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FISCAL REMEDIES FOR JAPAN'S SLUMP

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ABSTRACT

This paper asks how a fiscal expansion would affect Japan. It uses a textbook-style macro model

calibrated to fit the Japanese economy. According to the results, Japan's output slump would be

ended by a fiscal transfer of 6.6% of GDP. This policy raises the debt-income ratio in the short run,

but it reduces this ratio in the long run through higher inflation and tax revenue. The financing of

the transfer -- bonds or money -- affects debt in the short run but not the long run.

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I. INTRODUCTION

When an economy slumps, policymakers typically stimulate demand by reducing short-term interest rates. Japan's experience in the last decade has renewed interest in an old question: what to do when rates can't be lowered. Weak demand has produced an output slump and deflation. But short-term rates cannot fall because they are already at their lower bound of zero. Japan has experienced this "liquidity trap" since 1998. Can policy still stimulate demand?

The textbook remedy for a liquidity trap is a fiscal expansion. Japanese policy is complicated, however, by a large and rising government debt. This problem led the major rating agencies to downgrade Japan's debt in 2002. Policymakers resist a fiscal expansion because they believe it would exacerbate the debt problem.

Others, however, argue for a fiscal expansion. Kuttner and Posen (2001) suggest that this policy would not only boost output but also have benign effects on Japan's debt problem. They argue that Japan's large budget deficits have mainly been caused by its output slump. By ending the slump, a fiscal expansion would eventually raise tax revenues, and higher inflation would reduce the real value of debt. These effects would offset the direct costs of a fiscal expansion.

Several advocates of a fiscal expansion suggest a twist:

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money finance (e.g. Mankiw, 1999; Stevens, 2001). They advocate

a "helicopter drop" of money – or, equivalently, a bond-financed

fiscal expansion coupled with purchases of the new debt by the

central bank. Monetization of the debt would eliminate the

direct fiscal costs of the policy, leaving only the benefits from

economic stimulus. Bernanke (2003) summarizes the argument for a

money-financed tax cut:

> 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.

This paper examines these ideas. It uses a textbook-style

macro model calibrated to fit the Japanese economy. The model's

initial conditions are based on the situation in 2003. I

determine the fiscal transfer 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 bond-financed

transfer, a money-financed transfer, and a baseline case with

passive fiscal policy. In most exercises, I assume monetary

policy follows a Taylor rule once interest rates become positive.

The results are generally favorable to fiscal expansions.

For base parameter values, a transfer of 6.6% of GDP returns

output to potential in the following year, and thereafter only

small transfers are needed to keep it there. The output recovery

ends deflation, and the interest rate becomes positive; then the

Taylor rule guides the economy to a steady state with low

positive inflation. If the fiscal transfer is financed with

bonds, the debt-income ratio jumps up when the transfer occurs,

but then it falls as output and inflation rise. Two years after

the transfer, the debt-income ratio falls below its level under

passive policy, and it remains lower in steady state. Thus the

transfer improves the long-run fiscal situation as well as ending

the output slump.

Does it matter if the fiscal expansion is financed with

money rather than debt? Money finance prevents the debt-income

ratio from jumping up when the transfer occurs. For base

parameter values, this ratio remains lower with money finance

than with debt finance for nine years. In year ten, however, the

debt paths under the two policies converge. The initial

financing of the transfer is irrelevant in the long run.

These results arise because the Taylor rule becomes

operative in year 10. In that year the central bank sets a

positive interest rate, which requires a contraction of the

monetary base. It reduces the base by selling government bonds.

The necessary contraction is larger if the initial transfer was

money-financed, and the extra sales of debt offset the initial

savings from monetization.

The rest of this paper contains seven sections. Section II presents additional background and Section III presents the model. Sections IV-VI derive the implications of passive fiscal policy, debt-financed transfers, and money financed transfers. Section VII considers robustness and Section VIII concludes.

II. BACKGROUND

This section reviews Japan's recent history and the debate over fiscal policy.

A. Japan's Slump

Figure 1 presents annual data on 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 I. In simulating alternative policies, I use data from 2003 as initial conditions.

The top panel of the Figure shows the log of real output. Output growth averaged 1.3% per year over 1990-2003, compared to 4.0% 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 has fallen 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; Posen, 2004).

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There is, of course, uncertainty about the gap between output and potential output. Following McCallum (2000) and Hoshi-Kashyap, Figure 1 presents a path for potential based on the assumption that it has grown 2% per year since 1990. This approach produces an output gap of -9% in 2003. Using production functions, some researchers have estimated recent gaps of around -5% (e.g. Ahearne et al, 2002; Leigh, 2004). In my simulations, I assume an initial output gap of -7.5%.

Figure 1 also shows inflation, as measured by the GDP deflator and by core CPI. The slump of the 90s dragged inflation down, as predicted by the accelerationist Phillips curve. In 2000, inflation reached about -1% (a bit higher for the CPI and a bit lower for the deflator). Since then, inflation has remained fairly constant. I use -1% as the initial value of inflation.

The stability of inflation since 2000 is <u>not</u> 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

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deflation. I will incorporate this idea in the paper's model.[1]

The last two panels of Figure 1 show 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, the Taylor-rule interest rate became negative, and the actual rate hit the zero bound. The interest rate has stayed close to zero since then.

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% in 2002 and 16% in 2003, reaching 20% 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.

B. A Fiscal Solution?

The classic solution to a liquidity trap is a fiscal expansion. However, Japanese policymakers are reluctant to try this policy, for two reasons. First, many argue that fiscal policy is ineffective in raising output. Second, they fear that a fiscal expansion would exacerbate the problem of a growing

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

national debt.

This paper rejects the first reason. It is based on the view that Japan tried fiscal expansions in the 1990s without success (e.g. Friedman, 2001). This view has been debunked by Posen (1998) and Kuttner and Posen (2001). They show that several "expansion" programs failed because they were not really expansions – they consisted mainly of normal expenditures. There were large fiscal deficits, but these mainly reflected revenue losses caused by the slump. In periods of true fiscal loosening, such as 1995, output responded.

Kuttner and Posen also estimate multipliers for fiscal policy in Japan. They use the structural VAR approach of Blanchard and Perotti (2002), which controls for the cyclical behavior of deficits. Kuttner and Posen find that a 100 yen tax cut raises output one year later by about 125 yen.

This paper will worry more about the second objection to fiscal expansion: its effects on Japan's public debt. Figure 2 shows the path of net government debt as a percent of GDP. This ratio rose from 0.13 in 1991 to 0.79 in 2003, and forecasters predict that it will continue to rise. Long-term budget projections are bleak because of Japan's aging population. Many analysts fear an eventual fiscal crisis, possibly even default. As a result, Japan's debt has been downgraded to A2/AA-, the

level for many developing countries.[2]

This paper will look for policies that end Japan's slump without worsening its debt problem. I will ask whether a fiscal transfer can do so -- whether the fiscal benefits from higher output and inflation outweigh the direct costs of the transfer. I will also consider the effects of financing the transfer with money rather than bonds.

III. THE MODEL

Japan's problems are largely explained by textbook macro models. A fall in aggregate demand has reduced output, and monetary policy is ineffective because the interest rate has hit zero. Kuttner and Posen say "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

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[2] According to the OECD, Japan's gross government debt for 2003 was 157% of GDP and government assets were 78%, yielding net debt of 79%. Broda and Weinstein (2004) suggest two adjustments to this figure. Like this paper, they view the government and the central bank as the same entity, and thus subtract government bonds owned by the central bank. This reduces net debt by 16% of GDP. Second, they add bad loans from the government to the private sector, which by coincidence are also 16% of GDP. The two adjustments cancel, so net debt is still 79%.

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.

A. Assumptions

Output: Potential output Y* grows by g percent per year.

Actual output Y deviates from potential according to an IS

equation:

$$(1) \qquad (Y_t - Y^*_t)/Y^*_t \ = \ \lambda(Y_{t-1} - Y^*_{t-1})/Y^*_{t-1} \ - \ \beta(r_{t-1} - r^*_{t-1})$$

$$+ \ \delta(G_{t-1}/Y^*_{t-1}),$$

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 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 (see Kuttner and Posen).

Inflation: Inflation is determined by an expectations-

augmented Phillips curve:

$$(2) \qquad \pi_t \ = \ \pi_t^e \ + \ \alpha(Y_{t-1} - Y^*_{t-1})/Y^*_{t-1} \ ,$$

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

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

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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.

Section VII 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 fiscal expansions. It does change the baseline case with passive fiscal policy. If $\pi_t^e = \pi_{t-1}$ and policy is passive, the economy falls into a spiral of accelerating deflation.

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

(4) $M_t = M_{t-1} + Z_t$,

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

(5) $\ln(M_t/P_tY_t) = k - \gamma i_t$, $i_t > 0$;

                $\geq k$, $i_t = 0$,

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

graph.[3]

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

$$(6) \qquad D_t \;=\; D_{t-1} + i_{t-1}D_{t-1} + P_tG_t - Z_t - \theta(P_tY_t - P_tY^*_t) \;.$$

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.[4]

In reality, Japan's primary surplus would probably be

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[3] It is common to specify a demand function like (5) for M1 rather than the monetary base. This would not affect the analysis if one assumes a constant ratio of M1 to the base, i.e. a constant money multiplier. This multiplier is fairly stable in Japan.

[4] Equation (6) implicitly assumes that government debt has a maturity of one year. In reality, much of Japan's debt is long-term. Adding long-term debt to the model would strengthen the case for fiscal expansion. As shown below, an expansion raises the path of interest rates.   Higher rates imply capital losses for holders of long-term debt, which are capital gains for the government.

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negative even if output were at potential. Ignoring this fact

helps us isolate the effects of exogenous fiscal expansions.

Section VII extends the model to include a primary deficit when

Y=Y*.

B. Calibration

Table 2 presents base values for the model's parameters.

Section VII considers robustness to changes in these parameters.

In the IS equation, I set β, the coefficient on the real

interest rate, to 1.0. This follows Ball's (1999) calibration

for the U.S. (I have not found Japanese evidence). For the other

IS parameters, I use Kuttner and Posen's econometric results.

They estimate that δ, the effect of lagged transfers on output,

is 1.25 and λ, the effect of lagged output, is 0.6. The effect

of transfers is smaller than Blanchard and Perotti's estimates

for the U.S.[5]

I also use Kuttner and Posen's estimate of θ, the effect of

output on the primary surplus. They find θ=0.25. This appears

conservative, as taxes are 20% of Japanese output and marginal

taxes are higher than average taxes.

The Phillips curve slope, α, is 0.2. This estimate comes

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[5] More precisely, Kuttner and Posen estimate an equation for log output, and get a coefficient of -0.25 on log taxes. Dividing by the ratio of taxes to GDP (approximately 0.2) yields the yen-for-yen effect of taxes and transfers on output.

from studies at the BOJ (e.g. Hirose and Kamada, 2002). The

Phillips curve appears flatter in Japan than in the U.S., where α

is often estimated around 0.4.

In the money demand equation, the interest rate semi-

elasticity, γ, is 0.1, based on estimates by Fujiki et al. (2002)

and Miyao (2002). The parameter k is the point at which the

money demand curve hits an interest rate of zero. I calibrate it

using the historical evidence in Figure 1. When the interest

rate reached zero in 1998, the ratio of the monetary base to GDP

was about 0.1. This implies k=ln(0.1).

The growth rate of potential output, g, is 2% per year.

C. The Neutral Interest Rate

It remains to calibrate the neutral real interest rate, r*.

This is a thorny issue. There is debate about whether this

parameter is positive or negative in Japan (e.g. Krugman, 2000).

My view is that r* is currently negative, but unlikely to stay

negative forever. My calibration will capture this idea.

The neutral interest rate is the one that produces Y=Y* in

the absence of a fiscal expansion. It seems clear that r* has

been negative in the early 2000's. The actual real rate has been

about 1% and Y has been far below Y*. Thus r* must be well below

1%. I assume an initial r* of -2%, which implies r-r* = 3%. For

this value of r-r*, the output gap converges to -7.5% if there is

no fiscal transfer. Thus the calibration captures the idea that

output is stuck at a low level.

It is unlikely, however, that r* will stay negative forever. Iwamura et al. (2004) and Leigh (2004) estimate that r* was well above zero before the 1990s, but fell during the 90s slump. The fall in r* means the IS curve shifted in. This shift reflected adverse demand shocks, such as the credit crunch and fall in confidence. It is likely that these problems will someday abate. Eventually, a cleanup of banking may spur greater lending. Or a recovery due to external demand will raise confidence and improve balance sheets. Whatever the reason, the IS curve will shift back out and r* will return to a positive level.

I assume that r* eventually rises to +2%. Of course it is hard to guess how quickly this will happen. In the base specification, I assume that r* rises linearly from -2% to +2% over ten years. The IS curve shifts outward, but slowly. Since this assumption is arbitrary, variations on the r* path are a top priority among robustness checks.

IV. A BASELINE CASE

This section derives the path of the economy if there is no fiscal expansion: $G_t=0$ for all t. The economy starts in year 0 with the initial conditions in Table 2. This exercise provides a baseline for measuring the effects of fiscal policy.

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A. Monetary Policy

To close the model, I must specify the behavior of monetary policy. I assume an interest-rate rule based on the past behavior of the Bank of Japan. Recall that the BOJ appeared to follow a Taylor rule until the interest rate hit zero. This behavior is captured by

(7) $i_t = \max\{i^T_t, 0\}$,

        $i^T_t = r^*_t + \pi_t + a(Y_t-Y^*_t)/Y^*_t + b(\pi_t-\pi^*)$,

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., 2004).

When the rule 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. (Section VI examines an alternative assumption.)

In the Taylor rule, the coefficients a and b are chosen as follows. Taylor rules with certain parameters are equivalent to

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"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%, 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%

in year 6, and it becomes positive in year 10. From years 1 to

9, there is a cumulative output gap of -54%.

Inflation falls to -1.5% 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.

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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%. 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% 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 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%. The fall in the debt ratio results from seignorage revenue, as Z>0 in steady state. The ratio

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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.

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

    (8) G_t = $\max\{G_t$*, 0\} , t≥1 .

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% of output (Y), or

6.1% 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% gap of the baseline case. The transfer is

2.2% of output in year 2, less than 1% 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% 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% of GDP or more; a

1998 stimulus package was 4%. The total effect of fiscal policy

was small, because expansions in some years were offset by

contractions in others (such as the 1997 tax increase). The key

difference between the transfers proposed here and recent

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 period

2; most of the long slump in the baseline case is eliminated.

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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% inflation.

The large transfer in period 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 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 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: 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% of potential output. The cumulative gap with transfers is -5%, so the transfers raise output by a total of 39% of potential. The effect of output on

government revenue, θ, is 0.25; thus revenue rises by (0.25)39% = 9.8% of potential output. This gain more than offsets the initial transfers, which total 9.4% of potential. The transfers also reduce the debt-income ratio by raising inflation. Inflation reaches zero in period 3, while it stays negative through period 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:

   (9) Z_t = $P_t G_t$,   t=1,...,4 .

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

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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.

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, 1995). 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.[6]

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, for example, advocates money-financed transfers for

which "much or all of the increase in the money stock is viewed

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[6] Goodfriend (2001) and Suda (2001) 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-Obstfeld's results and mine arise from different assumptions about inflation. In the Auerbach-Obstfeld 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.

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 11, 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% in year 15 and 90% in year 25, and keeps rising forever.[7]

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[7] Eventually inflation reduces the money-income ratio sufficiently that the nominal

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

VII. ROBUSTNESS

This section considers the robustness of my results. I first vary the model's parameters, and then consider broader changes in assumptions.

The paper's main conclusions are fairly robust. A fiscal expansion always produces a faster output recovery. The long-run effects on the debt-income ratio vary across specifications. In most cases, however, a fiscal expansion reduces debt below its level under passive policy. In some cases, this gain is large. At worst, a fiscal expansion raises long-run debt by a small amount.

A. The Neutral Real Rate

As discussed in Section III, Japan's neutral real interest

interest rate starts rising. However, it rises more slowly than inflation, so the real rate falls forever.

rate appears to be negative, but is unlikely to stay negative forever. So far, I have assumed the neutral rate r* starts at -2% and rises linearly to +2% over ten years. Here I continue to assume r* rises linearly from -2% to +2%, but vary the speed of this rise. A fast increase in r* means the IS curve shifts out quickly.

A faster increase in r* weakens the case for fiscal expansion. This is illustrated by Figure 9. Like Figure 6, this Figure compares the economy's evolution with passive policy and with the fiscal rule (8). But it assumes that r* rises to +2% in five years rather than ten. Fiscal expansion still raises output, but its effects on debt are a bit less favorable than before. The debt-income ratio in year 25 is about one percentage point higher with the expansion than without.

This result reflects the effects of the r* path on output. If r* rises more quickly, then output recovers more quickly in the case of passive policy. This reduces the benefits of ending the initial slump with a fiscal expansion. There are smaller output gains, and hence smaller revenue gains to offset the initial cost of the expansion.

Figure 10 considers a range of paths for r*. I assume this parameter rises linearly from -2% to +2% in n years, and vary n from 1 to 20. For each n, the Figure shows the debt-income ratio in year 25 with passive policy and with a fiscal expansion. The

expansion raises the debt-income ratio for n<6, but only by
modest amounts. The costs of expansion when n is small are lower
than the gains when n is large.

B. Equation Coefficients

Table 3 examines robustness to varying the coefficients in
the model's equations -- the IS and Phillips curves and the debt
equation. Starting from the base values in Table 2, I change one
coefficient at a time, trying values that are twice as large and
half as large. For each variation, Table 3 reports the debt-
income ratio in year 25 with passive policy and with a fiscal
expansion.[8]

Not surprisingly, a key coefficient is δ, the fiscal
multiplier. A larger multiplier means a smaller transfer is
needed to return output to potential. This reduces the debt-
income ratio in the case of expansionary policy. Recall that the
base value of δ is 1.25; for this value, the debt-income ratio in
year 25 is 5 points lower with expansionary policy than with
passive policy. This gain rises to 9 points for $\delta=2.5$, but it
falls to -3 points for $\delta=0.625$. The gain is positive for all

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[8] As I vary the model coefficients, I also vary the coefficients in the central bank's
interest-rate rule, equation (7). As discussed in Section IV, the coefficients in (7) are chosen so
that inflation moves halfway to its target each period. The coefficients defined by this rule are
functions of the IS and Phillips-curve coefficients.

δ>0.76.

When the other coefficients change, the fiscal gains from transfers are robust. Transfers raise the long-run debt ratio in only one case (λ=0.3), and then by a trivial amount. Often transfers reduce debt by large amounts (e.g. 41% of GDP for α=0.4).

C. Perpetual Deficits

So far I have assumed the government's primary budget is balanced if output is at potential and the transfers G are zero. This assumption does not fit Japan today. There is a large primary deficit, which is only partly cyclical. It appears this deficit would be about 5% of GDP if output were at potential.

This fact can be captured by adding a term to the debt equation, (6). The equation becomes

$$(9) \quad D_t \;=\; D_{t-1} + i_{t-1}D_{t-1} + P_tG_t - Z_t - \theta(P_tY_t - P_tY^*_t)$$
$$+ (0.05)P_tY^*_t \;.$$

The last term is the primary deficit when output is at potential.

This modification does not change the behavior of output or inflation, but it does affect the debt path. For base parameter values, Figure 11 shows this path for the cases of passive and expansionary fiscal policy. In both cases the debt-income ratio rises forever. A permanent budget deficit leads to disaster.

However, fiscal expansion still compares favorably to passive policy. Starting in year 2, the debt-income ratio is

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always smaller with the expansion. This policy does not

eliminate the underlying deficit problem, but it slows the growth

of debt.

D. A Textbook Phillips Curve

The main model assumes that expected inflation cannot fall

below zero. Here I assume that expected inflation equals past

inflation, even if past inflation is negative:

(10) π_t^e = π_{t-1} .

This assumption and equation (2) produce an accelerationist

Phillips curve:

(11) π_t = π_{t-1} + $\alpha(Y_{t-1}-Y^*_{t-1})/Y^*_{t-1}$.

Figure 12 shows how this modification affects the economy under

alternative policies.

The largest changes occur for the case of no fiscal

expansion -- the solid line in the Figure. In this case, the

output slump leads to a deflationary spiral. Low output reduces

inflation, which raises the real interest rate, which further

reduces output. Inflation and output head to minus infinity.

With an accelerationist Phillips curve, passive policy is

disastrous.

The dashed line in the Figure shows the effects of the

fiscal rule (8). The outcomes from this policy are better than

from passive policy, but still not good. Inflation falls to -4%

and then remains at that level. The nominal interest rate stays

at zero, and the real rate rises to +4%. The economy stays in a

liquidity trap. To keep output at potential, as required by rule

(8), the government must provide transfers forever. This causes

the debt-income ratio to rise without bound.

In this version of the model, a more aggressive fiscal

expansion is better. The dotted line in Figure 12 shows what

happens if the transfer in year 1 is 15% of potential output,

rather than 7% as dictated by (8). This transfer creates a boom

in year 2, pushing inflation from -4% to -2% in year 3. With 2%

inflation, the real interest rate is low enough for the economy

to escape the liquidity trap. Eventually a non-negative output

gap can be sustained without transfers. The debt-income ratio

peaks at 0.91 in year 26 and then falls.

E. A Forward-Looking Real Interest Rate

The main model is backward-looking -- there is no role for

expectations of future variables. Here I introduce some forward-

looking behavior. I define the real interest rate as the nominal

rate minus expected future inflation, not current inflation.

Since the model is non-stochastic, expected inflation equals

actual future inflation. The real interest rate is

(12) $r_t = i_t - \pi_{t+1}$.

This variation has only minor effects on the results. Once

again, a fiscal expansion ends the output slump and reduces long-

run debt. The debt-income ratio in year 25 is 0.73 with fiscal

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expansion and 0.79 with passive policy.

VIII. CONCLUSION

This paper examines the effects of fiscal transfers in a
model of the Japanese economy. Initial conditions are set to
capture Japan's slump as of 2003. I determine the level of
transfers needed to return output to potential, and the effects
on inflation and the debt-income ratio. I assume that monetary
policy follows a Taylor rule once the interest rate becomes
positive.

A quick output recovery requires transfers totaling 9.4% of
potential GDP over four years. After the recovery, the Taylor
rule guides the economy to a steady state with output at
potential and 2% inflation. If the transfers are financed with
bonds, they cause the debt-income ratio to jump up. After that,
the ratio falls rapidly due to higher growth, inflation, and tax
revenue. In steady state, the debt-income ratio is lower than in
a baseline case with no transfers. Thus the transfers produce a
win-win: they end the output slump and reduce Japan's long-run
fiscal problem.

I also consider transfers financed with money rather than
debt. The finance method does not influence the paths of output
or inflation. It also does not affect the debt-income ratio in
steady state, because the initial monetization of debt is

eventually reversed. However, money finance prevents the initial run-up of debt that occurs with bond-financed transfers. Thus money finance is preferable if policymakers care about short-run as well as long-run debt levels.

The results in this paper capture the ideas of some Japan-watchers. For example, in discussing the downgrade of Japan's debt, Thomas Byrne of Moody's argues that Japan needs a fiscal expansion:

> Japan can't consolidate its way out of this (debt problem), it has to grow its way out. Any policy that ends deflation and stimulates growth (is good). A fiscal policy that didn't include a lot of wasteful spending may present near-term anxiety but, if it really did stimulate growth, it would be good over the long term. [quoted in Pilling (2002)]

Byrne suggests that the long-run fiscal benefits from expansionary policy would outweigh the costs, as this paper finds. The "near-term anxiety" he mentions is presumably caused by the temporary rise in debt from a bond-financed expansion. Thus Byrne also provides a rationale for money finance, which reduces debt in the short run.

REFERENCES

Ahearne, Alan, et al., "Preventing Deflation: Lessons from
    Japan's Experience in the 1990s," International Finance
    Discussion Paper, Board of Governors of the Federal Reserve
    System, 2002.

Auebach, Alan, and Maurice Obstfeld, "The Case for Open-Market
    Purchases in a Liquidity Trap," University of California,
    Berkeley, 2004.

Baba, Naohiko, et al., "Japan's Deflation, Problems in the
    Financial System, and Monetary Policy," Bank of Japan, 2004.

Ball, Laurence, "Efficient Rules for Monetary Policy,
    International Finance 2 (April 1999), 63-83.

Bernanke, Ben S., "Some Thoughts on Monetary Policy in Japan,"
    speech to Japan Society of Monetary Economics, May 31, 2003.

Blanchard, Olivier, "Bubbles, Liquidity Traps, and Monetary
    Policy," in Ryoichi Mikitani and Adam S. Posen (eds.),
    Japan's Financial Crisis and Its Parallels to U.S.
    Experience, Institute for International Economics, 2000.

_____ and Roberto Perotti, "An Empirical Characterization of
    the Dynamic Effects of Changes in Government Spending and
    Taxes on Output," Quarterly Journal of Economics 117
    (November 2002), 1329-1368.

Broda, Christian, and David E. Weinstein, "Happy News from the
    Dismal Science: Reassessing Japanese Fiscal Policy and
    Sustainability," Columbia University, 2004.

Friedman, Milton, "No More Economic Stimulus Needed," Wall Street
    Journal October 10, 2001, A17.

Fujiki, Hiroshi, Cheng Hsiao, and Yan Shen, "Is There a Stable
    Money Demand Function under the Low Interest Rate Policy? A
    Panel Data Analysis," Bank of Japan Monetary and Economic
    Studies 20 (April 2002), 1-23.

Fukao, Mitsuhiro, "Financial Strains and the Zero Lower Bound:
    The Japanese Experience," Keio University, 2004.

Goodfriend, Marvin, "Overcoming the Zero Bound on Interest Rate
    Policy," Journal of Money, Credit, and Banking 32 (November
    2000, Part 2), 1007-1035.

Hirose, Yasuo and Koichiro Kamada, "Time-Varying NAIRU and
    Potential Growth in Japan," Bank of Japan Research and
    Statistics Working Paper #02-8, 2002.

Hoshi, Takeo, and Anil K Kashyap, "Japan's Financial Crisis and
    Economic Stagnation," Journal of Economic Perspectives 18
    (Winter 2004), 3-26.

Iwamura, Mitsuru, Takeshi Kudo, and Tsutomu Watanabe, "Monetary
    and Fiscal Policy in a Liquidity Trap: The Japanese
    Experience 1999-2004," Institute of Economic Research,
    Hitotsubashi University, 2004.

Kuttner, Kenneth N., and Adam S. Posen, "The Great Recession:
    Lessons for Macroeconomic Policy from Japan," Brookings
    Papers on Economic Activity 2001:2, 93-160.

Krugman, Paul, "Thinking About the Liquidity Trap," Journal of
    the Japanese and International Economies 14 (December 2000),
    221-37.

Leigh, Daniel, "Monetary Policy and the Dangers of Deflation:
    Lessons from Japan," Johns Hopkins University, 2004.

Mankiw, N. Gregory, "Memo to Tokyo: Cut Taxes, Print Money,"
    Fortune, January 11, 1999.

McCallum, Bennett T., "Alternative Monetary Policy Rules: A
    Comparison with Historical Settings for the United States,
    the United Kingdom, and Japan," NBER Working Paper #7725,
    2000.

Miyao, Ryuzo, "Liquidity Traps and the Stability of Money Demand:
    Is Japan Really Trapped at the Zero Bound?," Kobe
    University, 2002.

Pilling, David, "Japan Braced for a Rating Downgrade as Economy
    Dips," Financial Times, March 9, 2002.

Posen, Adam S., Restoring Japan's Economic Growth, Institute for
    International Economics, 1998.

_____, "It Takes More Than a Bubble to Become Japan,"
    Institute for International Economics Working Paper #03-9,
    2003.

Svensson, Lars E.O., "Inflation Forecast Targeting: Monitoring

and Implementing Inflation Targets," <u>European Economic Review</u> 41 (June 1997), 1111-1146.

Stevens, Glenn, "Comment," Bank of Japan <u>Monetary and Economic Studies</u> 19 (September 2001), 313-321.

Suda, Miyako, "The Effect of 'Quantitative Monetary Easing' When the Nominal Short-Term Interest Rate is Zero," Bank of Japan, 2003.

Table 1

Conditions in 2003 (Initial Conditions for Simulations)

Output gap = -7.5%

Inflation = -1.0%

Nominal interest rate = 0

Base/GDP = 0.20

Debt/GDP = 0.79

Table 2

Base Parameter Values

IS: β=1.0,   λ=0.6,   δ=1.25

Revenue: θ=0.25

Phillips curve: α=0.2

Money demand: γ=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

Table 3: Varying the Parameter Values

Debt/GDP in year 25

	with baseline policy	with fiscal transfer
$\delta = 0.625$	0.77	0.79
$\delta = 2.5$	0.77	0.68
$\beta = 0.5$	0.67	0.66
$\beta = 2$	1.13	0.81
$\lambda = 0.3$	0.66	0.67
$\lambda = 1.2$	[very large]	0.86
$\alpha = 0.01$	0.65	0.64
$\alpha = 0.04$	1.20	0.79
$\theta = 0.125$	0.73	0.72
$\theta = 0.5$	0.85	0.71

Figure 1: Japan's Slump

Output

In output (billions, 1995 prices) — — 2% growth

Inflation

gdp deflator — — cpi (ex fresh food, adj for cons. tax hikes)
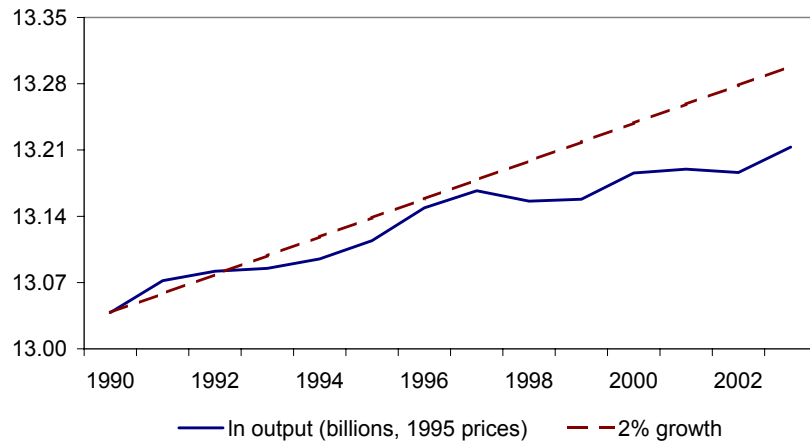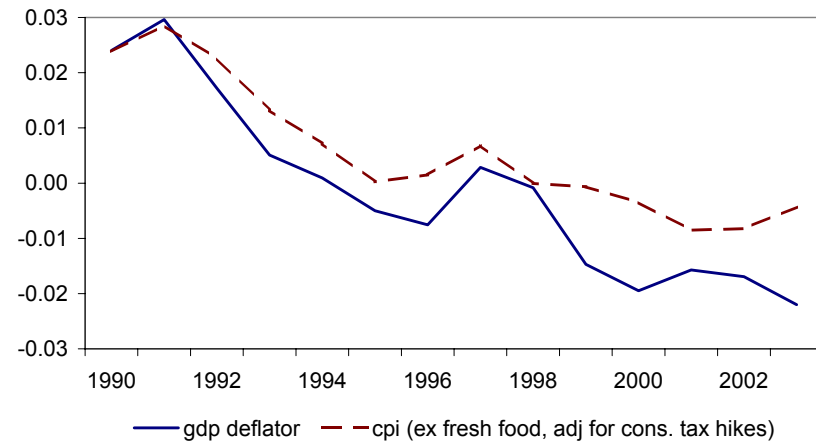
Short-term Interest Rate
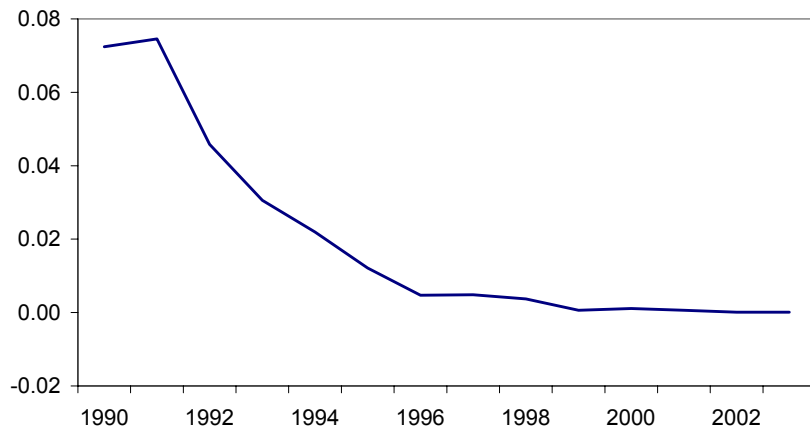
Monetary Base/GDP
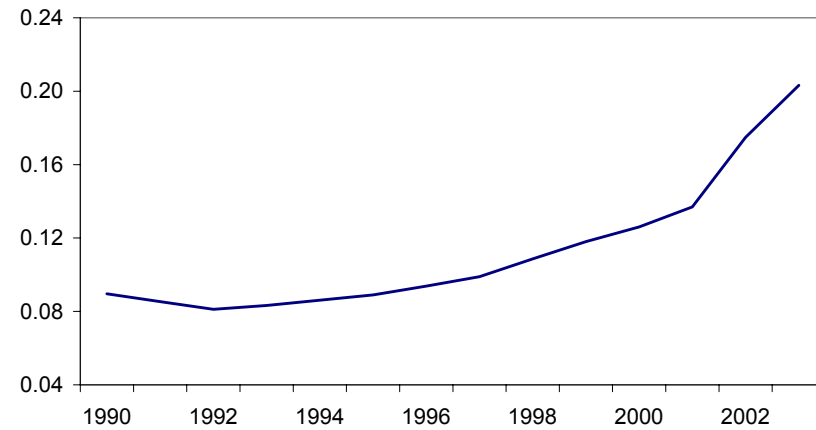
Figure 2: Rising Debt

Net Debt/GDP
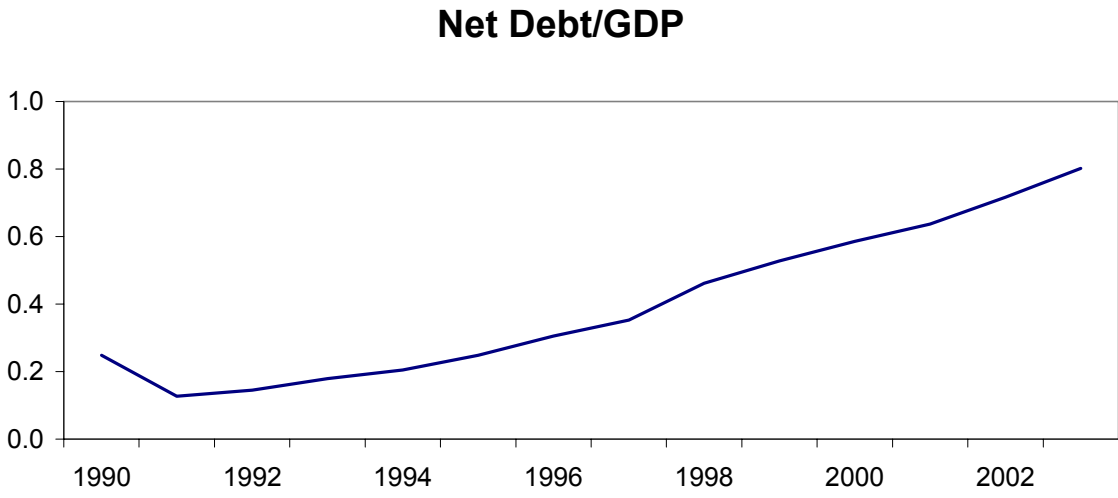
Figure 3: Money Demand
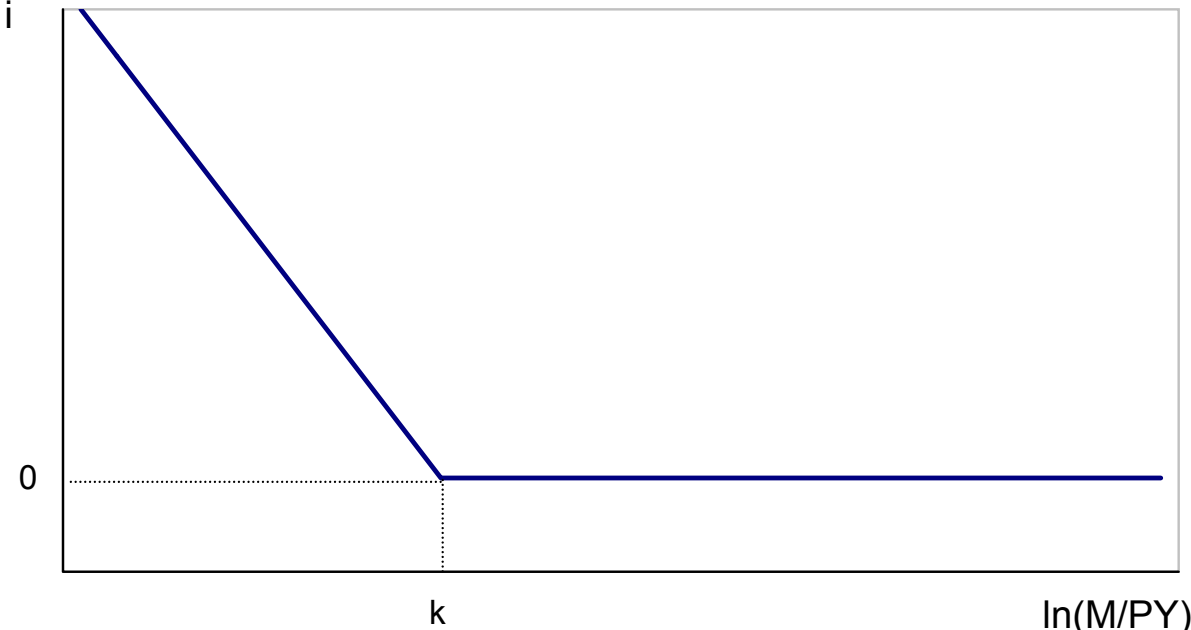
Figure 4: Baseline Case

Output Gap
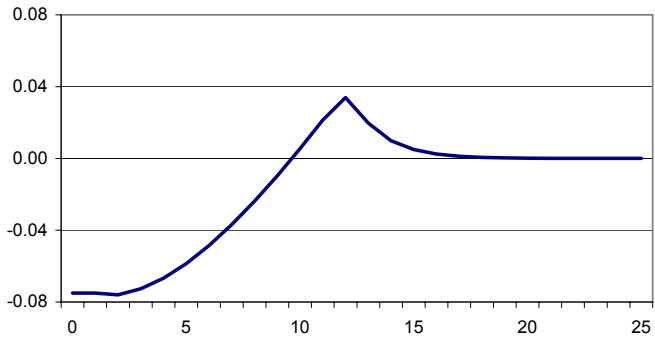
Inflation
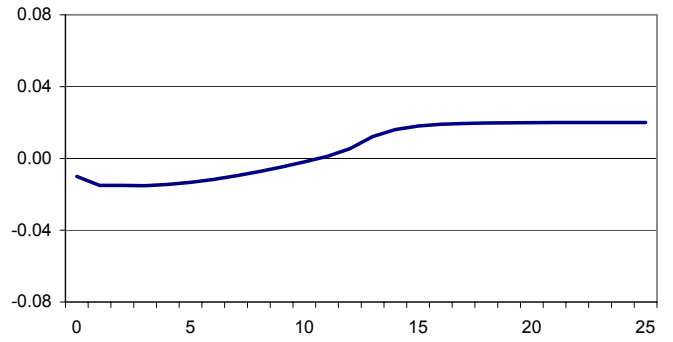
Nominal Interest Rate
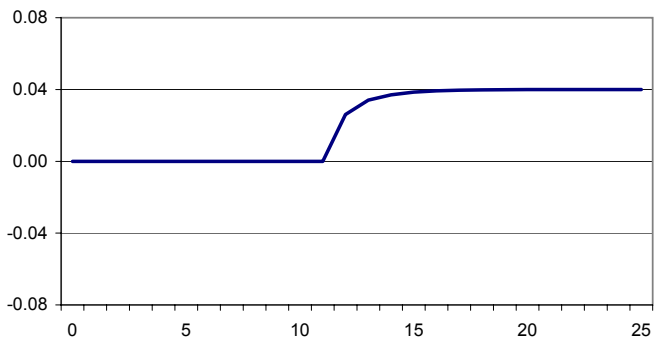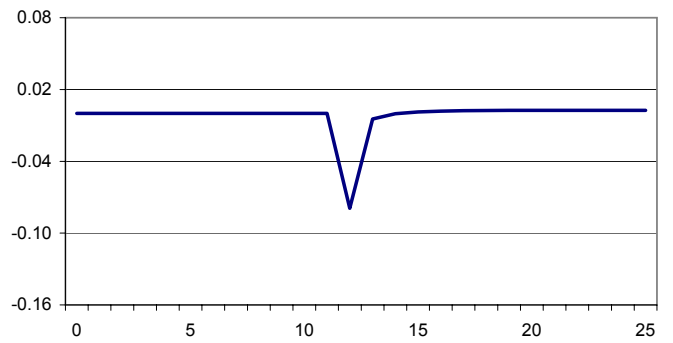
OMO/GDP
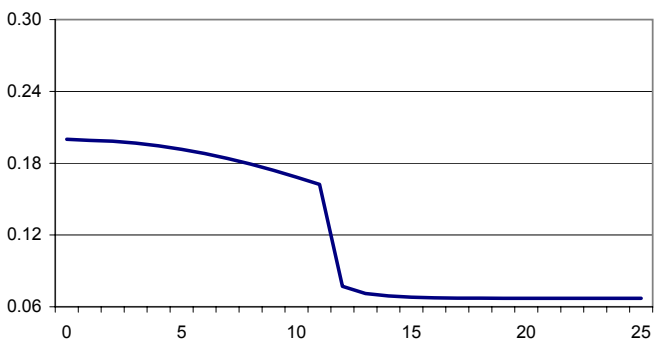
Monetary Base/GDP
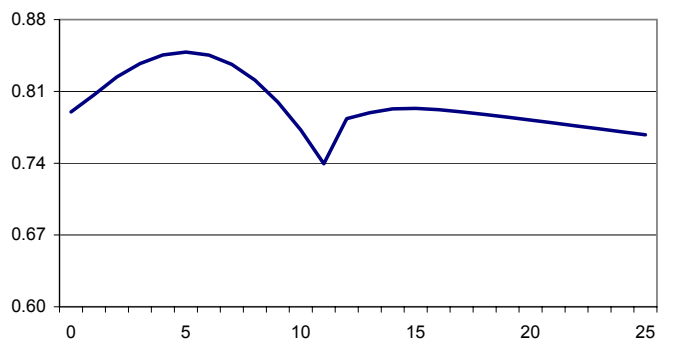
Debt/GDP

Figure 5: The Fiscal Expansion

Transfers/GDP
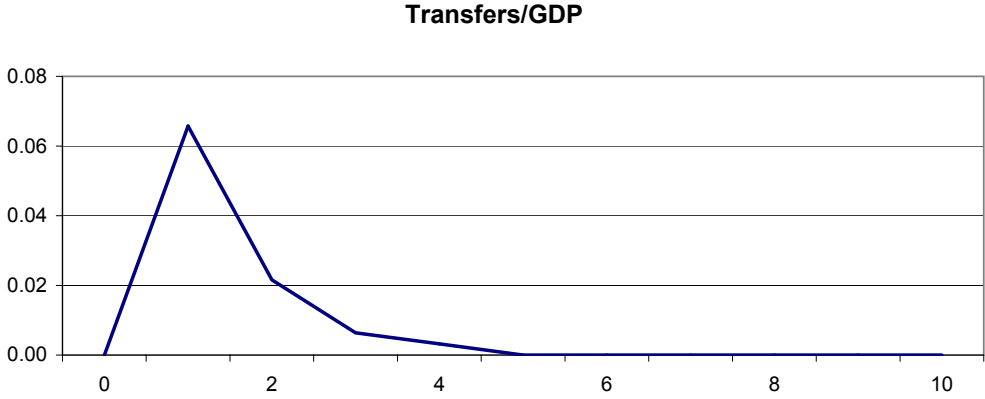
Figure 6: Effects of Fiscal Expansion

Output Gap

with bond-financed transfer

baseline
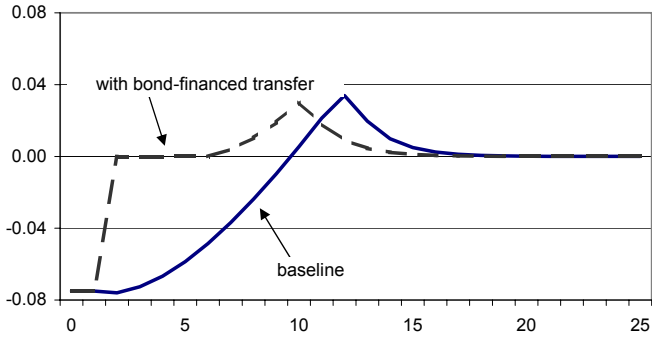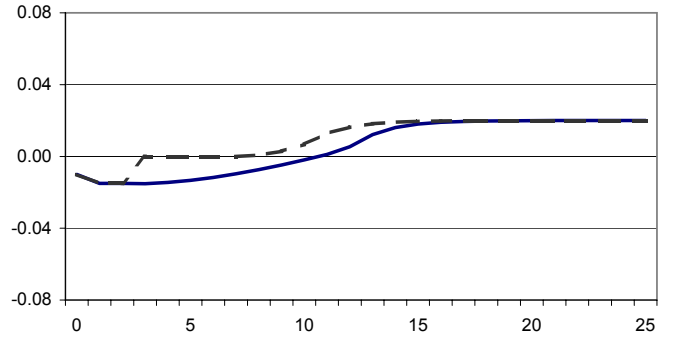
Inflation

Nominal Interest Rate
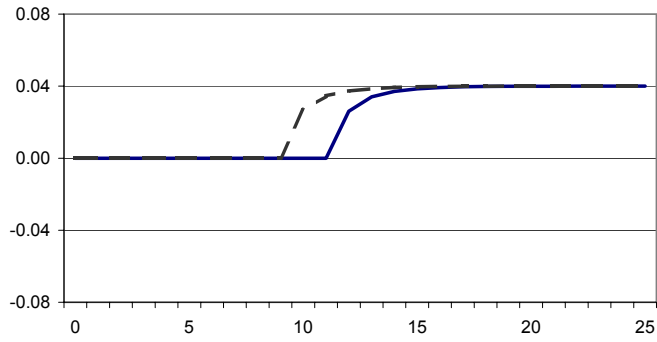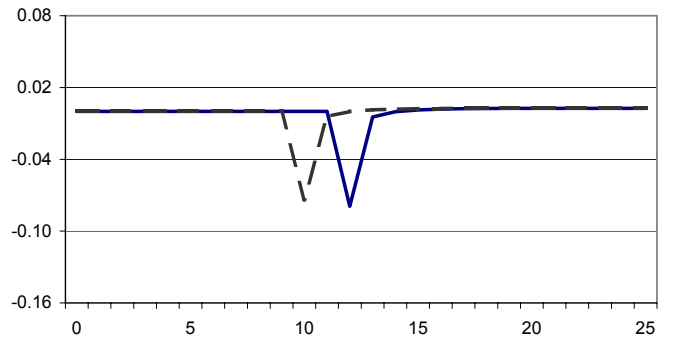
OMO/GDP
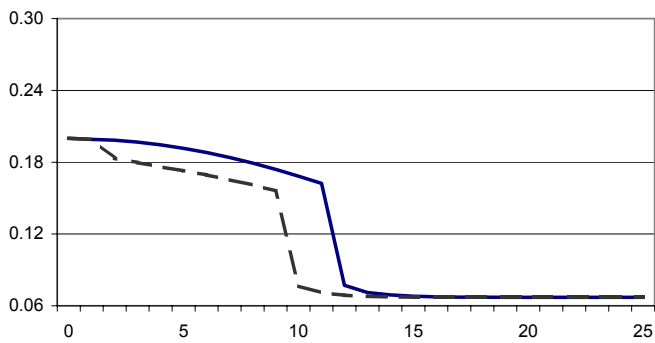
Monetary Base/GDP
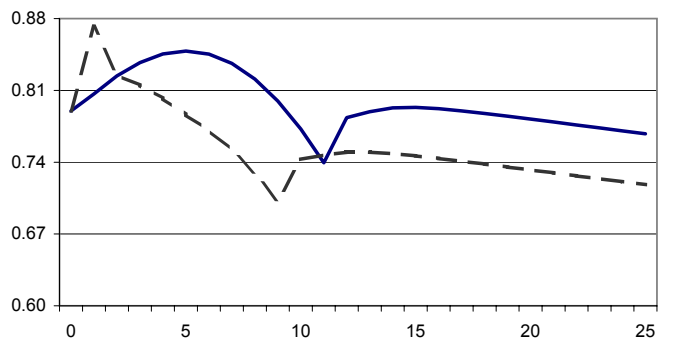
Debt/GDP

Figure 7: Money-Finance vs. Debt-Finance

Monetary Base/GDP

with money-financed transfer

baseline

with bond-financed transfer
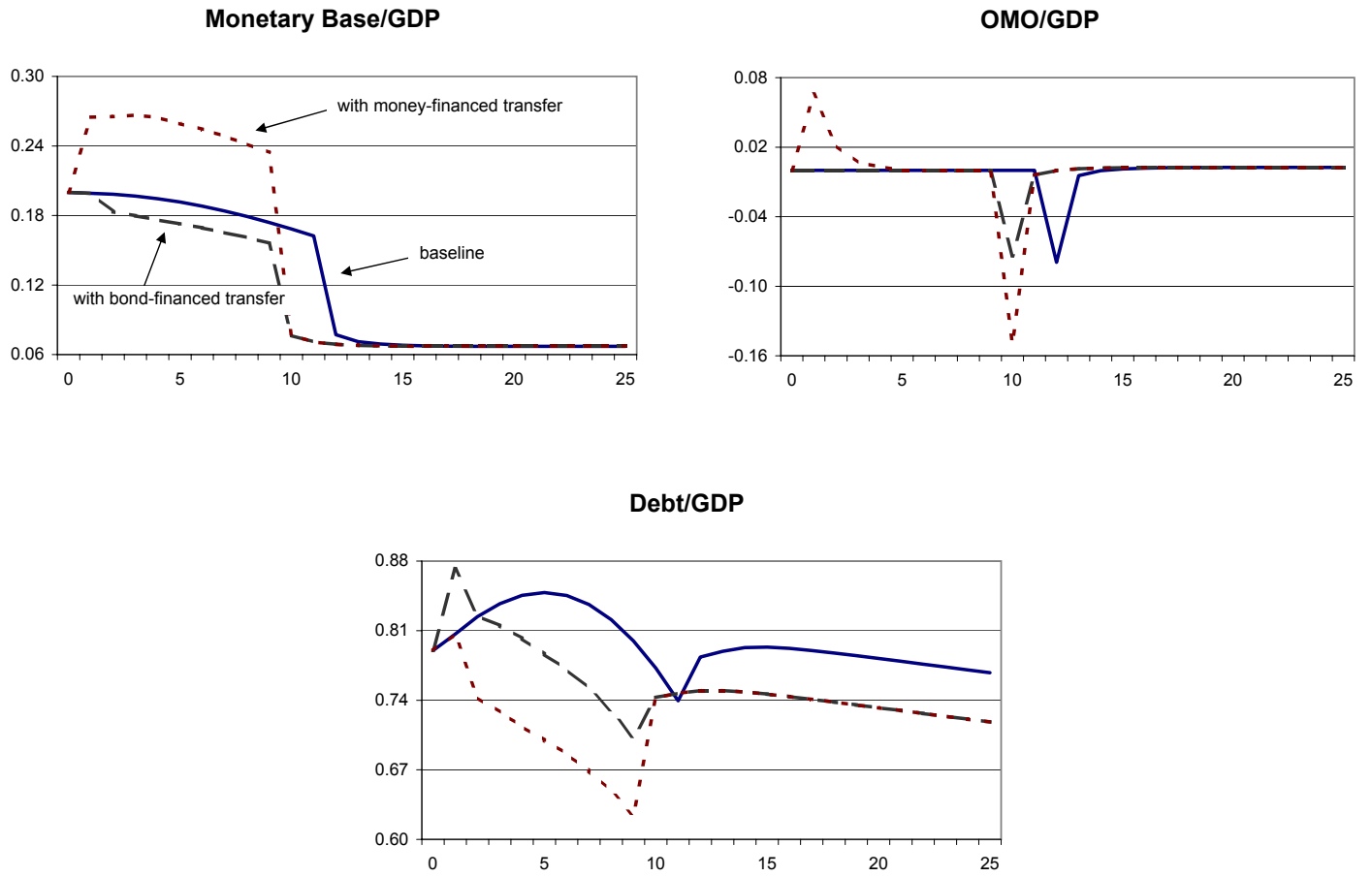
OMO/GDP

Debt/GDP

Figure 8: A Permanent Monetary Expansion

Output Gap

permanent expansion

expansion followed by Taylor rule

Inflation

Nominal Interest Rate

OMO/GDP

Monetary Base/GDP
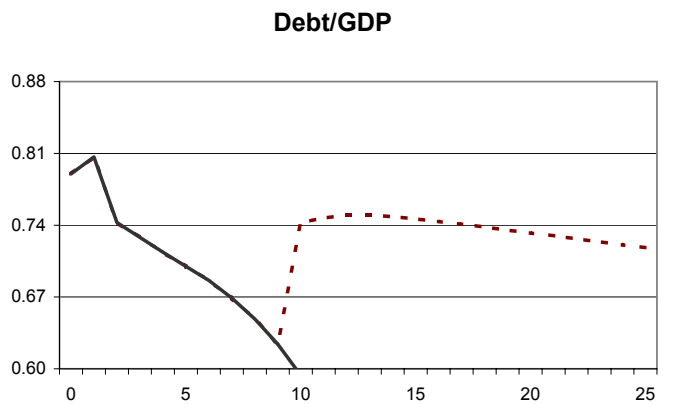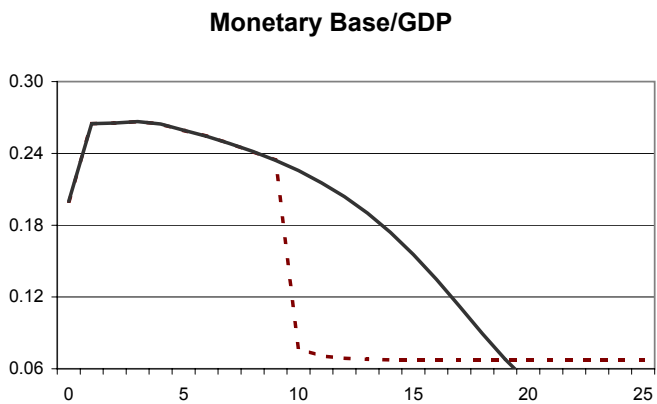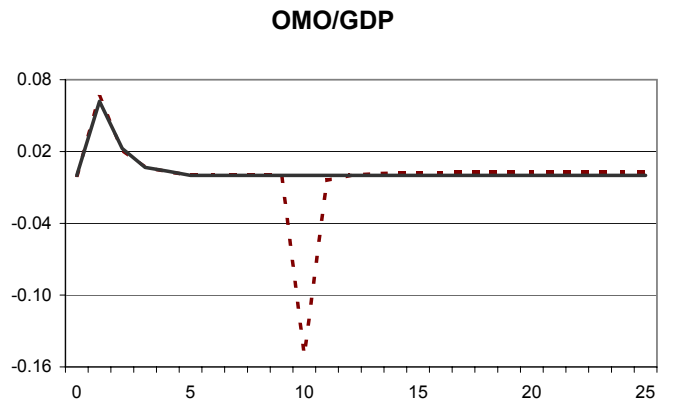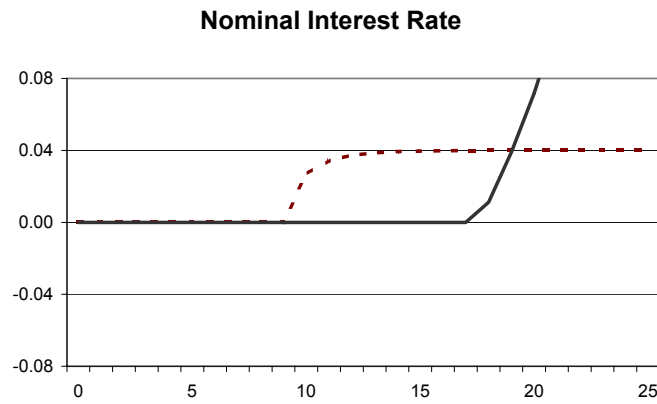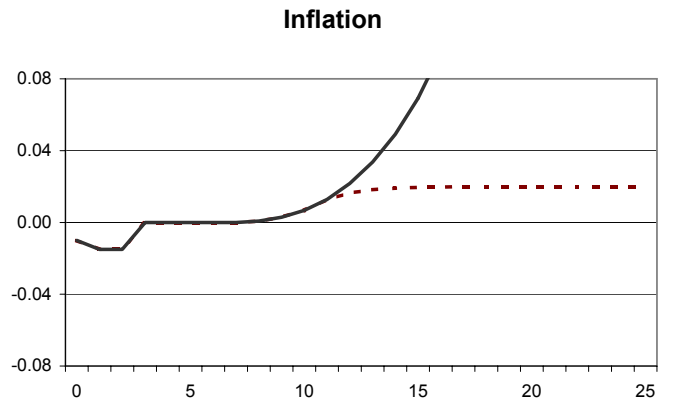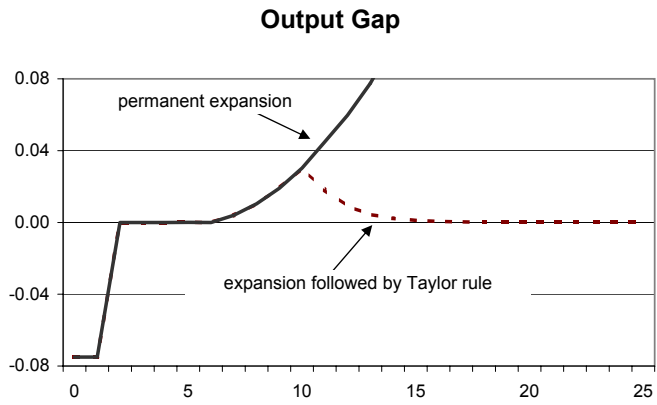
Debt/GDP

Figure 9: A Faster Rise in r*

Output Gap

with bond-financed transfer

baseline
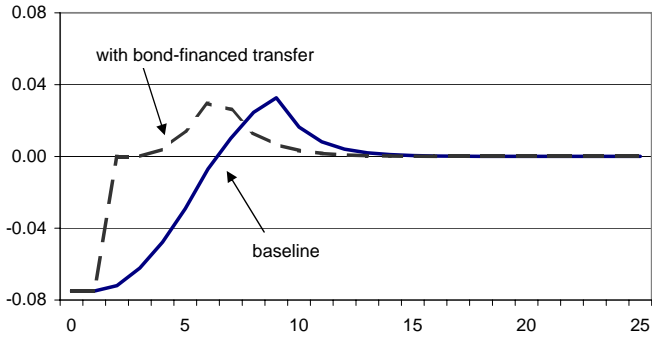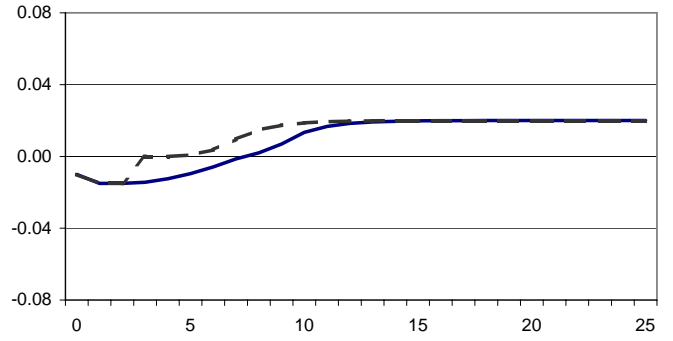
Inflation

Nominal Interest Rate
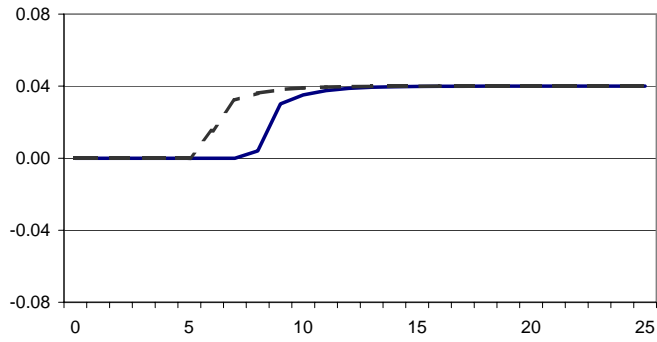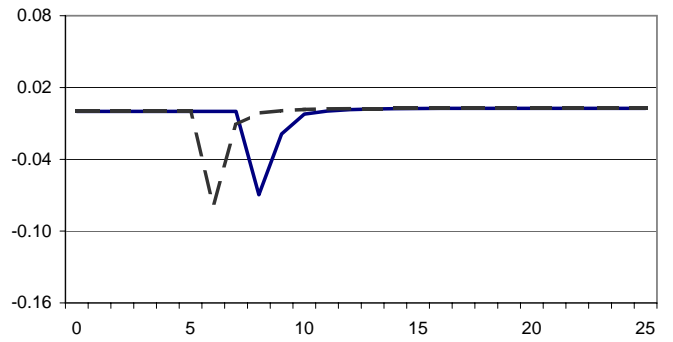
OMO/GDP
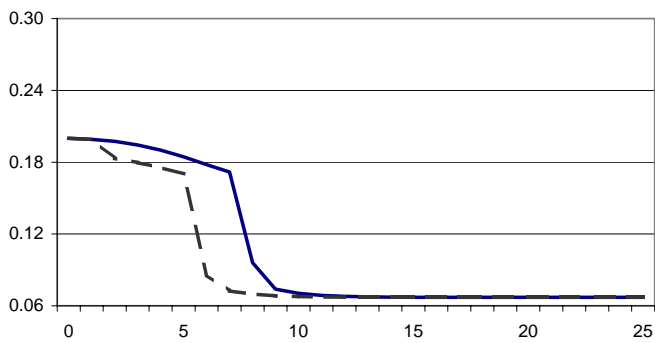
Monetary Base/GDP
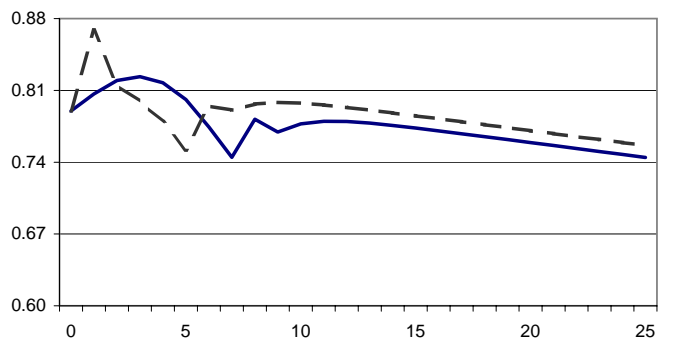
Debt/GDP
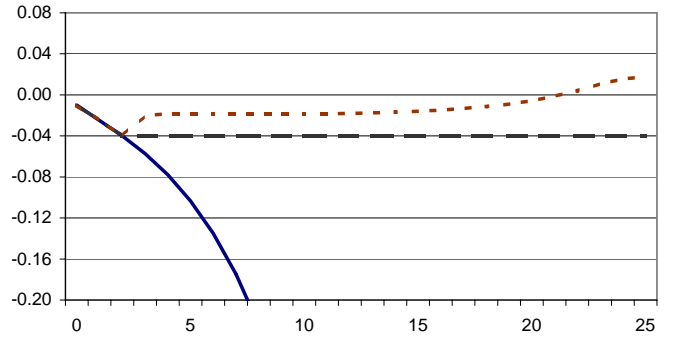
Figure 10: Varying the Path of r*
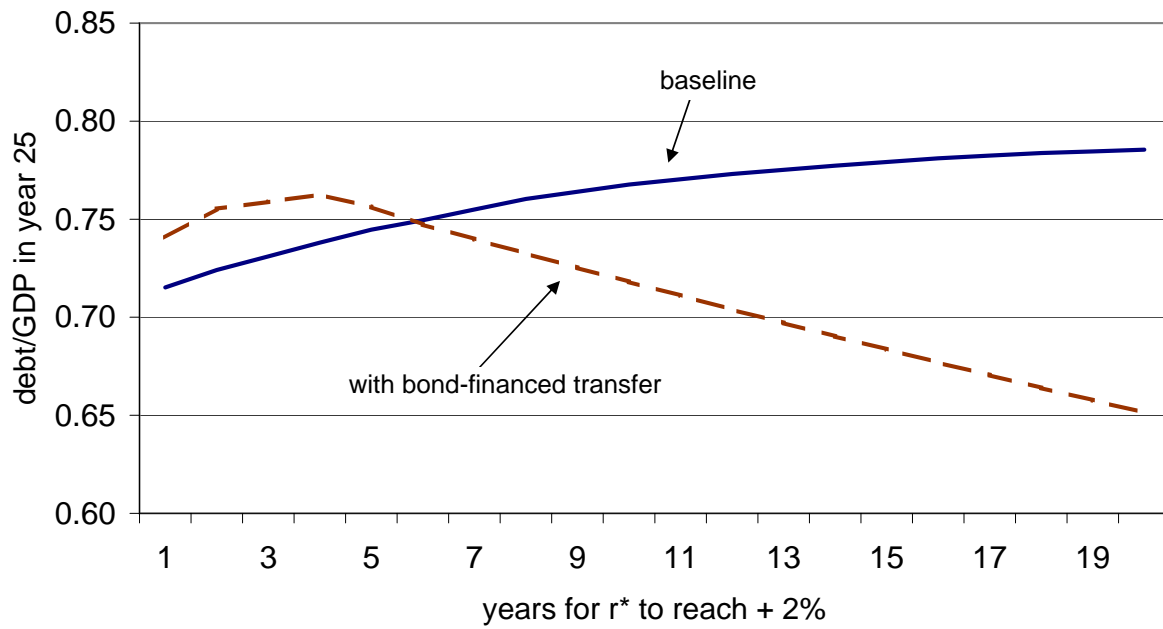
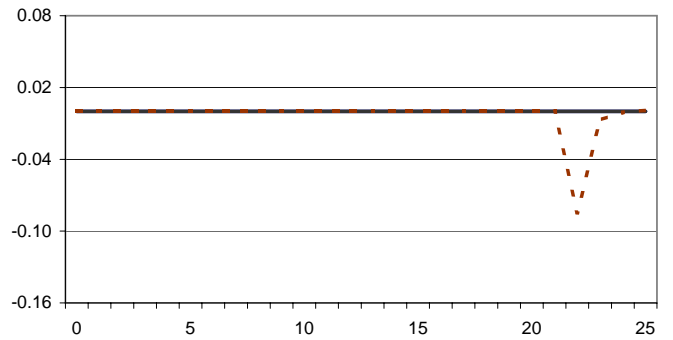# Figure 11: Perpetual Deficits
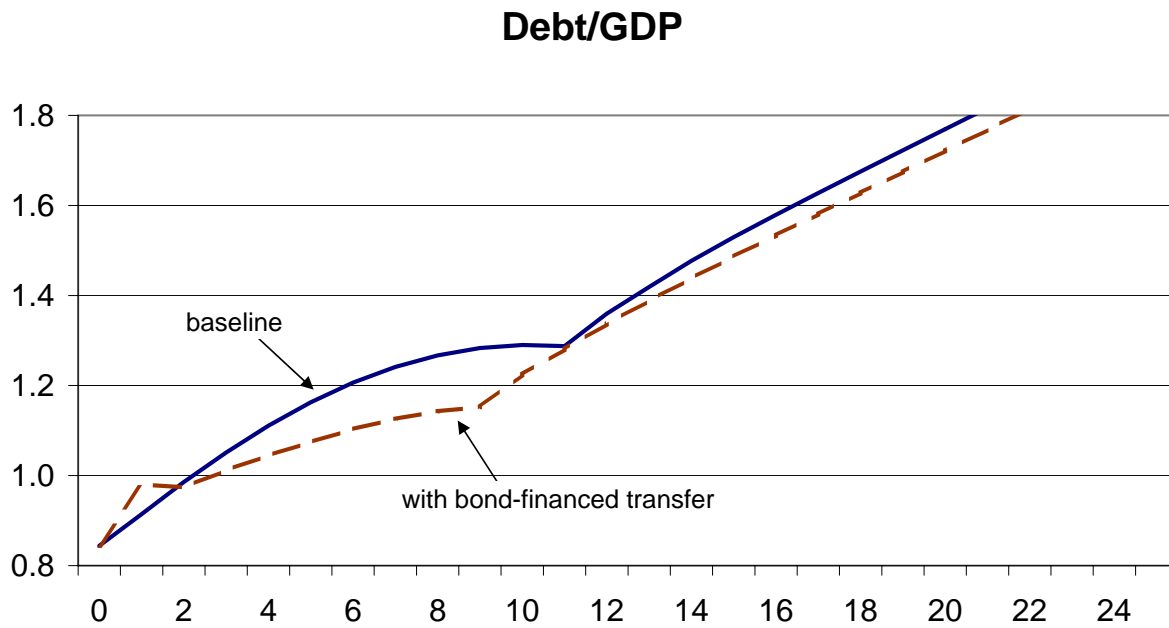
Debt/GDP
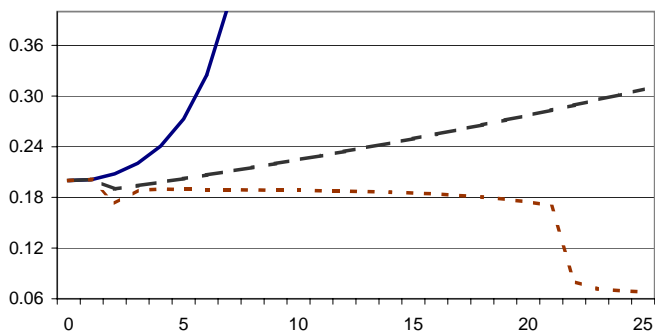
Figure 12: A Textbook Phillips Curve

Output Gap

Inflation

Nominal Interest Rate

OMO/GDP

Monetary Base/GDP

Debt/GDP