Helicopter Drops and Japan’s Liquidity Trap

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This paper examines the effects of a money-financed fiscal expansion—a helicopter drop—when an economy is in a liquidity trap. It uses a textbook-style model calibrated to fit Japan’s economic slump and deflation as of 2003. According to the results, money-financed transfers totaling 9.4 percent of GDP end the output slump and guide the economy to a steady state with 2 percent inflation. By raising output and inflation, the policy also reduces the ratio of government debt to GDP. The policy’s long-run effects are the same as those of a bond-financed fiscal expansion, but money finance prevents a short-run rise in debt.

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I. Introduction

When an economy slumps, the central bank typically stimulates aggregate spending by reducing short-term interest rates. As Keynes famously pointed out, this policy response is not possible if interest rates have hit a lower bound, putting the economy in a "liquidity trap." This problem has gained prominence from the experience of Japan, where short-term rates were zero from 1999 to 2006. Over this period, the Bank of Japan (BOJ) wanted to stimulate the economy, but lacked its usual interest rate tool. Economists have debated whether a central bank in a liquidity trap has other means to boost spending.

One suggestion is a "helicopter drop" of money (e.g., Mankiw [1999], Stevens [2001], and Bernanke [2003]). The idea of this policy is to print money and give it to the public, raising the public's disposable income and spending. To implement a helicopter drop, the government makes a fiscal transfer to the public, financed by issuing bonds, and the central bank purchases the bonds. That is, the government creates debt to finance a fiscal expansion, but the debt is monetized.

This paper examines the effects of a helicopter drop of money. It also compares this policy to the traditional Keynesian response to a liquidity trap: a bond-financed fiscal expansion without monetization. Advocates of a helicopter drop suggest that it is the better policy because it avoids an increase in privately held government debt. Indeed, by raising economic growth and inflation, a helicopter drop can reduce the ratio of debt to GDP. This potential benefit is important in the Japanese case because of concern over high government debt.[1]

This paper studies these issues in a textbook-style macro model calibrated to fit the Japanese economy. The model's initial conditions are based on the situation in 2003, when Japan was experiencing a liquidity trap, recession, and deflation. Starting from 2003 conditions, I determine what policies are needed to boost output to potential, and derive the effects over time on output, inflation, and the debt-income ratio. I compare results for a helicopter drop, a traditional fiscal expansion, and a baseline case with passive monetary and fiscal policy.

Overall, the results are favorable to the idea of helicopter drops. For base parameter values, a money-financed transfer of 6.6 percent of GDP returns output to potential in a year, and thereafter only small transfers are needed to keep it there. The output recovery ends deflation and the interest rate becomes positive, allowing the central bank to return to a more normal monetary policy.

The helicopter drop also has benign effects on the debt-income ratio. This ratio starts falling as the economy recovers, whereas it would rise without the helicopter drop. Part of this fiscal gain is permanent: a helicopter drop reduces the debt-income ratio in the long run as well as the short run.

1. Bernanke (2003) makes this point in arguing for a money-financed fiscal expansion: "Isn't it irresponsible to recommend a tax cut, given the poor state of Japanese public finances? To the contrary, from a fiscal perspective, the policy would almost certainly be stabilizing, in the sense of reducing the debt-to-GDP ratio. The BOJ's purchases would leave the nominal quantity of debt in the hands of the public unchanged, while nominal GDP would rise owing to increased nominal spending. Indeed, nothing would help reduce Japan's fiscal woes more than healthy growth in nominal GDP and hence in tax revenues."

There is an important qualification to this success story. The monetization of the fiscal transfer does not mean the transfer is forever free for the government. After the economy recovers, the central bank has to undo its monetary expansion to prevent inflation from rising. This requires contractionary open market operations, which cause a jump in privately held debt. Nonetheless, the overall effect of a helicopter drop is to reduce the debt-income ratio: the decrease in the ratio during the recovery exceeds the increase when the central bank sells debt.

A bond-financed fiscal expansion has different short-run effects than a helicopter drop. The sale of bonds causes a temporary run-up in the debt-income ratio before the output recovery starts to reduce it. In the long run, however, a bond-financed fiscal expansion leads to the same debt-income ratio as a helicopter drop. The reason is that the initial benefit from monetization is offset by the later need to undo monetization.

The rest of this paper contains six sections. Section II presents additional background, and Section III presents the model. Sections IV to VI derive the implications of passive monetary and fiscal policy, a bond-financed fiscal expansion, and a helicopter drop. Section VII concludes. (See Ball [2005a] for an analysis of the robustness of results to changes in the model and in parameter values.)

II. Background

This section reviews the history of Japan's economy from 1990 to 2003. I use the experience of this period to guide my modeling of the economy. The situation in 2003 is summarized in Table 1. In simulating alternative policies, I use data from 2003 as initial conditions.

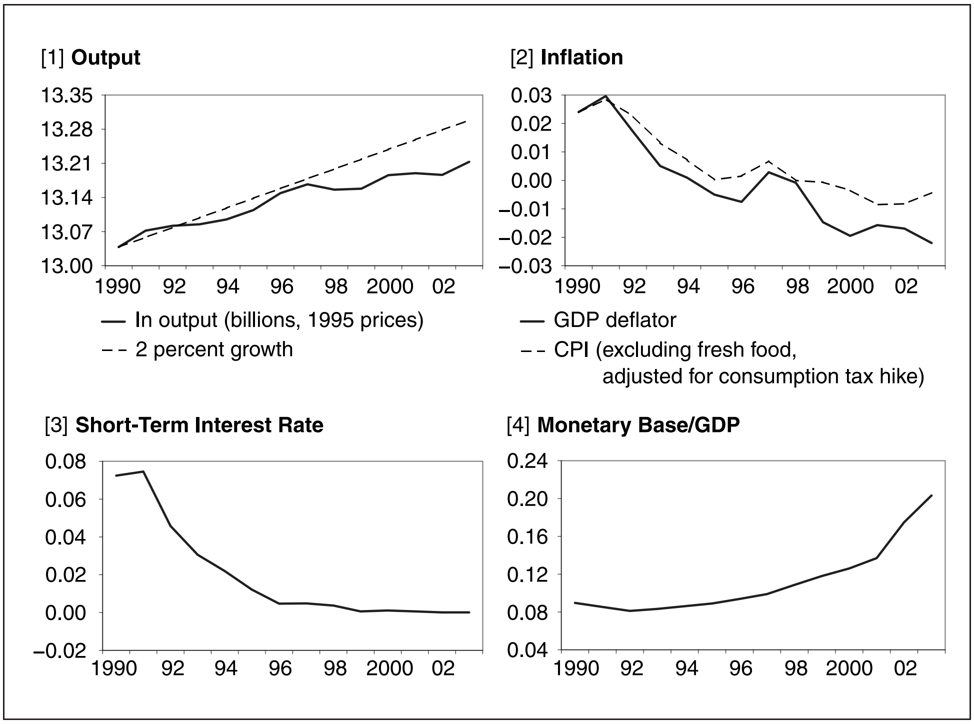
Figure 1 [1] shows the log of real output. Output growth averaged 1.3 percent per year over 1990–2003, compared to 4.0 percent from 1980 to 1990. Early in the slump, some blamed it on slow growth of potential output due to "structural" factors. Today, however, most economists agree that output fell below potential because of deficient demand. Apparent demand shocks include a collapse in asset prices, a credit crunch, and policy mistakes (e.g., Hoshi and Kashyap [2004] and Posen [2003]).

There is, of course, uncertainty about the gap between output and potential output. Following McCallum (2000) and Hoshi and Kashyap (2004), Figure 1 presents a path for potential based on the assumption that it has grown 2 percent per year since 1990. This approach produces an output gap of -9 percent in 2003. Using production functions, some researchers have estimated gaps of around -5 percent (e.g., Ahearne

Table 1 Conditions in 2003 (Initial Conditions for Simulations)

Output gap	-7.5 percent
Inflation	-1.0 percent
Nominal interest rate	0
Base/GDP	0.20
Debt/GDP	0.79

Figure 1 Japan's Slump



et al. [2002] and Leigh [2004]). In my simulations, I assume an initial output gap of −7.5 percent.

Figure 1 [2] shows inflation, as measured by the GDP deflator and by core CPI. The slump of the 1990s dragged inflation down, as predicted by the accelerationist Phillips curve. In 2000, inflation reached about −1 percent (a bit higher for the CPI and a bit lower for the deflator). After that, inflation remained fairly constant. I use −1 percent as the initial value of inflation.

The stability of inflation after 2000 is *not* consistent with a conventional Phillips curve. Such an equation predicts accelerating deflation when the output gap is negative. The cause of this anomaly is unclear, but Blanchard (2000) suggests one possibility. The accelerationist Phillips curve is based on the assumption that expected inflation equals past inflation. This relation breaks down if people view deflation as transitory—if they expect a return to non-negative inflation. In this case, an output slump causes deflation but not accelerating deflation. I will incorporate this idea in the paper's model.[2]

Figure 1 [3] and [4] shows the behavior of monetary policy. The BOJ responded to the slump and falling inflation by cutting the short-term interest rate. Leigh (2004) shows that a conventional Taylor rule captures this behavior up to 1998. At that point,

2. Econometric research suggests that the Japanese Phillips curve broke down sometime in the 1990s. See Fukao (2004).

the Taylor-rule interest rate became negative, and the actual rate hit the zero bound. The interest rate stayed close to zero after that.

The monetary base grew steadily as the interest rate fell. Base growth accelerated under the policy of "quantitative easing," which entailed large open market operations. The base grew 26 percent in 2002 and 16 percent in 2003, reaching 20 percent of GDP. With the interest rate stuck at zero, this monetary expansion did not have obvious effects on output or inflation. This experience is consistent with a textbook liquidity trap.

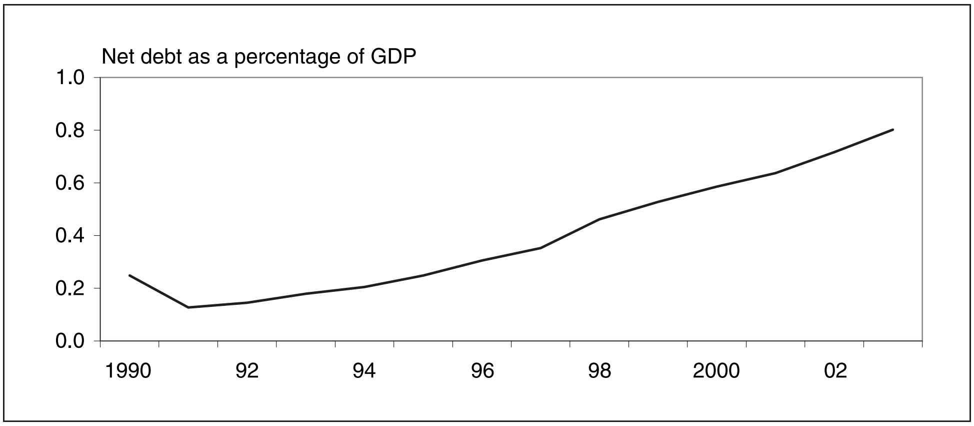
Finally, Figure 2 shows the path of net government debt as a percentage of GDP. This ratio rose from 0.13 in 1991 to 0.79 in 2003. This experience led to a downgrading of Japan's debt to A2/AA−, the rating for many developing countries, in 2002. In the early 2000s, many economists feared that Japan was heading for a fiscal crisis, possibly even for default. For that reason, we will look for policies that boost the economy out of a liquidity trap without exacerbating the debt problem.

III. The Model

The experience we have reviewed is largely explained by textbook macro models. A fall in aggregate demand reduced output, and monetary policy was ineffective because the interest rate hit the zero bound. Kuttner and Posen (2001) state, "The basic lesson of Japan's Great Recession for policymakers is to trust what you learned in intermediate macroeconomics class." In that spirit, I study a model with textbook equations such as an IS curve and a money demand function. I add simple dynamics following Svensson (1997) and Ball (1999). The only unorthodox equation is the Phillips curve, which is modified to capture Japan's steady deflation.

The model is "backward-looking," with expectations of future variables determined by past variables. Thus, the analysis differs from much of the literature on liquidity traps, which emphasizes forward-looking behavior. Section VII compares forward- and backward-looking models of liquidity traps.

Figure 2 Rising Debt



A. Assumptions

1. Output

Potential output Y^* grows by g percent per year. Actual output Y deviates from potential according to an IS equation:

$$\frac{Y_t - Y_t^*}{Y_t^*} = \lambda \frac{Y_{t-1} - Y_{t-1}^*}{Y_{t-1}^*} - \beta(r_{t-1} - r_{t-1}^*) + \delta\left(\frac{G_{t-1}}{Y_{t-1}^*}\right), \tag{1}$$

where t indexes years, G is real transfers from the government, r is the real interest rate, r^* is the "neutral" interest rate, and all parameters are positive. The real rate r is $i - \pi$, where i is the nominal rate and π is inflation. In other words, the output gap depends on the lagged gap, the lagged real interest rate, and lagged transfers. The one-year lags are consistent with Japanese evidence.

2. Inflation

Inflation is determined by an expectations-augmented Phillips curve:

$$\pi_t = \pi_t^e + \alpha \frac{Y_{t-1} - Y_{t-1}^*}{Y_{t-1}^*}, \tag{2}$$

where π^e is expected inflation. A conventional assumption is that expected inflation equals lagged inflation, $\pi_t^e = \pi_{t-1}$. I assume instead that

$$\pi_t^e = \max\{\pi_{t-1}, 0\}. \tag{3}$$

The conventional assumption holds when lagged inflation is non-negative, but expectations do not follow actual inflation below zero. When $\pi_{t-1} \geq 0$, (2) and (3) imply that output determines the change in inflation. When $\pi_{t-1} < 0$, output determines the *level* of inflation, as suggested by Blanchard (2000).[3]

3. Money

The central bank controls the stock of base money, M, through open market operations. Money evolves according to

$$M_t = M_{t-1} + Z_t, \tag{4}$$

where Z is central bank purchases of government bonds ($Z < 0$ means sales of bonds). The demand for base money is given by

$$\begin{aligned} \ln\left(\frac{M_t}{P_t Y_t}\right) &= k - \gamma i_t, \quad i_t > 0; \\ &\geq k, \qquad\quad i_t = 0, \end{aligned} \tag{5}$$

where P is the price level. This equation imposes a unit income elasticity of money demand (which is consistent with Japanese data). At positive interest rates, there is a

3. Ball (2005a) replaces equation (3) with the assumption that π_t^e always equals π_{t-1}. This change does not greatly affect the economy's response to helicopter drops. It does change the baseline case with passive monetary and fiscal policy. If $\pi_t^e = \pi_{t-1}$ and policy is passive, the economy falls into a spiral of accelerating deflation.

constant interest rate semi-elasticity; at a zero interest rate, money demand becomes flat. Figure 3 shows the money demand function in a graph.

4. Debt

I measure Japan's fiscal problem with privately held debt, which excludes debt held by the central bank. Thus, I ignore the separate balance sheets of the government and central bank and treat them as one entity. Nominal debt D_t evolves according to

$$D_t = D_{t-1} + i_{t-1} D_{t-1} + P_t G_t - Z_t - \theta(P_t Y_t - P_t Y_t^*). \tag{6}$$

Debt is past debt plus changes from four sources: interest payments on the past debt; current nominal transfers; open market purchases, which reduce debt; and a term for the government's primary surplus in the absence of transfers. This surplus is assumed to be zero when output equals potential ($Y_t = Y_t^*$). It varies procyclically when output fluctuates.

In reality, Japan's primary surplus would probably be negative even if output were at potential. Ignoring this fact helps us isolate the effects of exogenous fiscal expansions. Ball (2005a) extends the model to include a primary deficit when $Y = Y^*$.

B. Calibration

Table 2 presents base values for the model's parameters. Generally these values are based on studies of the Japanese economy, which have estimated parameters such as the Phillips curve slope (α) and the interest semi-elasticity of money demand (γ). See Ball (2005a) for citations and further discussion of the parameter settings.

Two assumptions are worth highlighting. The first concerns δ, the coefficient on fiscal transfers in the IS equation. This parameter is critical to the effects of helicopter drops. I take the value of $\delta = 1.25$ from Kuttner and Posen (2001), who estimate the

Figure 3 Money Demand

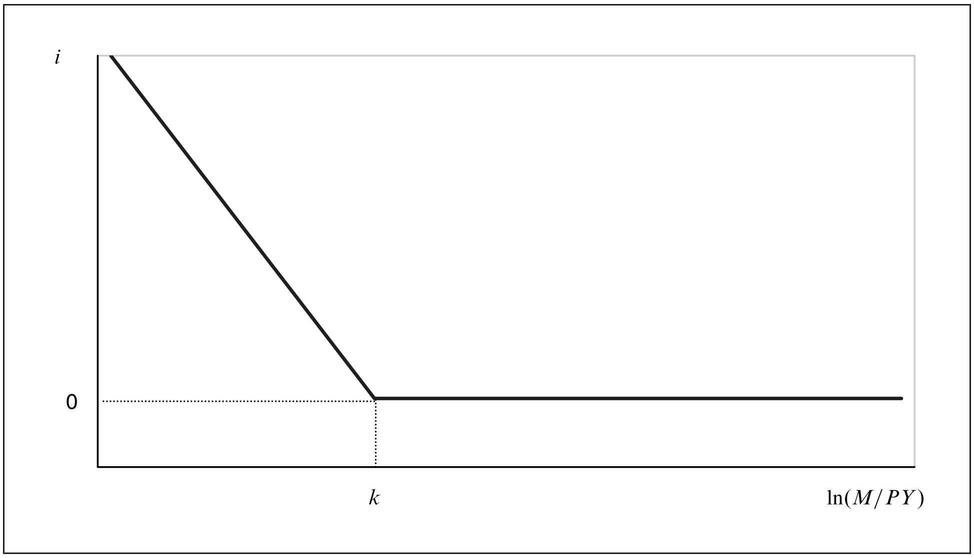


Table 2 Base Parameter Values

IS	$\beta = 1.0,\ \lambda = 0.6,\ \delta = 1.25$
Revenue	$\theta = 0.25$
Phillips curve	$\alpha = 0.2$
Money demand	$\gamma = 0.1,\ k = \ln(0.1)$
Potential output	$g = 0.02$
Neutral rate	$r^* = -0.02$ in year 0; grows linearly to $+0.02$ in year 10

effect of transfers on output using the structural vector autoregression (VAR) technique of Blanchard and Perotti (2002). Kuttner and Posen's estimated effect is substantial, although smaller than the effect that Blanchard and Perotti find for the United States.

The second key assumption concerns the neutral real interest rate, r^*. I assume that r^* rises over time: it starts at -2 percent and rises linearly to $+2$ percent over 10 years. As detailed in Ball (2005a), Japan's neutral rate appeared negative during the liquidity trap of the early 2000s, but this situation was not permanent. It reflected problems specific to the period, such as low confidence and weakness in the banking system. Therefore, it is plausible to assume that r^* eventually rises to $+2$ percent, a normal level for a developed economy.

The assumption of a rising r^* implies that the economy eventually escapes the liquidity trap, even if policy is passive. As r^* rises, the term $r - r^*$ in the IS equation falls, stimulating spending. We will see, however, that economic recovery is very slow unless policymakers take action to speed it up.

IV. A Baseline Policy

This section derives the path of the economy when no special policy is introduced to attack the liquidity trap. Monetary policy is modeled as following the approach of the BOJ through 2003. There is no fiscal transfer: $G_t = 0$ for all t. This exercise provides a baseline for measuring the effects of monetary and fiscal expansions.

A. Monetary Policy

Recall that the BOJ appeared to follow a Taylor rule until the interest rate hit zero. This behavior is captured by

$$i_t = \max\{i_t^T, 0\},$$

$$i_t^T = r_t^* + \pi_t + a\frac{Y_t - Y_t^*}{Y_t^*} + b(\pi_t - \pi^*), \tag{7}$$

where π^* is an inflation target. The variable i^T is the interest rate dictated by a Taylor rule: it depends on the output gap and inflation. The BOJ sets an interest rate of i^T if i^T is positive, and zero if i^T is negative. BOJ officials have suggested the same rule in describing their policy (Baba *et al.* [2005]). I assume here that this policy continues indefinitely.

When the rule in equation (7) delivers a positive interest rate, the money demand equation determines M. M and lagged M determine open market purchases, Z. When $i = 0$, M is not determined by the rule, because money demand is flat. In this case, I make the additional assumption that $Z = 0$, so M equals lagged M. That is, I assume the BOJ does not pursue open market operations if they do not affect the interest rate. (Ball [2005a] considers an alternative assumption.)

In the Taylor rule, the coefficients a and b are chosen as follows. Taylor rules with certain parameters are equivalent to "flexible" inflation targeting: a policy that returns inflation to π^* at a fixed rate (see Svensson [1997] and Ball [1999] for proofs in similar models). I assume that inflation moves halfway to its target each period. One can show that this implies $a = 1.1$ and $b = 2.5$.

I assume the inflation target π^* is 2 percent, which is close to the targets of many countries.

Given initial conditions and the policy rule, it is straightforward to derive the evolution of the economy. Each period, Y and π are determined by past conditions through (1)–(3). Inflation π determines the price level P. The policy rule determines i, M, and Z, as described above. Finally, equation (6) determines D.

B. Results

Figure 4 shows the paths of some key variables: the output gap, π, i, and the ratios of Z, M, and D to GDP. Starting from period 0, output stays in a deep slump for several years and then slowly recovers as r^* increases. The output gap rises above -5 percent in year 6, and it becomes positive in year 10. From years 1 to 9, there is a cumulative output gap of -54 percent.

Inflation falls to -1.5 percent and then inches up as the economy recovers. It becomes positive in year 11. Through that year, the Taylor rule prescribes a negative interest rate, so i is stuck at zero.

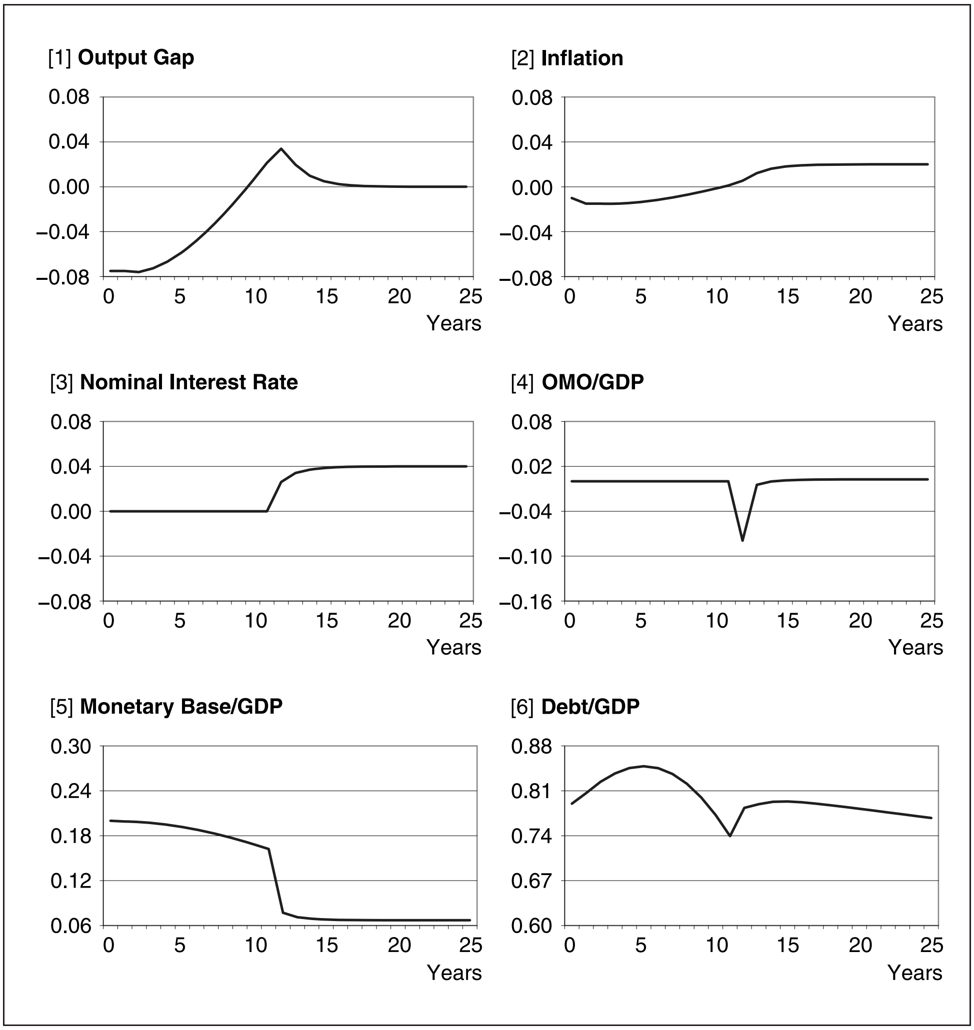
In year 12, the recovery pushes the Taylor-rule interest rate above zero. The rule begins to operate, and it guides inflation smoothly to the target of 2 percent. Output temporarily overshoots potential as inflation rises.

While the interest rate is zero, the money stock is constant and nominal GDP grows (the growth in Y exceeds the fall in P). The money/GDP ratio declines slowly. In year 12, when the interest rate becomes positive, the money/GDP ratio falls by more than half. This occurs through a large monetary contraction: open market purchases, Z, are -8 percent of GDP. This action is needed because of the high level of money at the start of the simulation. Although the money/GDP ratio falls in years 1–11, it remains far above the level that produces a positive interest rate. Thus, a large money absorption is needed when the Taylor rule takes effect.

The debt-income ratio rises initially, because the output slump produces primary deficits. The ratio peaks at 0.85 in year 5, then falls as the economy recovers. It jumps up in year 12, when the large monetary contraction occurs. The BOJ's sales of government bonds raise the level of privately held debt.

In a steady state, the debt-income ratio falls slowly. The primary deficit is zero, and interest payments are balanced by income growth, since $r = g = 2$ percent. The fall in

Figure 4 Baseline Case



the debt ratio results from seigniorage revenue, as $Z > 0$ in the steady state. The ratio reaches 0.77 in year 25.

V. A Bond-Financed Fiscal Expansion

This section examines how a bond-financed fiscal expansion changes the evolution of the economy. This exercise is a step toward analyzing a helicopter drop, which combines a fiscal expansion with a monetary expansion.

A. The Policy

In this experiment, interest rate policy is the same as before: $i = \max\{i^T, 0\}$. And once again, $Z = 0$ when $i = 0$.

However, this policy is now accompanied by fiscal transfers. These transfers add to government debt through equation (6). The transfers begin in year 1; given the lag in the IS curve, they start affecting output in year 2. The transfers are chosen to end the slump quickly and permanently: the output gap is non-negative in years 2, 3, ... Each period, the government makes the smallest transfer sufficient to achieve this result.

To state this policy formally, let G_t^* be the real transfer that produces $Y_{t+1} = Y_{t+1}^*$. G_t^* can be computed from the IS curve given the state at t. The rule for transfers is

$$G_t = \max\{G_t^*, 0\}, \quad t \geq 1. \tag{8}$$

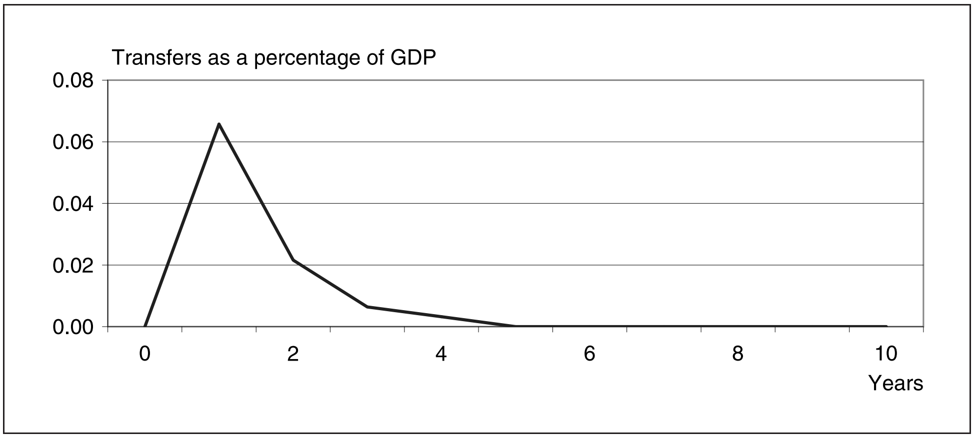
If a positive transfer is needed to keep output at potential, it is made. If a negative transfer would keep output at potential, no transfer is made. In this case, output exceeds potential.

B. The Path of Transfers

Figure 5 shows the series of fiscal transfers implied by equation (8). In year 1, the transfer is 6.6 percent of output (Y), or 6.1 percent of potential output (Y^*). Given the multiplier of 1.25, this transfer is needed to produce a zero output gap in period 2, rather than the -7.6 percent gap of the baseline case. The transfer is 2.2 percent of output in year 2, less than 1 percent in years 3 and 4, and zero thereafter. The necessary transfer peters out because $r - r^*$ falls, stimulating spending. (The real rate falls because π rises, and r^* rises by assumption.) The cumulative transfer over years 1–4 is 9.4 percent of output.

This fiscal expansion is large by historical standards, but not gigantic. Over the 1990s, Japan experienced a series of changes in taxes and government spending (Kuttner and Posen [2001]). Several of these shifts amounted to 2 percent of GDP or more; a 1998 stimulus package was 4 percent. The total effect of fiscal policy was small, because expansions in some years were offset by contractions in others (such as

Figure 5 The Fiscal Expansion



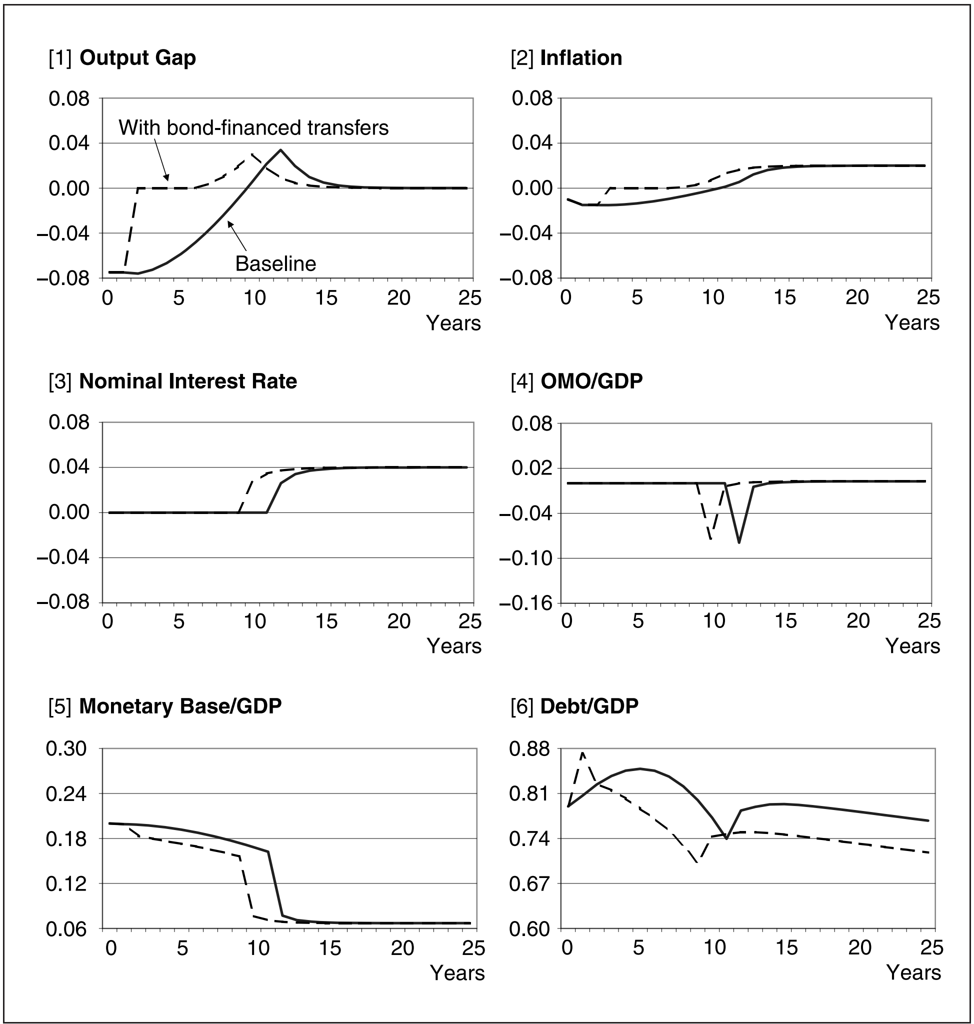
the 1997 tax increase). The key difference between the transfers proposed here and past practice is that policy pushes consistently in one direction.

C. Effects of the Transfers

Figure 6 shows the effects of fiscal transfers. It compares the economy's path under the transfer rule (8) (the dashed line) to the baseline case without transfers (the solid line). By construction, the transfers return output to potential in year 2; most of the long slump in the baseline case is eliminated. The faster recovery implies that inflation and the interest rate start rising sooner than before. Nonetheless, the Taylor rule guides the economy to the same steady state, with 2 percent inflation.

The large transfer in year 1 causes the debt-income ratio to jump up: it reaches 0.87, compared to 0.81 in the baseline case. After that, the ratio falls rapidly as the transfers

Figure 6 Effects of Fiscal Expansion



fuel growth and inflation. In year 2, the debt-income ratio with transfers (0.825) is very close to the ratio in the baseline case (0.824); in year 3, the ratio with transfers falls below the baseline case. It remains lower in all future years, except for year 11, when it is slightly higher. (The result for year 11 reflects the fact that the nominal interest rate rises earlier with transfers. The jump in debt from the necessary monetary contraction occurs sooner.)

In the steady state, the debt-income ratio falls slowly in both the baseline case and the case with transfers. However, the path of the ratio is lower with transfers. In year 25, the ratio is 0.72 with transfers and 0.77 without them. Thus, the transfers produce a win-win scenario: they end the output slump quickly *and* they improve the long-run fiscal situation.

To better understand these results, note that the cumulative output gap in the baseline case is -44 percent of potential output. The cumulative gap with transfers is -5 percent, so the transfers raise output by a total of 39 percent of potential. The effect of output on government revenue, θ, is 0.25; thus, revenue rises by 0.25 multiplied by 39 percent $= 9.8$ percent of potential output. This gain more than offsets the initial transfers, which total 9.4 percent of potential. The transfers also reduce the debt-income ratio by raising inflation. Inflation reaches zero in year 3, while it stays negative through year 10 in the baseline case. The faster rise in inflation reduces real interest rates on the debt.

VI. A Money-Financed Fiscal Expansion

This section considers fiscal transfers financed by printing money rather than issuing debt. I ask whether money finance produces lower debt-income ratios, as suggested by Bernanke and others.

A. The Policy

In this experiment, the fiscal transfers are the same as before (see the path in Figure 5). There are positive transfers in years 1 through 4. The government finances the transfers by issuing bonds, and the central bank buys the bonds. The central bank's purchases equal the nominal level of transfers:

$$Z_t = P_t G_t, \quad t = 1, \ldots, 4. \tag{9}$$

These actions raise the money stock by the amount of the transfers, and leave privately held debt unchanged. Thus, they are equivalent to a helicopter drop of money.

After year 4, monetary policy behaves as in the previous experiments. Open market purchases are zero until the Taylor rule prescribes a positive interest rate, and then this rule determines policy.

B. Results

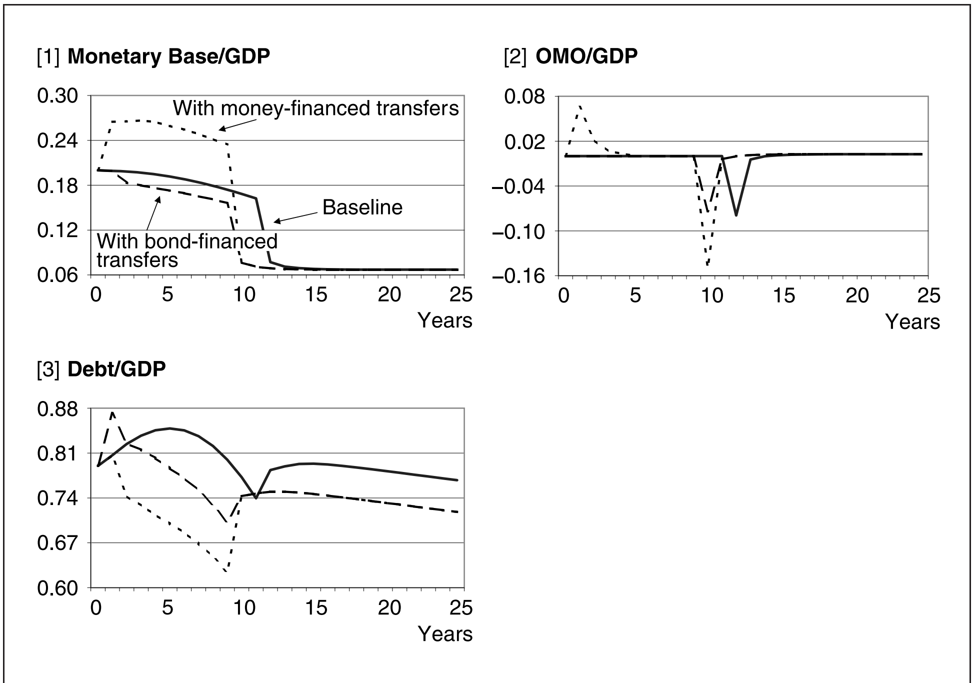
The fiscal multiplier does not depend on how transfers are financed. Thus, switching from debt to money finance does not change the path of output. There is also no effect on inflation or the interest rate, since the Phillips curve and Taylor rule are unchanged. The only changes are in open market operations, the money stock, and debt. Figure 7 shows the paths of these variables. It compares the case of money-financed transfers (the dotted lines) to the cases of bond-financed transfers and no transfers.

When the transfers are money-financed, the money/income ratio jumps up in year 1. In contrast to the case of bond finance, the debt-income ratio does *not* rise sharply. In years 1 through 9, the money-income ratio is higher with money finance, and the debt-income ratio is lower by the same amount. Policymakers have substituted money for debt.

Things change in year 10, when the Taylor rule becomes operative. As before, contractionary open market operations are needed to reduce money to the level consistent with the Taylor rule. The necessary open market sales are larger in the case of money-financed transfers, because the money-income ratio is higher in year 9. The extra sales of debt raise the debt-income ratio to its path in the bond-finance case. In other words, the monetization of debt in years 1–4 is reversed in year 10: money is turned back into debt. Starting in year 10, the initial financing of transfers is irrelevant to all variables in the model.

In light of these results, does it matter how transfers are initially financed? Monetization has no effect on output or inflation, and no long-run effect on debt. However, it prevents the jump in the debt-income ratio that occurs in year 1 if transfers are debt-financed. With money finance, the debt-income ratio never significantly exceeds its level in the baseline case. Thus, monetization matters if we care about the short-run path of debt, not just its steady-state behavior.

Figure 7 Money-Finance versus Debt-Finance



Do we care about the short-run path of debt? To address this question, we must go beyond the model and ask why debt matters. A high debt-income ratio is dangerous because investors may start to fear default, sparking a financial crisis (Ball and Mankiw [1996]). Higher debt at a point in time might increase this danger, even holding constant the long-run behavior of debt. Investors are more likely to panic when they hold more debt, because they have more to lose from an immediate default. However, the importance of this effect is unclear. The case for money-financed transfers is not as compelling as some economists suggest.[4]

C. A Permanent Monetary Expansion

In the previous experiment, the increase in money that finances transfers is reversed in the long run. This fact follows from the conventional assumption that the central bank eventually follows a Taylor rule. However, the reversal of the monetary expansion differs from some economists' suggestions. Bernanke (2003), for example, advocates money-financed transfers for which "much or all of the increase in the money stock is viewed as permanent." Here I consider such a policy. As one might guess, the policy prevents the debt-income ratio from jumping up at any point. Unfortunately, it also produces hyperinflation.

Specifically, I assume again that transfers are governed by equation (8), and that they are financed by money creation. Monetary policy after the transfers is the same as in earlier experiments, except for a constraint: open market purchases must be non-negative. That is, after the money stock rises, it can never fall. This constraint first binds in year 10, when the Taylor-rule interest rate becomes positive. When the Taylor rule implies $Z_t < 0$, the central bank sets $Z_t = 0$ instead.

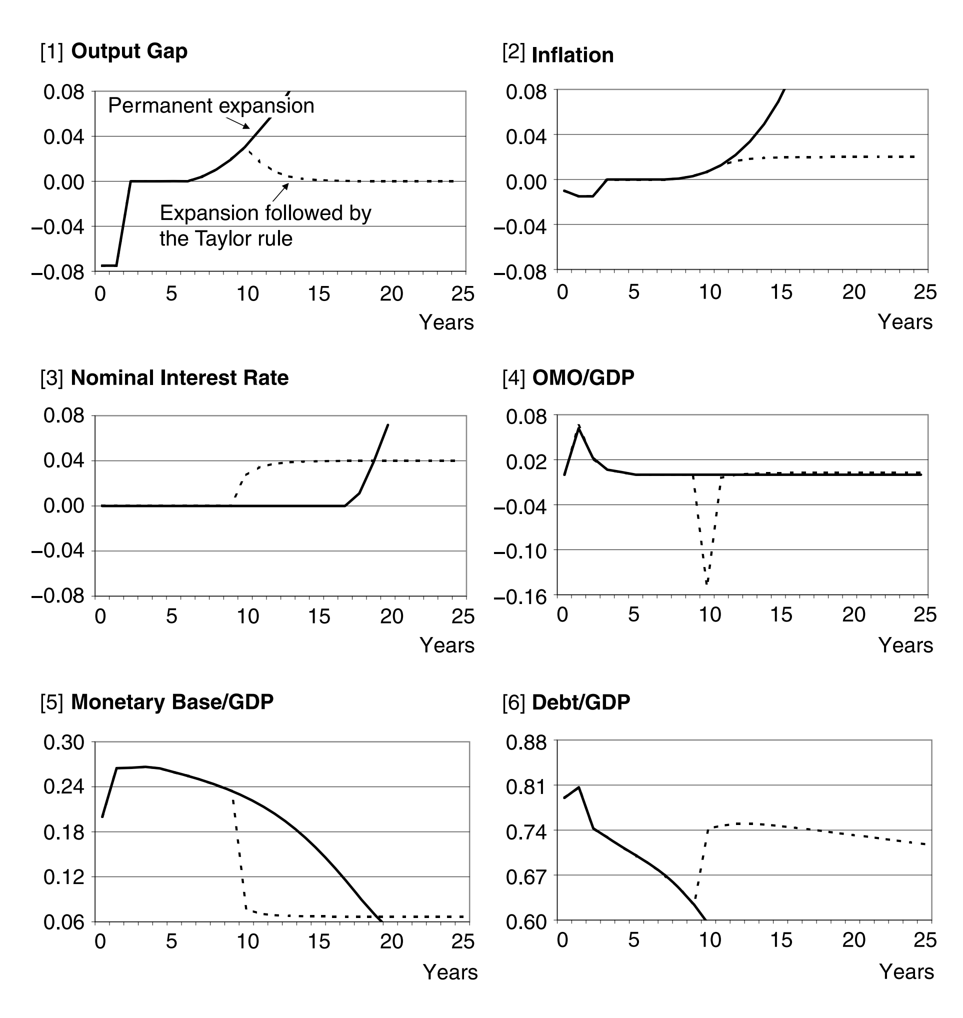
Figure 8 shows the effects of this policy. Through year 9, we see the same effects of money-financed transfers as before. In year 10, the Taylor rule starts calling for large open market sales, but they do not occur. Consequently, the money-income ratio stays high and the nominal interest rate stays at zero. The failure to tighten policy causes output and inflation to rise. At this point, the economy enters an unstable spiral: higher inflation reduces the real rate, which raises output, which further raises inflation. Without reducing money, the central bank cannot raise the interest rate to abort this process. Inflation reaches 7 percent in year 15 and 90 percent in year 25, and keeps rising forever.[5]

BOJ officials have criticized the idea of money-financed transfers on the grounds that they would eventually produce high inflation. Figure 8 shows a scenario in which this fear is realized. We have seen that policymakers can prevent this outcome by

4. Goodfriend (2000) and Suda (2003) argue that a monetary expansion to finance transfers would eventually have to be reversed, with adverse fiscal consequences. Their arguments anticipate the results of this section. Auerbach and Obtsfeld (2004) present a model in which expansionary open market operations reduce debt permanently. This result contradicts my finding that monetization of debt is irrelevant in the long run. The differences between Auerbach and Obstfeld's results and mine arise from different assumptions about inflation. In the Auerbach and Obstfeld (2004) model, a monetary expansion causes inflation to rise, reducing real government debt, even when the interest rate is zero. After that, inflation falls without a fall in output. In my model, monetary policy cannot affect inflation at a zero interest rate, and a fall in inflation requires lower output and tax revenue.

5. Eventually inflation reduces the money-income ratio sufficiently that the nominal interest rate starts rising. However, it rises more slowly than inflation, so the real rate falls forever.

Figure 8 A Permanent Monetary Expansion



reducing the money stock when inflation starts rising. But this action reverses the fiscal gain that money finance is intended to achieve.

VII. Conclusion

This paper examines the effects of a helicopter drop—a money-financed fiscal transfer—when an economy is in a liquidity trap. The model is calibrated to capture Japan's recession and deflation in 2003. The results are generally favorable to helicopter drops. Transfers totaling 9.4 percent of GDP return output to potential quickly, and the economy converges to a steady state with 2 percent inflation. By increasing output and inflation, the policy also reduces the ratio of government debt to GDP.

This paper also compares a helicopter drop to a bond-financed fiscal expansion. In the model, the two policies have the same effects on output and inflation. They also have the same *long-run* effects on the debt/GDP ratio. However, bond-financed transfers cause debt to rise in the short run, while money-financed transfers do not. This difference is an advantage of money finance, as rising debt could shake confidence in Japan's economy.

Some economists argue that fiscal transfers, whether financed by money or debt, are ineffective for stimulating Japan's economy. They claim that Japan tried fiscal expansions during the 1990s without success. If this view were correct, it would undermine this paper's argument for helicopter drops.

However, Posen (1998) and Kuttner and Posen (2001) show that fiscal policy *is* effective in Japan. As noted earlier, Kuttner and Posen (2001) present econometric evidence of a substantial fiscal multiplier. They also discredit the alleged examples of unsuccessful fiscal policy, showing that several "expansion" programs failed because they were not really expansions—they consisted mainly of normal expenditures. When true fiscal expansions occurred, as in 1995, output responded.

The policies considered in this paper—transfers financed with money or bonds—differ from those discussed in much of the literature on liquidity traps. Papers such as Eggertsson and Woodford (2003) and Auerbach and Obstfeld (2004) analyze models with forward-looking inflation expectations. In these models, central banks can engineer an escape from a liquidity trap through policies that manipulate expectations. Announcing an inflation or price-level target, for example, can raise expected inflation. Higher expected inflation reduces the real interest rate, stimulating spending.

This paper has ignored such policies because, in contrast to fiscal transfers, there is little evidence that they are effective. Policy announcements affect inflation expectations in theory, but not in practice. Empirical work generally finds that inflation expectations are tied to past inflation—they are backward-looking. Expectations do not shift when new policies are announced; they only shift when people see inflation change.

For example, policymakers in many countries have tried to manipulate inflation expectations to decrease the costs of disinflation. They have sought to reduce expected inflation by announcing such policies as inflation targets, new mandates for the central bank, or greater central bank independence. Historical analyses find that these announcements do not succeed in changing expectations (see Ball [2005b]). Expected inflation falls only after actual inflation falls, which happens when the central bank raises interest rates and reduces output. There is no reason to think that efforts to *raise* expected inflation, as proposed for Japan, would be more successful.

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