

To: Dr. Edmar Bacha

August 3, 1993

From: G. Calvo *GC*

Subject: Inflation: reply to your note

This is a quick response to your note about the conjecture that indexed money (as you call it), or interest-bearing money (as I would rather call it, but not here) could be an important factor underlying Brazil's inflation.

### I. Indexed Money and Inflationary Expectations

I have in mind a situation where, unless the policymaker is able to produce quick and dramatic results, inflationary expectations are bound to be somewhat exogenous. (This will hold, for example, if policymakers are not fully credible, and the public infers that sooner or later "business as usual" will win the day.) In the context of your model, the latter assumption implies a slower convergence to steady-state equilibrium. To illustrate this point, consider the case in which the demand for partially-indexed bonds,  $B$ , is just proportional to the price level. Thus

$$(1) \quad B = kP, \quad k > 0.$$

where  $P$  is the price level and  $k$  is a constant (and where I assume output is constant and equal to 1).

The government's budget constraint satisfies:

$$(2) \quad \dot{B} = G + i\theta B,$$

where  $0 \leq \theta \leq 1$  is the interest-bearing share in  $B$ ,  $i$  is the overnight nominal interest rate, and  $G$  is nominal primary deficit.

In contrast with your note, I will assume that expected inflation,  $\pi^e$ , may be different from actual inflation,  $\pi$ . Thus, assuming the real interest rate to be zero, we have  $i = \pi^e$ . Hence, by (1) and (2),

$$(3) \quad \frac{\dot{B}}{B} = \pi = \frac{g}{k} + \theta \pi^e,$$

where  $g = G/P$ . Consequently, expression (3) illustrates the proposition that with indexed money inflation,  $\pi$ , may be high just because expected inflation,  $\pi^e$ , is high.

To get a feel about dynamics, we could assume adaptive expectations. Thus,

$$(4) \quad \dot{\pi}^e = \gamma(\pi - \pi^e), \quad \gamma > 0.$$

Hence, by (3) and (4), we get

$$(5) \quad \dot{\pi}^e = \gamma \left[ \frac{g}{k} - (1 - \theta)\pi^e \right]$$

Assume perfect indexation, i.e.,  $\theta = 1$ . By (5),  $g = 0$  (primary balance) implies  $\dot{\pi}^e$  will be constant over time (and, therefore, equal to its initial level) and, by (3),  $\pi = \pi^e$ . In words, inflation remains at the initial expected-inflation level--not 0 as implied by the steady-state analysis in your note. In contrast, if indexation is less than perfect, then  $\pi$  converges to steady state. By (5), the rate of convergence is

$$(6) \quad \frac{\partial \pi^e}{\partial \pi^e} = -\gamma(1 - \theta).$$

which is  $\frac{\gamma}{2(1-\theta)}$   
but with  $\theta=1$   
and  $g=0$   
this is  
undetermined

However, the rate of convergence could be quite low if  $\theta$  is close to 1, or the policymaker's credibility is low.

Consider now the case in which the debt is truly indexed to the rate of inflation, namely, the government pays a predetermined real interest rate plus the actual rate of inflation. Thus, formally,  $i = \pi$ . Under these circumstances, (1) and (2) imply

This requires money growth is equal to  $i = r + \pi$   
 $\theta = 1$

$$(7) \quad \pi = \frac{g}{k(1 - \theta)}$$

Therefore, under true indexation the economy immediately converges to steady-state equilibrium. Expectations are irrelevant. Low primary deficit implies low inflation. In particular, as in your note,  $g = 0$  implies  $\pi = 0$  at all times.

Equation (7) is the inflation theory implied in your note. For it to be valid, though, convergence should be instantaneous and expectations highly adaptable. Thus, the main insight of the above is that true debt indexation bypasses the need for instantaneous adjustment of expectations for the disinflation policy to be successful. Consequently, the results of your note are obtained, even though the public may not believe that disinflation will succeed.

## II. Flex. Fixed and Current Mix

A possible difficulty of fixing under sticky inflation expectations is that there could be a massive loss of reserves. For example, if we adopt fixed exchange rates (and we set "the" exchange rate equal to unity = P), we have (the following is just the Monetary Approach to the BOP when the demand for money, B, is exogenous and, in the present context, constant over time)

$$(8) \quad \dot{R} = -g - \theta k \pi^e,$$

where R stands for international reserves. Thus, a high  $\pi^e$  may lead to a depletion of reserves even though g is low. However, this problem would go away with true indexation, as defined above.

The advantage of flexible exchange rates is that international reserves are not an issue. However, control on money will be limited for the reasons mentioned in Section I. Again, true debt indexation may help.

The present system is probably a mixed bag. In addition to the domestic-debt problem, the Brazilian economy is likely to be operating under weak nominal anchors. In fact, such weakness may make it rational for individuals to be skeptical about the success of anti-inflationary programs--thus, providing the microfoundations for sticky expectations. A possible story runs as follows:

"Private sector starts the day with preconceived notions about inflation,  $\pi^e$ . Government accommodates money/exchange rate so as to prevent misalignments, generating  $\pi = \pi^e$ . The latter requires the government to buy or sell foreign exchange (to be shown below)."

We now prove the last part of the statement. Since  $\pi = \pi^e$ , equation (3) will not be satisfied for arbitrary  $\pi^e$ ,  $\beta/\beta$  will not necessarily

generate  $\pi = \pi^e$ . To do so, the government may have to buy or sell foreign exchange, in which case budget equation (1) has to be modified as follows (assuming, for simplicity, that exchange rate  $E = P$ ):

$$(9) \quad B = G + iB + PR.$$

Solving for  $R$ , and recalling  $i = \pi^e$ , we get

$$(10) \quad R = k\pi^e(1 - \theta) - g.$$

In Brazil,  $g$  is negative or zero,  $\theta < 1$ , and  $\pi^e$  is large. Thus, this simple model rationalizes two key things at once: persistent high inflation--both existence and rationality--and large accumulation of international reserves at the central bank.

### III. Conclusions

In the first place, we have shown that inflation may persist, even though there is a primary fiscal surplus, if expectations are slow to adjust. Furthermore, slow expectational adjustment may be due to a policy of monetary accommodation.

A possible solution to the expectations problem is true debt indexation. However, this only works if policy is not accommodative, and I suspect the latter is also a key factor underlying Brazil's inflation.

Unfortunately, even if monetary policy is non-accommodative, true debt indexation may evoke memories of earlier legerdemain confiscations and, hence, the real-interest-rate part of the indexation formula may stay high. This would be a serious drawback because the fiscal burden of servicing the debt may thus remain unduly high, and truly indexed debt cannot be wiped out with a normal burst of inflation (it may require open confiscation or hyperinflation, like in Argentina). Furthermore, true debt indexation may lead to more wage indexation, weakening the monetary anchor.

A safer route may be to try to affect directly inflationary expectations. A tighter fiscal policy is a good candidate. However, this should be accompanied by non-accommodative monetary policy. Otherwise, the pain of fiscal adjustment will not be quickly reflected in lower inflation, and the political support of the program may vanish in a few months.