Money-Financed Fiscal Programs: A Cautionary Tale*

William English
Yale University

Christopher J. Erceg
Federal Reserve Board

David Lopez-Salido
Federal Reserve Board

January 9, 2017

Abstract

While some economists have argued that a money-financed program (helicopter drop) would be efficacious in boosting output and inflation, this paper underscores the many risks of such a program. These risks include persistently high inflation if the central bank fully adhered to the program; or alternatively, that such a program would be ineffective in providing stimulus in if the public doubted the central bank's commitment to such an extreme strategy. However, our paper also highlights how more limited forms of monetary and fiscal cooperation – such as a promise by the central bank to be more accommodative than usual in response to fiscal stimulus – may be more credible and easier to communicate, and ultimately more effective in providing economic stimulus.

JEL Classification: E52, E58
Keywords: Monetary Policy, Fiscal Policy, Liquidity Trap, DSGE Model, Currency Union.

*We thank James Clouse, Brian Doyle, Thomas Laubach, Brian Madigan, David Reifschneider, and Beth Anne Wilson for useful comments on an earlier draft. The opinions expressed here are solely those of the authors and do not necessarily reflect the views of the Board of Governors of the Federal Reserve System, the Federal Open Market Committee, or any members of their staffs.

1. Introduction

A number of economists have suggested that in sufficiently difficult economic circumstances, money-financed fiscal programs – sometimes referred to as "helicopter money" – could be used to provide stimulus beyond what can be accomplished with standard monetary policy alone. Such programs involve an increase in government spending or a reduction in taxation, with the fiscal policy financed directly by the central bank.[1] These economists argue that such policies can be effective in stimulating economies suffering from persistently low inflation and ongoing weakness in economic activity, even if monetary policy is constrained by the effective lower bound on interest rates and fiscal policy is constrained by high levels of government debt. Our paper uses a simple new-Keynesian model to examine the possible costs and benefits of coordinated monetary and fiscal policies, ranging from a combination of fiscal expansion and a temporary shift in the monetary policy reaction function all the way to a completely money-financed fiscal expansion. We discuss the possible effects of such programs and some of the practical considerations that would likely complicate their use.

In a simple textbook model, money-financed fiscal programs involve expansionary fiscal policy funded by central bank purchases of government securities with an equal-sized permanent increase in the central bank's non-interest bearing liabilities (currency plus reserves, with the latter generally assumed not to pay interest). Such a program would boost output directly, through the effects of the fiscal expansion. In addition, the permanent increase in non-interest-bearing liabilities ultimately generates a proportional increase in the price level, implying a temporarily higher level of inflation, which for a time boosts economic activity by reducing real interest rates. A critical feature of such a program is that the central bank has to commit not to reverse the increase in its non-interest-bearing liabilities in the future using open market operations or by paying interest on reserves.

[1] The term "money-financed fiscal program" is from Bernanke (2016). Sometimes these programs are referred to as "helicopter drops" of money, though we think it is useful to bear in mind that the policies involve a mix of traditional fiscal and monetary policy actions. For recent discussion of such programs, see Turner (2015), Buiter (2014), and Galí (2014). For a critical perspective, see Borio et al (2016) and Cecchetti and Schoenholtz (2016).

Importantly, such a program would not require the sale of government bonds to the public either at the time of the fiscal expansion or in the future. Instead, the government would, in effect, pay for the fiscal expansion with the inflation tax, obviating the need to increase ordinary taxes later. This use of the inflation tax could be desirable if the level of government debt were nearing the limit of what could be sustained, or if high tax rates were causing large distortions.

In this paper, we show that effects similar to those in the simple textbook model can be achieved by coupling a fiscal expansion financed by central bank purchases of the additional government debt with a commitment by the central bank to follow a much more accommodative monetary policy reaction function for some time in order to generate higher inflation. The higher price level path boosts nominal currency demand permanently, which generates the seigniorage required to finance the fiscal expansion. Crucially, because the inflation tax base is small (the currency share of GDP is currently about 8 percent), financing even a modest-sized fiscal program requires a large rise in the price level, and hence a major shift in the policy reaction function.[2] Such a commitment could be communicated in various ways, including through an increase in the inflation target, the introduction of an appropriate price level target, or the introduction of an appropriate nominal GDP target.[3]

Our model simulations show that a money-financed fiscal program could boost GDP substantially while reducing the public debt-to-GDP ratio. However, these programs come with significant costs and risks. Most saliently, our model simulations indicate that a fiscal expansion equal to 2.5 percent of annual GDP would boost the price level by roughly 25 percent relative to baseline after

[2] Without a shift in the monetary policy reaction function, the fiscal expansion is essentially debt financed. In particular, with the payment of interest on reserves, the central bank could finance a fiscal expansion with purchases of government securities, and commit to maintaining the increased holdings of securities indefinitely, but still use interest on reserves (and perhaps other tools, such as overnight reverse repurchase agreements) to maintain an unchanged interest rate reaction function. In this case, interest payments from the central bank would substitute for interest payments from the Treasury. While such an approach would still provide fiscal stimulus, and perhaps some quantitative easing as well, it would not provide the additional boost to economic activity and inflation that would come from easier current and future monetary policy. Some authors (e.g., Cechetti and Schoenholtz, 2015, and Borio et al, 2016) have interpreted a money-financed program more narrowly along these lines.

[3] For a discussion of the possible benefits of nominal GDP targeting coordinated with expansionary fiscal policy, see the comments by Woodford in Reichlin, Turner, and Woodford (2013).

10 years; given that inflation is forward looking in our model, inflation rises above 8 percent in the near term before gradually reverting to baseline.[4] Such outsized inflation effects could well give rise to concerns about the central bank's intentions, leading to an unanchoring of inflation expectations that might require costly policy actions to reverse.

Moreover, achieving a sizeable output boost from the combined program depends on the public both understanding the shift in the monetary policy strategy and regarding it as credible. From a practical perspective, these assumptions seem far too optimistic. First, such a change in strategy would be very difficult to communicate to the public. For instance, the central bank would have to explain how the target path for inflation in the medium-run would depend both on the size of the fiscal stimulus program(s) authorized by Congress, and on the public's demand for currency. Second, even if the public did understand what the new policy entailed, it would likely doubt that the central bank would carry through with a strategy that permitted a large and persistent rise in inflation. In particular, a money-financed program suffers from a serious "time-inconsistency" problem: While the benefits are concentrated in the near-term when the economy is in recession, policymakers would have an incentive to renege on their promise to allow inflation to remain high once the economy had recovered. For both of these reasons, the shift in monetary policy might not do much to amplify the effects of the fiscal stimulus on output; and even inflation might not respond for a long time until the public became convinced of the authorities' resolve to follow through with the new policy.[5]

To address these concerns, we analyze more limited forms of monetary and fiscal policy coordination that involve more modest shifts in the monetary policy reaction function that might be more credible and easier to communicate. For example, we consider the possibility that the central

[4] The long-run effects on the price level are determined by the familiar relationship linking real seigniorage revenue to money growth scaled by the ratio of currency to GDP (see Fischer 1982). Because currency is a small share of GDP, fiscal expansion causes a large rise in the price level. While this implication is likely to be robust, the contour of the inflation response – as well as of output and debt – depend more on the particular features of our model.

[5] Such a major change in the monetary policy framework could even cause output to fall due to increased uncertainty and associated widening of risk premiums. See Bernanke (2010).

bank would commit to a reaction function that puts a larger weight on inflation and output gaps than under the baseline rule, implying a more accommodative response to the fiscal stimulus in a deep recession. Such a commitment by the central bank would tend to make fiscal expansion more attractive, since it would boost the output effects of any given-sized fiscal program, while reducing the upward pressure on the debt-to-GDP ratio compared with the baseline policy. While these implications are qualitatively similar to a money-financed program, we see an incremental shift in monetary policy as more likely to be credible, in part because it poses much less risk of creating outsized and costly increases in inflation.[6] Moreover, especially in difficult economic circumstances in which the central bank cannot signal a change in the reaction function by lowering the policy rate, a coordinated fiscal program can boost the public's confidence in the central bank's ability to achieve its objectives.[7]

Our paper is organized as follows. Section 2 uses a stylized model to examine the effects of money-financed fiscal programs on output and inflation, as well as on government revenues and debt. In Section 3, we consider more modest changes in monetary policy that could be used to complement a fiscal stimulus program. The final section discusses the implications of our results for the different forms of monetary and fiscal policy coordination, as well as some of the practical issues that would need to be addressed before any such program could be considered.

2. Benchmark Model

Our benchmark model builds on the workhorse New Keynesian model by incorporating a demand function for money (which consists exclusively of currency). A key objective is to show how a rule for setting money growth to yield a given amount of seigniorage can be re-interpreted in terms of

[6] As the price level only increases modestly, only a small fraction of the fiscal expansion is ultimately financed through seigniorage.

[7] It bears emphasizing that even these more limited forms of monetary-fiscal coordination may pose important risks, including to central bank independence (as discussed later in the memo). Accordingly, central banks may well opt to provide additional monetary stimulus without explicit coordination with the fiscal authority.

an instrument rule for the policy rate.

2.1. Households

Households derive utility from consumption c_t and from their holdings of real money balances m_t, but experience disutility from the hours they spending working n_t. The period utility function of households is assumed to take the separable form:

$$u(c_t, n_t, m_t) = \frac{[c_t - \psi_c c_{t-1}^a + \nu_0 \xi_t]^{1-\frac{1}{\sigma}} - 1}{1-\frac{1}{\sigma}} - \chi_0 \frac{n_t^{1+\chi}}{1+\chi} - \frac{\mu_0}{1+\mu}[\max\{v_t^* - \frac{m_t}{c_t^a}, 0\}]^{1+\mu} \qquad (1)$$

where the discount factor $\beta \in (0,1)$, $\sigma \geq 0$, $0 \leq \psi_c < 1$, $\chi \geq 0$, $\chi_0 > 0$, $\mu_0 > 0$, and $\mu > 0$. The subutility function over consumption allows for external habit persistence in consumption, with c_{t-1}^a denoting lagged aggregate consumption that households take as given in deciding on their own consumption. The consumption taste shock ξ_t is an exogenous AR(1) process with a persistence parameter of ρ_ξ. The final term of equation (1) implies that real balances – expressed as a ratio to consumption – are valued at the margin until reaching a stochastic bliss point of v_t^*. For simplicity, we assume that the scaling factor is aggregate consumption c_t^a, which is taken as given by the household; this formulation implies that the consumption Euler equation doesn't depend on the level of real balances, consistent with most empirical analysis.

Households face a budget constraint that may be expressed in real terms as:

$$b_t + m_t + c_t = (1-\tau_{n,t}) w_t n_t + \frac{1}{1+\pi_t}((1+i_{t-1}) b_{t-1} + m_{t-1}) + \mathfrak{d}_t - \tau_t \qquad (2)$$

The household's after-tax income consists of labor income $(1-\tau_{n,t}) w_t n_t$ (where w_t denotes the real wage and $\tau_{n,t}$ is a distortionary labor income tax), dividends $\mathfrak{d}_t$ from the ownership of firms, minus the lump-sum taxes τ_t paid to the government. The household uses this income to purchases consumption goods, increment its real bond holdings $b_t = \frac{B_t}{P_t}$ (nominal holdings B_t divided by the price level P_t), and accumulate real balances $m_t = \frac{M_t}{P_t}$. The real return on bonds is $\frac{1+i_{t-1}}{1+\pi_t}$, where

i_{t-1} is the nominal interest rate and $\pi_t = \frac{p_t}{p_{t-1}} - 1$ is the inflation rate; the gross real return on money is simply $(1+\pi_t)^{-1}$.

The household's problem consists of choosing its consumption, labor hours, real balances, and bond holdings to maximize its discounted utility $E_0 \sum_{t=0}^{\infty} \beta^t \; U(c_t, n_t, m_t)$ subject to the budget constraint given by equation (2). The first order conditions imply the usual consumption Euler equation and household labor supply decision, respectively:

$$\lambda_t = \beta E_t \left\{ \frac{1+i_t}{1+\pi_{t+1}} \lambda_{t+1} \right\} \tag{3}$$

$$-\frac{u_{n_t}}{\lambda_t} = w_t(1-\tau_{n,t}), \tag{4}$$

where λ_t is the marginal utility of consumption (which depends partly on lagged consumption). Household money demand can be expressed as:

$$\mu_0(v_t^* - \frac{m_t}{c_t})^{\mu} = \lambda_t \left(1 - \frac{1}{1+i_t}\right), \text{ if } i_t > 0 \tag{5}$$

Given the opportunity cost of holding money balances when the (net) interest rate is positive, real money demand (expressed relative to consumption) is less than its satiation level v_t^*. As in Eggertsson and Woodford (2003), the money demand function is continuous at $i_t = 0$ with $\frac{m_t}{c_t} \geq v_t^*$ if $i_t = 0$.

2.2. Firms and Price-Setting

We assume that there is a single final domestic output good Y_t that is produced from a continuum of differentiated intermediate goods $Y_t(f)$ according to the Dixit-Stiglitz technology $Y_t = \left[\int_0^1 Y_t(f)^{\frac{1}{1+\theta_p}} df\right]^{1+\theta_p}$ where $\theta_p > 0$. Firms that produce the final output good are perfectly competitive in both product and factor markets, purchasing intermediate good $Y_t(f)$ at a price of $P_t(f)$ to minimize the cost of producing Y_t. The demand schedule for each intermediate good derived from this cost-minimization problem is of the form:

$$Y_t(f) = \left[\frac{P_t(f)}{P_t}\right]^{\frac{-(1+\theta_p)}{\theta_p}} Y_t. \tag{6}$$

where P_t is the aggregate price index (i.e., $P_t = \left[\int_0^1 P_t(f)^{\frac{-1}{\theta_p}}\, df\right]^{-\theta_p}$).

Intermediate good f is produced by a monopolistically competitive firm according to a Cobb-Douglas production function:

$$Y_t(f) = K_t(f)^{\alpha}(Z_t L_t(f))^{1-\alpha}, \tag{7}$$

where Z_t denotes a stationary, country-specific shock to the level of technology. The intermediate goods producers face perfectly competitive factor markets for hiring capital $K(f)$ (at a real rental price of r_{Kt}) and labor $L_t(f)$ (at a real wage of $\frac{W_t}{P_t}$). The first-order conditions for the cost-minimizing input choices imply that all intermediate producers have an identical real marginal cost per unit of output $\frac{MC_t}{P_t}$. Real marginal cost can be expressed as the ratio of the real wage to the marginal product of labor:

$$\frac{MC_t}{P_t} = \left(\frac{\frac{W_t}{P_t}}{MPL_t}\right) = \left(\frac{\frac{W_t}{P_t} L_t}{(1-\alpha)K}\right), \tag{8}$$

noting that the aggregate ratio of labor to capital appears in (8) because all firms choose the same factor proportions, and that the aggregate capital stock is assumed fixed.

Intermediate goods-producing firms set prices according to Calvo-style staggered contracts, with firm f facing a constant probability, $1-\xi_p$, of being able to re-optimize its price, $P_t(f)$. Each firm that is allowed to reoptimize chooses its price ($P_t^{opt}(f)$) to maximize:

$$\max_{P_t^{opt}(f)} \mathrm{E}_t \sum_{j=0}^{\infty} \xi_p^j \psi_{t,t+j} \left[(1+\pi)^j P_t^{opt}(i) - MC_{t+j}\right] Y_{t+j}(i), \tag{9}$$

subject to its demand curve (6), where $\psi_{t,t+j}$ is the stochastic discount factor (i.e. $\beta^j \mathrm{E}_t \frac{\lambda_{t+j}}{\lambda_t}$). The term $(1+\pi)^j$ reflects that the price of firms not able to reset their price is assumed to increase at the steady state inflation rate of π each period. The first order condition (together with the

identity for the evolution of the aggregate price index) yields the standard New Keynesian Phillips Curve.

2.3. Fiscal Policy

It is convenient to consider the fiscal authority (Treasury) and central bank as a single consolidated entity (the "government"). The government finances its purchases of real goods and services g_t either through taxation, real seignorage revenue, or by issuing debt. Accordingly, the government's flow budget constraint which determines the evolution of government debt b_t is:

$$b_t = \left(\frac{1+i_{t-1}}{1+\pi_t}\right) b_{t-1} + g_t - \tau_t - \tau_{n,t} w_t n_t - s_t, \tag{10}$$

where s_t is real seignorage revenue, and recalling that τ_t is a lump-sum tax on households and $\tau_{n,t}$ the labor tax rate. Real seignorage revenue in turn is equal to the new nominal monetary liabilities issued by the government divided by the price level (i.e., the purchasing power of newly issued money):

$$s_t = \frac{M_t - M_{t-1}}{P_t} = m_t - \pi_t^{-1} m_{t-1}. \tag{11}$$

We assume that government spending is exogenous and follows an exogenous ARMA process (specified below). We also assume that the income tax rate τ_n is constant. Thus, lump-sum taxes adjust to satisfy the government budget constraint (10).

2.4. Market Clearing

The aggregate production function is given by:

$$y_t = \widetilde{a}_t \, k^a {n_t}^{1-\alpha} \tag{12}$$

where $\widetilde{a}_t$ denotes the level of technology scaled by price dispersion (see the appendix and Woodford (2003)), and aggregate labor and capital are $n_t = \int_0^1 L_t(f)df$ and $k = \int_0^1 K_t(f)df$, respectively.

The aggregate resource constraint is:

$$y_t = c_t + g_t \tag{13}$$

2.5. Monetary Policy

Our benchmark assumption is that monetary policy sets seigniorage revenue to be proportional to the *shock* to government spending on goods and services, i.e., to the deviation of government spending from its steady state level.

$$s_t = \frac{M_t - M_{t-1}}{P_t} = \frac{M_t - M_{t-1}}{M_{t-1}} \frac{M_{t-1}}{P_{t-1}} = \left(\frac{g_t - g}{g} \right)^{\phi} \tag{14}$$

We devote considerable attention to the case in which any shock to government spending is fully financed by seigniorage (i.e., $\phi = 1$). However, we also consider cases in which government spending is only partially financed by seigniorage, and also the special case in which the money stock is held constant ($\phi = 0$). As we will discuss, this money-based rule can be recast in terms of a reaction function for the policy rate that makes it easier to interpret.

3. Effects of a Money-Financed Fiscal Program

It is useful for comparative purposes to begin by considering the familar case of a fiscal expansion under the standard (1993) Taylor rule (with the policy rate constrained to be non-negative). In this vein, Figure 1 shows a fiscal expansion equal to 1 percent of GDP that lasts 10 quarters (the blue dashed lines). The fiscal expansion is assumed to occur against the backdrop of a deep recession that pins the policy rate at zero for 10 quarters: this baseline without fiscal expansion is generated by a negative consumption taste shock, and is shown by the solid black lines.

Consistent with an expansion literature (e.g., Christiano, Eichenbaum, and Rebelo 2011), the multiplier effects of the fiscal expansion are fairly large: The output gap is narrowed by about $1\frac{1}{4}$ percentage points in the near term and inflation is about $\frac{1}{2}$ percentage point higher. The

output multiplier is above unity because – with the federal funds rate constrained by its effective lower bound – monetary policy does not react to the higher inflation for some time. Thus, real interest rates fall for a time, and private demand is crowded in. The effects of the increase in government spending on output and inflation are considerably larger than would be the case in "normal times," in which output is close to potential, and, accordingly, monetary policy simply follows an unconstrained version of the Taylor rule. For illustrative purposes, the red dash-dotted lines show the effects of the rise in government spending under the assumption that monetary policy reacts as in normal times by raising interest rates and thus crowding out private demand.

The fiscal expansion puts noticeably less upward pressure on the ratio of government debt to GDP than would be the case in normal times (comparing the blue and red lines, respectively). The rise in government debt is muted in a liquidity trap because the relatively large multiplier implies a bigger effect on tax receipts, reflecting that receipts from the labor tax rise with the level of economic activity. In addition, with the policy interest rate constrained by its effective lower bound, the higher inflation rate generated by the fiscal expansion reduces the real interest rate paid on outstanding government debt. Higher inflation also increases seigniorage income from the larger outstanding stock of currency, though this effect is small quantitatively.

Even though the output effects of fiscal expansion are relatively large if the nominal short-term rate is constrained by the effective lower bound – and consequently the rise in government debt is more subdued – policies that boost debt may still be regarded as undesirable or unsustainable, especially in economies with high levels of public debt. Accordingly, our second exercise considers a money-financed fiscal program. In this simulation we assume the same fiscal expansion as before, but also assume a radical shift in monetary policy, under which the central bank commits to raising the demand for nominal currency permanently by the amount required to finance the increase in government spending. Crucially, the price level must eventually rise enough that the public

demands this additional currency: No additional interest-bearing government debt is created by either the government or the central bank (including interest-bearing central bank reserves). This change in monetary policy is assumed to be fully understood by the public and completely credible – an assumption to which we will return below.

The red dashed lines in Figure 2 show the results of this money-financed fiscal program in our model. The money-financed program generates a large and persistent rise in the inflation rate – which peaks at 8 percent after two years – and correspondingly, boosts the price level by a whopping 20 percent after five years. Because real interest rates decline substantially, the money-financed program causes GDP to expand well above baseline in our simulation, and elicits a large decline in the debt-to-GDP ratio. While seigniorage revenue rises by the size of the government spending hike by assumption (i.e., 1 percent of GDP for 10 quarters), most of the improvement in the debt-to-GDP ratio reflects a rise in tax revenues due to the output expansion, and also the depressing effects of low real interest rates on interest expenses and hence outstanding debt. As we will discuss more below, the large increase in the price level in the longer-run is likely to be a robust result across alternative economic models: Given the small size of the inflation tax base, financing a sizeable rise in government spending requires a large percentage rise in the nominal money supply, and hence in the price level. On the other hand, the stimulus to output could be much smaller if the money-financed program caused risk premiums to rise.

While the central bank's reaction function under this program is typically described as a money supply rule, it is helpful to express the rule in a more familiar form in terms of the policy rate. In general, the policy reaction function implied by monetary financing depends on the form of the demand for currency. Under the reasonable assumptions about currency demand implied by our model —that real currency demand varies directly with activity, and inversely with the policy rate—the central bank's reaction function under a money-financed fiscal program can be interpreted

as a form of "flexible price-level targeting" in which the policy rate varies with the gap between the price level and its target path, and also with real activity (output or consumption). The crucial twist is that the growth rate of the target price level path varies with the size and persistence of the fiscal expansion, rather than growing at fixed rate of (say) 2 percent.

The green dashed line in Figure 2 shows the target path for the price level in our simulation (depicted as a deviation from its constant 2 percent growth rate). The central bank must lower the trajectory for the real interest rate in order to raise output by enough to boost the price level toward this new target path, and hence generate the seigniorage needed to finance the fiscal expansion. The strong expansion of output and inflation translates into a sizeable rise in the nominal interest rate.

It bears emphasizing that the effects of a money-financed fiscal expansion on inflation over the short and medium run are probably quite uncertain, as they depend critically on the specific features of money demand. Quite intuitively, inflation would rise more if real money demand was smaller relative to output – as the base for the inflation tax would be smaller – and conversely, inflation would rise less if money demand was larger. Under our interpretation of the monetary policy rule, the magnitude of the shift in the price level target path corresponding to a given-sized fiscal expansion would vary directly with the level of money demand. Thus, as seen in Figure 3, while our baseline calibration of money demand implies that the price level rises about 25 percent relative to baseline under the benchmark case of money-financed fiscal expansion in the long-run, the price level would rise 50 percent under a calibration in which money demand were only half as large (at any given interest rate). Given that the uncertainty surrounding estimates of money demand is likely higher after a long period of near-zero interest rates, confidence intervals around the predicted effects of a money-financed fiscal expansion would likely be very wide.

3.1. More Limited Forms of Monetary-Fiscal Cooperation

A money-financed fiscal expansion may be appealing in some circumstances because it has the potential to raise nominal aggregate demand while reducing the debt-to-GDP ratio, perhaps significantly. Nevertheless, our analysis suggests several major drawbacks of such an approach. First, the effects on inflation are likely to be very large given plausible estimates of the inflation tax base, even for a modest-sized fiscal expansion. Second, the size of the effects on inflation are difficult to predict, and correspondingly, would compound the difficulties of explaining such a program to the public. Not only would such a program involve a major shift in the central bank's reaction function – towards flexible price level targeting – but the path of the price level target would have to be adjusted based on unexpected changes in money demand. Finally, while we have assumed in our model simulations that long-run inflation expectations remained well anchored at the central bank's 2 percent target, this assumption may seem heroic given the large and persistent rise in inflation above target. Inflation would rise even more than in our simulations if high realized inflation pushed up long-run inflation expectations, and the central bank might have to take costly actions later on to re-anchor expectations.

Given these considerations, in this section we explore the potential benefits of complementing fiscal stimulus with a more modest shift in the monetary policy reaction function. Such a shift would be "in the spirit" of a money-financed program insofar as it would be intended to make fiscal expansion more effective in raising output, while at the same time putting less upward pressure on public debt than under the baseline rule.

In this vein, Figure 4 considers the same recession baseline (the black solid lines) and government spending expansion against the backdrop in Figure 1 (the red dashed lines), but also illustrates a case in which the government spending expansion is accompanied by a central bank commitment to follow a more accommodative policy rule. The latter alternative – shown by the blue dashed

lines – assumes that the central bank commits to following a Taylor rule that puts a weight of unity on the output gap, rather than 0.5 as under the standard Taylor rule, and also puts a larger weight on deviations of inflation from its 2 percent target. With this alternative rule, output and inflation rise more in response to the fiscal expansion, and the debt/GDP ratio rises by less than under the standard Taylor rule.

Figure 5 examines the consequences of fiscal stimulus coupled with a more substantial shift in the policy framework to flexible price level targeting (again against the same recession baseline shown by the black solid lines). The key difference relative to the monetary financing case is the central bank does not commit to adjust the price level target path to ensure that the fiscal expansion is fully monetized (as in Figure 2). Thus, the first alternative – shown by the red dashed lines – involves a shift toward flexible price-level targeting in which the target path rises at a constant rate of 2 percent. Given the very strong assumption that the new policy rule is immediately understood by the public and regarded as fully credible, the combined monetary and fiscal program is effective in keeping inflation close to 2 percent and in eliminating most resource slack. Moreover, the resulting stronger nominal aggregate demand causes the debt-to-GDP ratio to fall relative to the baseline (even though only a small fraction of this decline is due to increased seigniorage).

In a second alternative, the target path for the price level is allowed to grow at an average rate of about 3 percent per year during the fiscal expansion before gradually reverting to 2 percent. This policy provides more stimulus to inflation and output, and thus results in a larger decline in the debt-to-GDP ratio. Given the greater rise in the price level, this policy rule also yields noticeably larger seigniorage revenue than in the alternative with a constant 2 percent target, and thus moves further in the direction of monetary financing. Even so, a key difference – including in communicating the policy – is that the target path for the price level would not be linked explicitly to raising a specific amount of seigniorage, and hence would not be required to shift in response to

unexpected changes in money demand. Of course, the downside of this approach is that it leaves the debt-to-GDP ratio at a significantly higher level than in the case of full monetary finance, although the ratio still declines as a result of the program.

4. Monetary-Fiscal Cooperation in Practice

Our simulations suggest that a money-financed fiscal expansion, if understood and seen as credible by the public, could provide very substantial stimulus. In particular, a commitment to use monetary policy to boost nominal currency holdings by enough to finance the fiscal action would increase the effects of the combined action well beyond those of the fiscal stimulus alone because the change in monetary policy would increase the expected future price level – and so actual and expected inflation – substantially, reducing real interest rates. However, as discussed above, policymakers may find the economic effects of such a program to be undesirable because of the very large (and unpredictable) effects on inflation, and because it would risk unanchoring longer-term inflation expectations that could require costly actions to rectify.

Moreover, making such a change in monetary policy clear and credible would likely be very difficult, and the macroeconomic effects could well prove to be very limited in practice. With monetary policy constrained by the effective lower bound on the policy rate, the change in monetary policy could not be signaled by a change in the current policy rate, but rather only by providing forward guidance regarding future short-term nominal rates. In addition, the announced change in monetary policy would not be time consistent, and policymakers would likely find it very difficult to constrain future monetary policy decisions. Indeed, with central banks having spent considerable time building their reputations for low and stable inflation, the public would probably anticipate that policymakers would not follow through with the announced change in policy once the economy had recovered sufficiently and inflation had risen to undesirable levels. Moreover, by increasing

uncertainty, the announcement could even boost risk premiums and so be counterproductive. If the change in monetary policy had little effect on the economy in the near term, then the impact of the new policy on inflation would come later, after the economic recovery was well underway, at which point the higher inflation would not offer any benefit. That possibility could further undermine the credibility of the program, since it would increase the degree to which it was not time consistent.

The credibility of the change in monetary policy might be strengthened if such a change were relatively modest – along the lines of the policies considered in section II – because it would not require a drastic change in the monetary policy framework, with all of the risks that such a change would entail. Such a limited approach would reduce the effects of the change on inflation and so make the policy less time inconsistent, while still supporting the effects of the fiscal action.

Coordinated changes in monetary and fiscal policy could also help to make the change in monetary policy more credible than it would be on its own. Such a coordinated change could be seen as a signal that the authorities were committed to taking bold action to address a persistently weak economy and were willing to accept the consequences. In addition, expansionary fiscal policy, by stimulating output and inflation, would bring forward the date when monetary policy would have tightened in the absence of the associated change in monetary policy. Thus, the fiscal expansion could help make the change in monetary policy visible to the public sooner, enhancing the credibility of the change. Moreover, Congressional action on the fiscal component of the program would allow the Congress to signal its agreement with the proposed change in monetary policy and acknowledge the higher inflation that it would imply. That signaling might also include an indication that the Congress anticipates that higher inflation will help keep the debt-to-income ratio in check, which would provide additional support for the change in monetary policy.

Of course, such steps on the part of the Congress could call into question the independence

of the central bank. Indeed, the central bank could, in the future, be pressed to engage in such coordinated policies in situations when they were not warranted (that is, when output is not persistently low, inflation is not below target, and the policy interest rate is not constrained by its effective lower bound). However, even in the extreme case of a money-financed program, it may be possible to develop approaches that would help preserve monetary policy independence. For example, Bernanke (2016) has suggested a "dual key" approach in which the Federal Reserve would authorize the placement of funds in a special account that the Treasury could use to finance spending. However, the Congress would have to authorize the spending of funds in that account. Thus, both the Federal Reserve and the Congress would have to agree that a money-financed fiscal program was desirable before it could be undertaken.

A final issue, which we do not try to address here, is the possible international implications of money-financed fiscal programs. In particular, some recent research suggests that when monetary policy is constrained by the effective lower bound, more accommodative policy in one economy may have adverse implications for other economies through its effects on exchange rates and trade. Thus, implementation of a money-financed fiscal program in one country could hurt its trading partners and potentially lead to the implementation of such programs in those economies as well. Such an outcome would not be undesirable in some circumstances, but given the possible spillovers, it might be appropriate to consult with policymakers in other jurisdictions before implementing such a program. Doing so could help to avoid disorderly outcomes in foreign exchange markets.

5. Conclusions

References

Bernanke, Ben S. (2010). "The Economic Outlook and Monetary Policy," speech at the Federal Reserve Bank of Kansas City Economic Symposium, Jackson Hole, Wyoming, August.

Borio, Claudio, Piti Disyatat, Anna Zabai (2016). "Helicopter money: The illusion of a free lunch," blog post, Vox, May.

Buiter, Willem H. (2014). "The Simple Analytics of Helicopter Money: Why It Works – Always," Economics, volume 8, August.

Caballero, Riccardo, Emmanuel Farhi, and Pierre-Olivier Gourinchas (2016). "Safe Asset Scarcity and Aggregate Demand," mimeo., MIT, January.

Cecchetti, Stephen and Kermit Schoenholtz (2016). "A Primer on Helicopter Money," blog post, June.

Eggertson, Gauti B., Neil R. Mehrotra, Sanjay R. Singh, and Lawrence H. Summers (2016). "A Contagious Malady? Open Economy Dimensions of Secular Stagnation," NBER Working Paper No. 22299. June.

English, William B., David Lopez-Salido, and Robert J. Tetlow (2013). "The Federal Reserve's Framework for Monetary Policy: Recent changes and new questions," presented at the 14th Jaques Polak Annual Research Conference, November.

Erceg, Christopher J. and Jesper Linde (2014). "Is There a Fiscal Free Lunch in a Liquidity Trap?" Journal of the European Economic Association, vol. 12 (1), 73-107.

Farhi, Emmanuel and Ivan Werning (2012) "Fiscal Multipliers: Liquidity Traps and Currency Unions." Manuscript, Harvard University.

Fischer, Stanley (1982). "Seigniorage and the Case for a National Money," Journal of Political Economy, vol. 90, issue 2, pages 295-313.

Gali, Jordi (2014). "The Effects of a Money-Financed Fiscal Stimulus," CEPR Discussion Paper No. 10165. September.

Reichlin, Lucrezia, Adair Turner, and Michael Woodford (2013). "Helicopter money as a policy option," VoxEu, 20 May.

Romer, Christina (2014). "It Takes a Regime Shift: Recent Developments in Japanese Monetary Policy through the Lens of the Great Depression," NBER Macroeconomics Annual 2013, vol. 28, pp. 383-400.

Turner, Adair (2015). "The Case for Monetary Finance: An essentially political issue," presented at the 16th Jaques Polak Annual Research Conference, November.

Woodford, Michael (2012). "Methods of Policy Accommodation at the Interest-Rate Lower Bound," paper presented at the Federal Reserve Bank of Kansas City Symposium on "The Changing Policy Landscape," Jackson Hole, Wyoming, August 3 (Revised September 16).

Figure 1: Rise in Government Spending under Taylor Rule

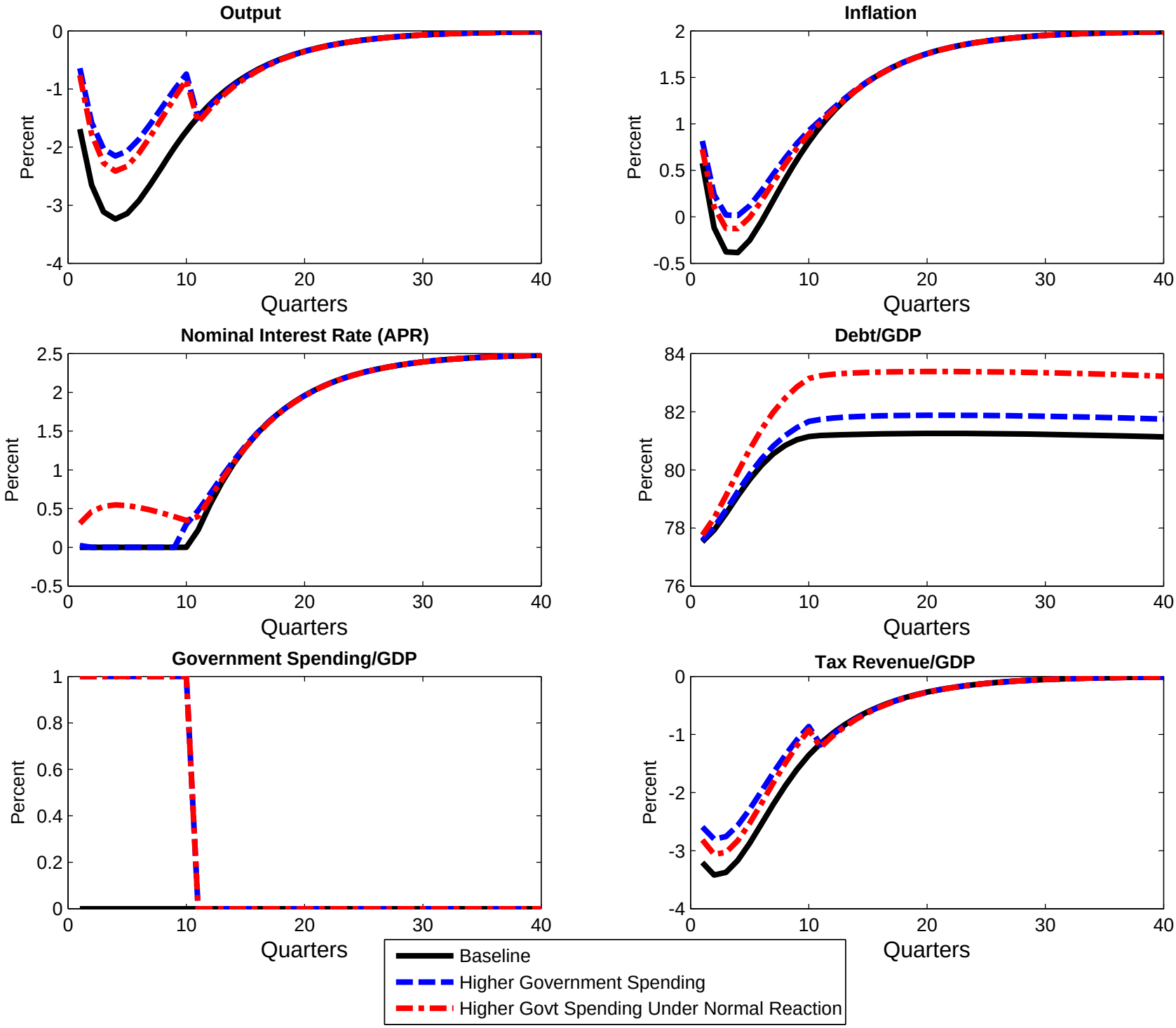


Figure 2: A Money-Financed Fiscal Expansion

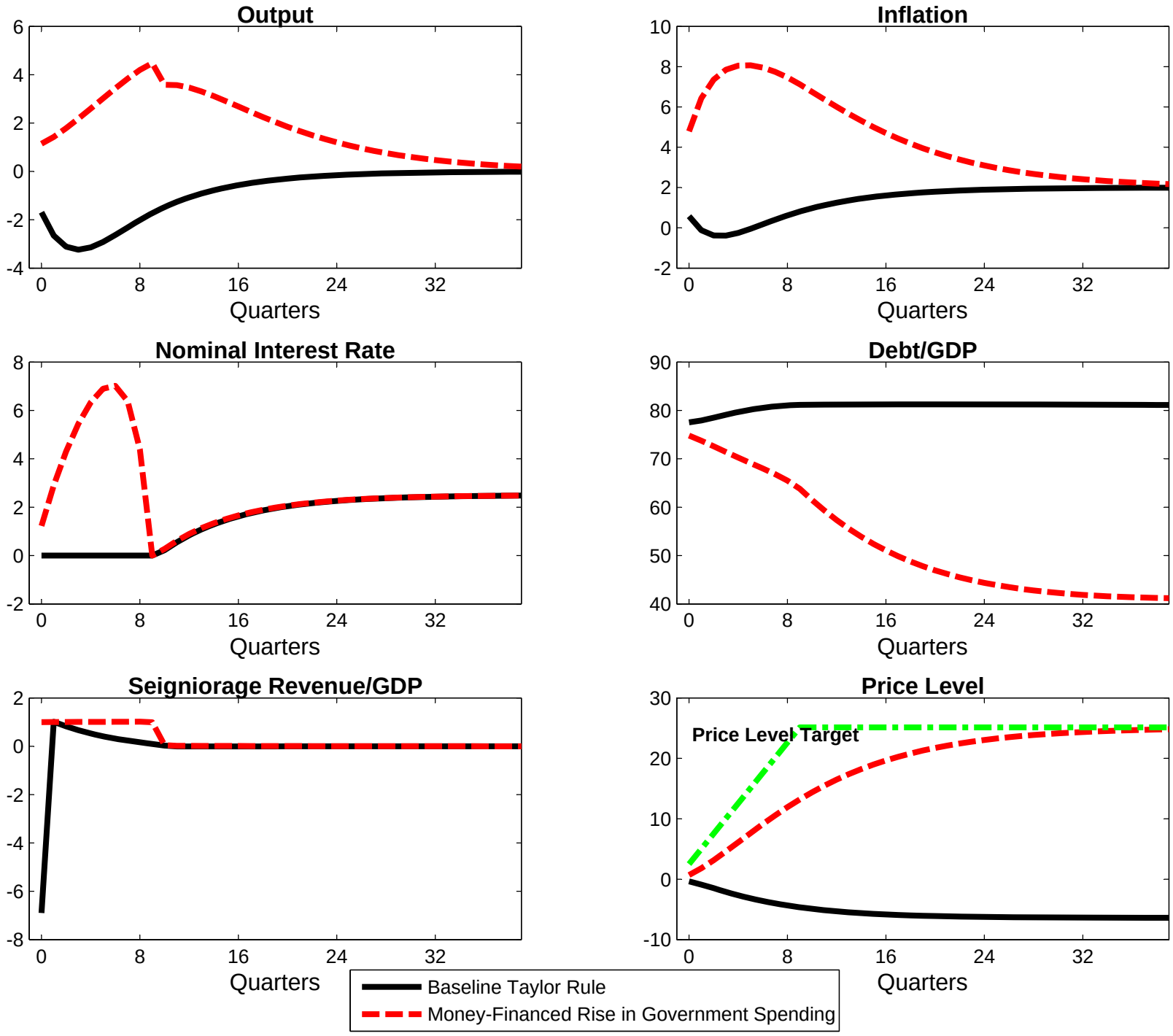


Figure 3: Money-Financed Fiscal Expansion: Alternative Cases

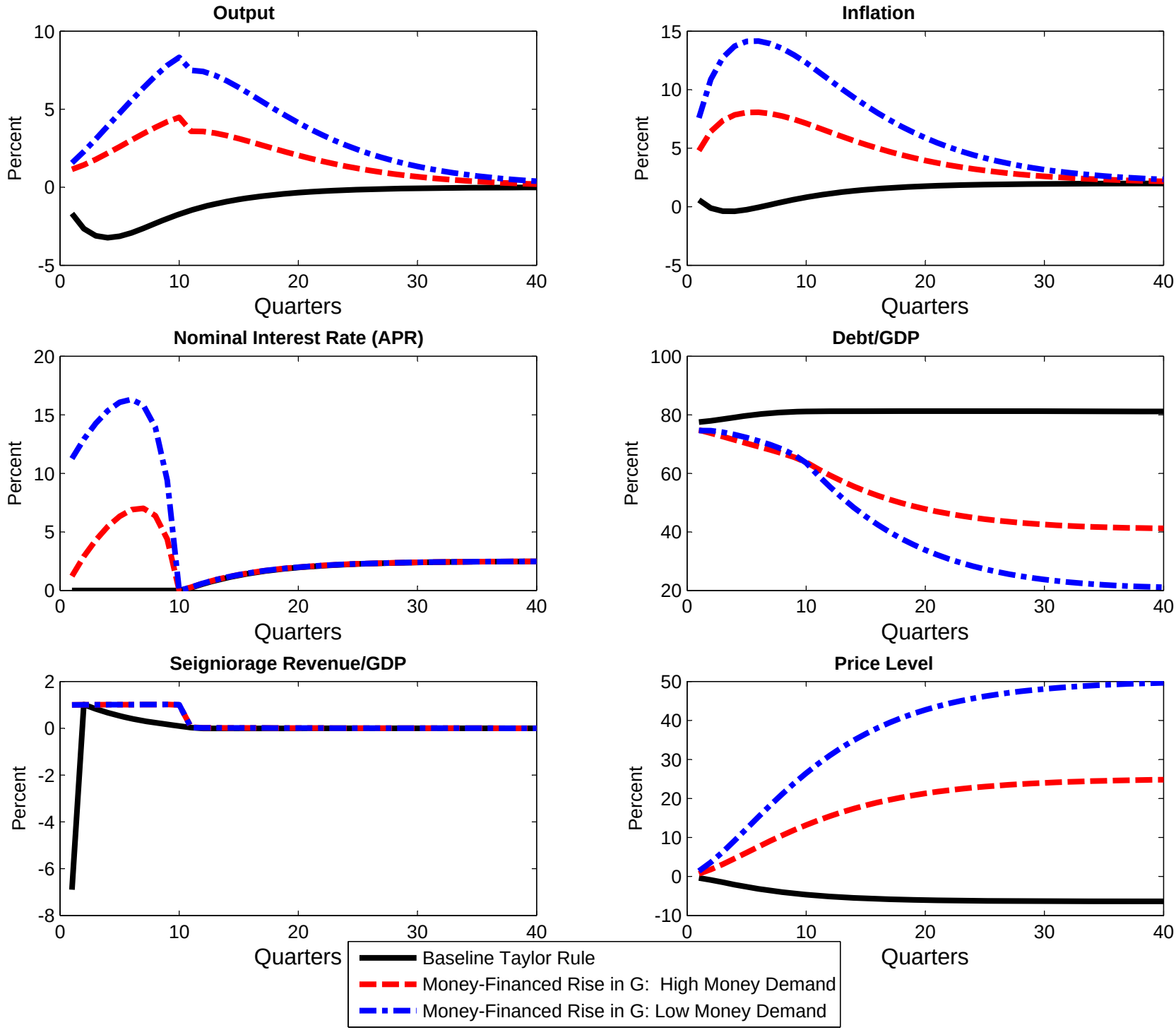


Figure 4: Higher Govt Spending under Alternative Monetary Responses

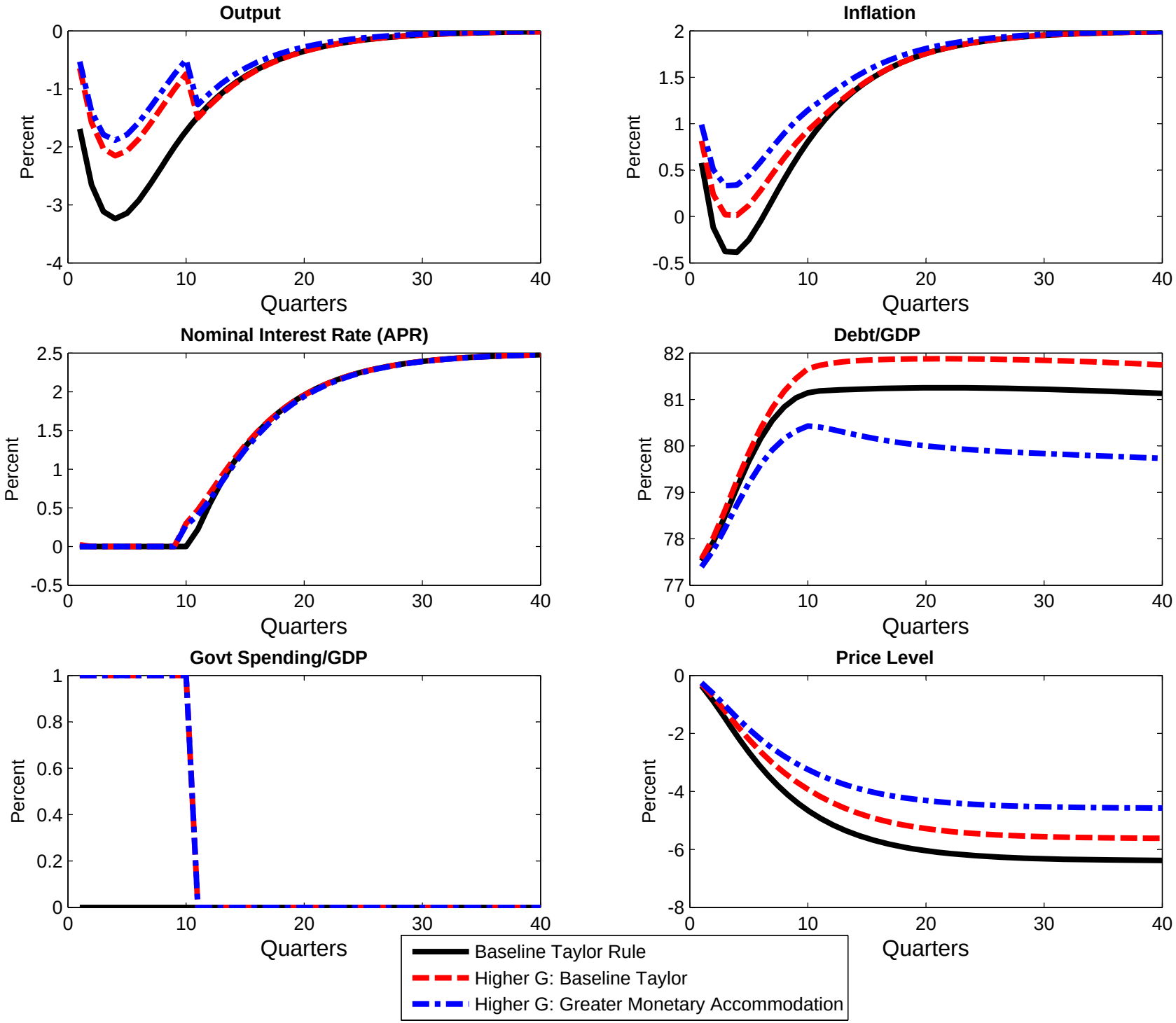


Figure 5: Higher Govt Spending with Flexible Price-Level Targeting

