Money-Financed Fiscal Stimulus: The Effects of an Anticipated Shock*

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Abstract

This note investigates the effect of an anticipated shock to money-financed government spending on output and inflation. Using the standard New Keynesian framework, Galí (2014) showed that the unanticipated increase in the government spending financed by money creation can generate a boom with relatively mild inflation and thus improve the welfare. We show that, if a government spending shock is anticipated due to time lags between the decision and the implementation, (1) such a shock may cause a recession rather than a boom; (2) the longer the implementation lag, the deeper the recession; (3) whether or not the anticipated money-financed fiscal stimulus causes a recession critically depends on the interest semi-elasticity of money demand; and (4) the welfare-improving effect of the money-financed fiscal stimulus declines.

JEL Classification: E32; E52; E62

Keywords: Seigniorage, Government spending, News shock, Anticipation effect

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1 Introduction

Government spending to stimulate the economy is typically financed through government debt and eventually taxes. The great recession of the last decade led to high levels of the government-debt-to-GDP ratio in many countries and these countries' policy interest rates hit the zero lower bound. Against this backdrop, Galí (2014) discusses the government spending financed by money creation, as a policy option to boost the aggregate demand. He shows that, in the presence of nominal rigidities, an unexpected shock to money-financed government spending can stimulate economic activity with mild inflation. Such a "money-financed fiscal stimulus" is shown to improve the welfare, if output sufficiently falls short of the efficient level.

This note investigates the effect of an *anticipated* money-financed fiscal stimulus, using Galí's (2014) New Keynesian framework with nominal rigidities. This is an extremely straightforward extension of the model, but it captures an important aspect of fiscal policy. Recent studies on fiscal policy emphasize that one should distinguish between anticipated and unanticipated shocks to the fiscal policy variables. Ramey (2011) provides empirical evidence that government spending tends to involve long lags between the decision to spend and an actual increase in spending. Yang (2005), Leeper, Richter, and Walker (2010), Mertens and Ravn (2011), and Fujiwara and Waki (2016), among others, use general equilibrium models with a distortionary tax and find that model responses to an anticipated tax change and its policy implications differ substantially from those to a surprise tax shock.

We find that the distinction between anticipated and unanticipated shocks matters in the evaluation of the money-financed fiscal stimulus. As Galí (2014) emphasizes, an (unexpected) money-financed fiscal stimulus directly stimulates aggregate demand through increases in government spending and the money supply, and thus causes a boom under reasonable degrees of nominal rigidity. By contrast, we show that, if the money-financed fiscal stimulus is anticipated due to implementation lags, the anticipated policy change may lead to a recession rather than a boom. We also show that, as the implementation lag lengthens, the economy experiences a deeper recession and a weaker expansionary effect of government spending after the implementation.

The mechanism behind this result can be understood from an influential work by Ball (1994), who finds that a credible disinflationary announcement in the presence of nominal rigidities causes a boom rather than a recession. In his analysis, if a decline in the money growth rate is anticipated, forward-looking firms reduce prices prior to the actual decline in the money growth rate. Ball (1994) assumes that households' consumption is constrained by their real money balances (i.e., the cash-in-advance (CIA) constraint). In this case, the lower aggregate prices result in higher real money balances and this in turn generates the higher aggregate expenditure, implying an expansion prior to the decline in the money growth rate.

The argument of Ball (1994) is completely applicable to our context, but in an opposite direction. In our analysis, if the money-financed fiscal stimulus is fully anticipated, forward-looking firms increase prices prior to the actual increase in money supply that finances new government spending. The higher aggregate prices result in the lower real money balances and thus generate the lower aggregate expenditure, leading to a recession prior to the fiscal stimulus. If the implementation lags lengthen, the firms have more chances to increase prices before the implementation of fiscal policy. As a result, the higher aggregate prices deepen the recession and may reduce the welfare-improving effects of the money-financed fiscal stimulus.

Our results are fairly robust to changes in model parameters, except for the interest semi-elasticity of money demand. If the money demand is inelastic to the nominal interest rate, the nominal and real interest rates are expected to increase sharply, reducing aggregate consumption. However, if the money demand is elastic to the nominal interest rate, the nominal interest rate is not as volatile as the case of money demand with low interest semi-elasticity. As a result, together with a positive inflation expectation, the real interest rate continues to be lower than the steady-state level, boosting the aggregate consumption. After all, even if the money-financed fiscal stimulus is anticipated, the fiscal stimulus under a high interest semi-elasticity has a strong effect on output with relatively mild inflation.

Following Galí (2014), we also compute the welfare of the economies. Our simulation suggests that the welfare-improving effect of the money-financed fiscal stimulus lessens if it is anticipated in advance. The extent to which the welfare-improving effect lessens depends on the interest semi-elasticity of money demand. If the interest semi-elasticity of money demand is low, the welfare-improving effect of the money-financed fiscal stimulus can even

disappear. On the other hand, when the semi-elasticity is high, the reduction of the welfare-improving effect is relatively small.

We thus conclude that the efficacy of money-financed fiscal stimulus depends critically on the extent of "surprise" and the interest semi-elasticity of money demand. An implication for fiscal policy is that policymakers should be keen on the interest semi-elasticity of money demand in evaluating the money-financed fiscal stimulus. If policymakers are faced with a low interest semi-elasticity of money demand, they should shorten the implementation lag of the fiscal stimulus. If the implementation lag is difficult to shorten, the money-financed fiscal stimulus would be a useful policy option only under a high interest semi-elasticity of money demand.

2 The model

The model we consider here is a small-scale New Keynesian model that simplifies the model of Galí (2014).[1] He analyzes the effect of an unanticipated change in the government spending financed through seigniorage. By contrast, we focus on the impacts of anticipated shocks to government spending on macroeconomic aggregates. We introduce the anticipated shocks in the form of news shock. In what follows, we describe the log-linearized equations of the model.[2] Unless otherwise noted, the variables in this note are the log-deviations from the steady state.

Aggregate consumption of the households follows the consumption Euler equation:

$$c_t = E_t c_{t+1} - \sigma^{-1}(i_t - E_t \pi^p_{t+1}), \tag{1}$$

where c_t denotes consumption and i_t is the log-deviation of the gross nominal interest rate. Also, π^p_t is price inflation and E_t is the expectations operator conditional on the information available at period t. The parameter σ is the degree of relative risk aversion. The relation between the nominal and real interest rates is given by the Fisher equation: $r_t \equiv i_t - E_t \pi^p_{t+1}$.

[1] The model we present here removes capital and investment from the model of Galí (2014). However, our main results remain unaltered in the model with capital.

[2] The details of the model are discussed in the Appendix A of this note. The appendix is available upon request.

Price and wage inflation evolves as

$$\pi_t^p = \beta E_t \pi_{t+1}^p - \lambda_p \mu_t^p, \tag{2}$$

$$\pi_t^w = \beta E_t \pi_{t+1}^w - \lambda_w \mu_t^w, \tag{3}$$

where π_t^w denotes wage inflation. Here, β is the discount factor satisfying $\beta \in (0,1)$. The coefficients $\lambda_p \equiv \frac{(1-\theta_p)(1-\beta\theta_p)}{\theta_p}\frac{1-\alpha}{1-\alpha+\epsilon_p\alpha}$ and $\lambda_w \equiv \frac{(1-\theta_w)(1-\beta\theta_w)}{\theta_w(1+\epsilon_w\varphi)}$, respectively. In these coefficients, θ_p and θ_w index the degree of nominal rigidities, $\epsilon_p > 1$ (or $\epsilon_w > 1$) is the elasticity of substitution across goods (or labor services), and $1-\alpha$ is the labor share in the firm's production function and φ points to the inverse of the Frisch elasticity of labor supply. The average price and wage markups denoted respectively μ_t^p and μ_t^w are

$$\mu_t^p = -\omega_t - \alpha n_t, \tag{4}$$

$$\mu_t^w = \omega_t - (\sigma c_t + \varphi n_t), \tag{5}$$

where ω_t is real wages and n_t denotes employment. Real wages follow $\omega_t = \omega_{t-1} + \pi_t^w - \pi_t^p$.

The equilibrium condition for the final goods market is

$$y_t = (1-\gamma)c_t + g_t, \tag{6}$$

where the parameter γ is the steady-state share of government spending to output. Note that g_t denotes deviations of government purchases from its steady-state value, expressed as a fraction of steady-state output. Namely, g_t is defined by $g_t = (G_t - G)/Y$, where G_t is the level of government purchases and G and Y are the steady-state value of government purchases and output, respectively.

We assume that g_t follows an exogenous AR(1) process as in Galí (2014), but allow for the implementation lag:

$$g_t = \rho_g g_{t-1} + u_{t-h}^g, \tag{7}$$

where $\rho_g \in [0,1)$ indexes the persistence for g_t and u_{t-h}^g is an independent and identically distributed exogenous government spending shock. Note that u_{t-h}^g indicates that shocks to

government spending materiarize in period t but agents learn the news at period $t-h$.

The aggregate production function can be approximated by

$$y_t = (1-\alpha)n_t. \tag{8}$$

For simplicity, we assume that the money demand function reflects the CIA constraint:

$$m_t - p_t = c_t, \tag{9}$$

where $m_t - p_t$ denotes the real money balances. We decompose the real balances into m_t and p_t, where these variables are defined as the log-deviation from the initial value before government spending shocks hit the economy. This equation implies that $\Delta m_t = \pi_t^p + c_t - c_{t-1}$, where $\Delta m_t = m_t - m_{t-1}$. Without loss of generality, we normalize the initial value of m_t to zero.

Let V be the steady-state income velocity of money. As discussed in Galí (2014), the level of the seigniorage expressed by a fraction of the steady-state output can be approximated by $(1/V)\Delta m_t$ in a neighborhood of zero inflation steady state.[3] If the government spending is fully financed by money creation,

$$\Delta m_t \simeq V g_t. \tag{10}$$

Following Galí (2014), we refer to g_t that satisfies (10) as the "money-financed fiscal stimulus" (or money-financed contraction if $g_t < 0$). In the original model of Galí (2014), he specified the debt dynamics from the government budget constraint and the market clearing condition for the government bond. As discussed in Galí (2014), the debt dynamics are residually determined in the case of the money-financed fiscal stimulus. Hence, we drop the equation from the system of linearized equations.

[3] When government spending exceeding the steady state level $(G_t - G)$ is financed by the seigniorage, $G_t - G = \Delta M_t / P_t$ holds, where M_t and P_t are the levels of money supply and prices, respectively. Dividing both sides of the equation by Y yields $g_t = \Delta M_t / (P_t Y)$. The first-order approximation of the right-hand side around the zero inflation steady state results in $(1/V)\Delta m_t$.

3 Results

3.1 The effect of anticipated government spending on output

For simulations, we select $\beta = 0.99$, $\sigma = 1$, $\varphi = 1$, $\alpha = 1/4$, $\gamma = 0.2$, $\rho_g = 0.5$, $\epsilon_p = 6$, $\epsilon_w = 21$, and $\theta_p = \theta_w = 3/4$. These parameters are all standard, consistent with Christiano, Eichenbaum and Evans (2005) and Galí (2014). Given the CIA constraint, the steady-state income velocity V is 1.25.[4] In terms of the length of implementation lag h, there is no strong consensus about how far in advance agents become aware of possible changes to the money-financed fiscal stimulus. Hence, we consider a relatively wide range of h for simulations. Ramey (2011) argues that defense spending shocks identified by vector autoregressions using postwar U.S. data are forecastable four quarters in advance. She also argues that even nondefense spending would be known at least months in advance. Using a narrative-approach tax shock series of Romer and Romer (2010), Mertens and Ravn (2011) find that the median implementation lag is six quarters for a tax shock. Taking these previous studies into account, we set $h = 4$ as a benchmark and, later, we look into $h = 1$ and $h = 6$ for robustness.

Figure 1 plots the impulse responses of output to a 1 percent increase in the anticipated shocks to government spending relative to the steady-state output. For comparisons, we also plot the impulse responses to an unanticipated shock, which was analyzed by Galí (2014). In the figure, the shock hits the economy in period 0. In response to the unanticipated fiscal stimulus, output exhibits a large expansion, which amounts to about 1.5 percent in magnitude.

By contrast, if the shock is anticipated four quarters in advance, the output responses dramatically differ from the case of unanticipated shock. Output gradually decreases and the decline is substantial: about -0.7 percent immediately before the shock materializes. We also note that the positive effect of the fiscal stimulus on output is smaller than the case of an unanticipated shock.

The reason for the recession in response to an anticipated shock of the fiscal stimulus is

[4] In particular, denoting the steady-state level of real money balances and consumption by $\mathcal{L}$ and C, respectively, $V \equiv Y/\mathcal{L} = \frac{C}{\mathcal{L}}\frac{Y}{C} = 1/(1-\gamma) = 1.25$, where the third equality follows from the CIA constraint.

straightforward. When government purchases are announced in advance, expected inflation increases due to higher aggregate demand in the future. On the other hand, the money market equilibrium is characterized by $m_t - p_t = c_t$ and money supply increases only after the fiscal policy is implemented. For the money market to be balanced, consumption must decline until the money supply used for the fiscal stimulus is increased. Note also that $y_t = (1-\gamma)c_t$ before g_t increases. Hence, the money-financed fiscal stimulus in this model causes a recession rather than a boom, if it is anticipated.

The mechanism behind the output reduction is the same as what Ball (1994) discovered in the context of the credible announcement of disinflationary policy. Ball (1994) shows that the credible announcement of disinflationary policy (i.e., an anticipated decline in the money growth rate) causes a boom rather than a recession in a sticky price model. In our model with government expenditure, the anticipated money-financed fiscal stimulus is essentially equivalent to an announcement of inflationary policy, causing a recession rather than a boom.

Let us turn to the responses of other macroeconomic variables. Figure 2 displays the impulse response functions to the anticipated shock. As shown in the upper-right panel, inflation immediately responds to the news of fiscal stimulus due to the forward-looking property of inflation. Consumption and real wages exhibit dynamic patterns similar to output. Due to reduced consumption and output, labor demand declines, reducing real wages. The nominal and real interest rates are volatile, peaking in period -1. This is because an extremely high growth in consumption at the time of the fiscal stimulus requires extremely high real interest rate (i.e., $E_{-1}c_0 - c_{-1} = \sigma^{-1}(i_{-1} - E_{-1}\pi_0)$). Given the relatively low expected inflation, the nominal interest rate also shows a spike before the fiscal stimulus.

3.2 The effect of the implementation lags

Due to a lack of broad consensus on the length of implementation lag, it is useful to compare the output responses for different values of h. The results are shown in the left panel of Figure 3. The panel indicates that the longer implementation lags lead to a deeper recession. To understand the mechanism behind the output dynamics, note that, together with the CIA constraint (9), the market clearing condition for final goods (6) can be rewritten

as follows:

$$y_t = (1-\gamma)(m_t - p_t) + g_t. \tag{11}$$

Recall that m_t and p_t were defined as the log-deviation from the initial value before government spending shocks hit the economy. Hence, m_t equals zero before the money-financed fiscal stimulus is announced. This implies that p_t also equals zero before the announcement. While m_t and g_t remain unchanged until the implementation (i.e., $m_t = g_t = 0$ for $t < 0$), however, p_t can change during periods between the announcement and implementation (i.e., $-h \leq t < 0$). Hence, $y_t = -(1-\gamma)p_t$ for period $-h \leq t < 0$. The right panel of the figure shows that the increase in p_t is larger under longer implementation lags. The forward-looking price responses imply that the recession becomes more severe as h increases. Intuitively, as the implementation lags lengthen, firms have more chances to adjust their nominal prices upward before the fiscal stimulus is implemented, leading to a larger decline in output.

3.3 The role of the interest semi-elasticity of money demand

The findings in the preceding subsections are qualitatively robust to parameter values such as σ, φ, α, and V as well as ϵ_p and ϵ_w. An exception is the interest semi-elasticity of money demand. In this subsection, we discuss how and why our findings in the preceding sections critically depend on the interest semi-elasticity of money demand.

To highlight the role of the interest semi-elasticity of money demand, we replace the CIA constraint by the more general money demand function used in Galí (2014):

$$m_t - p_t = c_t - \eta i_t, \tag{12}$$

where η denotes the interest semi-elasticity of money demand. Combining (6) with (12), we have

$$y_t = (1-\gamma)(m_t - p_t) + (1-\gamma)\eta i_t + g_t. \tag{13}$$

Imposing $m_t = g_t = 0$ for period $t < 0$ on the above equation, we have $y_t = -(1-\gamma)p_t + (1-\gamma)\eta i_t$ for period $-h < t < 0$. Hence, if $i_t > 0$ for period $t < 0$, a recession may not take place even if the fiscal stimulus is anticipated. Obviously, as η is larger, the recession is less

likely to occur.

To see the impact of η on the consequence of the fiscal stimulus, we set η at 0.5 and 40. These parameters reflect the fact that the interest semi-elasticity varies somewhat across the model's specifications. Using a small-scale New Keynesian model, Ireland (2004) reports that η ranges between 0.12 and 0.72. On the other hand, Guerron-Quintana (2011) finds η to be much larger under a model similar to Christiano, Eichenbaum, and Evans (2005): $\eta = 40$.[5] Hence, considering the elasticity estimates that vary widely across the previous studies, we take the two parameter values and compare the model dynamics.

Figure 4 reports the comparisons of impulse responses for different values of η. In each panel of the figure, the line with circular markers represents the impulse responses for $\eta = 0.5$ and the line with plus markers is for $\eta = 40$. Unlike the case of the CIA constraint that restricts the steady-state income velocity at $V = 1.25$, we follow Galí (2014) and set $V = 4$, a more reasonable value for the U.S. economy.

When the interest semi-elasticity of money demand is low, the model dynamics are qualitatively very similar to those in Figure 2. Given the increased prices before the implementation of the fiscal stimulus, the nominal money demand increases, which raises the nominal interest rate before the implementation of the fiscal stimulus. The higher nominal interest rate leads to a higher real interest rate. Hence, output falls as in Figure 2.

By contrast, if the money demand is elastic to the nominal interest rate, the money-financed fiscal stimulus is strongly effective. The anticipated money-financed fiscal stimulus does not generate a recession, in contrast to the case of low η. Furthermore, the output exhibits strong positive responses even before actual government spending takes place. Inflation increases at the time of anticipation of the money-financed fiscal stimulus. Due to the highly elastic interest semi-elasticity of money demand, the nominal interest rate rises only slightly. As a result, the real interest rate declines over time with a substantial degree of persistence.

[5] This parameter value is in terms of the quarterly rate. Guerron-Quintana (2011) originally reports that the interest semi-elasticity is 10 in terms of the annualized interest rate.

3.4 Welfare

Given that we have specified the money demand with (12), we can compute the first-order effect of the money-financed fiscal stimulus on welfare, following Galí (2014). Suppose that the period utility is $\log C_t + \chi \log(M_t/P_t) - \int_0^1 N_t(z)^{1+\varphi}/(1+\varphi)dz$, where C_t, M_t/P_t, and N_t are the *levels* of consumption, real money balances, and employment, respectively. The index $z \in [0,1]$ denotes the differentiated labor, but can be negligible to a first-order approximation.[6] To be consistent with the linearized equations in the previous section and the money demand function (12), we assume the above additively separable period utility with respect to consumption and real money balances. The parameter χ is calibrated such that the steady-state income velocity of money equals 4. Finally, we assume that the steady-state output is sufficiently below its efficient level due to monopolistic competition in goods and labor markets.

Table 1 reports the welfare improvement against the implementation lags. The welfare improvement is expressed as the present discounted sum of the percentage changes in the period utility relative to the steady state. Overall, regardless of the calibrated values of η, the welfare-improving effect declines if the money-financed fiscal stimulus is anticipated. The first column of the table shows the welfare improvement under $\eta = 0.5$. If the money-financed fiscal stimulus is anticipated one quarter in advance, the welfare-improving effect of the policy under $\eta = 0.5$ declines from 2.79 (i.e., the case of an unanticipated fiscal stimulus) to 1.92. When $h = 4$ and $h = 6$, the welfare-improving effect disappears (i.e., changes are both negative, –0.23 and –1.05, respectively). We also note that, as shown in the second column, the welfare-improving effect under $\eta = 40$ is decreased by the anticipations, but the impact is small. In particular, even when $h = 4$ and $h = 6$, the welfare-improving effect of the money-financed fiscal stimulus remains large.[7]

The policy implications of our analysis for the implementation of the money-financed fis-

[6] See the Appendix B for the first-order approximation of the households' period utility. Even under the assumption of the additively separable period utility, the period utility approximated to a first order turns out to take the same functional form as Galí (2014).

[7] The result that the welfare-improving effect decreases in h is consistent with the findings by Fujiwara and Waki (2015), who elegantly show that the private sector's acquisition of accurate information about future shocks deteriorates the welfare in New Keynesian models. In our case, an increase in the implementation lag corresponds to the private sector's acquisition of information on the fiscal stimulus and the increased money growth in the future.

cal stimulus are threefold. First, obviously policymakers should possess detailed knowledge on the money demand function in the economy to successfully implement the money-financed fiscal stimulus. Without this knowledge, the money-financed fiscal stimulus may reduce the welfare. Second, if policymakers are faced with the low interest semi-elasticity of money demand, they should activate the money-financed fiscal stimulus without long implementation lags. As long as government spending shocks are not anticipated, the policymakers can secure the welfare-improving effect of the policy. Finally, if policymakers face difficulties in shortening implementation lags, the money-financed fiscal stimulus would be a reasonable policy option only when the interest semi-elasticity of money demand is sufficiently large.

4 Concluding remarks

Using the standard New Keynesian framework with nominal rigidities, we analyzed the effect of the anticipated money-financed fiscal stimulus on output. The introduction of the implementation lags that are specific to fiscal policy may have nonnegligible impacts on output response to a shock to government spending. While the money-financed fiscal stimulus has a strongly positive effect on output if it is unexpected, such a fiscal stimulus may have a weak or even negative effect on output if anticipated. We showed that the longer implementation lags make the effect on output weaker. At the same time, our analysis indicated that the effect of the anticipated fiscal stimulus varies, depending on the interest semi-elasticity of money demand.[8] An implication for policymakers is that detailed knowledge of the money demand function is important for a better understanding of the efficacy of money-financed fiscal stimulus. In this regard, empirical work on the money demand function, especially in an economy where the policy interest rate is close to zero, would be an important avenue for future research.

[8] The importance of the money demand function for the efficacy of fiscal policy was also pointed out by Holmes and Smyth (1972) and Mankiw and Summers (1986), based on the old-fashioned Keynesian IS-LM model. However, they emphasize the roles of the scale variable (e.g., consumption vs. income) in the money demand function.

References

[1] Ball, L. (1994) "Credible Disinflation with Staggered Price-Setting," *American Economic Review*, 84 (1), 282–289.

[2] Christiano, L. J., M. Eichenbaum, and C. L. Evans, (2005). "Nominal Rigidities and the Dynamic Effects of a Shock to Monetary Policy," *Journal of Political Economy*, 113 (1), 1–45.

[3] Fujiwara, I., and Y. Waki (2015) "Private News and Monetary Policy Forward Guidance or (The Expected Virtue of Ignorance)," Federal Reserve Bank of Dallas Globalization and Monetary Policy Institute Working Paper No. 238.

[4] Fujiwara, I., Y. and Waki (2016) "Fiscal Forward Guidance," unpublished manuscript.

[5] Galí, J. (2014) "The Effects of a Money-Financed Fiscal Stimulus," Barcelona Graduate School of Economics Working Paper No. 786.

[6] Guerron-Quintana, P. A. (2011) "The Implications of Inflation in an Estimated New Keynesian Model," *Journal of Economic Dynamics and Control*, 35 (6), 947–962.

[7] Holmes, J. M., and D. J. Smyth (1972) "The Specification of the Demand for Money and the Tax Multiplier," *Journal of Political Economy*, 80 (1), 179–185.

[8] Ireland, P. N. (2004). "Money's Role in the Monetary Business Cycle," *Journal of Money, Credit and Banking*, 36 (6), 969–983.

[9] Leeper, E. M., A. W. Richter, and T. E. Walker (2010) "Quantitative Effect of Fiscal Foresight," NBER working paper No. 16363.

[10] Mankiw N. G., and L. H. Summers (1986) "Money Demand and the Effects of Fiscal Policies," *Journal of Money, Credit and Banking*, 14 (1), 27–54.

[11] Mertens, K., and M. O. Ravn (2011) "Understanding the Aggregate Effects of Anticipated and Unanticipated Tax Policy Shocks," *Review of Economic Dynamics*, 14 (1), 27–54.

[12] Ramey, V. A. (2011) "Identifying Government Spending Shocks: It's All in the Timing," *Quarterly Journal of Economics*, 126 (1), 1–50.

[13] Romer, C. D., and D. H. Romer (2010) "The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks," *American Economic Review*, 100 (3), 763–801.

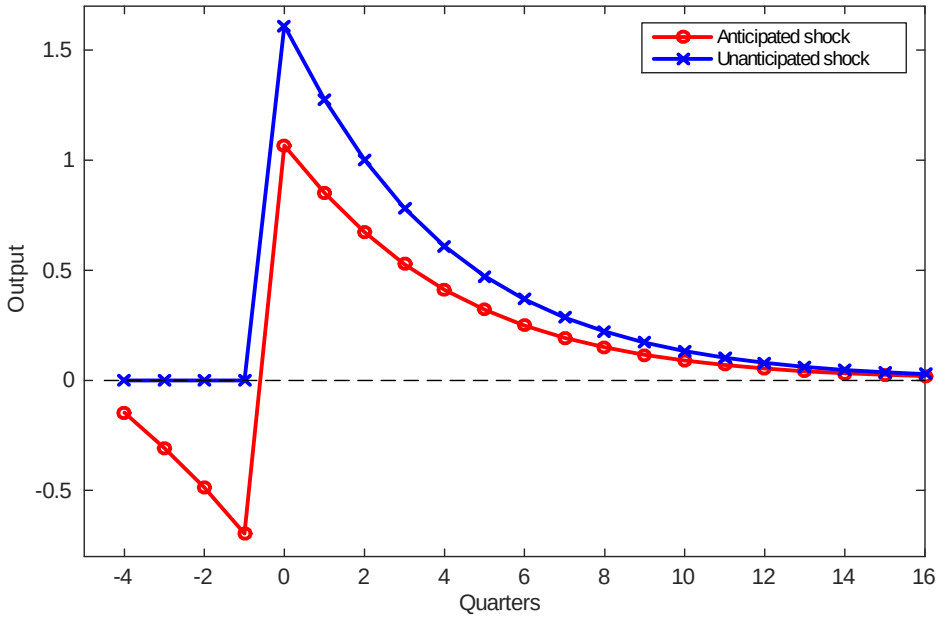
[14] Yang, S. S.-C. (2005) "Quantifying Tax Effects under Policy Foresight," *Journal of Monetary Economics,* 52 (8), 1557–1568.

Table 1: Increase in the welfare caused by the money-financed fiscal stimulus

h	$\eta = 0.5$	$\eta = 40$
0 (unanticipated shock)	2.794	3.587
1	1.924	3.526
4	–0.232	3.291
6	–1.045	3.112

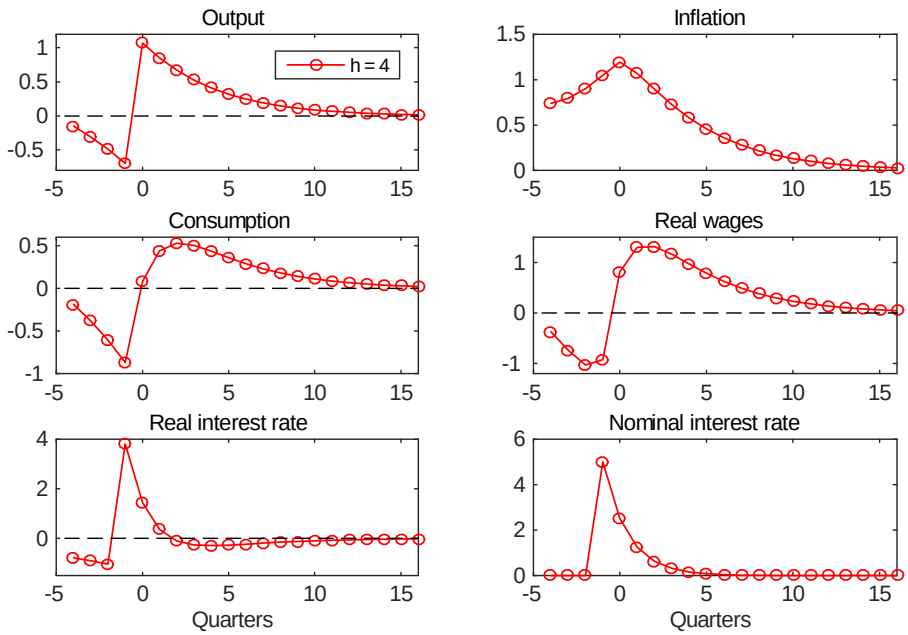
Notes: The numbers represent a percentage increase in the welfare relative to the steady-state level. In the calculation, we normalize the subjective discount factor at $t = 0$ to unity.

Figure 1: Effects of the government spending shock on output



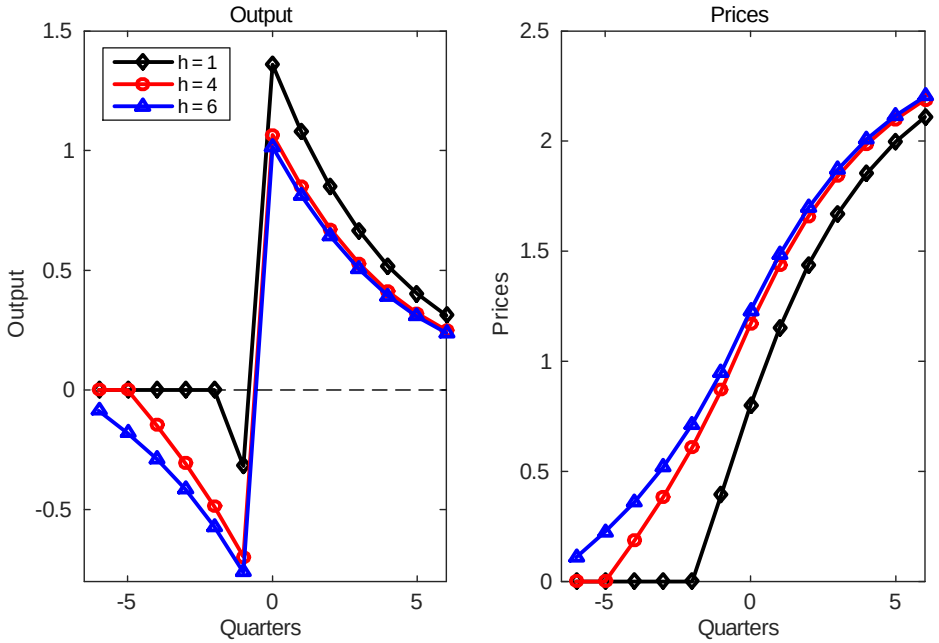
Note: Responses of output to a 1 percent increase in government spending financed by money creation. The shock is materialized in period 0. The unit of a period is a quarter.

Figure 2: Impulse responses to an anticipated shock



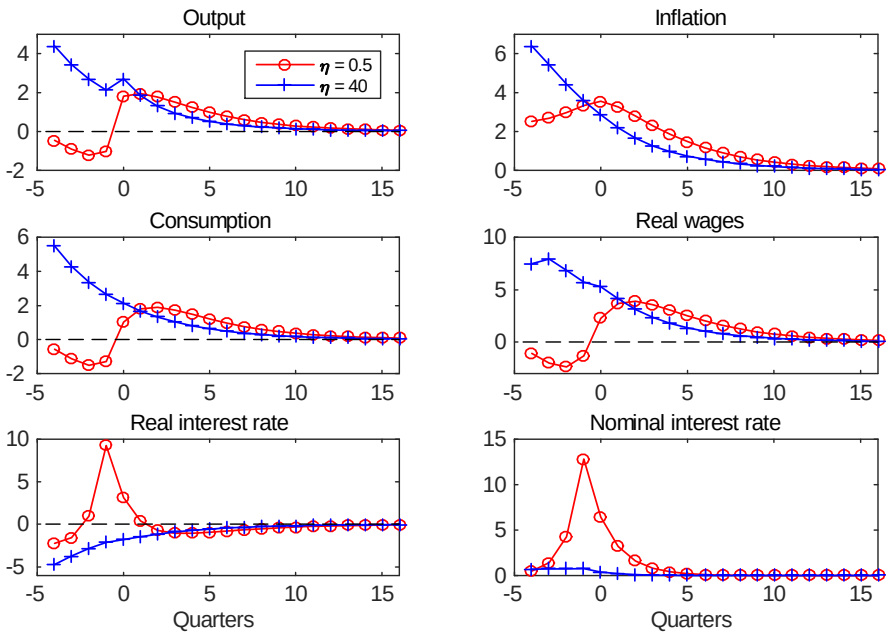
Note: Responses to a 1 percent increase in government spending that is materialized in period 0 but is anticipated four quarters in advance ($h = 4$).

Figure 3: Effects of implementation lags on output and prices



Notes: Responses of output and prices to a 1 percent increase in government spending. Each panel plots responses of the variable to a government spending shock anticipated h periods in advance.

Figure 4: Effects of the interest semi-elasticity of money demand



Notes: Responses to a 1 percent increase in government spending anticipated four quarters in advance.