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The Perils of Sterilization

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Abstract

The paper argues that the sterilization of capital inflows at the start of a price-stabilization program may give rise to future pressures to discontinue the program as a result of the unduly high debt-service burden that the sterilization policy may generate.

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Summary

The paper develops an example in which a stabilization program can run into problems if the initial capital inflows, provoked by an increase in the domestic demand for money, are sterilized by issuing domestic nominal debt.

The basic argument is that the larger debt, which sterilization brings about, may increase the debt-service burden so much that policy-makers may be tempted to depart momentarily from earlier promises and, for instance, stage a surprise devaluation. The paper shows that this pernicious cycle is more likely to occur if the private sector understands the economics of the situation, because the latter will induce a further increase in domestic interest rates on account of the expected devaluation.

Debt indexation is shown to be a possible solution to make sterilization compatible with the sustainability of the stabilization program, but this conclusion is tempered by noting that the presence of indexed debt may induce government to resort to possibly more costly forms of debt confiscation.



## I. Introduction

Policymakers in charge of launching a price-stabilization program under fixed exchange rates -- a popular exchange rate system in stabilization packages -- have to decide what to do about the initial capital inflows that typically occur during the first stages of the program.

If the new funds are not sterilized, domestic money supply may take a sizable upward jump. This may be seen as a dangerous outcome because it may be taken to signal a weakening of the anti-inflationary stance, threatening the program's credibility.

The objective of this note is to argue that the alternative to money creation, i.e., sterilization of initial capital inflows, may also lead to serious problems. Sterilization has the advantage of keeping money supply under control, but it does so by expanding the stock of domestic debt. If the latter consists of nominal, non-indexed debt, its larger stock may increase the policymaker's temptation to depart from the predetermined exchange-rate path, in order to liquidate part of the domestic debt through surprise inflation. However, since the public anticipates government's policy, the higher domestic debt will command a higher interest rate (to cover against higher future inflation) which, in turn, will add fuel to the inflation-temptation process (by, ceteris paribus, bolstering the fiscal deficit). As a result, sterilization may jeopardize the success of the stabilization program. The next section will illustrate this point in terms of a simple example.

## II. An Example

Let the "present" be period 0 and the "future" be period 1. Distorting taxes in period 1 in real terms,  $x$ , are given by the following period-1 government budget constraint:

$$(1) \quad x = g + \frac{B}{P}(1+i) - R(1+r^*)$$

where  $g$  is non-interest real government expenditure and  $P$  is the price level in period 1;  $B$  is the stock of nominal bonds outstanding at the end of period 0 and  $i$  is the nominal interest rate from period 0 to period 1; finally,  $R$  is the stock of interest-bearing reserves at the end of period 0 and  $r^*$  is the international interest rate. 1/ In other words, future taxes,  $x$ , equal government expenditure plus the cost of servicing present debt (interest plus amortization), minus the gross revenue from international reserves.

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1/ International prices are constant and equal to unity.

We assume that the government dislikes taxes,  $x$ , and inflation  $\pi$  (where  $\pi$  is the rate of inflation between periods 0 and 1). More specifically, the future government's loss function is assumed to take the following form:

$$(2) \quad x^2 + A\pi^2$$

where  $A$  is a positive number.

A basic assumption of this example is that the present government cannot tie the hands of the future government. In formal terms, this means that the future government will try to minimize its loss function by resorting to any admissible policy in period 1.

The example will focus on the case in which the future government is free to choose the rate of inflation,  $\pi$ , to minimize its loss (2) subject to its budget constraint (1). This implies, in particular, that the future government will honor any previous debt commitment, and it is, thus, not allowed to confiscate  $B$  or to change its contractual interest rate,  $i$ .

Assuming that the present price level is equal to unity, it follows that  $P = 1 + \pi$ . Consequently, we can express (1) as

$$(1') \quad x = g + \frac{B}{1+\pi}(1+i) - R(1+r^*)$$

Hence, optimal inflation from the point of view of the future government will be the one that minimizes (2) with respect to  $\pi$  subject to (1'). The first-order condition for this problem is

$$(3) \quad -x B \frac{1+i}{(1+\pi)^2} + A\pi = 0$$

The private sector is assumed to know the government's objective function. Hence, given that there is no uncertainty in this model and we assume perfect capital mobility, at equilibrium domestic bonds must exhibit the same rate or return as international assets. Thus, the following Fisher equation holds:

$$(4) \quad 1+i = (1+r^*)(1+\pi).$$

Employing (1') and (4) into (3), we get

$$(5) \quad [g + (B - R)(1+r^*)]B(1+r^*) = A\pi(1+\pi)$$

which is a central analytical result. Thus, assuming that at equilibrium distorting taxes and the stock of nominal bonds are positive, it follows from (5) that inflation will also be positive. Moreover, inflation is an increasing function of the domestic nominal public debt. This captures one of the effects mentioned in the introduction. More intuitively, a larger nominal debt requires, *ceteris paribus*, raising more distorting taxes. This gives the future government greater incentives to use inflation instead of distorting taxes, which explains the *ex post* positive association between nominal public debt and inflation. It should be noted, however, that, given the rationality assumption (4), in equilibrium distorting taxes are independent of the inflation rate, since the public anticipates inflation and incorporates it in  $i$ , as implied by the Fisher equation (4). Consequently, in this model inflation is just a pure negative externality which would disappear if there was no public nominal debt  $B$  (recall (5)). 1/

Let us now go back to the sterilization issue. Let  $M$  stand for the demand for money to be held from period 0 to period 1, and  $M_0$  denote the stock of money in the hands of the public at the beginning of period 0. Hence, assuming, for the sake of concreteness, that at the beginning of period 0 there are no domestic bonds or reserves at the Central Bank, we have (recalling that the price level in period 0 is equal to unity)

$$(6) \quad R = B + M - M_0$$

In other words, the accumulation of reserves at the Central Bank results from an increase in the demand for money,  $M - M_0$ , and from the issuance of more Central Bank debt,  $B$ . Notice, incidentally, that  $(1+i)B$  constitutes what is usually called the quasi-fiscal deficit.

We assume that individuals expect that the government will be ready to exchange  $M$  for goods in period 1. Thus, they expect to get  $M/P$  units of output in period 1. Consequently, the opportunity cost of holding money from period 0 to period 1 is, as in standard models, the nominal interest rate  $i$ . Hence, we can write

$$(7) \quad M = L(i), \quad L' < 0$$

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1/ Thus, in the present model optimal inflation would be achieved if public debt was fully (and credibly) indexed to the price level. This result -- which is not stressed in this note -- is not robust to realistic extensions of the model (see Calvo and Guidotti(1989)), and does not necessarily hold if open debt confiscation is allowed.

Furthermore, we assume that the output required to buy up M/P in the future is obtained through non-distorting taxes. 1/

Suppose that it is possible to launch a credible stabilization program that substantially lowers  $i$  and, hence, increases the demand for money by a sizable amount. This generates, by (6), the capital-inflows problem cited in the Introduction. One option is to expand money supply accordingly. Since, by assumption, the initial stock of bonds is zero, then  $B=0$  and, by (5), equilibrium inflation is equal to zero. In other words, recalling (2), full accommodation of money supply implies, in the present model, that optimal inflation ( $\pi=0$ ) is attained. 2/ Under the present circumstances, distorting taxes are, by (1'), (4) and (6),

$$(8) \quad x = g - [L(0) - M_0](1+r^*).$$

Consider now the policy of full capital-inflows sterilization. This requires being able to keep the interest rate  $i$  such that  $M - M_0 = 0$ , which, by (6), implies  $R = B$  (i.e., reserves are bought entirely through the issuance of Central Bank debt). Let  $\bar{i}$  be defined as the interest rate that discourages any change in the demand for money, i.e.,

$$(9) \quad L(\bar{i}) = M_0.$$

Naturally, given that the economy comes from experiencing high inflation, we assume  $\bar{i} > r^*$ . The last step will be to show that there exists a positive level of  $B$  that generates  $\bar{i}$  and, hence, that full sterilization is possible.

By (4), there exists a positive level of inflation associated with  $\bar{i}$  which we denote  $\bar{\pi}$ . Therefore, by (5), and recalling that full sterilization requires  $R = B$ , we get

$$(10) \quad gB(1+r^*) = A\bar{\pi}(1+\bar{\pi}).$$

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1/ In an infinite-horizon model, the public also expects to be able to exchange M/P for goods, as in the present setup, and there is no need to assume that the government stands ready to implement the exchange itself. So, our somewhat contrived assumptions -- that the government buys up the whole of M/P in the future, and that the funds required for the transaction involve non-distorting taxes -- should be seen as an attempt to capture the flavor of more realistic models without having to pay the high price of their much more complex analytical structures. It should be noted, however, that it is straightforward to extend the model to the case which money in period 1 is brought back employing distorting taxes.

2/ If, contrary to this model, the cash-output buy-back required distorting taxes, then full monetary accommodation would be associated with positive inflation. The main thrust of my argument, however, remains unchanged.

Therefore, there is a sufficiently high stock of Central Bank debt and reserves that generates the rate of inflation consistent with full sterilization. What have we achieved? Well, nothing good really. Inflation is now positive, not the bliss zero level as before, while distorting taxes are, by (1'), recalling that  $R = B$ ,

$$(11) \quad x = g,$$

which exceeds the level needed under no sterilization (8). Hence, in this example sterilization is definitely worse than full monetary accommodation. Furthermore, inflation could be very large given that initial real monetary balances,  $M_0$ , are inherited from a high-inflation episode -- destroying the credibility of the stabilization program.

### III. Conclusions

This note gives an example in which a stabilization program could run into serious credibility problems as a result of sterilizing, partially or totally, the money supply increase that would be associated with initial capital inflows. The note examined the effect of sterilization through the issuance of nominal debt. The Achilles' heel of such a policy was shown to be the additional debt itself. To keep money at the initial pre-program level, for example, the nominal interest rate must be kept high, which requires equally high inflationary expectations. This can come about only if the public thinks inflation will be high. The policymaker - - unwittingly, one hopes - - generates those expectations by buying a large stock of reserves in exchange for new public debt. The larger public debt induces people to expect high inflation, because sticking to a stable price level, for example, would make servicing the public debt politically infeasible. 1/

To avoid the above difficulties, governments could try issuing domestic debt indexed to the price level or to the market exchange rate. This would certainly remove the incentive to inflate away the debt. However, in order to increase domestic interest rates so as not to have to increase the supply of money (full sterilization) would in this case require an increase in the domestic real rate of interest. Why would this happen? If the country has a large international debt, this may reflect the fact that the country is perceived as being a bigger risk. Could that be possibly optimal? I doubt it very much.

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1/ To a large extent, the failure of the July 1989 stabilization program in Argentina appears to be linked to issues discussed in the present note. See Fernandez(1989) for a fascinating account of that and several other related episodes in Argentina during the last fifteen years.

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