LIMITS TO INFLATION TARGETING

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ABSTRACT. Inflation targeting may do more harm than good if there is a substantial chance that the central bank cannot in fact control inflation. A prerequisite for central bank control of inflation is appropriate coordination with or backup by fiscal policy, and the nature of the required coordination will depend on whether and how central bank independence from the fiscal authority has been implemented. These considerations suggest that in those countries where inflation control has in the past been most difficult, inflation targeting may be least useful. Where inflation control has in the past been successful, the benefits of inflation targeting may have more to do with the associated changes in the policy process and in the central bank's communication with the public than with the inflation target itself.

I. THE TWO FACES OF INFLATION TARGETING

Economists should recognize that they have a history of proposing simple "nominal anchor" prescriptions for monetary policy that have eventually proved not to be very useful. If economists satisfy a demand for spurious technocratic solutions to the political and institutional pathologies that generate destructive episodes of deflation or inflation, they can do harm by diverting attention from the sources of the problem. Such nostrums can also be harmful, usually with a delay, by failing to work, and thereby undermining the credibility of monetary policy. A cynical view might be that inflation targeting has become attractive less because of advances in our discipline than because of the demand for a replacement for the gold standard, monetarism, and exchange rate anchors.

There is some reason to hope, though, that inflation targeting is a "better nostrum". This anchor is something that people do in fact care about, rather than

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an "intermediate target". It is therefore likely to remain credible that the central bank is committed to its inflation target even through periods when its policies are having difficulties. This anchor is widely recognized not to be directly and immediately under the central bank's control. Inflation targeting therefore requires that the central bank explain how its current actions relate to its view of the future course of the economy and that it be explicit about how precisely it can control inflation.

But there are in fact bounds, set by fiscal policy broadly conceived, on the central bank's control over inflation. It may lose control of a deflation. Benhabib, Schmitt-Grohe, and Uribe (2001) (BSU) show that an interest rate rule that satisfies the "Taylor principle", because of the zero lower bound on nominal rates, can lead inevitably to a deflationary spiral.[1] They did not emphasize that the result depends on a decidedly peculiar-looking fiscal policy. Peculiar though it is, we see historical examples of something close to such a policy. To understand how such a policy can arise, it may help to step outside the framework of models that treat the central bank and the treasury as a unified entity, with a single budget constraint.

The central bank may be faced with a fiscal policy that fails to make primary surpluses respond to the level of debt, and thereby undoes any effort by the bank to restrict the volume of outstanding nominal liabilities. Loyo (2000) shows how a failure of fiscal backing for monetary policy can leave interest rate increases powerless to restrain inflation, and applies his model to interpreting Brazilian experience. Even when what are usually thought of as appropriate fiscal policies prevail, there are generally competitive equilibria in which spiralling inflation leads to the disappearance of real balances. Such equilibria can be suppressed by "backup" policies that put a floor on the value of money, either via taxation or reserve holdings. But it is not automatic that such backup policies are credible.

And as a theoretical possibility, the lack of a credible fiscal policy may open the door to equilibria in which accelerating inflation leads to demonetization of the

[1]"Inevitably" is arguably too strong a word here. They find indeterminacy. But in a stochastic world, indeterminacy reappears at every moment, and any random perturbation of a nicely behaved equilibrium is likely to lead to the deflationary trap.

economy, even when policies are also consistent with stable equilibria. This theoretical possibility may influence central bank thinking, even though it has rarely if ever been observed.

II. DEFLATIONARY TRAPS VIA "RICARDIAN" FISCAL POLICY

In this section and the next we consider two models, both highly simplified, that display in stark form the nature of fiscal bounds on the ability to control the price level. There is no claim here of originality. The basic idea of the deflationary model is in the work of BSU, and the interest-rate-rule model is a variant of one worked out in Sims (2000). And these models in turn draw on early work on the fiscal theory. The point of displaying these models here is to provide some reminders of the ways control over the price level can fail and of how the failures depend on fiscal policy.

The first model we consider is not an inflation targeting model in any sense. The BSU models it parallels consider interest rate policy rules that have, in much of the literature, been taken to guarantee a determinate price level. The BSU models therefore can be interpreted as showing that making interest rates respond to inflation in a way that would widely be thought of as guaranteeing that inflation stays close to target, can instead leave the economy open to a deflationary spiral. The model we present here strips away non-neutralities and even bonds and interest rates, to show that the type of *fiscal* policy BSU consider will produce their sort of result even without an interest rate rule. The pathology they display is likely to be possible whenever policy in effect provides a tax backing for money, as if monetary liabilities were interest bearing.

The model has many identical agents, choosing time paths for their consumption C and money holdings M. They receive an endowment income of Y each period and pay lump sum taxes τ. They have time-separable logarithmic utility functions in C. They value money because increased real balances reduce transactions costs.

Agents:

$$\max_{\{C_t, M_t\}} E\left[\int_0^\infty e^{\beta t} \log C_t \, dt\right] \text{ s.t.} \tag{1}$$

$$C(1+\gamma V) + \frac{\dot{M}}{P} = Y - \tau \tag{2}$$

$$V = \frac{PC}{M}\,. \tag{3}$$

Government:

policy: $$\tau = -\phi_0 + \phi_1 \frac{M}{P} \tag{4}$$

gov't. budget constraint: $$\frac{\dot{M}}{P} = -\tau\,. \tag{5}$$

The first order conditions of the representative agent are

∂C: $$\frac{1}{C} = \lambda(1 + 2\gamma V) \tag{6}$$

∂M: $$\frac{\lambda}{P}\left(-\frac{\dot{\lambda}}{\lambda} + \frac{\dot{P}}{P} + \beta\right) = \frac{\lambda}{P}\gamma V^2\,. \tag{7}$$

In continuous time rational expectations models like this one it is particularly important to keep track of what the model defines as able to "jump" and what it constrains not to jump. Often this is done by listing variables that can jump and that can't, but not every model is properly characterized this way. It is quite possible for certain functions of variables in the model to be constrained not to jump, whereas all the arguments of the functions individually are not so constrained. In this paper we use the convention that all equations representing constraints hold not only for all $t \geq 0$, but also in a neighborhood of $t = 0$. First order conditions, on the other hand, apply only for $t \geq 0$. Thus if a constraint equation contains a single dotted variable (e.g. the $\dot{M}$ in (2) or (5)), the dotted variable, because its derivative must exist in a neighborhood of $t = 0$, is implied to have time paths continuous at $t = 0$.[2] An equation that is a constraint and contains multiple dotted variables does not constrain each individual dotted variable to have an absolutely

[2]The derivative itself does not have to be continuous at $t = 0$. What is required is that M be absolutely continuous with a derivative defined except on a set of measure zero and with the time path of M the integral of its time derivative.

continuous path. In a linear equation, it will be only the linear combination whose derivative appears in the constraint that is constrained to be absolutely continuous. On the other hand, a variable like P in this model, which appears "dotted" only as the highest-order derivative in first order conditions, is constrained only to have a *right*-derivative, with a possible discontinuity in its level at $t = 0$.

Some algebraic manipulation allows us to derive from the FOC's and the model constraints the following differential equation in V:

$$\frac{\dot{V}(1+4\gamma V)}{V(1+2\gamma V)} = \gamma V^2\left(1-\frac{\phi_0}{Y}\right) - \frac{\phi_0 V}{Y} + \phi_1 - \beta\,, \tag{8}$$

which, because its derivation uses first-order conditions, holds only for positive t, so that V is allowed to be discontinuous at $t = 0$.

If we assume Y to be constant and impose the fairly reasonable conditions that $\phi_0 < Y$ and $\phi_1 > \beta$, but $\phi_1 - \beta$ small, then this equation in V has two steady states, a smaller one that is approximately $(\phi_1 - \beta)Y/\phi_0$ and a larger one. The smaller is stable and the larger is unstable.

In this model the definition of V and the social resource constraint $C(1+2\gamma V) = Y$ together imply a monotone increasing relation between PY/M and V for positive V. Thus we can conclude that every initial value of P below some critical value is consistent with equilibrium, each implying a different initial V, and all these possible initial V's imply the same limiting behavior — convergence of V to the lower steady state value. At this lower steady state for V, if $\phi_1 > \beta$ and $\phi_1 - \beta$ is small, we have that

$$\frac{\dot{M}}{M} = \frac{\dot{P}}{P} \doteq -\beta \tag{9}$$

to first-order accuracy in $\phi_1 - \beta$. Thus we have the same kind of behavior found by BSU: indeterminacy of the price level and convergence, from a wide range of initial values, to the same equilibrium of steady deflation.

It is not difficult to understand why this policy results in indeterminacy — the policy authority has committed to back the real value of money balances with taxes *regardless of how large this real value might be*. The policy therefore implies no nominal "anchor". Prices can fall to arbitrarily low levels, boosting real balances to arbitrarily high levels, and even though no one has a transactions use for the additional real balances, the tax backing and resulting deflation makes holding the real balances attractive.

Above the upper steady state, the price level explodes rapidly upward and velocity also rises rapidly. In fact, velocity converges to infinity in finite time. There is no violation of transversality or of feasibility conditions in these explosive equilibria.

In this model simple, apparently realistic policies will eliminate the indeterminacy. For example, if the government replaces its "tax-backed money" rule (4) with a commitment to hold M constant, the differential equation in V (8) is replaced by

$$\dot{V} = \frac{(\gamma V^2 - \beta)V(1 + 2\gamma V)}{1 + 4\gamma V} \,. \tag{10}$$

This equation has a unique, unstable steady state. Initial conditions with $V < \sqrt{\beta/\gamma}$ imply V converging to zero, but this entails here that $M/P \to \infty$. Since agents in this equilibrium have bounded consumption paths, their accumulation of arbitrarily large real money balances violates transversality, so these deflationary paths are not equilibria.

With either constant-M or Ricardian policy, the inflationary paths that start with V above its steady state value are equilibria. They can be eliminated by an apparently simple policy, a commitment to back a minimal value for money with taxation. It is well known, though, that there have in fact been historical episodes of hyperinflation in which far from using taxes to put a floor on the value of money, fiscal authorities have persisted in running primary deficits as inflation has accelerated to extreme levels. Furthermore, as we will discuss at more length below, some institutional frameworks aimed at ensuring "independence" of the central bank undermine the credibility of any claim to provide a tax-backed floor to the value of money.

With the Ricardian policy, real money balances grow very large on the paths toward the lower steady state and in the case where $\phi_1 = \beta$ grow without bound in equilibrium. The growth does not violate individual optimizing behavior, however, because the foreseen steady rise in taxes makes individuals see themselves as dependent on the deflationary real return on their money balances to maintain intertemporal budget balance. The usual argument that arbitrarily high real wealth with bounded consumption violates transversality fails because the real-balance wealth is offset by the discounted present value of future taxes.

Since in this abstract model the consequences of backing money with a "Ricardian" fiscal rule are undesirable, and since better policies are easily available, one might ask why we need pay any attention to these results. The Ricardian policy looks crazy because the model assumes homogeneous, freely marketable, nominal government debt or money. This makes it easy for the government to dilute the claims of existing asset holders by new borrowing, without obviously targeting a narrow and organized constituency. It also makes it easy for asset holders, were the real current market value of their holdings of government liabilities to grow while their future tax liabilities apparently did not, to try to turn their increased wealth into current purchases.

In Japan today, and probably also the US in the thirties, deflation has its strongest effect in increasing non-marketable, heterogeneous, government liabilities. Tomita (2002) explains the variety of ways in which Japan's explicit debt is less easily marketed, more concentrated in the hands of banks and government agencies, and less homogeneous than government debt in the US or Europe. And it is widely understood that both in the US in the 30's and in present day Japan, the existence of large institutions with negative net worth that grows more negative with declining prices, creates implicit, non-marketable government liabilities, via potential claims to bailouts, as prices decline. When price declines create perceptions of claims on future tax revenues via bailouts as fast or faster than they increase the value of marketable nominal securities in the hands of the public, they can fail to produce any strong positive wealth effects.

Another route by which deflationary equilibria might arise is via central bank balance sheet illusion.[3] We have seen in the US just a few years ago a discussion of the consequences for the Federal Reserve balance sheet of the vanishing of the US public debt. In simple macroeconomic models, the balance sheets of the central

[3] The discussion of balance sheet illusion here and the model below of inflation-stabilization with reserves draws on the discussion in Sims (2000).

bank and the treasury are consolidated, so that the public debt has vanished when only debt held by the central bank remains. But in the recent policy discussions it was assumed that the Fed might need to turn to holding private securities as backing for monetary reserves. That is, it was assumed that the treasury would continue to tax to run surpluses to retire the debt held by the Fed. This is exactly the assumption of BSU's Ricardian fiscal policy, though BSU require further that as deflation proceeds the treasury will continually replenish the central bank balance sheet by further purchases of private assets as the real value of high powered money increases.

In the case of the US Federal Reserve, it may seem unreasonable that the treasury should see debt held by the Federal Reserve as a liability requiring tax backing or that the Federal Reserve should ever perceive a need to ask for treasury replenishment of its balance sheet. The Federal Reserve has a nearly perfectly hedged balance sheet, with most of its assets nominal US government bonds and its liabilities mostly high powered money. Even if it did somehow develop substantial negative net worth, why would this be a problem? Its high-powered money liabilities carry no explicit promise that they are redeemable, so there are no creditors whose demands could make negative net worth a problem.

But there are other structures for central bank balance sheets. The most common direction of deviation is toward holding large amounts of "reserves", in the form of securities that are not denominated in domestic currency, and hence leave the central bank less than perfectly hedged. A good example is the European System of Central Banks, which holds most of its assets in non-Euro securities. This clearly introduces balance sheet risk, and the possibility of the bank arriving at a situation of negative net worth. While it is true that there is no explicit promise to redeem high-powered money, we shall see that for a bank that must rely on reserves rather than fiscal resources, any attempt to commit to stabilizing the price level or inflation will make net worth a concern. This fact may both limit the bank's ability to dampen fluctuations in inflation and contribute to inappropriate "Ricardian" policy behavior in a deflationary environment.

III. Stabilizing inflation, with reserves or tax backing

Here we return to modeling both bonds and money, so that we can discuss policy in terms of an interest rate rule, as has recently been standard practice. We also introduce a foreign-currency denominated asset, so that we can consider a central bank with reserves only, and no access to a backup taxing power.

In Sims (2000) I considered a model like this one, but with a central bank that tries to control the price level. That model made the point, which is perhaps nearly obvious, that when the central bank tries to enforce an upper bound on the price level, it must either limit its goals when its net worth is negative (or might become negative), or else have access to fiscal backing that would restore net worth whenever necessary. The outstanding high-powered money, while carrying no explicit promise of redemption, acquires an implicit redemption value when there is a commitment to a bound on the price level. A central bank that relies on the value of its reserves to back its money issue cannot guarantee a value for the currency stock outstanding that exceeds the value of its reserves. If it tries to do so, it is likely to face a run. A bank that uses an interest rate rule that aims at control of the price level does not avoid the problem. To implement its interest rate rule, the bank will have to stand ready to supply bonds for high-powered money. Disturbances to the economy — e.g. to the real interest rate — can require time paths for reserves that are not feasible without replenishment of the balance sheet by fiscal actions. The likelihood of this happening is greater the more seriously under water is the central bank balance sheet and the more tightly the bank attempts to control the price level.

Here we consider a policy authority that uses interest rate rules. Because in this model there is no tax backing of non-interest-bearing money, the model does not have the indeterminacy and deflationary equilibria of the BSU model. Nonetheless it retains the "inflationary demonetization" equilibria, which can be avoided only with tax backing or reserves.

We suppose an economy with a representative agent maximizing

$$\int_0^\infty e^{-\beta t} \log C_t \, dt \tag{11}$$

with respect to the time paths of C, F_P, B and M, subject to the constraint

$$C(1+\psi(v)) + \dot{F}_P + \frac{\dot{M}+\dot{B}}{P} = Y + \rho F_P + \frac{rB}{P} + \tau\,. \tag{12}$$

Here C is consumption, $v = PC/M$ is velocity of money, F_P is private holdings of the real asset, B is nominal government debt, M is money (non-interest-bearing currency), Y is an exogenous endowment stream, and τ is transfer payments from the government. The real and nominal interest rates are, respectively, ρ and r.

The first order conditions for the private agent are

$$\partial B: \qquad \frac{\lambda}{P}\left(-\frac{\dot{\lambda}}{\lambda} + \beta + \frac{\dot{P}}{P}\right) = \frac{r\lambda}{P} \tag{13}$$

$$\partial F: \qquad -\dot{\lambda} + \beta\lambda = \rho\lambda \tag{14}$$

$$\partial M: \qquad \frac{\lambda}{P}\left(-\frac{\dot{\lambda}}{\lambda} + \beta + \frac{\dot{P}}{P}\right) = \frac{\lambda}{P}\psi' v^2 \tag{15}$$

$$\partial C: \qquad C^{-1} = \lambda(1+\psi+\psi' v)\,. \tag{16}$$

These equations can be reduced to

$$r = \rho + \frac{\dot{P}}{P} \tag{17}$$

$$r = \psi' v^2 \tag{18}$$

$$\rho - \beta = \frac{\dot{C}}{C} + \frac{(2\psi' + \psi'' v)\dot{v}}{1+\psi+\psi' v}\,. \tag{19}$$

As usual, the equations derived from first-order conditions hold only for $t \geq 0$, while the constraint (12) holds continuously. The only variable forced to be continuous at $t = 0$ by this single private constraint is the artificial construct "cumulative real asset purchases by the private sector, valued at acquisition cost", i.e.

$$\int_{-T}^{t}\left(\dot{F}_P(t) + \frac{\dot{M}_t + \dot{B}_t}{P_t}\right) dt\,.$$

So instantaneous, discontinuous portfolio adjustments, swapping among M, B, and F_P, are not ruled out. Instantaneous changes in wealth can occur, but only via jumps in P that revalue bond and money holdings. Instantaneous jumps in wealth via purchases or sales of assets are not possible, because they would have to draw on savings or dissavings, and consumption and income flow at finite rates.

The consolidated government budget constraint is

$$\dot{F}_G = \rho F_G - r\frac{B}{P} + \frac{\dot{M} + \dot{B}}{P} - \tau\,, \tag{20}$$

where F_G is government holdings of the reserve asset. Substituting (20) in the private budget constraint gives us the social resource constraint

$$C \cdot (1 + \psi) + \dot{F} = \rho F + Y\,, \tag{21}$$

where $F = F_P + F_G$ is total holdings of the reserve asset, by both private individuals and the government.

Assuming the central bank is the only government holder of the reserve asset and that government bonds are not held by the central bank, we get as the central bank's budget constraint

$$\dot{F}_G = \rho F_G + \frac{\dot{M}}{P} - \tau_B\,. \tag{22}$$

It is natural to assume that in normal times, when seignorage $\rho F_B + \dot{M}/P$ is positive, the bank will transfer sufficient revenues to the treasury or the public that its reserves remain aligned with outstanding money balances. When seignorage revenue becomes negative, we assume that τ_B is set to zero. It may seem that it would be better policy to prevent net worth from deteriorating by allowing τ_B to go negative, but here we are trying to model a central bank whose "independence" entails not being dependent on the legislature for funding bailouts when net worth goes negative.

Now suppose that the monetary authority adopts an interest rate rule that reacts to inflation, setting

$$\dot{r} = \theta_0 + \theta_1\frac{\dot{P}}{P} - \theta_2 r\,. \tag{23}$$

Note that this policy rule makes r react to inflation with a delay, though the delay will be small if θ_2 is large. This equation does not imply that r and P must have continuous time paths. It allows discontinuous jumps Δr in r so long as they are matched by corresponding jumps $\Delta \log P/\theta_1$ in $\log P$.

Using (17) to eliminate $\dot{P}/P$ in (23), we arrive at

$$\dot{r} = \theta_0 + (\theta_1 - \theta_2)r - \theta_1\rho\,. \tag{24}$$

If $\theta_1 > \theta_2$, the unique stable solution to this equation is

$$r = \theta_1 \int_{s=0}^{\infty} e^{-(\theta_1-\theta_2)s} \rho_{t+s}\, ds - \frac{\theta_0}{\theta_1 - \theta_2} \tag{25}$$

$$\frac{\dot{P}}{P} = -\rho + \theta_1 \int_{s=0}^{\infty} e^{-(\theta_1-\theta_2)s} \rho_{t+s}\, ds + \frac{\theta_0}{\theta_2 - \theta_1}\,. \tag{26}$$

Note that despite the interest-rate smoothing policy, r must move immediately in response to jumps in ρ that are expected to have any persistence. This entails v jumping in response to shifts in ρ. Here P jumps up when ρ does, but $d \log P/d\rho$ is less than $-d \log C/d\rho$. M must therefore decrease to allow the equilibrium jump in velocity. The interest-rate-setting bank must therefore be concerned with having reserves on hand to meet sudden shifts in real rates.

The differential equation (24) in r has unstable solutions in addition to the stable ones. The solutions that explode downward are unsustainable. They force r, and hence v, to zero in finite time. But this can occur only via M/P going to infinity, and in this setup, with tax backing only for bonds, the upward explosion in M/P violates transversality: agents will try to spend the high real balances, cutting off the deflation.

The solutions that make $\dot{P}/P$ explode upward have no such internal cutoff mechanism, however. Though they imply the economy converges to a barter equilibrium, no market mechanism along the path to this outcome provides incentives to stop the explosion. If such paths do not occur, it has to be because of a backstop commitment, based on taxation or reserves.

A bank backed by a fiscal authority that can credibly increase its primary surplus to provide resources to redeem money at some fixed ceiling price level can cut off the explosive paths. Of course as we have already pointed out, fiscal authorities have historically continued to run primary deficits during high inflations, so that no such backstop commitment was credible. (Where such a commitment were credible, the model implies that the inflation would never get underway.)

A bank relying on reserves can set a fixed ceiling to the price level at any point where its reserves are adequate to redeem the entire stock of money. But if it follows the policy rule (23), there is no guarantee that it can always be in this positive net worth position. It earns a return ρ on its reserves, while the value of its liabilities M/P either remains constant or grows at the rate of deflation. So long as there are no surprise jumps in the price level (or, what is equivalent in this abstract model, the exchange rate between reserve assets and domestic currency), the return on non-interest bearing money will be less than that on nominal bonds, and the bonds earn the same real return as reserves. Therefore a bank that has reserves whose value matches its liabilities always earns positive *expected* seignorage if it is undertaking no open market operations.

However, if rising inflation requires rapid shrinkage of nominal money balances in order to implement the policy rule, seignorage can turn negative. Along an unstable path, in which inflation accelerates and interest rates rise, the bank will of course be undertaking contractionary open market operations. Whether these force it into negative seignorage depends on the nature of the demand for money. If money is "essential", in the sense that as velocity increases the public is willing to pay ever increasing opportunity costs to avoid further small decreases in real balances, then large rises in the interest rate can be accomplished with small rates of contraction in money balances, and seignorage may remain robustly positive. If instead demand for real balances falls rapidly when interest rates reach high levels, then increasingly high rates of contraction in M may be required for given amounts of increase in r. This can result in large negative values of seignorage, and hence in disappearance of reserves while non-zero money balances remain outstanding.

To illustrate these points, we consider a version of the model in which the transactions technology has the specific form

$$\psi(v) = \frac{\gamma v}{1 + \phi v} \,. \tag{27}$$

This gives (18) the specific form

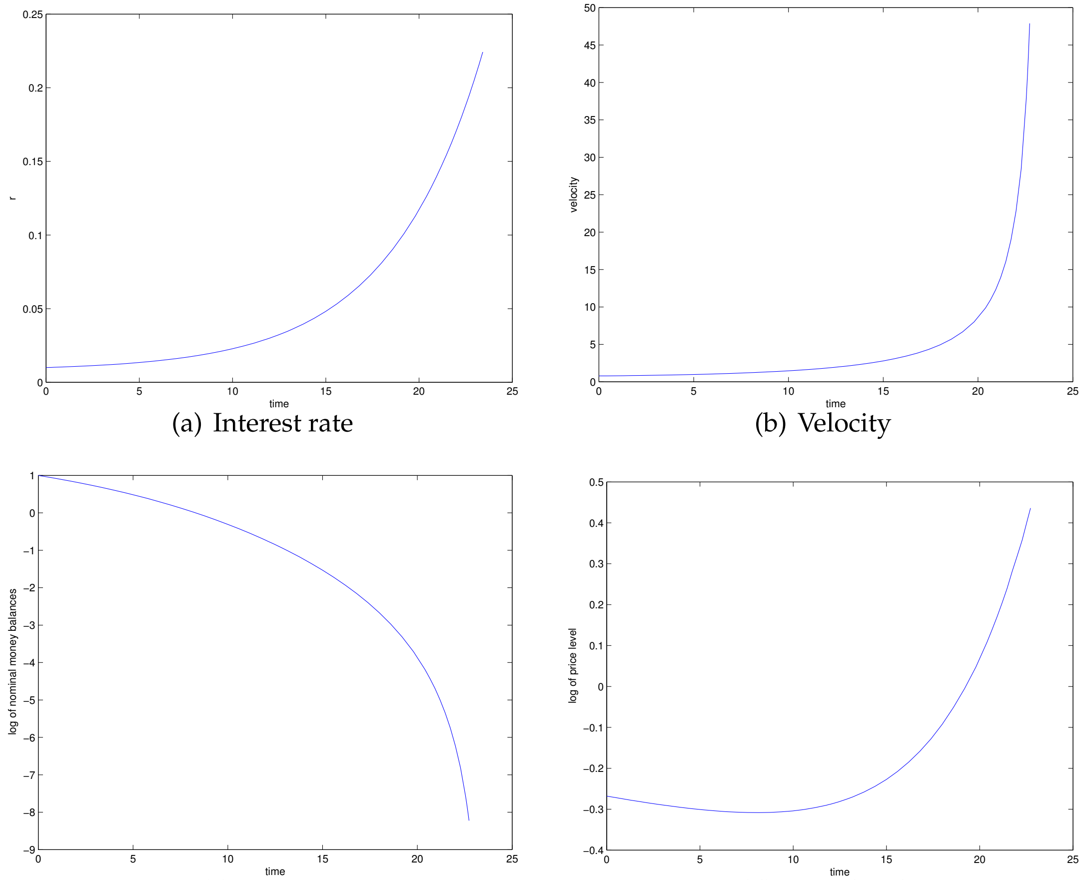
$$r = \frac{\gamma v^2}{(1 + \phi v)^2} \,. \tag{28}$$

This implies that if ϕ is positive, there is an upper bound on the nominal interest rate, beyond which demand for real balances is totally extinguished. Also, with $\phi > 0$ there is an upper bound on the fraction of income that can be absorbed by transactions costs. With $\phi = 0$ nominal interest rates are unbounded above and transactions costs can absorb a fraction of income arbitrarily close to one.

We consider a scenario in which the economy begins in a steady state with zero inflation, real and nominal interest rates both constant at 2% per year. The policy rule has $\theta_0 = .02$, $\theta_1 = 1.2$, and $\theta_2 = 1$. We consider an unanticipated drop in the real interest rate ρ to a new level, 1.8% per year. A new stable equilibrium requires that the nominal interest rate drop to 0.8%, with a corresponding drop of 1% in the price level. The result will be a new equilibrium that again has a constant interest rate, but now has steady deflation at 1% per year, lower velocity, higher real balances, and slightly higher consumption.

Suppose that instead the price level does not drop far enough, so that the nominal interest rate falls only to 1%. Because the price level is above the level consistent with a stable solution of the system, it sets the economy on a path of rising nominal interest rates. Consider the case where $\gamma = .02$, $\phi = .3$. This implies that in non-inflationary steady state transactions costs consume 2% of income and that there is an upper bound on the nominal interest rate, beyond which demand for money disappears, at 22%. The time paths for interest rates, velocity, the log of nominal money balances, and the log of the price level, are shown in Figures 1(a)-1(d).

Whether or not a central bank reliant on reserves can extinguish this explosive path depends on its initial net worth position and its policy on distributing or accumulating seignorage revenue. Assuming it accumulates all of its seignorage revenue results in time paths for $F_G P/M$ as shown in Figure 2. If its initial net worth is negative, but it has assets worth 90% of its outstanding real balances at the initial date, then accumulating its seignorage in the initial period allows it to achieve positive net worth, at which point it could cut off the inflation by announcing it will redeem money for the reserve asset at a fixed rate of exchange. But if its initial net worth is much below this, it never achieves positive net worth, and indeed its reserves hit zero before the date at which real balances disappear. Obviously this makes it impossible for the bank to continue implementing its interest rate policy rule with open market operations. The likely outcome would be an immediate jump to the barter equilibrium, and if this were foreseen, the jump would occur at the initial date.



(a) Interest rate

(b) Velocity

(c) Money

(d) Price level

FIGURE 1. Consequences of an insufficient response of p to a ρ drop

That such scenarios are possible legitimizes attention to its balance sheet by a central bank that does not have reliable fiscal backing. The radical approach to central bank independence in the setup of the ECB, by cutting all explicit connections with fiscal authorities and ruling out the holding of government debt as assets, has resulted in both an unhedged balance sheet and the absence of any explicit institutional structure for the ECB to use in case it were to need balance sheet replenishment. The Bank of Japan appears to be concerned that it would lose its recent gains in independence from the Ministry of Finance were it arrive at a need for balance sheet replenishment. Records of monetary policy discussions in the US in the thirties show that there was concern about the "soundness" of assets being discounted by the Federal Reserve.

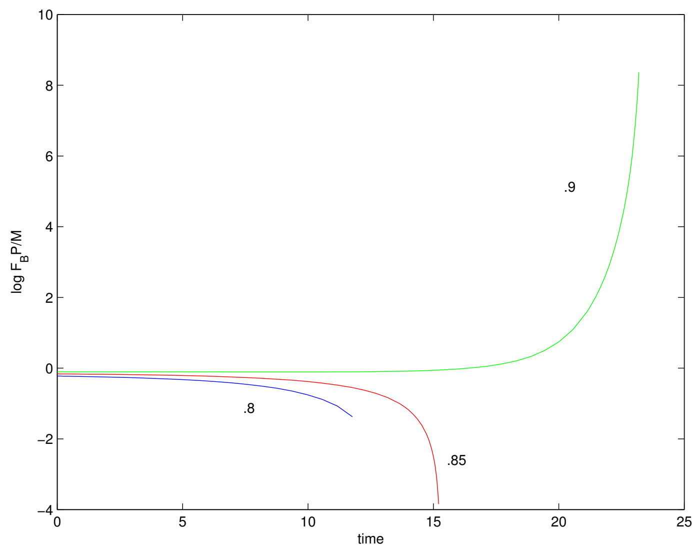


FIGURE 2. Ratio of reserves to real balances outstanding under three assumptions about initial $F_G P/M$

But in a deflationary environment, when the interest rate has hit its zero lower bound, the effective policy measures available to a central bank all carry balance sheet risk. This is obviously true of purchases of illiquid bank loans or of long term government bonds whose current value will fall if deflation ends and interest rates rise. Even the “foolproof way” of Svensson (2001), which prescribes massive purchases of foreign-currency-denominated bonds, because of the inherent volatility of exchange rates, creates substantial balance sheet risk for the central bank.

Our conclusion is that a central bank can lose control of the price level during a liquidity trap episode because of timidity induced by balance sheet worries. These balance sheet worries are justified, if there truly is no fiscal backing for the bank, because of the opposite possibility, that a bank with negative net worth and no fiscal backing can lose control of the price level in an explosive inflation.

In our discussion of this model to this point, we have not paid any attention to fiscal policy. This can be justified only by assuming a passive fiscal policy that keeps real debt under control regardless of the path of inflation. Suppose instead, as in the scenario Loyo considers, the fiscal authority does not make the primary surplus respond to the level of the real debt. As an extreme case, suppose it sets the primary surplus to be constant. Then in this, as in many previous models of this type, going back at least to Sargent and Wallace (1981), there is no equilibrium with active monetary policy ($\phi_1/\phi_2 > 1$).

Some economists believe that there is an asymmetry here, that when these incompatible monetary and fiscal policies are asserted, a firmly committed monetary authority can always prevail over any attempt by the fiscal authority to commit to an incompatible policy. But this is not true. It cannot even be discussed coherently in a conventional macro model with a unified budget constraint for the central bank and the treasury. If we introduce separate budget constraints for the CB and the treasury, so that each can be imagined to possibly go bankrupt independently, we see that there is no formal asymmetry. If anything, the asymmetry is the other way. Central banks have died while the legislature that created them survived, but are there any examples of the reverse? And the lack of central, rational direction of the fiscal policy process in democratic countries probably makes it easier, not harder, for the fiscal authority to "commit" to a policy in the face of a threat (from the CB) that it could lead to disaster.

IV. Pros and cons of inflation targeting

It's plausible that the CB wants to bring inflation or deflation under control, even when it has recently been having trouble doing so. This may be less true of more artificial targets like M growth or the exchange rate. The credibility of a commitment to inflation targeting may therefore be somewhat more stable. Because monetary policy can affect inflation only with a substantial delay, inflation targeting CB's in practice produce explicit projections, generally quarterly, for a time horizon of about 2 years into the future. This entails their explaining, at least to some extent, how current policy actions are related to future objectives. This allows greater public understanding of policy, and thereby greater credibility. The delay means that there are generally many ways to get inflation into the target range over the policy horizon. This creates room for other objectives to affect policy choices, thereby further improving the alignment between the public rationale for policy choices and the actual interests of the polity.

Since there are conditions under which an inflation targeting commitment, as a central bank policy, has a high probability of proving unsustainable, it should not be recommended in those conditions. It can easily lead to disaster, or to an apparent initial success that magnifies a later disaster, when the necessary fiscal backup to monetary policy is not available. It would not be a good idea in Argentina today, and it may yet prove to have been a mistake, or at least unsustainable, in Brazil. It can worsen the situation for a central bank that is at the zero bound on its policy rate and thus has no tools to influence inflation. A projection for a desirable path for inflation (or deflation) that cannot be backed up with an explanation of how current central bank actions are expected to lead to the desired path, will undermine central bank credibility. Inflation targeting is therefore not in itself a policy prescription for the Bank of Japan.

V. How to improve it

The main virtue of an inflation-targeting regime is that it leads to increased transparency as to the objectives of the central bank and as to how the bank believes its current actions contribute to achieving those objectives. These aspects of the regime ought to be pursued even where (the US?) the inflation target itself meets resistance. In fact, I would argue that if, in contrast to other countries, here the "inflation-targeting" label is a hindrance to getting the Federal Reserve Board to be more explicit about its projections of the path of the economy and about how its actions are expected to affect that path, it would be a good idea to abandon the campaign for inflation targeting.

We could extend the virtues of inflation targeting by accompanying inflation-report projections of inflation, output, etc. with projected time paths of the policy rate. We could improve central bank models so that they become capable of providing realistic probability bands on projections and can be invoked in explaining central bank policy choices to the public.

It would be a good idea to make explicit the conditional nature of the commitment to an inflation target. It is already well accepted that some kinds of "shocks" can push the economy away from the inflation target temporarily. When these occur, an inflation-targeting bank explains the source of the shock and explains its plans to bring inflation back into the target range over time. This enhances credibility, compared to taking drastic policy actions to get quickly back into the target range at the cost of a potential backlash from the political system.

Fiscal policy ought to be treated as a potential source of "shocks". Ideally, where fiscal policy that undermines central bank control of inflation is a real possibility, this be should be accounted for, discussed in inflation reports, and reflected in central bank projections. Such proposals meet stiff resistance. They can be seen as threatening the current conventions of central bank "independence", which depend on keeping a firm distinction between fiscal policy, where political considerations are considered inevitable, and monetary policy, which is seen as a technical matter, ideally completely insulated from politics. [Recently Fed Staff, in conversation, cited the danger that Fed projections of fiscal variables would become public as a reason to maintain the 5-year secrecy rule for Fed Green Book and model forecasts.]

Where there is little prospect of fiscal policy becoming a constraint on monetary policy, or of fiscal policy becoming the only instrument available for controlling the price level, detailed fiscal projections would not be important. But where there is such a prospect, the central bank is likely to be the leading candidate for an institution that can analyze the policy options for controlling inflation. As the designated steward of the inflation rate it could make a contribution by conducting and disseminating such analysis, even when it has reached the point where its own policy levers are not effective.

VI. Conclusion

Inflation targeting is in most countries an improvement in the monetary policy regime. But the improvement comes from its being a step toward goal and model transparency. Inflation targeting is a dubious recommendation in precisely those economies where advice from economists about controlling inflation is most needed. If we separate the transparency aspects of inflation targeting from its nominal-anchor-nostrum aspect, we may come up with a more widely applicable policy recommendation. The central bank should probably everywhere be charged with making projections of inflation, laying out policy actions that could stabilize inflation, and either taking those actions or explaining why it cannot and who could.

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