The Canon Institute for Global Studies

CIGS Working Paper Series No. WP 13-003(E)

Asset Price Targeting Government Spending and Equilibrium Indeterminacy in A Sticky-Price Economy

Kengo NUTAHARA

University College London, London, UK
Senshu University, Tokyo, Japan
The Canon Institute for Global Studies, Tokyo, Japan

May 6, 2013

*(Visiting until March 2014) Room 110, Drayton House, 30 Gordon Street, London WC1H 0AX, United Kingdom. Email: k.nutahara@ucl.ac.uk. (After April 2014) 2-1-1 Higashimita, Tama-ku, Kawasaki, Kanagawa 214-8580, Japan. Tel.: +81-44-911-1230. Fax: +81-44-911-1231. E-mail:
nutti@isc.senshu-u.ac.jp

General Incorporated Foundation
The Canon Institute for Global Studies
11F Shin-Marunouchi Bldg., 5-1 Marunouchi 1-chome,
Chiyoda-ku, Tokyo 100-6511 Japan
Phone: +81-3-6213-0550 http:/www.canon-igs.org

Abstract

This study investigates aggregate implications of fiscal policy that responds to asset price fluctuations. In our sticky-price model, the monetary authority follows a Taylor rule and the fiscal authority follows a rule that the target of government spending is asset prices and responds negatively to the asset price fluctuations. It is shown that government spending that targets asset prices is a source of equilibrium indeterminacy.

Keywords: asset prices; fiscal policy; equilibrium determinacy; sticky prices

JEL classification: E32; E52; H50

1 Introduction

The design of fiscal policy is often discussed in economics. However, in many cases, the discussion focuses on taxation. Since the determinants of government spending are sometimes highly political issues such as wars and elections, they are beyond the scope of research in macroeconomics. Thus, a traditional treatment in economic theory is considering government spending as an exogenous variable.

However, government spending is sometimes affected by economic variables and is endogenously determined in an economy. For example, Fukuda and Yamada (2011) find empirically that, during the 1990s, stock prices were a target of the Japanese government and government spending was a decreasing function of share prices; if the stock price decreased, the Japanese government increased their spending to stimulate the economy. The Japanese government used asset prices as an index of economic performance, since they are observable immediately while current GDP is not. They conclude that this fiscal policy was a cause of the increase in Japanese fiscal deficit during the 1990s. While their finding is applicable only to the Japanese economy, such a fiscal policy might possibly be adopted by other countries.

In this study, we investigate theoretically the aggregate implication of fiscal policy that targets asset prices. Our baseline model is a standard New Keynesian one. Nominal prices are sticky under a Calvo-style price setting, and the production technology gives constant returns to scale. The monetary authority follows a Taylor rule, and the nominal interest rate is an increasing function of inflation and output. The government spending is a decreasing function of share price. The share price reflects monopolistic firms' profits as in Carlstrom and Fuerst (2007). We find that if the elasticity of government spending to the share price is sufficiently high, equilibrium indeterminacy arises. This indeterminacy does not occur if output is a target of government spending. Thus, our result implies that the asset price should not be a target of fiscal policy.

The key to interpret this indeterminacy result is the relationship between output and inflation. It is well known that the stance of a central bank toward inflation is important for equilibrium determinacy; for example, as in the Taylor principle. In the standard sticky-price models, including an output term in the Taylor rule strengthens the overall reaction to inflation because a permanent increase in inflation generates an increase in output. However, if the government spending is affected by the share price negatively, there is a possibility that inflation and output would move in opposite directions. A permanent increase in inflation generates a decrease in the share price since the sticky price generates an increase in the real marginal cost of firms. Under our fiscal policy rule, this induces an increase in government spending. An increase in government consumption induces an increase in output and a decrease in private consumption. Then, the labor supply curve shifts downward, the real wage rate and the real marginal cost of firms decreases, and firms lower their prices. Finally, this mechanism generates pressure owing to an increase in output and a decrease in inflation.

Our result is robust to a sticky price–wage economy à la Erceg, Henderson, and Levin (2000), and a sticky price–wage economy with rule-of-thumb households and debt dynamics, à la Galí, Lopéz-Salido, and Valléz (2007). In the latter economy, the aggregate consumption increases in response to a government spending shock. However, the government spending shock decreases the consumption of standard Ricardian households that decide the labor supply, and the labor supply curve shifts downward; in this case, there is a pressure of increase in output and decrease in inflation as in the baseline economy.

The relationship between fiscal policy and equilibrium indeterminacy was investigated by many researchers—for example, by Leeper (1991), Guo and Harrison (2004) and Giannitsarou (2007). In such literature, the design and effects of a taxation rule are mainly focused and there is little discussion on those of a government spending rule. There is also little discussion on the fiscal policy response to asset prices. In contrast, in monetary policy literature, some studies investigate the macroeconomic consequence of monetary policy response to asset prices. Bullard and Schaling (2002) and Carlstrom and Fuerst (2007) find that monetary policy response to asset prices is a source of equilibrium indeterminacy. Thus, the present study aims to fill the gap in existing literature on fiscal policy. The results presented here suggest that fiscal policymakers must exercise caution in adjusting levels of government spending to counter asset price fluctuations.

The rest of this paper is organized as follows. Section 2 introduces the model used in this study. Section 3 presents the main result, its interpretation, and a case where government spending targets output. Section 4 determines the robustness of our results. We consider two cases: (i) an economy with sticky prices and wages, and (ii) a sticky price–wage economy with rule-of-thumb households and debt dynamics. Finally, Section 5 presents our concluding remarks.

2 The baseline model

Our baseline model is a standard sticky-price economy. One departure is that government spending is affected by asset price fluctuation.

2.1 Households

Assume that the household in our model begins period t with M_t cash balances, B_t one-period nominal bonds that pay R_{t-1} gross risk-free interest rate, and S_t shares of stock that sell at price Q_t.

The utility function is

$$U\left(C_t, H_t, \frac{M_{t+1}}{P_t}\right) = \frac{C_t^{1-\sigma}}{1-\sigma} - \phi\frac{H_t^{1+\gamma}}{1+\gamma} + V\left(\frac{M_{t+1}}{P_t}\right), \tag{1}$$

where $\sigma > 0$, $\phi > 0$, $\gamma > 0$, $V(\cdot)$ is increasing and concave, C_t denotes consumption, H_t denotes labor supply, P_t denotes aggregate price level, and M_{t+1}/P_t denotes real cash balances at the end of period t.

The household's budget constraint is

$$P_t C_t + M_{t+1} + B_{t+1} + P_t Q_t S_{t+1} \\ \leq P_t W_t H_t + M_t + R_{t-1} B_t + P_t (Q_t + D_t) S_t + X_t - T_t, \tag{2}$$

where W_t denotes wage rate, D_t denotes share dividends, X_t denotes monetary injection, and T_t denotes a lump-sum tax.

The first order conditions of households are

$$\phi C_t^{\sigma} H_t^{\gamma} = W_t, \tag{3}$$

$$C_t^{-\sigma} = \beta C_{t+1}^{-\sigma} \cdot \frac{R_t}{\Pi_{t+1}}, \tag{4}$$

$$C_t^{-\sigma} Q_t = \beta C_{t+1}^{-\sigma} \left[Q_{t+1} + D_{t+1} \right], \tag{5}$$

where $\Pi_{t+1} \equiv P_{t+1}/P_t$ denotes gross inflation. Equation (3) is the intratemporal optimization condition, equation (4) is the Euler equation for consumption, and equation (5) is the Euler equation for shares.

Equation (5) can be rewritten as a familiar asset price equation:

$$Q_t = \left[Q_{t+1} + D_{t+1} \right] \frac{\Pi_{t+1}}{R_t}. \tag{6}$$

2.2 Firms

Our model has monopolistically competitive intermediate-goods firms and competitive final-goods firms. The markets for production factors are competitive.

The production technology of final-goods firms is

$$Y_t = \left(\int_0^1 Y_t(i)^{\frac{\theta-1}{\theta}} di \right)^{\frac{\theta}{\theta-1}}, \tag{7}$$

where θ denotes the elasticity of substitution and $Y_t(i)$ denotes outputs of intermediate-goods indexed by i. The profit maximization of final-goods firms implies the demand curve for $Y_t(i)$ as

$$Y_t(i) = \left(\frac{P_t(i)}{P_t}\right)^{-\theta} Y_t, \tag{8}$$

where $P_t(i)$ denotes the price level of intermediate-goods indexed by i. Combining equations (7) and (8) yields the following price index for intermediate goods:

$$P_t = \left(\int_0^1 P_t(i)^{1-\theta} di\right)^{\frac{1}{1-\theta}}. \tag{9}$$

The intermediate-goods firms are monopolistically competitive and produce intermediate-goods $Y_t(i)$ employing labor $H_t(i)$ from households. The production function of intermediate-goods firms is

$$Y_t(i) = H_t(i). \tag{10}$$

The cost minimization problem implies

$$W_t = Z_t, , \tag{11}$$

where Z_t denotes the Lagrange multiplier of the cost minimization problem and can be interpreted as the real marginal cost.

Intermediate goods firms set their prices subject to Calvo-type price staggering. The price can be re-optimized at period t only with probability $1 - \kappa$. Under this setting, as shown by Yun (1996), the New Keynesian Phillips curve is

$$\pi_t = \beta\pi_{t+1} + \lambda z_t, \tag{12}$$

where

$$\lambda \equiv \frac{(1-\kappa)(1-\kappa\beta)}{\kappa(1+\eta\beta)},$$

and π_t and z_t denote the log-deviations from a steady state of inflation and the real marginal cost, respectively.

2.3 Fiscal and monetary policies

The main feature of this model is that the fiscal authority cares about asset price fluctuations:

$$G_t = \Psi(Q_t), \tag{13}$$

where $\Psi(\cdot)$ is a decreasing function. Let $-\eta \equiv \Psi'(Q)/\Psi(Q)$ denote the steady-state elasticity of the government purchase to the asset price.

The monetary authority follows a standard Taylor rule:

$$r_t = \tau_\pi \pi_t + \tau_y y_t, \tag{14}$$

where r_t and y_t denote the log-deviations from a steady state of R_t and Y_t, respectively. The sensitivities of the central bank to inflation and output are τ_π and τ_y, respectively. We focus on the case with $\tau_\pi > 1$ and $\tau_y \geq 0$.

2.4 Equilibrium

The market clearing conditions for labor, share, and debt are, respectively,

$$H_t = \int_0^1 H_t(i)di, \tag{15}$$

$$S_t = 1, \tag{16}$$

$$B_t = 0. \tag{17}$$

The resource constraint is

$$C_t + G_t = Y_t, \tag{18}$$

and the aggregate production function is

$$Y_t = \frac{1}{\Delta_t} H_t, \tag{19}$$

where Δ_t is a measure of resource cost of price dispersion:

$$\Delta_t \equiv \int_0^1 \left(\frac{P_t(i)}{P_t} \right)^{-\theta} di. \tag{20}$$

For simplicity, we ignore effects from the price dispersion.

We focus on an equilibrium where all monopolistic competitive firms are symmetric. As in Carlstrom and Fuerst's (2007) study, the firm's profits are paid out as dividends to the shareholders. For simplicity, we assume that the measure of firms is equal to the measure of households. The dividend of intermediate-goods firms is given by

$$D_t = Y_t - W_t H_t. \tag{21}$$

By equation (11), the dividend is written by

$$D_t = (1 - Z_t) Y_t. \tag{22}$$

2.5 Linearized system

The linearized system is given as follows:

$$\sigma c_t + \gamma y_t = w_t, \tag{23}$$

$$\sigma(c_{t+1} - c_t) = r_t - \pi_{t+1}, \tag{24}$$

$$q_t = \beta q_{t+1} + (1 - \beta) d_{t+1} + (\pi_{t+1} - r_t), \tag{25}$$

$$d_t = y_t - \frac{z}{1 - z} z_t, \tag{26}$$

$$y_t = \phi_c c_t + (1 - \phi_c) g_t, \tag{27}$$

$$g_t = -\eta q_t, \tag{28}$$

$$w_t = z_t, \tag{29}$$

$$\pi_t = \beta \pi_{t+1} + \lambda z_t, \tag{30}$$

$$r_t = \tau \pi_t + \tau_y y_t, \tag{31}$$

where the small letters denote the log-deviations from the steady state, ϕ_c, the steady-state ratio of consumption to output, and z, the steady-state real marginal cost.

The equilibrium system is reduced to the following matrix form:

$$\begin{bmatrix} 1 & \chi & \eta\gamma\chi(1-\phi_c) \\ \beta & 0 & 0 \\ 1 & -(1-\beta)A & \beta-\eta\chi(1-\beta)(1-\phi_c) \end{bmatrix} \begin{bmatrix} \pi_{t+1} \\ z_{t+1} \\ q_{t+1} \end{bmatrix} = \begin{bmatrix} \tau_\pi & \chi+\tau_y\frac{\phi_c}{\sigma+\phi_c\gamma} & (\gamma-\tau_y)\eta\chi(1-\phi_c) \\ 1 & -\lambda & 0 \\ \tau_\pi & \tau_y\frac{\phi_c}{\sigma+\phi_c\gamma} & 1-\chi\tau_y\eta(1-\phi_c) \end{bmatrix} \begin{bmatrix} \pi_t \\ z_t \\ q_t \end{bmatrix},$$

where

$$\chi \equiv \frac{\sigma}{\sigma+\phi_c\gamma} > 0,$$
$$A \equiv \frac{z(\phi_c+\sigma+\phi_c\gamma)-\phi_c}{(1-z)[\sigma+\phi_c\gamma]}.$$

The first equation is the consumption Euler equation (24); the second, the New Keynesian Phillips curve (30); and the third, the Euler equation for shares (25).

For the analysis, we transform this system as follows:

$$\begin{bmatrix} \pi_{t+1} \\ z_{t+1} \\ q_{t+1} \end{bmatrix} = \boldsymbol{F} \begin{bmatrix} \pi_t \\ z_t \\ q_t \end{bmatrix},$$

where

$$\boldsymbol{F} \equiv \begin{bmatrix} 1 & \chi & \eta\gamma\chi(1-\phi_c) \\ \beta & 0 & 0 \\ 1 & -(1-\beta)A & \beta-\eta\chi(1-\beta)(1-\phi_c) \end{bmatrix}^{-1} \begin{bmatrix} \tau_\pi & \chi+\tau_y\frac{\phi_c}{\sigma+\phi_c\gamma} & (\gamma-\tau_y)\eta\chi(1-\phi_c) \\ 1 & -\lambda & 0 \\ \tau_\pi & \tau_y\frac{\phi_c}{\sigma+\phi_c\gamma} & 1-\chi\tau_y\eta(1-\phi_c) \end{bmatrix}.$$

3 Main result

3.1 Main result

For simplicity, we specify that the relative risk aversion is one, that is, $\sigma = 1$, and the Frisch elasticity of labor supply is zero, that is, $\gamma = 0$. Under these parameter values, the characteristic equation is

$$\Gamma(x) = -x^3 + Tx^2 - Mx + D, \tag{32}$$

where

$$\begin{aligned}
D &\equiv \frac{\beta\left[\beta - (1-\beta)(1-\phi_c)\eta\right]}{\tau_\pi\lambda + 1 + \tau_y[\phi_c - (1-\phi_c)\eta]}, \\
M &\equiv \frac{1}{\tau_\pi\lambda + 1 + \tau_y[\phi_c - (1-\phi_c)\eta]}\left\{\Phi_1\eta + \beta\left[(2+\lambda) + \beta(1+\tau_y\phi_c)\right]\right\}, \\
T &\equiv \frac{1}{\tau_\pi\lambda + 1 + \tau_y[\phi_c - (1-\phi_c)\eta]}\left\{\Phi_2\eta + 1 + \lambda + \beta(2 + 2\tau_y\phi_c + \tau_\pi\lambda)\right\}, \\
\Phi_1 &\equiv \beta\left[\lambda - \tau_y(1+A) + \phi_c\tau_y(\phi_c + A)\right] - \lambda\left[1 - \phi_c(1-\beta)\right] - (1-\phi_c) \\
&\qquad + \beta^2(1-\phi_c)\left[\tau_y(\phi_c + A) + 1\right], \\
\Phi_2 &\equiv -(1 + \tau_y A + \tau_\pi\lambda)(1-\phi_c)(1-\beta) - \tau_y\left[1 + \beta(1-2\phi_c) - \phi_c^2(1-\beta)\right].
\end{aligned}$$

As shown by Brooks (2004), a necessary and sufficient condition for equilibrium determinacy of this three-dimensional system is

$$|D| < 1, \tag{33}$$

$$|T + M| < M + 1, \tag{34}$$

$$D^2 - TD + M < 1. \tag{35}$$

Since this condition is very complicated, we employ numerical analysis here. We use the following parameter values. The discount factor, β, is 0.99. The steady-state real marginal cost, z, is 0.85. The sticky-price parameter, λ, is 0.019. These are taken from Carlstrom and Fuerst (2007). The steady-state ratio of consumption to output, ϕ_c, is 0.8.

Figure 1 shows the equilibrium determinacy region.

[Inset Figure 1]

In the region with red diamonds, equilibrium is determinate and in others, indeterminate. The vertical axis shows the central bank's stance to inflation τ_π. The horizontal axis shows the fiscal authority's stance to the share price η. It is found that if η is sufficiently high, equilibrium indeterminacy arises.

The key to interpret the result is the relationship between output and inflation. In a standard sticky-price model, the stance of a central bank to inflation is important for equilibrium determinacy. One of the most famous ones is the Taylor principle: if a one-percent permanent increase in inflation occurs, a central bank should increase the nominal interest rate by more than one percentage point.

Since a fraction of firms cannot re-optimize their prices in a sticky-price economy, a permanent increase in inflation generates an increase in real marginal cost. This increase in the real marginal cost implies a decrease in the markup rate of firms, and the aggregate demand and the output increase. Consequently, as discussed by Woodford (2003), including an output term in a Taylor rule just as in (14) strengthens the overall reaction to inflation and is helpful for equilibrium determinacy.

However, in our model, this inclusion of the output term is harmful for equilibrium determinacy. The intuition is as follows. A permanent increase in inflation implies a decrease in the profit of firms because their markup declines. Then, their share prices decline. This relationship between inflation and share prices is highlighted by Carlstrom and Fuerst (2007). In the current model, such decline in share price generates an increase in government consumption. In standard dynamic stochastic general equilibrium models, an increase in government consumption generates an increase in output and a decrease in private consumption. Then, the labor supply curve (23) shifts downward, and the real wage rate decreases. The decrease in the real wage implies a decrease in the real marginal cost of firms by (29), and firms lower the prices by the Phillips curve (30). Finally, this mechanism generates a pressure of an increase in output and a decrease in inflation.

If the elasticity of government consumption to the share price η is sufficiently high, the effect explained in the previous paragraph is large, and a permanent increase in inflation implies a decrease in output. Then, a combined fiscal policy response to the share price and monetary policy response to output weakens the overall reaction to inflation and equilibrium indeterminacy likely arises.

If a central bank does not care about output, namely, $\tau_y = 0$, the fiscal policy response to the share price is not a source of equilibrium indeterminacy. Figure 2 illustrates the case where $\tau_y = 0$ and other parameters are the same as those of Figure 1.

[Inset Figure 2]

This is because the government spending that targets asset price generates no effect on the overall reaction of the nominal interest rate to inflation in the case where there is no term of output in the Taylor rule.

Figure 3 shows other evidence supporting our intuition.

[Inset Figure 3]

It is the determinacy region if $\eta = 4.5$ on the (τ_π, τ_y) plane. Parameters are the same as those of Figure 1. It is found that increasing τ_y enlarges the equilibrium indeterminacy region.

3.2 Government spending that targets output

In the baseline model, we consider a government spending policy that targets asset price. Here, we consider an alternative target of the fiscal authority: output.

We replace the fiscal policy rule (28) by the following rule:

$$g_t = -\eta y_t, \tag{36}$$

Under this policy, the government spending increases if the output decreases.

In this case, the equilibrium system is summarized to the following bivariate one:

$$\begin{bmatrix} 1 & -\xi\tau_y & 0 \\ \beta & 0 & 0 \\ 1 & -(1-\beta)B-\xi\tau_y & \beta \end{bmatrix} \begin{bmatrix} \pi_{t+1} \\ z_{t+1} \\ q_{t+1} \end{bmatrix} = \begin{bmatrix} \tau_\pi & 0 & 0 \\ 1 & -\lambda & 0 \\ \tau_\pi & 0 & 1 \end{bmatrix} \begin{bmatrix} \pi_t \\ z_t \\ q_t \end{bmatrix},$$

where

$$\xi \equiv \frac{\phi_c}{\sigma[1+\eta(1-\phi_c)]+\gamma\phi_c} > 0,$$
$$B = \frac{z\{\sigma[1+\eta(1-\phi_c)]+\gamma\phi_c\} - \phi_c(1-z)}{(1-z)\{\sigma[1+\eta(1-\phi_c)]+\gamma\phi_c\}}.$$

Inflation π_t and the real marginal cost z_t are determined only by the first two equations:

$$\begin{bmatrix} 1 & -\xi\tau_y \\ \beta & 0 \end{bmatrix} \begin{bmatrix} \pi_{t+1} \\ z_{t+1} \end{bmatrix} = \begin{bmatrix} \tau_\pi & 0 \\ 1 & -\lambda \end{bmatrix} \begin{bmatrix} \pi_t \\ z_t \end{bmatrix},$$

The characteristic equation of this system is

$$\Gamma_2(x) = x^2 - T_2 x + D_2,$$

where

$$D_2 \equiv -\frac{\tau_y\xi\beta}{\tau_\pi\lambda},$$
$$T_2 \equiv \frac{\lambda-\tau_y\xi}{\tau_\pi\lambda}.$$

A necessary and sufficient condition for equilibrium determinacy is characterized by $D_2 < 1$ and $D_2 > |T_2| - 1$. It is obvious that the first equation is satisfied for $\tau_\pi > 0$ and $\tau_y \geq 0$. The second equation is reduced to the following condition:

$$(\tau_\pi - 1)\lambda + \tau_y\xi(1-\beta) > 0. \tag{37}$$

Since ξ is decreasing in η, an increase in η makes it difficult to hold this condition. However, it is found that if $\tau_\pi > 1$, equilibrium indeterminacy never arises for all $\eta > 0$ and $\tau_y \geq 0$. Therefore, if output is the target of fiscal policy, there is no indeterminacy problem.

4 Robustness

4.1 Sticky price–wage economy

To this point, we assumed that wages are flexible. In this subsection, à la Erceg, Henderson, and Levin (2000), we introduce nominal wage rigidity to the model presented in the previous section. This is because the labor supply curve is different if wages are sticky. In this economy, both prices and wages are sticky.

The labor supply behavior is given by

$$\phi C_t^{\sigma} L_t^{\gamma} = Zh_t W_t, \tag{38}$$

where Zh_t is the monopoly distortion, which measures the difference between the household's marginal rate of substitution and the real wage. Erceg, Henderson, and Levin (2000) demonstrate that the nominal wage adjustment is given by

$$\pi_{t+1}^{w} = \beta \pi_t^{w} + \lambda^{w} zh_t, \tag{39}$$

where zh_t denotes the log-deviation of Zh_t from a steady state and π_t^w denotes the nominal wage inflation:

$$\pi_t^{w} = (w_t - w_{t-1}) + \pi_t, \tag{40}$$

where w_t denotes the log-deviation of real wage from a steady state.

To investigate determinacy regions of equilibrium, we employ numerical analyses. The nominal wage-stickiness parameter λ^w is 0.035, the value also employed by Carlstrom and Fuerst (2007). Other values are the same as in the previous section. Figure 4 presents the determinacy and indeterminacy regions on the (η, τ_π) plane.

[Inset Figure 4]

As in the previous section, in the model with sticky prices and wages, fiscal policy response to the share price is a source of equilibrium indeterminacy.

4.2 Rule-of-thumb households and debt dynamics

The key mechanism of indeterminacy in our model is that an increase in government spending generates a decrease in consumption. However, many empirical studies on structural VARs including that by Blanchard and Perotti (2002) find that a positive government spending shock increases private consumption.

In this subsection, we introduce rule-of-thumb households and debt dynamics to the model in the previous subsection à la Galí, Loéz-Salido, and Valléz (2007) who propose a model where a government spending shock increases consumption.

In their model, there are rule-of-thumb households, an addition to standard Ricardian households. Rule-of-thumb households are assumed to behave in a "hand-to-mouth" fashion, consuming their entire current income. Then, the budget constraint is

$$C_t^R = W_t L_t^R - T_t, \tag{41}$$

where C_t^R, L_t^R, and T_t denote the consumption level, labor supply, and lump-sum tax of rule-of-thumb households, respectively. Following the discussion in Galí, Loéz-Salido, and Valléz (2007), we assume that the labor supply of rule-of-thumb households is the same as that of Ricardian households.

The aggregate consumption level C_t^a is defined as

$$C_t^a = \theta C_t + (1 - \theta) C_t^R, \tag{42}$$

where θ is the fraction of rule-of-thumb households and C_t is the consumption of standard Ricardian households.

The government budget constraint is

$$P_t T_t + R_t^{-1} B_{t+1} = B_t + P_t G_t. \tag{43}$$

The log-linearized condition of rule-of-thumb households is

$$c_t^R = \left(\frac{WL^R}{C^a}\right) w_t + \ell_t^R - \left(\frac{Y}{C^a}\right) t_t, \tag{44}$$

and the linearized tax rule is

$$t_t = \phi_g g_t + \phi_b b_t, \tag{45}$$

where t_t and b_t denote the log-deviations from a steady state of the lump-sum tax and the government debt, respectively.

Figure 5 shows the determinacy and indeterminacy region on the (η, τ_π) plane. Following Galí, Lopéz-Salido, and Vallléz (2007), we set $\theta = 0.5$, $\phi_b = 0.33$, and $\phi_g = 0.1$. Other parameters, including a sticky-wage parameter, are the same as those of the previous subsection.

[Inset Figure 5]

In this economy, the aggregate consumption increases as a response to a government spending shock. Thus, it seems that the intuition regarding the baseline economy no longer holds. However, the government spending shock decreases the consumption of standard Ricardian households who decide the labor supply. Hence, the labor supply curve shifts downward and the increase in output and decrease in inflation causes pressure, as in the baseline economy.

5 Concluding remarks

Traditional economic theory treats government spending as an exogenous variable. However, as recently ascertained by Fukuda and Yamada (2011), government spending is endogenously determined in an economy.

In the present theoretical study, we investigated the aggregate implication of fiscal policy that targets asset price. Our baseline economy is a standard, constant returns to scale, New Keynesian model. The monetary authority follows a Taylor rule, and the government spending is a decreasing function of the share price. The share price reflects monopolistic firms' profits. We found that if the elasticity of government spending to the share price is sufficiently high, equilibrium indeterminacy arises.

Our result occurs because fiscal policy response to asset prices changes the relationship between inflation and output. In a standard sticky-price model, a permanent increase in inflation implies an increase in output. However, if the government spending is affected by asset prices, inflation and output move in opposite directions since an increase in the government spending has positive effects on output but negative effects on inflation.

Fukuda and Yamada (2011) point out that in Japan, the government spending that targets asset price is a cause of increase in its fiscal deficit. Thus, our result highlights another undesirable feature of such government spending.

References

[1] Blanchard, O., and R. Perotti, 2002, An empirical characterization of the dynamic effects of changes in government spending and taxes on output, Quarterly Journal of Economics, 117, 1329–1368.

[2] Brooks, B. P., 2004, Linear stability conditions for a first-order three-dimensional discrete dynamic, Applied Mathematics Letters, 17, 463–66.

[3] Bullard, J., and E. Schaling, 2002, Why the Fed should ignore the stock market, Review, Federal Reserve Bank of St. Louis, issue Mar., 35–42.

[4] Carlstrom, C. T., and T. S., Fuerst, 2007. Asset prices, nominal rigidities, and monetary policy, Review of Economics Dynamics, 10, 256–275.

[5] Fukuda, S., and J. Yamada, 2011, Stock price targeting and fiscal deficit in Japan: Why did the fiscal deficit increase during Japan's lost decades?, Journal of Japanese and International Economies, 25 447–464.

[6] Erceg, C.J., D.W., Henderson, and A.T. Levin, 2000, Optimal monetary policy with staggered wage and price contracts, Journal of Monetary Economics, 46, 281–313.

[7] Galí, J., J. D. López-Salido, and J. Vallés, 2007, Understanding the effects of government spending on consumption, Journal of European Economic Association, 5(1), 227–270.

[8] Giannitsarou, G, 2007, Balanced budget rules and aggregate instability: the role of consumption taxes, Economic Journal, 117, 1423–1435.

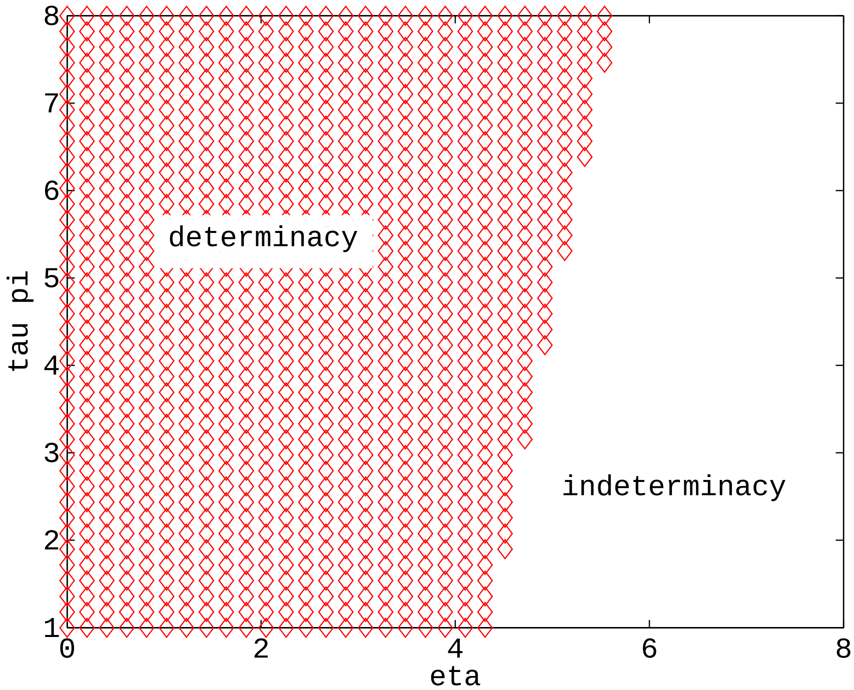
[9] Guo, J. T., and S. G, Harrison, 2004, Balanced-budget rules and macroeconomic (in)stability, Journal of Economic Theory, 119(2), 357–363.

[10] Leeper, E., 1991, Equilibria under "active" and "passive" monetary and fiscal policies, Journal of Monetary Economics, 27, 129–147.

[11] Yun, T., 1996. Nominal price rigidity, money supply endogeneity, and business cycles. Journal of Monetary Economics, 37(2), 345–370.

[12] Woodford, M., 2003, Interest and Prices: Foundations of a Theory of Monetary Policy, Princeton University Press.

Figure 1: Determinacy region (1): Baseline

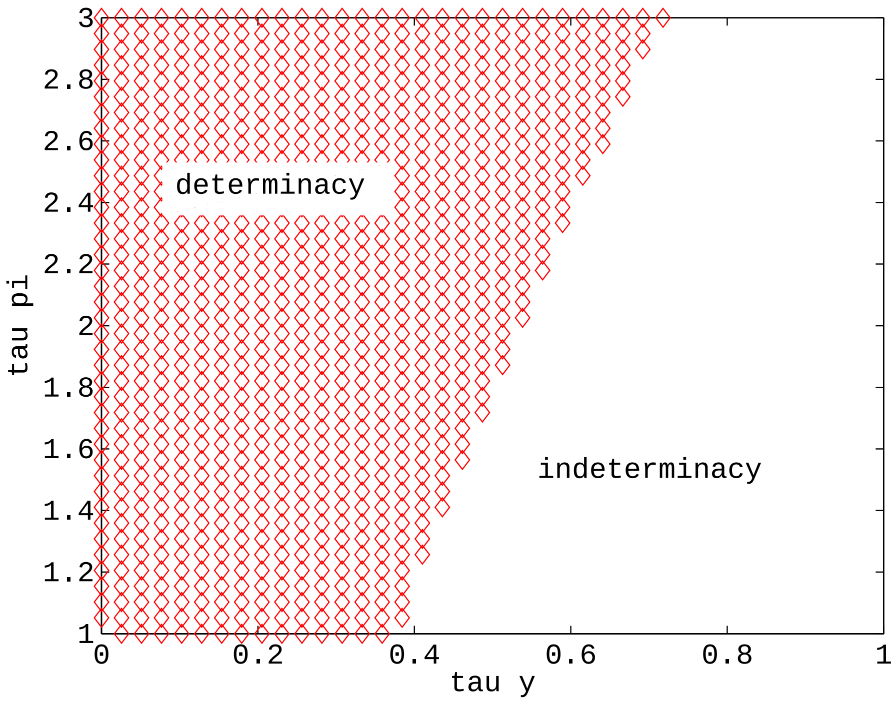


Notes: In the region with red diamonds, equilibrium is determinate and in others, indeterminate. The vertical axis shows the central bank's stance to inflation τ_π. The horizontal axis shows the fiscal authority's stance to the share price η.

Figure 2: Determinacy region (2): Baseline with $\tau_y = 0$

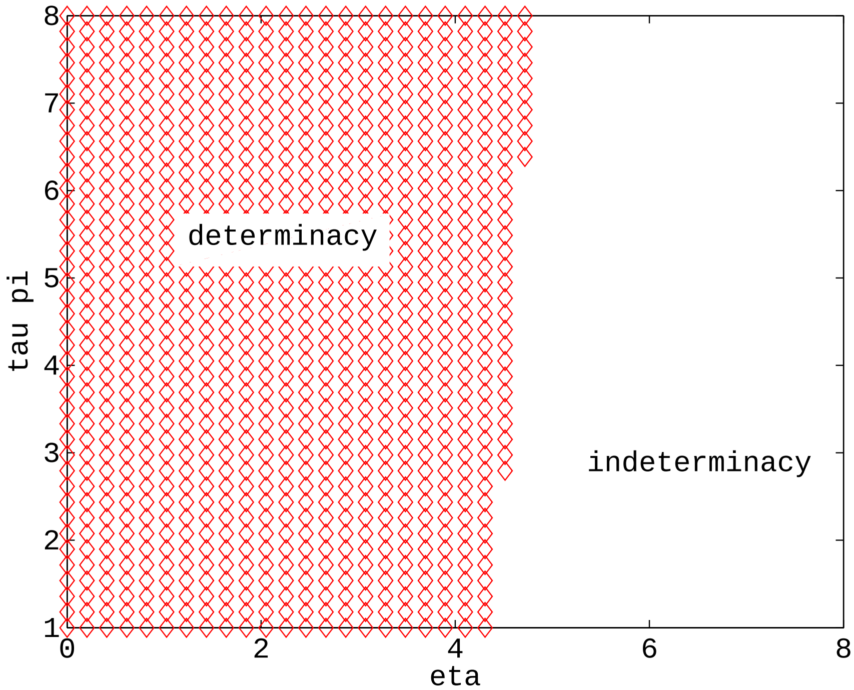
Notes: In the region with red diamonds, equilibrium is determinate and in others, indeterminate. The vertical axis shows the central bank's stance to inflation τ_π. The horizontal axis shows the fiscal authority's stance to the share price η.

Figure 3: Determinacy region (3): Baseline with $\eta = 4.5$



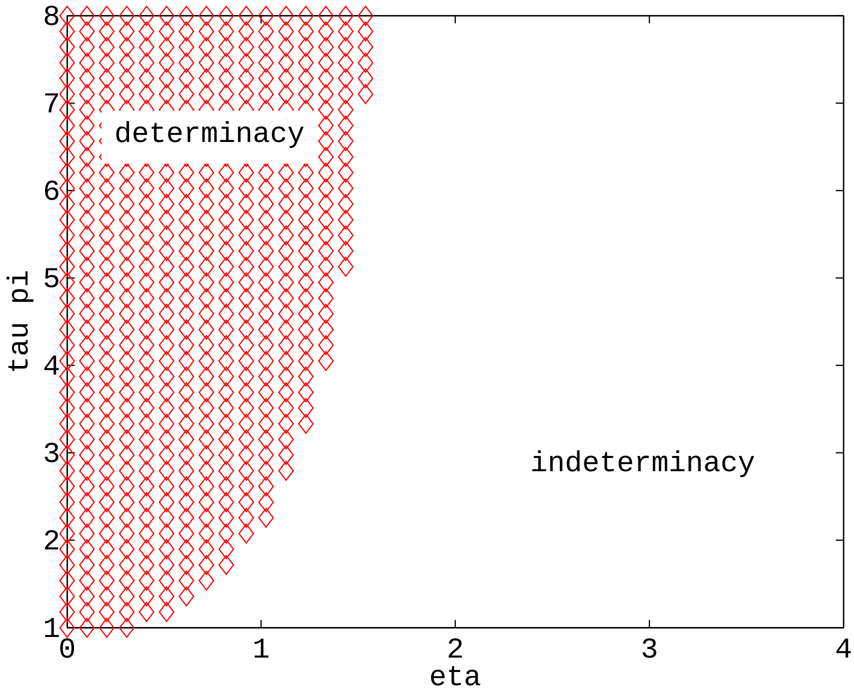
Notes: In the region with red diamonds, equilibrium is determinate and in others, indeterminate. The vertical axis shows the central bank's stance to inflation τ_π. The horizontal axis shows the central bank's stance to output τ_y.

Figure 4: Determinacy region (4): Sticky price–wage economy



Notes: In the region with red diamonds, equilibrium is determinate and in others, indeterminate. The vertical axis shows the central bank's stance to inflation τ_π. The horizontal axis shows the fiscal authority's stance to the share price η.

Figure 5: Determinacy region (5): With rule-of-thumb households and debt dynamics



Notes: In the region with red diamonds, equilibrium is determinate and in others, indeterminate. The vertical axis shows the central bank's stance to inflation τ_π. The horizontal axis shows the fiscal authority's stance to the share price η.