject to(2), (3), (5), (8), (9), and the following resource constraint

$$A_t F(k_t, h_t) - FC = c_{it+s} + i_{it+s} + g_{it+s} \quad (20)$$

where $F(k_t, h_t)$ is a Cobb=Douglas production function and FC refers to the fixed cost.

Thus, the Lagrangian is given by

$$\begin{aligned}\mathcal{L} = E_t\left\{\sum_{s=0}^{\infty}\Omega_{t,t+s}\varphi_{it}\right\} &+ MC_t(A_t F(k_t, h_t) - FC - c_{it+s} \\ &- c_{it+s} - i_{it+s} - g_{it+s}) + \upsilon_t((P_{it}^{c}/P_t^{c})^{-\eta}x_t \\ &+ \theta s_{it-1} - c_{it}) + \mu_t(\rho s_{it-1} + (1-\rho)c_{it} - s_{it}) \\ &+ \upsilon_t^{g}\left((P_{it}^{c}/P_t^{c})^{-\eta}x_t^{g} + \theta s_{it-1}^{g} - g_{it}\right) + \\ &+ \mu_t^{g}\left(\rho s_{it-1}^{g} + (1-\rho)g_{it} - s_{it}^{g}\right)\end{aligned}$$

where MC_t is the marginal cost and the multiplier of the resource constraint; ν_t is the multiplier associated with the optimal demand constraint; μ_t represents the multiplier associated with the evolution of private consumption habits; υ_t^{g} and μ_t^{g} are the multipliers for the optimal demand for public consumption and evolution of public consumption habits, respectively.

Similar to Cantore et al. (2012) and Ravn et al. (2006), the first order conditions are derived with respect to $c_{it}, g_{it}, s_{it}, s_{it}^{G}, h_{it}, k_{it}, P_{it}$, respectively:

$$-MC_t - \upsilon_t + \mu_t(1-\rho) + (P_{it}^{c}/P_t^{c}) = 0 \quad (21)$$

$$-MC_t - \upsilon_t^{g} + \mu_t^{g}(1-\rho) + (P_{it}^{c}/P_t^{c}) = 0 \quad (22)$$

$$\theta E_t\beta\Omega_{t,t+s}\upsilon_{t+1} - \mu_t + \rho\beta E_t\Omega_{t,t+s}\mu_{t+1} = 0 \quad (23)$$

$$\theta E_t\beta\Omega_{t,t+s}\upsilon_{t+1}^{g} - \mu_t^{g} + \rho\beta E_t\Omega_{t,t+s}\mu_t^{g} = 0 \quad (24)$$

$$-w_{it} + MC_t A_t F_h(k_t, h_t) = 0 \quad (25.1)$$

$$-r_t^{k} + MC_t A_t F_k(k_t, h_t) = 0 \quad (25.2)$$

$$\begin{aligned}(C_{it+s} + I_{it+s} + G_{it+s}) - \eta(P_{it}^{c}/P_t^{c})^{-\eta-1}\upsilon_t x_t \quad (26) \\ - \eta(P_{it}^{c}/P_t^{c})^{-\eta-1}\upsilon_t x_t + (1-\eta)(P_{it}^{c}/P_t^{c})^{-\eta} i_t \\ + \eta_t(P_{it}^{c}/P_t^{c})^{-\eta-1}MC_t i_t = 0\end{aligned}$$

Calibration Strategy

The calibration follows closely that of Ravn et al. (2006), but I now use Philippine data for some parameters such as respective shares of consumption, taxes, investment, and government spending. Following McNelis et al. (2009), I set both $\boldsymbol{\theta^{C}}$ ***and*** $\boldsymbol{\theta^{G}}$ to 0.5.[8] Using UN Data and Penn World Tables, the labor share $s_h = \frac{wh}{k^{\alpha}h^{1-\alpha-\phi}} = 0.34$, the share of consumption to output $s_c = \frac{c}{k^{\alpha}h^{1-\alpha-\phi}} = 0.75$. The share of government expenditures to output is 0.13. and investment's share to output is 0.17. Using data on interest rates from the Bangko Sentral ng Pilipinas, the annual interest rate is pegged at 3%, and I followed Ravn et al. (2006) by setting the Frisch labor supply elasticity to 1.3 $\beta = \frac{1}{R} = 0.992$. Given that the labor share is $1-\alpha$,the elasticity of output to capital is 0.68. I also assumed that in the steady state, $R_t = R_{t-1} = \bar{R} = 0.0334$.

Adopting most of the parameter values inRavn et al. (2006), Table 1 shows the calibrated parameters.

For this study, I assumed a 1% increase in the consumption tax rate and a 1% reduction in labor earnings tax rates. Given the model solution, the impulse response function results should indicate percent deviations from the steady state.

Results

The central finding in Ravn et al. (2006) is the counter cyclicality of markups induced by a change in aggregate demand due to unexpected government spending shocks. Using my model, I examined whether there is evidence that a reduction in the labor earnings tax rate or an increase in consumption tax will influence the countercyclical pricing behavior of firms.[9] After all, a reduction in earnings taxes, although less expansionary relative to fiscal spending, is also expected to induce an expansion in aggregate demand by stimulating private consumption. I am also interested in comparing the effectiveness of consumption tax relative to an earnings tax.

I begin by stating that outcomes may be induced by preference structures. Starting with the specification (16.1), Inoted that the addition of endogenous taxpolicies dampens private consumption even in the presence of a government spending shock. This is reminiscent of the general A positive fiscal spending shock increases wages, expands output, and results in markups behaving countercyclically.

Table 1
Calibrated Parameters

Parameter	Value	Description
$\boldsymbol{\beta}$	0.992	Subjective discount factor
$\boldsymbol{\sigma}$	2	Inverse of intertemporal elasticity of substitution
$\boldsymbol{\theta^C}, \boldsymbol{\theta^G}$	0.5,0.5	Degree of habit formation
$\boldsymbol{\rho}$	0.85	Persistence of habit stock
$\boldsymbol{\alpha}$	0.68	Capital elasticity of output
$\boldsymbol{\delta}$	0.025	Quarterly depreciation rate
$\boldsymbol{\eta}$	6.0	Elasticity of substitution across varieties
h	0.2	Steady state fraction of time devoted to work
$\boldsymbol{\epsilon_{hw}}$	1.3	Frisch elasticity of labor supply
$\boldsymbol{RT}$	0.0344	Interest rate on bonds
R		Nominal interest rate
$\boldsymbol{\bar{\tau}^h}$	0.32	Steady state earnings tax rate
$\boldsymbol{\bar{\tau}^c}$	0.10	Steady state consumption tax rate
$\boldsymbol{\rho_g, \rho_\tau^h, \rho_\tau^c, \rho_v, \rho_A}$	0.9,0.9, 0.9,0.9, 0.95	Persistence of government spending, earnings and consumption taxes
$\boldsymbol{\omega}$	1;-1.5	Parameter determining the degree of complementarity/substitutability between private and public consumption
$\boldsymbol{\kappa}$	0.5	Parameter in the CES Utility Specification
$\boldsymbol{\iota}$	0.5	Parameter in the CES Utility Specification

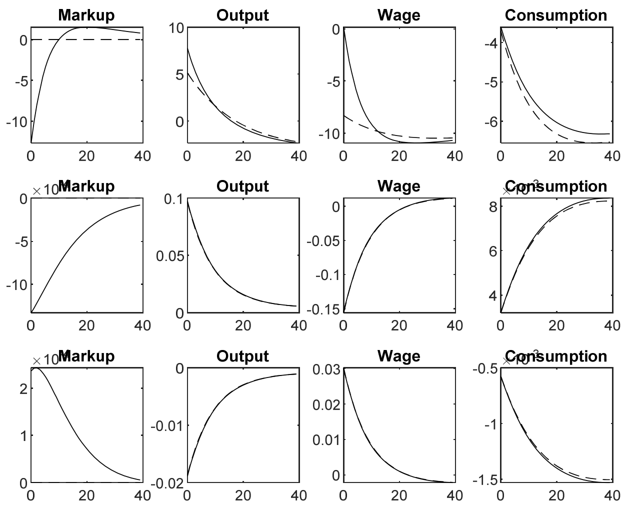

Figure 1. Effects of fiscal spending, earnings and consumption tax shocks: Base specification (deep habits – solid line; superficial habits – dashed line).

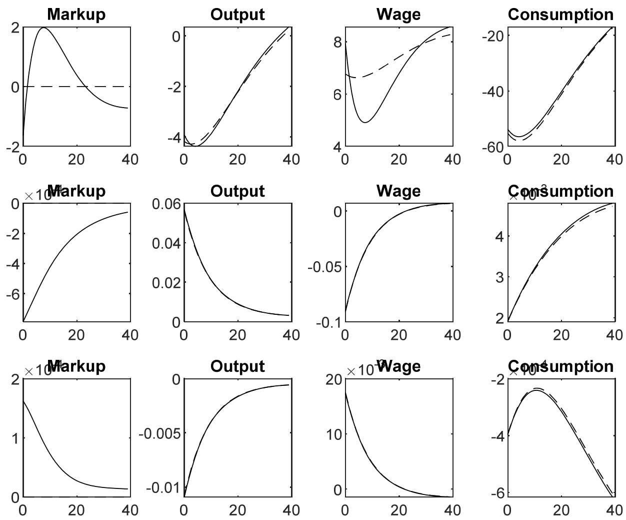

Figure 2. Effects of fiscal spending, earnings and consumption tax shocks: Perfect substitutes (deep habits – solid line; superficial habits – dashed line).

In contrast, a 1% reduction in earnings taxes is expected to boost private consumption. This is a consequence of a countercyclical markup and higheroutput, but such reduction allows wages to fall,as workers now have less incentive to work longer. Consistent with expectations, private consumption increases.

As noted previously in Dacuycuy (2016), a change in specification to one that introduces public consumption in the utility function as a perfect substitute forprivate consumption leads to different dynamics of the outcomes.As shown in Figure 2, private consumption falls because of fiscal spending, which is consistent withthe neoclassical prediction. While markup initially dips, there is clearly an upward pressure before leveling up. The notso countercyclical profile induces households to substitute away from private consumption goods,and this results in a decline in output. A 1% reduction in earnings tax replicates results in terms of a countercyclical pricing behavior andincreases in output and private consumption. Wages also decline.An increase in consumption taxes increases markup and wages, reduces output, and increases private consumption.

As already known, a negative coefficient of public consumption in specification (16.2) may change the dynamics of the outcomes. As shown in Figure 3, when government spending increases, markup exhibits countercyclically at first and becomes cyclical, output falls, wages retain their downward trajectory, and private consumption declines. A reduction in earnings taxes would preserve everything. This is consistent with the labor supply effect of increases in income.In contrast to a reduction in earnings tax, consumption taxreduces output, increasesprivate consumption, and wages.

What will happen if private and public consumption are not treated as substitutes but rather complements can be observed.It seems that increasing fiscal spending replicates the results in Ravn et al. (2006), except that private consumption falls. In here, deep habits matter, as the output's response is higher.In contrast, a reduction in earnings tax appears consistent with an increase in fiscal spending under the deep habits framework only in terms of its effects on output and wages but significantly deviates from results that show countercyclicality of markups and private consumption. Given an increase in consumption tax, markups are not countercyclical, output and private consumption fall, and wages rise.

Finally, as shown in Figure 4, it can be observed that when CES specification is adopted, favorable earnings taxes would expand output, private consumption, and reduce markups and wages.Higher consumption

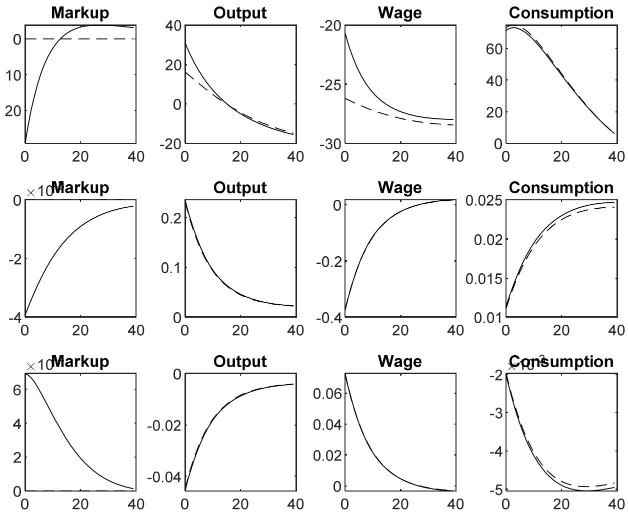

Figure 3. Effects of fiscal spending, earnings and consumption tax shocks: Complements (=-1.5) (deep habits – solid line; superficial habits – dashed line).

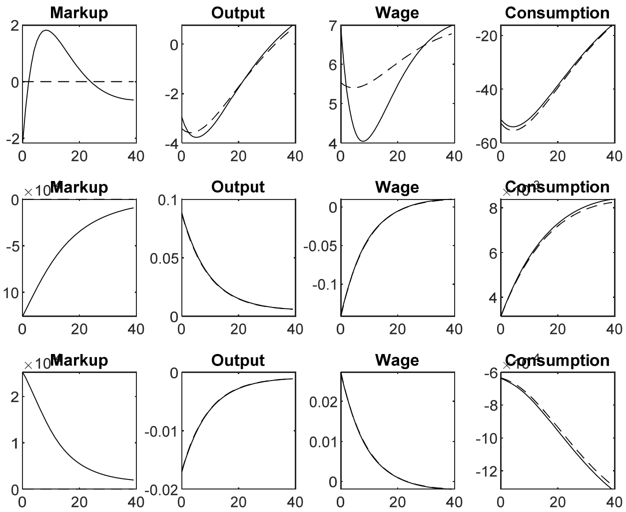

Figure 4. Effects of fiscal spending, earnings and consumption tax shocks: CES ((deep habits – solid line; superficial habits – dashed line).

taxes increaseboth markups and wages and reduce output and private consumption. When fiscal spending shocks occur, output expansion is short-lived, as wages increase but private consumption falls. Markups also increase.

Discussion

Using calibration, the model estimates are clearly addressing positive issues, specifically the response of output and private consumption to exogenous shocks in government spending and tax rates. Though the impact of spending shocks depends on preference structures, it is clear that output is stimulated more compared with the effects of tax shocks. This is consistent with the observation of Villaverde (2010). Following Uhlig's (2010)line of argument, however, it is possible that in the presence of distortionary taxes, output increases attributable to fiscal spending may be counteracted by the distortions in the labor market brought about by future tax increases designed to balance the budget.

The results suggest thata labor earnings tax rate cut would replicate the nice properties associated with a fiscal stimulus in a deep habits model of Ravn et al. (2006). Apparently, the inclusion of distortionary taxation policies has negatively affected the ability of fiscal shocks to stimulate private consumption when the preference structure follows Ravn et al. (2006), indicating that households may view that increases in government spending will trigger future tax increases, thereby eroding their wealth in the process. However, it is also clear that markups become significant once consumption taxes are factored in. An increase in consumption taxes would likely result in an increase in markups, while the opposite happens when such taxes are reduced. Both private consumption and output are negatively affected by a higher consumption tax.

While the model does not consider key labor market outcomes such as unemployment, it is known that reductions in earnings taxes may also affect labor market outcomes by reducing labor supply. The simulation exercisesclearly showed the theoretical and empirical value of using specifications that jointly integrate public and private consumption into utility representations, thereby lending support to DSGE models that introduce more flexible interactions between public and private consumption in shaping preferences.

Concluding Remarks

Using a calibrated dynamic model that embeds endogenous fiscal policy tools, this note provides simulation evidence on the effectiveness of tax and fiscal policies in determining key macroeconomic outcomes. The model was chosen because newly imposed taxes have affected the prices of consumption varieties and because of deep habits, pricing policies of firms have become dynamic. Building upon the base model of Ravn et al. (2006), the note shows that preference structures have a key role to play in determining the response of private consumption to fiscal stimulus represented by increases in government spending and tax cuts.

The results show that lowering labor earnings taxes stimulate the economy through a higher level of output and private consumption. In the case of consumption taxes, they exacerbate markups, resulting in lower private consumption. Wages also increase, and output reacts negatively.

Endnotes

[1] I am grateful to the anonymous referee for his excellent comments and suggestions. Thanks are also due to the administrators of De La Salle University for logistical and financial support, as well as to the speakers and participants of the 2nd De La Salle University – National Institute for Development Administration (DLSU – NIDA) Macroeconomics Workshop held on May 28, 2018 in De La Salle University. All remaining errors are, of course, my responsibility.

[2] Literature discussing the role of habits in the Philippines remain sparse. As a rare contribution,McNelis, Glindro, Co, and Dakila(2009) calibrated a DSGE model, assigning a moderate value of 0.5 to the habit formation parameter due to income uncertainty. No other authoritative study has put forward a value for the said parameter.

[3] This section builds upon the seminal model of Ravn et al. (2006), draws heavily from their Technical Notes and augments model elements using Cantore et al. (2012) and Leith et al. (2015).

[4] When habits do form around aggregate consumption goods, then they are called superficial habits.

[5] Following Leeper, Walker, and Yang (2010), households optimally purchase 1 – period bonds that yield in period t. The interest rate on bonds is determined through the interaction between households (demand side) and the government (supply side).

[6] Note that the specification does not include output and the elasticity parameter. In Ganelli and Tervala (2009), a sufficient condition for the positive response of private consumption to fiscal spending shocks is that $\boldsymbol{\omega} < 0$.

[7] Cantore et al. (2012)also used a CES aggregator function to form the consumption composite embedded in a multiplicative utility function.

[8] The obvious implication of a reduction in the value of the deep habit parameter relative to Ravn et al.'s (2006) is to make the deep habit-based IRFs closer to those based on superficial habits.

[9] For replicability, I used MATLAB codes of Ravn et al. (2006), appropriately modifying some codes. The code, along with component programs,were downloaded from http://www.columbia.edu/~mu2166/1st_order/1st_order.htm.

References

Cantore, C., Levine, P., Melina, G., & Yang, B. (2012). A fiscal stimulus with deep habits and optimal monetary policy. *Economics Letters, 117*, 348–353.

Coenen, G., Straub, R., & Trabandt, M. (2013). Gauging the effects of fiscal stimulus packages in the Euro area. *Journal of Economic Dynamics & Control, 37*, 367-386.

Dacuycuy, L. (2016). Preferences, government investment, and disbursement sudden stops. *Philippine Review of Economics, 53*(1), 1–18.

Ganelli, G., & Tervala, J. (2009). Can government spending increase private consumption? The role of complementarity. *Economics Letter, 103*, 5–7.

Leeper, E., Walker, T., & Yang, S. (2010). Government investment and fiscal stimulus. *Journal of Monetary Economics, 57*, 1000–1012.

Leith, C., Moldovan, I., & Rossi, R. (2015). Monetary and fiscal policy under deep habits. *Journal of Economics Dynamics & Control, 52*, 55–74.

Linnemann, L., & Schabert, A. (2004). Can fiscal spending stimulate private consumption? *Economics Letters, 82*, 173–179.

McNelis, P., Glindro, E., Co, F., & Dakila, J. F. (2009*). Macroeconomic model for policy analysis and insight:Adynamic stochastic generalequilibrium model for the Bangko Sentral ng Pilipinas*(BSP Working Paper Series No. 2009-01).Manila: Bangko Sentral ng Pilipinas.

Ravn, M., Schmitt-Grohe, & Uribe, M. (2006). Deep habits. *Review of Economic Studies, 73*, 195–218.

Ravn, M., Schmitt-Grohe, S., & Uribe, M. (2004). *Deep habits: Technical notes*.Unpublished.

Uhlig, H. (2010). Some fiscal calculus. *American Economic Review,100*(2), 30–34.

Villaverde, J. (2010). Fiscal policy in a model with financial frictions. *American Economic Review, 100*(2), 35–40.

Zubairy, S. (2014). On fiscal multipliers: Estimates from a medium scale DSGE model. *International Economic Review, 55*(1), 169–195.