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EXCHANGE RATE POLICY AND HYPERINFLATION

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Abstract.

This paper studies the problem of foreign exchange policy emphasizing the portfolio and liquidity services of domestic and foreign currency. It shows that the impact of increasing borrowing to finance deficits requires a higher rate of devaluation for the domestic currency. The analysis provides a generalization of the Unpleasant Monetarist Arithmetic of Sargent and Wallace for an open economy and with unique solutions on both sides of the Laffer curve.

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I. Introduction.

Exchange rate policies in hyperinflationary countries deserve special consideration because the external sector plays a different role. High inflation implies that the stock of foreign exchange hold by domestic residents usually becomes the target of runs against domestically produced nominal assets.

When runs are not the cause of sharp devaluations, erratic inflation and portfolio shifts dominates the short run dynamics of either market exchange rates or exchange rate policies.

In this paper we will discuss the foreign exchange policy emphasizing the portfolio and liquidity services of the foreign exchange. Export and imports, and in general the current account of the balance of payments, would play no role in the theoretical analysis. Although important developments in terms of trade will be mentioned to understand some particular aspects of the stabilization efforts in Argentina.

Then, a fundamental simplifying assumption is the following. Although foreign assets can be held by domestic residents and by the government, a closed economy is assumed. There is no trade in goods, services, and foreign assets with the rest of the world; but the government and private agents always can trade domestic assets against foreign assets. I have analyzed exchange rate policy in other paper (Fernández 1985) where the current account plays a significant role with moderate inflation.

Section II presents a summary of recent economic developments in Argentina providing the background information for the theoretical analysis of section III. Section IV presents concluding remarks.

II. Recent Economic Developments in Argentina.

Beginning in 1985 Argentina experimented several stabilization plans to reduce inflation. The first plan was the Austral Plan, the second plan was the Primavera Plan. None of these plans worked and the economy headed to hyperinflation in mid 1989. To stop the hyperinflation a new administration introduced a plan that did not work either. A summary of these plans is presented below (for a extended discussion of these plans see Fernández (1990a,b).

The Austral Plan relied on three basic measures. First, prices of public sector enterprises were increased to reduce their cash flow deficit. Second, all prices, public and private, were frozen at the level prevailing on June 14, 1985. Third, the President promised in a public speech that from June 14 on, the Central Bank would not print any money to finance public sector operations. The government operated with a system of fixed exchange rate and exchange controls.

The lack of fiscal discipline -jointly with an unsound monetary management - accelerated inflation in 1986-1987 to reach an average level close to 10% per month. Interest rates for loans denominated in Australes increased with expected inflation, and domestic interest rates for operations in US dollars reflected an important element of country risk. The exchange rate policy introduced devaluations several times introducing wide fluctuations in its real value.

As fiscal discipline was not achieved with the Austral Plan, deficits forced the government to borrow from different sources to close the budget. One source of financing was monetary creation by the Central Bank. To sterilize part of the monetary emission the Central Bank increased reserve requirements paying competitive interest rates on them.

This disguised borrowing eventually resulted in a dominant force driving the hyperinflation of mid 1989, a subject we will discuss later.

Argentina's favorable terms of trade during 1988, mostly due to the draught in the northern hemisphere, increased the international price of some agricultural commodities. This allowed the government to realize a profit in the exchange operations. The proceeds from exports were obtained at a lower commercial exchange rate and were sold at a higher rate in the financial market (this was a part of stabilization plan known as "Primavera Plan").

During several months the spread between the financial rate and the commercial rate exceeded 20%. To sell dollars in the financial market the Central Bank fixed a minimum value above which would sell foreign exchange, although not in unlimited amounts. The amount announced were large enough to affect the price of the dollar in the short run.

Reserve requirements for different kind of deposits were substituted by two special government obligations denominated "A-1241" and "A-1242" according to the Central Bank resolutions that created them. A large part of reserve requirements were not "reserves" as banks could not cash them. They were special bonds (or non-disposable deposits in the Central Bank) that substituted reserve requirements.

The government obligations A-1241 and A-1242 were remunerated with the average deposit rate of commercial banks plus 0.5% monthly. This meant that a large part of commercial banks assets were a particular bond that, in average, would pay whatever average interest rate the commercial banks were willing to pay to depositors.

Price controls - of the sort introduced with income policies and heterodox policies of the Austral Plan and Primavera Plan - delayed the adjustment path to steady state equilibrium. Firms, anticipating price controls in oligopolistic markets, set higher prices than otherwise to protect themselves from the government political incentive to fix prices lower than long run marginal costs. With a positive probability of a stabilization failure the firm may be temporarily better off with a "non-

optimal" higher price. It may perfectly be the case that if stabilization fails the higher price will cushion the firm for a while from arbitrary government-authorized-prices lower than long run marginal costs.

Slow to adjust prices imply that real monetary aggregates would adjust slower than otherwise; and slow moving monetary aggregates imply that higher real interest rate would be necessary to clear assets markets.

Those conclusions had three important implications. First, given that delaying the adjustment implies that the real interest rate can remain for a longer period at higher values it is doubtful - at the least - that price controls can help to avoid the recessionary effects usually associated with stabilization. Second, higher real rates introduced by a particular stabilization plan with price controls suggest the existence of short run economic wealth transfers across sectors that should be carefully evaluated before justifying the "social advantage" of price controls. Third, price controls with fiscal lags imply an important delay in the adjustment of the global deficit, since its size depends on the magnitudes of the real rate of interest and of the rate of inflation.

Although the economic plan failed the authorities insisted in price and exchange controls even after the monthly rates of devaluation and inflation were well above 10% monthly. Of course, controls were totally ineffective and a high inflation accelerated even more. When the authorities abandoned the idea of "heterodox" economic policy making, and gradually moved to more orthodox measures such as reduction of public sector deficit and sound monetary management, it was too late.

The strong credibility available at the beginning of the Austral plan was gone, and the side effect of orthodox measures in absence of credibility was taking a significant political cost. The lack of credibility and the fear of repudiation of the government debt stimulated the demand for foreign exchange and increased interest rates at levels never seen before in

Argentina. Government borrowing in the domestic financial system, at the beginning of 1988, took place at annual effective rates larger than 30% for operations adjusted to the US dollar, that is, four times the LIBOR rate.

Structural reform of the public sector was never given a serious consideration by the political authorities. There were timid attempts to deregulation and privatization, and when they wanted to be more effective on structural reform it was too late, they awoke in the middle of the hyperinflation.

The severity of hyperinflation and the danger of social unrest forced the elected government to accept an immediate transfer of power. A new populist administration took power on July 9 to insist with price controls, although not everything was heterodoxy.

The announcements of the new administration were a mix of heterodox and orthodox doctrines. On the one hand, the idea of having an income policy was heterodox and was always present from the very beginning. But on the other hand, the rhetoric and the appointment of high ranking officials tended to be orthodox.

The preliminary figures for 1989 indicated that the overall deficit was decreased 1.6% of GDP from 1988 to 1989. A further reduction was expected for 1990 according to budgetary projections.

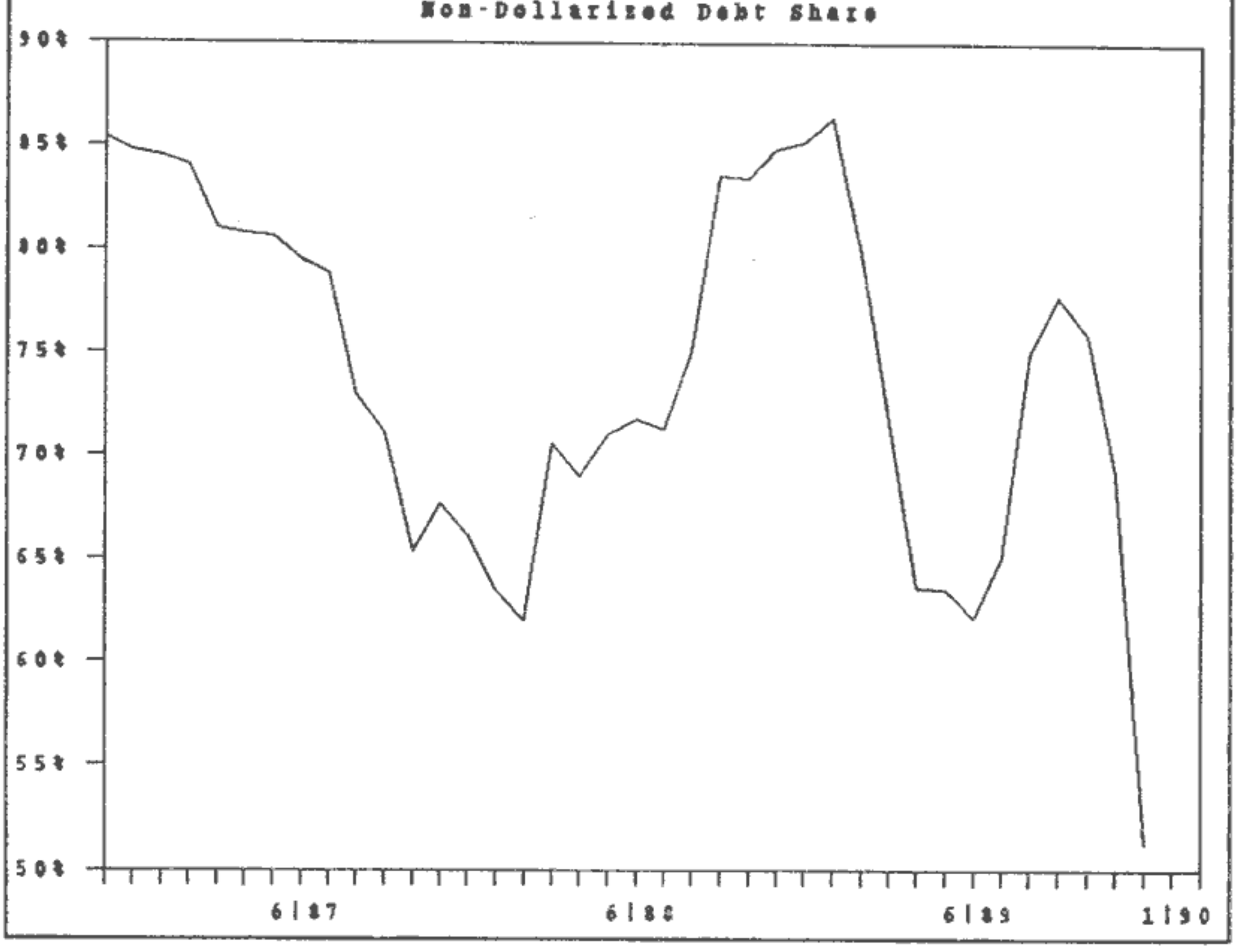
The evidence available so far does not support the hypothesis of a fiscally-ridden high inflation process toward the end of 1989. During the months following the hyperinflation of June - July, the Central Bank did not issue any significant amount of money to cover operating expenses of the public sector. Most of the monetary emission of the period was generated by the purchases of foreign exchange by part of the Central Bank (some of it was used to pay international organizations). Part of the monetary emission was sterilized issuing CEDEPS or short term Central Bank debt.

This new debt was issued at very high nominal rates. Given that it was announced to keep a fixed exchange rate of 650

australes per US dollar up to the end of 1990, in the period going from July to October the average yield of financial assets was more than 15% monthly in US dollars. This seemed not to be a serious trouble for bankers or depositors because most of the money was lent to the government, which remunerated average reserve requirements of about 80% of private banks deposits.

All indexed debt created by Resolution A-1388 that became due in the second half of 1989 was compulsively reprogrammed with a new bond denominated BOCON.

Figure 1



Even the most naive of depositors knew that the situation could not last long, and at a given point of time would consider it reasonable to convert Austral deposits to US dollars. In a few months a few smart depositors could realize in Argentina a gain that would take almost a decade to obtain in the world financial market. Of course, not all could realize such a gain. It was the attempt of many to capitalize such a gain what promoted a run on the financial system leading to hyperinflation. I believe that this is the most simple and more powerful explanation of the hyperinflations of 1989, the one beginning in February and the other starting in October, but aborted in January 1990.

The figure illustrates the portfolio shifts from 1987 to 1989. Government debt was of three types: non-indexed debt yielding a nominal interest rate, indexed debt (adjusted to price indexes with certain lags), and debt adjusted by the price of the US dollar. The data used in the figure does not include external bonds or external debt. The portfolio shifts registered in the figure as two sharp decrease in the non-dollarized debt share predict correctly the two hyperinflations: one in mid 1989 and the other at the end of 1989.

III. A Theoretical Framework for Exchange Rate Policy During High Inflation.

In Fernández (1990b) I have analyzed the empirical evidence during high inflation in Argentina finding a negative association between inflation and the real quantity of money defined as M1 (currency plus demand deposits) and a positive association between real M1 and real interest rate.

One main reason for a positive association between the real interest rate and M1 is the complementarity between time deposits and M1 in producing liquidity services. This can be formalized in several ways: either using a standard cash in advance constraint of the Clower type where money and deposits (bonds) are needed to buy goods; or with M1 used jointly with other deposits to save

shopping time (Brock (1989) follows this approach but assumes substitutability).

Assume four assets: money yielding no interest (M); a bond (B) that represents all government obligations, including high reserve requirements yielding competitive interest rate; a foreign assets (E) in the form of US dollars "under the mattress" plus deposits in foreign banks yielding liquidity services; and (Z) a pure foreign bond that does not yield liquidity services. Let P be the general price level, total real wealth, a ≡ A/P, is

$$A/P = M/P + B/P + E/P + Z/P \qquad (1).$$

All variables are time dependent, but time-subscripts are omitted to simplify notation.

The lifetime utility of the representative consumer is given by

$$\int_0^\infty u(c)\exp(-\delta t)dt \qquad (2),$$

where u(.) is increasing, twice-continuously differentiable, and strictly concave; c denotes consumption; and $\delta > 0$ is a constant subjective discount rate.

Following Calvo and Végh (1990) and Walsh (1984), we will assume that the consumer is subject to a liquidity-in-advance constraint that requires the use of money (foreign and domestic) and interest-bearing deposits (most of them were government bonds in Argentina) to purchase goods. Formally,

$$c \leq g(m,b,e), \qquad (3)$$

where m, b, and e denote the real stock of money, bonds, and foreign assets held by domestic residents. The partial differentiation of g is as follows: $g_m>0$, $g_b>0$, $g_e>0$, $g_{mm}<0$, $g_{bb}<0$, $g_{ee}<0$, $g_{mb}>0$, $g_{me}>0$, and $g_{be}>0$.

Defining non-financial real income with y, interest on bonds with i, interest on foreign assets yielding liquidity with r^* (international inflation is assumed equal to zero), interest on the pure foreign bond with ξ, and with τ government lump- sum net subsidies, the consumer's flow constraint can be written as:

$$\dot{a} = y + \tau - c + a.\xi + b.(i-\pi-\xi) + e.(r^*+\epsilon-\pi-\xi) + z.(\epsilon-\pi) - m.(\xi+\pi) \quad (4)$$

where $\dot{a}=da/dt$, π is the rate of inflation, and ϵ the rate of devaluation of the domestic currency.

The consumer's optimization problem consists of maximizing (2) subject to (1), (3) and (4). As in Calvo and Végh, output will be always demand-determined so that the consumer is not subject to quantity constraints, and the analysis will be restricted to equilibrium paths where (3) holds with equality to assure the existence of positive financial assets. Steady state equilibrium and the first order conditions for a maximum, imply the following relationships:

$$g_m/g_e = [\xi + \epsilon]/[\xi-r^*] \quad (5)$$

$$g_b/g_e = [\xi-(i-\epsilon)]/[\xi-r^*] \quad (6)$$

where r is the domestic real interest rate defined by $i - \epsilon$. (5) and (6) state that the ratio of marginal products of assets producing liquidity services must equal the ratio of their corresponding opportunity costs. With δ and r^* constant and exogenously given; (5), (6), and (3) (holding with equality) implicitly define the demand for money, the demand for bonds, and the demand for foreign assets yielding liquidity services.

The sign for the arguments of the explicit form depends upon the relative sizes of the partial differentials of the liquidity constraint. Assets functions consistent with the empirical finding discussed in previous sections requires the following conditions: $g_e^2 g_{mm} g_{bb} > g^2_{mb}$; $g_e g_{mb} - g_b g_{em} > g_m g_{be} - (g_b/g_e) g_{ee} g_m$; and

$g_e g_{mb} - g_m g_{eb} > g_b g_{me} - (g_m/g_e) g_{ee} g_b$; which are assumed to be met. Then the demand functions representing equilibrium in assets markets are:

$$M/P = L(r,\epsilon,c), \quad L_r>o,\ L_\epsilon<o,\ L_c>o \qquad (7)$$

$$B/P = b(r,\epsilon,c), \quad b_r>o,\ b_\epsilon<o,\ b_c>o \qquad (8)$$

$$f.E/P = e(r,\epsilon,c), \quad e_r<o,\ e_\epsilon>o,\ e_c>o \qquad (9)$$

where the real stock of foreign assets yielding liquidity is redefined as f.(E/P) to distinguish the physical stock of foreign assets from the real exchange rate, E/P=e.

Foreign assets not yielding liquidity are held only by private agents and, for simplicity, we assume a fixed stock of these assets in the hands of domestic residents.

The government will be assumed "honest", as in Auernheimer (1974), and will not permit price jumps. If a change of policy occurs the government will accommodate all once and for all portfolio shifts of private agents modifying its physical holdings of foreign assets. This means that the government (Secretary of Commerce) enforces a path for prices (and inflation) and the Central Bank keeps a crawling peg or an indexation scheme to maintain a constant real exchange rate, by setting $\epsilon=\pi$ at all times.

The economy produces a fix amount of aggregate output, that jointly with real earnings of foreign assets held by private agents and government give a fixed amount of real income. For simplicity, consumption, that will always equals fixed real income, will be ignored form assets functions.

To get results that could be easily compared with previous studies of hyperinflations, the demand for money is redefined as follows:

$$\Phi(\epsilon).b(\epsilon,r) \equiv L(r,\epsilon), \quad \Phi_\epsilon<o \quad (10).$$

Also it is assumed that $\epsilon.\Phi(\epsilon)$ is increasing in $\epsilon < \epsilon'$ and decreasing in ϵ for $\epsilon > \epsilon'$. This implies that if the stock of

bonds b(.) were a constant or independent of ϵ and r (as in most of the literature on inflation tax), the graph of seigniorage revenue against the inflation rate would have the usual Laffer curve property.

Let T be revenue generated by net lump-sum taxes and by earnings of government's foreign assets, the budget constraint is:

$$b.i + \dot{f}e_o = T + \dot{m} + m.\pi + \dot{b} + b.\pi \qquad (11).$$

where $\dot{f}e_o$ is the change in government's foreign assets evaluated at the constant real exchange rate e_o; and $\dot{m}$, $\dot{b}$ the change in real money and bonds respectively. Equation (11) states that the current interest deficit and changes in government's foreign assets are financed by current revenues, by printing money, or by printing bonds.

At each moment of time the government sets a fiscal policy modifying lump-sum taxes or subsidies such that the following relationship holds

$$T = s + \dot{f}e_o + \Phi.b.(\epsilon - \pi) \qquad (12)$$

where s represent a constant primary surplus (that is, a surplus definition that excludes from government spending interest accruals). Fiscal policy represented by (12) means that neither the primary surplus nor the financial policy to be described below will be affected by flow changes in government's foreign assets or changes in the real exchange rate. Notice that in the steady state $\dot{f}=0$, and the second term in the right hand side of (12) vanishes. Out of the steady state the fiscal policy sterilizes the transitory impact on the budget of gradual changes in the stock of foreign assets and changes in the real exchange rate.

Using $i = r + \epsilon$, (11), (12), and the differentiation of (8) and (10), the budget constraint can be written,

$$b.r - s = (b.\Phi_\epsilon + (1+\Phi)b_\epsilon)\dot{\epsilon} + (1+\Phi)b_r\dot{r} + \Phi.b.\epsilon \qquad (13).$$

The term "b.r" is sometimes denominated the quasi-fiscal deficit when most of the debt has the form of remunerated reserve requirements. In Argentina - for the period under analysis - most of the domestic debt was Central Bank debt with different type of obligations, the most important of which were remunerated reserve requirements. Other domestic government debt existed, and some of it was adjusted for different type of indexes. For simplicity we assume that all debt is remunerated with competitive, market determined, nominal interest rates.

Given the budget constraint (13), financial policy is undetermined. The reason is that to finance the deficit the government can print money, can print bonds, or can print both. It has been frequently claimed that a driving force to hyperinflation was the expected monetary emission by part of the Central Bank to pay for the quasi-fiscal deficit. We will not make a priori judgment of this statement, but we will introduce a financial policy that will allow us to analyze that type of conjecture.

We will incorporate a financial policy - similar to one previously introduced by Blanchard and Fischer, also used in Fernández (1990b) - stating that a fraction of real interest accruals is financed by the seigniorage of the Central Bank. The part that is not paid by seigniorage would be paid either with the primary surplus or borrowing. Using α to split the financing of the deficit we will represent this sort of assumption with the following two relationships to split the right hand side of (13):

$$\alpha.b.r = (b.\Phi_\epsilon + \Phi.b_\epsilon + b_\epsilon)\dot{\epsilon} + \Phi.b.\epsilon \qquad (14),$$

$$(1-\alpha).b.r - s = (1+\Phi)b_r\dot{r} \qquad (15).$$

Equation (14), in a steady state equilibrium, will be understood as the fraction of quasi-fiscal deficit financed with inflation-devaluation, while (15), in steady state, is the fraction financed with primary surplus (s). Notice that the right hand side of (14), out of steady state, is not strictly seigniorage neither the right hand side of (15) is strictly borrowing. The terms in (13) have been grouped, not based on the demand for money and the demand for bonds, but under a policy assumption of netting the effects of devaluation and real interest on the government budget constraint.

Define $\beta \equiv -b/[b\Phi_\epsilon + (1+\Phi)b_\epsilon]$ and $\Gamma \equiv 1/[(1+\Phi)b_r]$, and the reduced form of the system is

$$\dot{\epsilon} = \beta.[\Phi\epsilon - \alpha.r] \qquad (16),$$

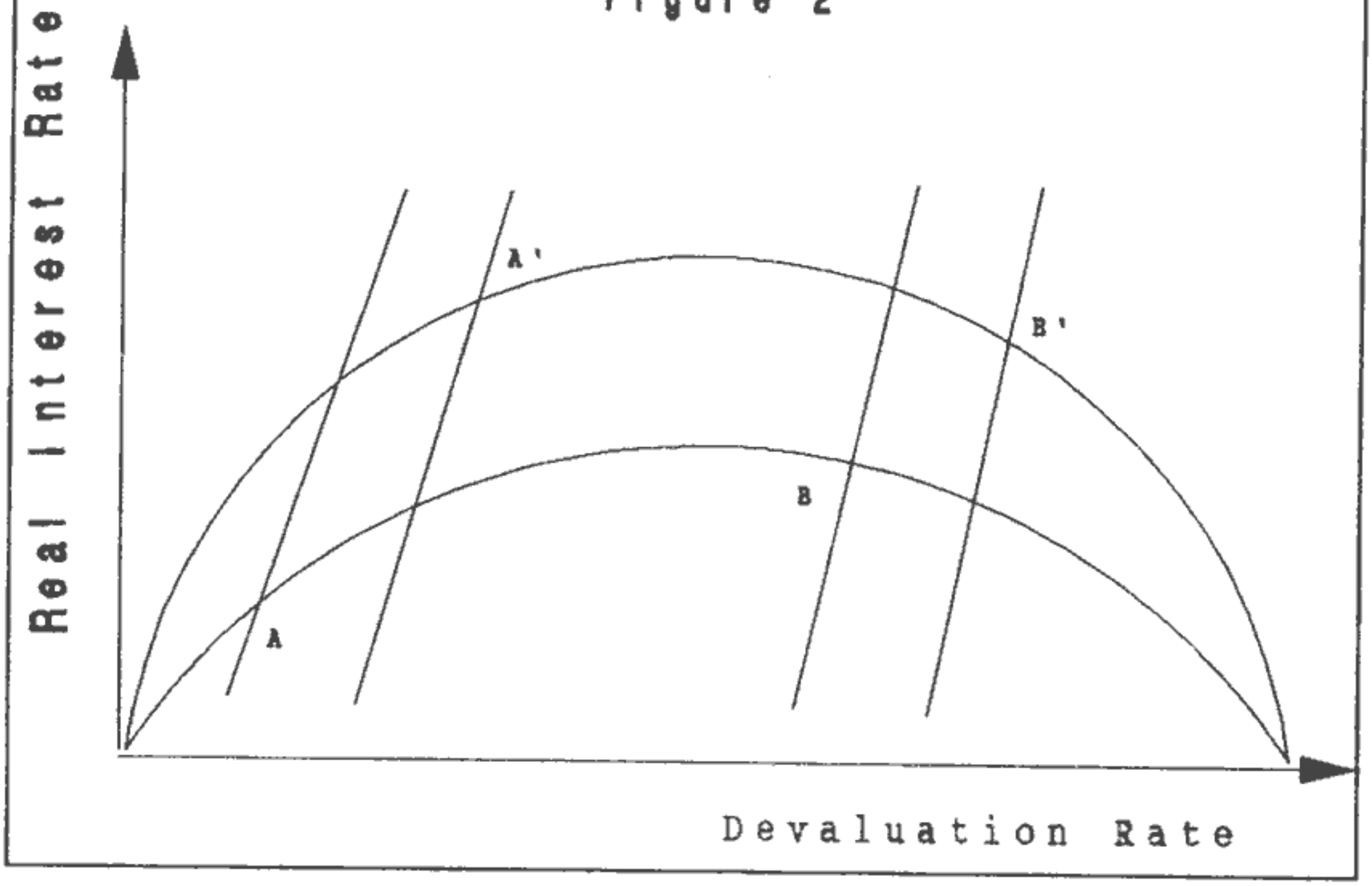
$$\dot{r} = \Gamma.((1-\alpha).b.r - s) \qquad (17).$$

Equations (16) and (17) give a solution path for ϵ and r. With P given at t=0, equations (7), (8), (9) must solve the rest of the system as follows. The "honest" government assumption implies that immediately with the announcement of a new policy at t=0 the government step in the assets market and trade money and bonds against foreign assets to avoid a once and for all changes in E. As the economy moves along the trajectory for ϵ and r determined by (16) and (17), equations (7), (8) and (9) set the path for nominal money, nominal bonds and the real stock of foreign assets in private hands.

IV. Analysis of Exchange Rate Policies and Conclusions.

Straightforward computations in the system given by (16) and (17) show that the system is either unstable or has unique solution with a saddle point equilibrium. Divergent equilibrium paths can be ruled out with arguments similar to those of Obstfeld and Rogoff (1983, 1986).

Figure 2



A saddle point requires that the line representing (17) cuts from below the Laffer curve representing (16) (see Figure 2). Saddle points are possible on any side of the Laffer curve. This result contrasts with previous rational expectations literature where the right hand side of the Laffer curve is usually associated with multiple solutions.

A higher primary surplus implies that the line representing (17) shifts leftward, then, it is perfectly possible to stabilize an economy standing on the right hand side of the Laffer curve. In this economy, an "inflation trap" (Bruno and Fischer (1987)) is not possible.

Hyperinflation can be produced by policies that moves the economy along a Laffer curve and not as result of an unstable path. Consequently, the old remedy to cure inflation (increasing primary surplus or reducing the deficit) works independently of the side of the Laffer curve. This result contrast with most of the standard analysis on the inflation tax.

Exchange rate policy in high inflation economies must be coordinated with policies that attempt to find a solution to the fiscal disarray. In particular policies attempting to find financing to the fiscal deficit.

Policymakers frequently believe that with high inflation anything is better than just printing money to finance the deficit. In particular they tend to think that by decreasing the share of deficit financed by printing money one can reduce the devaluation of the domestic currency. As we show next this turns out to be false.

A decrease in the share of the deficit financed by printing money implies a decrease in α, that, in turn, implies an upward shift in the curve representing (16) and a rightward shift in the line representing (17). As shown by Figure 2, we obtain a solution with higher devaluation irrespective if the economy is on the left side or on the right side of the Laffer curve (see points A' and B').

What this analysis tells us is that the crowding out effect on the service of government debt by increasing borrowing produces higher devaluation. The impact of higher borrowing on the stock of debt and on real interest requires more inflation to pay for it than the alternative of not borrowing. The alternative of just printing money to pay for debt services produces less inflation than the alternative of paying a lower share but of a higher total debt service increased by borrowing.

The former analysis is related to the "unpleasant monetarist arithmetic" of Sargent and Wallace (1981) that, as originally formulated, is true only if the economy is on the left side of the Laffer curve. In the way formulated in this paper is true on both sides.

The Sargent and Wallace argument can be stated as follows. With a positive constant real interest rate, a higher debt means higher interest payments in the steady state. If the economy is on the left side of the Laffer curve an increase in the stock of debt implies a higher inflation tax in the steady state.

However, if the economy is on the right side of the Laffer curve, a higher debt will require a lower inflation. And the Sargent and Wallace proposition would not hold.

When the assumption of a constant interest rate for different levels of government debt is replaced by the assumptions of this paper, higher inflation is obtained on both sides of the Laffer curve.

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