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EXCHANGE RATE MANAGEMENT AND STABILIZATION POLICIES IN DEVELOPING COUNTRIES

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1. Introduction

In a world without money illusion a nominal exchange rate devaluation per se will not have any persistent real effects. Under various plausible circumstances however, a devaluation may speed up adjustment of the real economy to disturbances, be they exogenous or policy induced. It is in this vein that a devaluation is nearly always one of the major components of stabilization programs such as those routinely administered by the IMF.

Until quite recently the communis opinio was that a devaluation, if it had real effects at all, was expansionary: the resulting increase in competitiveness would switch foreign and domestic demand towards home goods, which, in the presence of idle factors of production, would lead to an expansion in output, thus supporting one of the aims of stabilization policy (output and, via output, employment).

Early doubts were voiced in the development literature: see Hirschman (1949) and, especially, Diaz Alejandro (1963). That strand of literature is lucidly summarized and extended in a well known paper by Krugman and Taylor (1978). All these contributions have in common that they point out various channels (distributional effects, consequences of initial fiscal or current account deficits and real balance effects) via which contractionary effects on aggregate demand may reverse the expansionary effects of the expenditure switching a devaluation is intended to achieve.

In this paper we first outline several mechanisms, substantially more likely to be of importance in LDC's than elsewhere, via which a devaluation has a direct negative impact on aggregate supply.

We then discuss the influence of a large foreign debt (obviously predominantly a LDC problem), first on the impact of a discrete devaluation on output; then on the results to be expected from an anti-inflation policy used exclusively in LDCs, a preannounced crawling peg exchange rate regime.

We do not address floating exchange rates, since financial institutions in most LDCs are insufficiently developed to make that a viable option; nor do we discuss the interesting question of which "basket" to peg one's rate to if a country has decided on some sort of a fixed rate: on this we do not have anything to add to the existing literature (see for example Branson and Katseli (1980)).

In section 2 we present a stylized model that incorporates a financial structure typical for many LDCs: there are no markets for primary securities (government bonds, equity), but we assume and model the existence of flourishing curb markets. Bank credit and loans taken out on the curb market are used to finance working capital of firms, not consumer expenditure: all this provides a direct link between the financial system and the aggregate supply side of the economy that will play an important role at various points in the paper.[(1)] We will then use variants of this model to illustrate several negative impacts of a devaluation on aggregate supply in section 3. We discuss, in turn, the role of intermediate imports, real wage indexation in the presence of imported wage goods (food!) and the link between the real volume of bank credit and aggregate commodity supply via financing of working capital requirements. All three will be shown to provide a channel via which a nominal devaluation has a direct contractionary effect on aggregate supply, as opposed to Diaz-Alejandro/Krugman/Taylor contractionary effects on aggregate demand. This paper should therefore be seen as a complement to that work.[(2)] It should be noted that a fall in output induced by a backward shift in the aggregate supply schedule will be accompanied by upward pressure on inflation, contrary to a demand-induced Alesandro/Krugman/Taylor contraction, and will therefore jeopardise the real depreciation a nominal devaluation intends to achieve, also contrary to a demand-induced contraction.

In Section 4 we introduce private foreign borrowing and illustrate the consequences of the resulting foreign debt on the impact of a discrete devaluation and on the effects of a preannounced crawling peg regime. Section 5 provides a summary and concludes.

2. The Basic Model

The model to be presented is similar, although not identical, to the one used in van Wijnbergen (1983a), so we will only describe it briefly. The reader interested in more details and motivation than provided here should consult that paper.

First the financial sector. The model presented here incorporates several stylized facts characterizing the financial structure in many LDCs. We assume absence of markets for government bonds or equity. Intermediation between firms and private wealth holders takes place via the official banking system and the Unofficial Money Market (UMM), or curb market. Therefore, firms finance fixed and working capital requirements by bank loans, loans taken out at the UMM or retained earnings. Since firm owners could (and do) lend on the UMM, the opportunity cost of using retained earnings is the UMM rate. We will in fact model these as loans from owners of the firms to the firm and lump them together with UMM loans.

Commercial Banks are assumed not to hold free reserves. This means that reserve requirements and credit ceilings are mutually dependent instruments. We assume the use of credit ceilings. For simplicity, their sources of funds consist of Demand Deposits only; a more sophisticated liability structure is easily introduced but would add unnecessary detail.

The private sector allocates its wealth W equal to the real value of the monetary base MR (plus the capital stock) over loans made to firms via the UMM, deposits in banks and cash. We will further assume a fixed deposit rate and a fixed cash-bank deposit ratio in private portfolios.

If we define a Tobin-type asset model to govern the allocation of wealth over the UMM and other financial assets, all this leads to a private supply of loans on the UMM, B_p:

$$B_p = (1 - m(i, y))\, W \qquad (1)$$

where B_p and W are real variables expressed in terms of domestic goods (nominal quantities are deflated by the price of domestic goods, p), y is real output of home goods. Since the private sector does not directly hold foreign assets, foreign interest rates or the expected rate of depreciation, θ, do not appear in (1).

Firms demand loans for working capital D to finance variable costs of wages and payments for intermediate imports, oil for brevity sake. D depends positively on the real product wage (in terms of domestic goods) w, the real price of imported oil $p_O = \frac{ep_O^*}{p}$ where p_O^* is the "dollar price" of oil and e the exchange rate ("pesos per dollar"), and domestic output y:

$$D = D(w, p_O, y) \qquad D_w, D_{pO}, D_y > 0 \qquad (2)$$

Firms will of course first try to satisfy their need for funds from official banks, since lending rates are invariably far below UMM rates, with loan quantities rationed as a consequence. So their net demand for loans at the curb market is $D + K - B_b$, where K is the real value of the capital stock and B_b the real volume of bank credit (deflated by p). This leads to an equilibrium condition for the UMM:

$$D(w, p_O, y) + K = B_b + (1 - m(i, y))\, W \qquad (3)$$

In what follows we will suppress K for notational convenience: we will only discuss short run phenomena, so changes in the capital stock will be ignored. It is straightforward to show, via manipulation of various budget constraints, that (3) also implies money market equilibrium. (3) can be graphically represented in i-y space (the Asset Market equilibrium locus AM in figure 1).

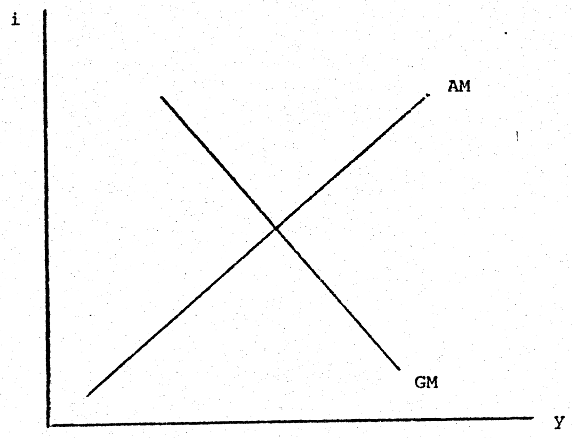

Figure 1   Asset and Goods Market Loci

Along AM, (4) holds:

$$\frac{di}{dy} = -\frac{(D_y + m_y W)}{m_i} > 0$$

AM slopes upward ($m_i < 0$!): higher income y will increase private money demand ($m_y > 0$) and therefore reduce the private supply of loans at the UMM; at the same time demand for loans to finance working capital goes up ($D_y > 0$). The resulting excess demand for funds necessitates an increase in the UMM rate, so AM slopes up.

Consider now the real part of the model. Production technology is assumed to be Cobb Douglas in capital on the one hand and labour and energy on the other. This allows us to write variable costs (which need to be financed by working capital) as

$$D = g(w,\ p_O)\ y^a\ K^{(a-1)} \qquad a = 1/(1-\alpha)$$

α CD share parameter.

Total variable costs inclusive costs of credit are accordingly $LC = D\ (1+i-\hat{p})$. Firms maximize profits $p(y - LC)$, which leads to an aggregate supply function:

$$1 = ay^{a-1}\ g(w,\ p_O)\ (1+i-\hat{p}) \qquad (4)$$

where we suppressed terms involving K.

Aggregate demand for domestic goods, A_d, consists of foreign demand $E(q)$, with $q = p/(ep^*)$ the relative price of domestic final goods in terms of foreign final goods, of domestic consumption demand for domestic goods $C_d\ (q,\ i-\hat{p},\ y-p_O\ O - \hat{p}\ MR,\ W)$, investment $I(i-\hat{p},\ w,\ p_O)$ and government expenditure G:

$$A_d = C_d + I + E + G$$

Disposable income equals output minus oil imports $p_O O$ minus capital losses on nominal assets, $\hat{p}MR$ (equal to $\hat{p}MR$ rather than $\widehat{CPI}$ MR because we have expressed income and MR in terms of domestic goods).

Finally we assume the price level to be sticky, relative prices change only gradually over time. The inflation rate however can change instantaneously in response to anticipated foreign inflation Π^*, expected rate of devaluation θ or excess demand for domestic goods:

$$\hat{p} = \theta + \Pi^* + \lambda\ (A_d - y) \qquad (5)$$

A micro-economic rationale for equations like (5) is presented in Barro (1974) and Sheshinsky and Weiss (1977). Gradual price adjustment implies the possibility of disequilibrium in the goods market. We will assume throughout that the country under consideration is in a régime of classical unemployment (i.e. we start out in a position where $\hat{p} > \theta + \Pi^*$). This implies that output will be supply-determined. We do this because most of the discussion to follow focuses on aggregate supply effects, which lose much of their relevance in a Keynesian régime. Anyhow the case of Keynesian unemployment is the subject of Krugman-Taylor (1978) and is treated more than adequately there.

The assumption of classical unemployment implies that output will be determined by the aggregate supply function (4). Using (4) to substitute out $\hat{p}$ from (5) gives us a goods market locus GM (cf figure 1):

$$\left.\frac{di}{dy}\right|_{GM} = - \frac{(\lambda\ (1-C_{dy}) + (1+\lambda(C_{dy}\ MR+I_1))\ \frac{(a-1)}{y}\ (1+i-\hat{p}))}{1+\lambda\ C_{dy}\ MR}$$

The denominator is always positive; the numerator will also be positive if $1+\lambda(C_{dy}\ MR + I_1) > 0$. This is not necessarily so since $I_1 < 0$. This term plays a crucial role in the stability analysis of Keynes-Wicksell growth models, which have similar price dynamics (cf Fischer (1972)). If it is positive that type of model will have stable dynamics. An intuitive interpretation of that term is given and discussed in Fischer (1972) and in van Wijnbergen (1983a); we follow these two papers in assuming it to be positive. That implies that $\left.\frac{di}{dy}\right|_{GM} < 0$, since there is a minus sign in front of the whole expression: GM slopes downward (cf figure 1). The reason is simple: higher production y will, given everything else, lead to a lower $\hat{p}$ via (5) as it leads to excess supply. Unless the interest rate i falls, the real rate will go up, which, from (4), can be seen to be incompatible with a higher y. In other words, higher output will, given everything else, lead to less inflation; since the aggregate supply schedule tells us however that the real interest rate $i - \hat{p}$ will have to fall before firms will increase output given other factor costs, it follows that nominal rates i will have to fall even further than inflation $\hat{p}$ or GM slopes downward.

3. Contractionary Effects of a discrete devaluation on the aggregate supply side of the economy

In this section we will discuss three channels via which a devaluation exerts a contractionary effect on aggregate supply, involving respectively intermediate imports, wage indexation on a commodity bundle involving foreign goods, and the real volume of bank credit available to the business sector. Rather than throwing everything in at once, we choose to work with slight variants of the model, designed to highlight each channel in isolation. In the real world of course countries are hit by all three mechanisms simultaneously.

3.1 The role of intermediate imports

Consider the short run impact of a devaluation within the context of the model outlined in the previous section. In this subsection we will make the simplifying assumption that nominal wages are indexed on the price of domestic goods rather than the CPI, which also includes the price of imported final goods. This assumption is made simply because it allows us to defer discussion of the role of wage indexation to the next section, where proper indexation on the CPI will be introduced.

Under that assumption a devaluation will disturb two variables: the relative price of domestic in terms of foreign goods q falls (competitiveness increases) and the real price of oil in terms of home goods rises:

$$\frac{dp_O}{de} = \frac{p_O^*}{p} > 0 \quad \text{and} \quad \frac{dq}{de} = -\,q/e < 0 \qquad (6)$$

The effects of that can be seen in figure 2. The AM curve is not affected by q but does shift because of the devaluation induced increase in p_O: higher oil prices raise variable costs and therefore working capital requirements. This will, for given output levels lead to more demand on the UMM and so to higher interest rates: the AM curve shifts up (figure 2):

$$\left.\frac{di}{dp_O}\right|_{\substack{AM \\ y=\bar{y}}} = \frac{-D_{p_O}}{m_i W} > 0 \qquad (7)$$

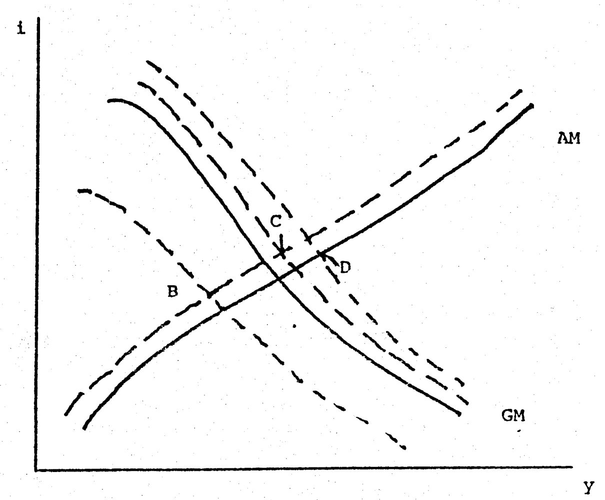

Figure 2 Effects of devaluation via its impact on p_O and q

The effects on the GM curve is more complicated. Consider first the effect of the change in p_O, our "structuralist" channel. Higher oil prices will directly reduce aggregate supply since they constitute an increase in the price of a factor of production. Added to that are deflationary effects on demand via reduced investment and consumer spending:

$$\left.\frac{di}{dp_O}\right|_{\substack{GM \\ y=\bar{y}}} = \frac{\lambda(I_O - Cd_y\,(1-\epsilon^O_{pO})\,O) - (1+\lambda(Cd_y\,MR+I_1))\,\psi_O\,(1+i-\hat{p})/p_O}{1 + \lambda Cd_y\,MR} < 0 \qquad \ldots (8)$$

where ψ_O is the share of intermediate imports in variable costs. We made the plausible assumption of a short run energy demand price elasticity below one $(1-\epsilon^O_{pO} > 0)$. Accordingly the GM curve shifts down, leading to a new short run equilibrium at B. At B output has fallen but the curb market rate could go up or down (in figure 2 it falls): higher working capital requirements push i up but lower income pulls it down. The contractionary effect on output is unambiguous however.

This is of course not the end of the story, there still is the standard expenditure switching effect via $dq/de < 0$. A lower q switches world demand to our goods, which shifts the GM curve back up:

$$\left.\frac{di}{dq}\right|_{\substack{qM \\ y=\bar{y}}} = \frac{\lambda A_{dq}}{1+\lambda C_{dy}\,MR} < 0 \qquad (9)$$

This corresponds to an upward shift after a devaluation, since $dq/de = -q/e < 0$ also.

Accordingly, we arrive at a point like C with higher output and interest rates than would have obtained without the expenditure switching effect. Without intermediate imports, AM would have stayed put and GM would have shifted upwards because of expenditure switching, and an equilibrium like D would have resulted. It is straightforward to show that $y_C < y_D$:

$$\frac{dy}{de} = \underbrace{\frac{dy}{dq}\frac{dq}{de}}_{(II;+)} + \underbrace{\frac{dy}{dp_O}\frac{dp_O}{de}}_{(II;-)} \tag{10}$$

D corresponds to the first term in (10), the positive expenditure switching effect. C results by adding the structuralist effect via intermediate inputs (term II in (10)), which is always contractionary. So $y_C < y_D$.

Summarizing, if final goods prices adjust only gradually (cannot "jump") a devaluation raises the real price of imported inputs in terms of domestic final goods. This adds a contractionary element to a devaluation. Intermediate goods typically make up the bulk of most LDC's imports (50 à 60% is not an unreasonable number); this effect is therefore likely to be more important in LDCs than in DCs, where consumer goods imports typically are more and intermediate imports less important.

3.2 Real Wage Indexation, Imported Consumer Goods and Devaluation

A second contractionary channel runs via real wage indexation and is, in a way, the counterpart of the increase in competitiveness a successful devaluation also needs to achieve.

Consider again the basic model of section 2, with two changes. For clearer focus we will ignore intermediate imports from now on, they have already been discussed in the previous section. The second change is the assumption of real wage indexation on the CPI, enforced either via formal contracts, implicit arrangements or social pressure. That introduces a negative relation between the real domestic product wage w and the terms of trade q:

$$w = q^{-\gamma} \tag{11}$$

where γ equals the share of foreign imports (food!) in wage earners' consumption basket.

Furthermore, in the classical unemployment set up of our model, real product wage increases reduce output via two different channels: a higher w increases demand for working capital (some of which is needed to finance wage payments) which results in an upward shift of the AM curve:

$$\left.\frac{di}{dw}\right|_{\substack{AM \\ y=\bar{y}}} = \frac{-D_w}{m_i W} > 0$$

It also raises labour costs and therefore reduces aggregate supply: the GM curve shifts to the left:

$$\left.\frac{dy}{dw}\right|_{\substack{GM \\ i=\bar{i}}} = \frac{\lambda I_w - (1+\lambda(C_{dy}\ MR + I_1))\quad \psi_L\ (1+i-\hat{p})/w}{\lambda(1-C_{dy}) + (1+\lambda(C_{dy}\ MR + I_1))} > 0$$

where ψ_L is the labour share in variable costs. The net results can be seen in figure 3: output will fall unambiguously. This, combined with the negative link between terms of trade q and w because of indexation, is what causes problems after a devaluation that succeeds in lowering q (increasing competitiveness). Higher competitiveness implies that foreign goods are more expensive in terms of our goods; this is only compatible with an unchanged real consumption wage if real domestic product wages go up, which adds an aggregate supply shock effect to a devaluation.

$$\frac{dy}{de} = \underbrace{\underset{(-)}{\frac{\partial y}{\partial q}}\ \underset{(-)}{\frac{\partial q}{\partial e}}}_{\text{Expenditure switching effect; } +} + \underbrace{\underset{(-)}{\frac{\partial y}{\partial w}}\ \underset{(-)}{\frac{\partial w}{\partial q}}\ \underset{(-)}{\frac{\partial q}{\partial e}}}_{\text{Effect via wage indexing; } -} \qquad (12)$$

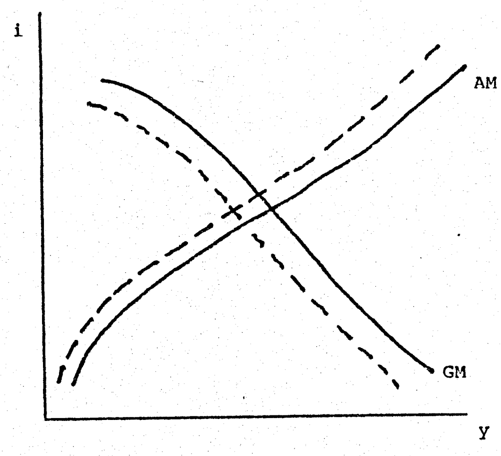

Figure 3 Effects of an increase in w

3.3 Contractionary Impact on aggregate supply via a reduced real volume of credit

The final contractionary channel leading to aggregate supply runs via the real volumes of bank credit (important for aggregate supply because of working capital requirements). Of course with the sticky price level assumptions made so far this effect will come into play only gradually; rather than engage in a fully-fledged dynamic analysis (the way the dynamics of a similar model are analyzed, be it in a different context, in van Wijnbergen (1983a,b), we will once again slightly modify the model used to eliminate contractionary effects already discussed and focus more clearly on effects via the real volume of bank credit.

In particular we will assume that via indexing arrangements the devaluation is passed on one for one in domestic prices and wages, thereby leaving q and w unaffected. This leads to a discrete change in p, of equal proportion as the percentage increase in e, which in turn implies a reduction in B_p and MR, the real volume of bank credit and the monetary base. The contractionary effects via a lower real monetary base are of course well known and will, via standard monetary approach channels, be counteracted over time via a Current Account Surplus.

Consider however, the effects of a devaluation induced reduction in the real volume of bank credit. There is no <u>direct</u> effect on the GM curve, since the link between the financial system and the real part of the model runs via the real interest rate (cf figure 4).

However, the AM curve <u>is</u> affected. A lower B_p means less bank credit for firms, who are therefore forced to rely more on the curb market for funds. creating an incipient excess demand there. To get back at financial sector equilibrium the interest rate on the curb market will have to rise: the AM curve shifts up (figure 4):

$$\left.\frac{di}{dB_p}\right|_{\substack{AM \\ y=\bar{y}}} = \frac{1}{m_i W} < 0 \qquad (13)$$

Since we are discussing a decline in B_p, (13) implies an upward shift of AM.

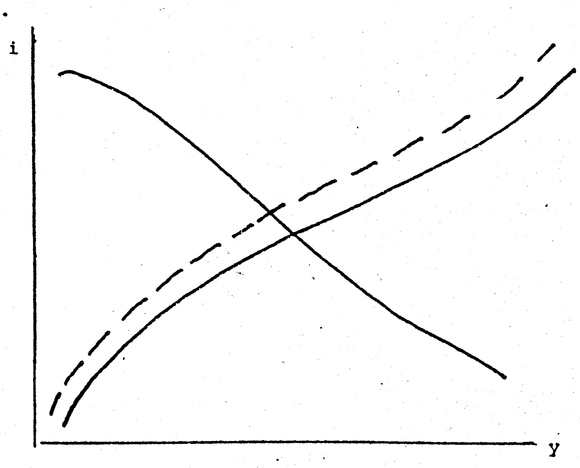

Figure 4 Effects of a devaluation induced reduction in the real volume of bank credit B_p

The net effect of $dB_p/de < 0$ on output y is negative as can be seen in figure 4: the cut in B_p pushes up the interest rate for a given rate of inflation; this raises the real rate which will reduce aggregate demand via traditional mechanisms, but also aggregate supply via the resulting higher cost of working capital. Whether inflation accelerates or declines depends on whether the aggregate supply effect via costs of working capital dominates additional effects reducing aggregate demand:

$$\frac{d\hat{p}}{dB_p} = \frac{I_1\ (a-1)\ (1+\bar{i}-\hat{p})/y - \lambda(1-C_{dy})}{\Delta} \lessgtr 0 \qquad (14)$$

If $\hat{p}$ goes up it will do so less than i however, so that the real rate $i-\hat{p}$ increases and, from our aggregate supply equation (4), y falls. For a more extensive discussion of the effects of changes in bank credit on inflation and output see van Wijnbergen (1983a).

Empirical evidence for Argentina (Cavallo (1977)) and South Korea (van Wijnbergen (1982)) strongly supports the initial (say two quarters) dominance of the aggregate supply effect on inflation. That raises the intriguing possibility that inflation might accelerate on top of the one for one pass through of the devaluation in the price level already incorporated, so leading to the possibility of at least an initial gradual real appreciation after a nominal devaluation!

Of course standard deflationary effects on aggregate demand via a lower real monetary base will make this less likely to happen. Whether it will or not is an empirical issue, but the theoretical possibility is there, in a stable model without money illusion.

4. Foreign Debt, Devaluation and the Crawling Peg

In this section we will discuss another issue complicating exchange rate policy, the existence of a substantial foreign debt, bringing with it a debt service burden. This is substantially more - if not exclusively - important in LDCs (not counting the majority of oil exporters of course) than it is in developed countries. To incorporate foreign borrowing, we will first modify the simplest version of the model, the one of section 2, but without intermediate imports. Also we go back to the no-immediate-pass-through assumption used in 3.1 and 3.2. We will then briefly discuss the effect of foreign debt on the impact of a devaluation and finally we will describe its consequence for the results of an interesting policy experiment recently tried (without too much success) in several Latin American countries, an attempt to bring inflation down via a preannounced slowdown in the rate of depreciation of the exchange rate.

4.1 Foreign Debt Introduced

The bulk of private foreign debt in LDCs consists of liabilities of commercial firms. It is moreover almost exclusively Eurodollar debt, Western bond markets are by and large closed to LDCs. Therefore, contrary to what is usually done, we will not model capital mobility as foreign investors buying domestic bonds or vice versa, this is not the way capital flows in and out LDCs work. Instead we will assume that foreign borrowing is done by firms. Exchange risk is always borne by the borrower, and the borrower pays the foreign interest rate i^*. The cost of a foreign loan is accordingly $i^* + \theta$, with θ the expected (and actual, in this perfect foresight model) rate of devaluation. Substitution between foreign and domestic sources of funds is assumed to be imperfect: the larger the interest differential $i - i^* - \theta$, the higher the (stock) demand for foreign loans by firms, B_f $(= e\, B_f^*/p)$ where B_f^* is the dollar value of the debt):

$$B_f = eB_f^*(\bar{i} - i^* - \theta)/p, \quad B_f^{*'} > 0 \qquad (15)$$

Dependence on y is easily introduced but adds only uninformative algebra. We will regularly use B_f' for $eB_f^{*'}/p$, for notational convenience.

Introducing foreign borrowing as a third source of funds for firms modifies the financial sector equilibrium condition, equation (3), which now becomes:

$$D(w, y), + K = (1-m(i, y)\ W + B_p + B_f^*\ (i-i^*-\theta)e/p \qquad (16)$$

Note that firms may take out foreign loans, but private wealth holders still do not hold foreign assets so i^* and θ do not appear as arguments of $m(\ )$. This assumption about portfolio structure is realistic for all but a few LDCs. The only change needed in the real part of the model is in the definition of disposable income (an argument of c_d, domestic consumer demand for our goods). Disposable income now not only incorporates capital losses $\hat{p}mR$ but also interest payments abroad and anticipated capital losses on foreign debt due to depreciation :

$$y_d = y - \hat{p}MR - (\bar{i^*} + \theta)B_f \qquad (17)$$

The diagrammatical apparatus of figure 1 remains intact, although the algebraic expressions for slopes and shifts change somewhat (see the appendix).

4.2 Foreign debt and devaluation

A discrete devaluation in the presence of foreign debt raises a technical problem in a continuous time-instantaneous loans framework used here: $de > 0$ does not of course increase the amount of liquidity provided by existing debt, the exchange rate at which the debt was contracted is relevant, say e^-, where e^- is the old rate prevailing just before the devaluation. Accordingly, the AM curve is not affected directly (cf. figure 5).

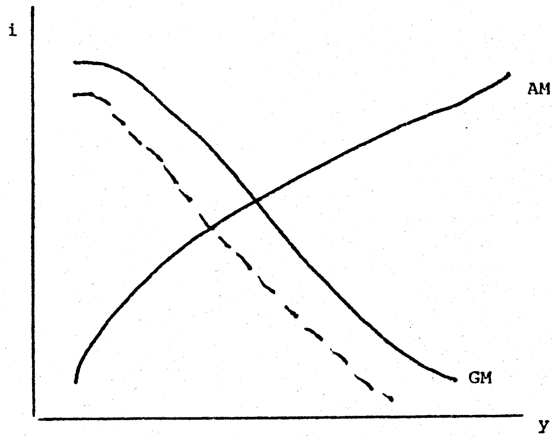

Figure 5 Effects of a devaluation induced increase in debt service burden

$$\left.\frac{di}{de}\right|_{\substack{GM\\ y=\bar{y}}} = -\lambda\, C_{dy}\,(i^{*}+\theta-\hat{p})\,B_{f}^{*}/p + \lambda\, A_{dq}\,\frac{dq}{de} \qquad (18)$$

$$(A;-) \qquad\qquad (B;+)$$

The first term (A) gives the contractionary effect via the debt service burden and is negative;[1/] this is the shift indicated in figure 5. The second term represents the standard expenditure switching effect via the terms of trade that we already discussed in section 3.1.

The net effect on output is ambiguous of course since the expenditure switching effect is expansionary, but the debt service effect adds a contractionary channel:

$$\frac{dy}{de} = (mB_{f}^{*'}/e - m_{i}\,MR)\,(-\lambda A_{dq}\,q/e + \lambda\, C_{dy}\,(1^{*}+\theta)\,B_{f}^{*}/p)$$

$$(A;+) \qquad\qquad (B;-) \qquad\qquad (19)$$

1/ Assuming the real rate on foreign loans $i^{*}+\theta-\hat{p}$ is positive, which may fail to hold during a strong real appreciation $(\hat{p} > \theta + i^{*})$.

This contractionary channel is more in the Krugman/Taylor style, since it operates on aggregate demand contrary to the three channels analyzed in section 3.

4.3 Inflation, Output and the Crawling Peg

In the late seventies several Latin American countries tried out an innovative policy to bring down inflation: a preannounced slowdown in the rate of devaluation of the nominal exchange rate. (For an interesting discussion of the results see Diaz-Alejandro (1981)). One of the more puzzling effects was the huge real appreciation (around 40% in one year in Argentina) that resulted from the persistence of domestic inflation at a rate way above foreign inflation plus the rate of crawl. In fact in Argentina domestic inflation accelerated in the first few months, rather than falling off.

There is by now quite a literature on this subject (see for example Calvo (1981), Obstfeld (1983) or Taylor (1983)). Only Calvo and Taylor address the real appreciation issue (Obstfeld uses a one good model). Their stories are essentially similar: the slowdown in the rate of crawl causes an incipient exces demand for domestic assets; that causes an initial real appreciation, which will disappear gradually as BOP surpluses augment the domestic money stock. Remains however the Argentinian puzzle of an acceleration of the inflation rate rather than an initially less than one for one slowdown which would also cause a real appreciation. In this section we will show that the existence of a large foreign debt may be the clue to the solution of the puzzle, since a lower rate of crawl reduces the debt service burden for any given volume of debt and so provides an expansionary stimulus.

Consider then what an announced (and, a non-trivial restriction, believed) slowdown of the rate of devaluation θ does in the context of our model. As a mental experiment, assume that things would go as they were expected to go;

i.e. assume that inflation and the rate of interest go down one for one with the slowdown in θ. Would this be a sustainable equilibrium, with an unchanged real rate and inflation down to the new value of $\Pi^* + \theta$? As we will see that is clearly not the case.

In the asset markets, our experiment would leave the interest differential, $i-i^*-\theta$ unchanged, so B_f would remain unchanged. But at the lower interest rate, money velocity would fall, the private sector would increase its demand for domestic money and, therefore, as a consequence of the wealth constraint, cut back on its supply of funds on the unregulated market. This will push the interest rate back up, widening the gap $i-i^*-\theta$, and making it more attractive for firms to borrow abroad, leading to an inflow of foreign capital. The incipient excess demand for money will therefore partially be met by higher domestic interest rates (which reduce money demand) and partly via an inflow of foreign capital, which increases the money supply (if at least the inflow is not sterilized a realistic assumption in LDCs). The net effect is that the AM curve will shift down after a reduction in θ, but less than one for one:

$$\left.\frac{di}{d\theta}\right|_{AM,\ y=\bar{y}} = 1 - \frac{\bar{m}_i\ MR}{m_i\ MR - mB_f^1} = \epsilon, \quad 0 < \epsilon < 1. \qquad (20)$$

Note that we are reducing θ, so a positive sign on expression (20) corresponds to a downward shift of the AM curve (see Figure 6).

This part of the story is essentially similar to what is done in Calvo (1981), Obstfeld (1983), Taylor (1983) and other papers on this issue.

But consider now what happens in the real part of the model. If our mental experiment is followed again, i and $\hat{p}$ would go down one for one with θ and $i - \hat{p}$ would remain unchanged, as would real output. This would correspond

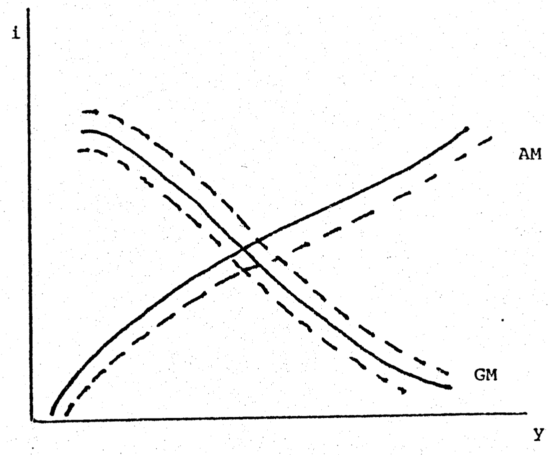

Figure 6 Effects of a reduction in the rate of crawl, $d\theta < 0$. Both curves shift down less than $d\theta$

to a downward shift of GM one for one with the reduction in θ (note that i is on the vertical axis, so dimensions are commensurate). However, at a lower inflation rate and rate of crawl, capital losses on the Monetary Base MR and the debt service burden $(i^{*}+\theta)\ B_f$ will have gone down, which, given everything else, will imply an increase in disposable income, putting upward pressure on aggregate demand and shifting the curve back up, so that this curve too will shift down less than one for one with θ (cf. figure 6). In fact if the foreign debt is large enough, leading to high favourable income effects because of the reduction in the debt service burden caused by the lower θ, it is even possible that the GM curve shifts up rather than down:

$$\left.\frac{di}{d\theta}\right|_{\substack{GM \\ y=\bar{y}}} = 1 - \frac{\lambda\ C_{dy}\ MR}{h} - \frac{\lambda C_{dy}\ B_f}{h}$$

where $h = 1+ \lambda(C_{dy}\ (MR + (i^{*} + \ )\ B_f') + C_{dW}\ B_f^{1}) > 0$. The second term is smaller than one, so $1 - \frac{\lambda C_{dy}\ MR}{h} > 0$ but if B_f is large enough the whole expression could turn negative, leading to an upward shift, rather than a downward one (keep in mind we are discussing a reduction in θ).

We show in the appendix that what the diagram suggests is indeed the case: interest rates will fall but less than one for one with θ, leading to an increase in $i-i^{*}-\theta$ and a capital inflow. The intriguing results come however if one looks at the inflation response. There are two reasons why, if it falls, it will fall less than one for one with θ, causing a real appreciation to develop over time.

Consider what would happen if it would go down one for one. Since we already saw that i will not fall all the way, the real rate $\dot{i}-\hat{p}$ would rise. This would lead to higher costs of working capital and so to a cut in aggregate supply, which in turn would push the inflation rate up (the higher real rate would also cut demand; there is strong empirical evidence however that working capital effects on the supply side dominate in the short run((Cavallo (1977), van Wijnbergen (1982)).

The second reason why inflation will not go down one for one is the increase in disposable income due to lower debt service on foreign debt $(1^{*} + \theta)$ B_f triggered by the reduction in θ.

In fact if the foreign debt is large enough the reduction in debt service may become so large, and the resulting demand expansion so big that inflation will in fact accelerate after the slowdown in θ. The debt service element in this study is what distinguishes it from the existing literature on the crawling peg, where such an acceleration of inflation cannot occur, contrary to the set up presented here.

5. Conclusions

In this paper we discussed a variety of problems complicating exchange rate management and, more in particular, the use of the exchange rate as an instrument of stabilization policy, on LDCs. In the first part of the paper we outlined three channels via which a devaluation has a direct contractionary impact on the aggregate supply side of the economy: via local currency costs of intermediate imports, via wage indexing (because of explicit contracts, implicit arrangements or social pressure) in the presence of foreign goods in wage earners' consumption bundles (food imports!) and via a reduced volume of real credit to firms. The last channel has its impact on the supply side of the economy because firms, needing funds to finance working capital, are pushed into the curb market if bank credit is reduced, driving up interest rates there and shifting back the aggregate supply curve as a result. The contractionary effect via the latter channel is of course exacerbated if the devaluation is accompanied by a cut in the nominal volume of bank credit, as is often the case.

There is by now an extensive literature on contractionary devaluation, aptly summarized and extended by Krugman and Taylor (1978). They, as most, of that literature, focus on contractionary effects on aggregate demand (and, via Keynesian multiplier effects, only indirectly on aggregate supply). Both types (Krugman-Taylor demand contractions and our backward shifts in the aggregate supply curve) are deplorable of course since nobody wants to incur the social costs of lost output and employment unnecessarily; however contractionary effects via the supply side are more damaging than those via aggregate demand in the context of a devaluation since a cut in aggregate supply leads to upward pressure on inflation while a cut in aggregate demand tends to abate inflation. Upward pressure on inflation may over time threaten the increase in competitiveness a nominal devaluation is usually also intended to achieve.

In the second part of the paper we discuss a second issue complicating exchange rate management in LDCs, the presence of a substantial foreign debt.

We first briefly demonstrate that if a devaluation succeeds in increasing competitiveness, it will also temporarily raise the real (in terms of domestic good) burden of servicing that foreign debt, causing a Krugman-Taylor like contractionary effect on aggregate demand.

We then proceed to analyse the effects of a preannounced slowdown of the rate of depreciation, and show, as other authors have done, that interest rates and inflation will go down less than one for one with the slowdown in the rate of crawl, if at all, so that a real appreciation will emerge. The new point in this analysis is our demonstration that the existence of a substantial foreign debt (leading to a substantial decline in capital losses on foreign debt if the rate of devaluation goes down) may lead to such an expansionary effect on aggregate demand that inflation actually accelerates in the early phases of the program. This is more than a theoretical curiosum, since it is exactly what happened in the first few months of the Argentina experiment with a slowdown of the rate of devaluation.

All this of course does not imply that a devaluation should never be considered. It does suggest however that a devaluation is likely to be an ineffective tool for demand management since it may cut aggregate supply as much or more in the short run. Another conclusion should be that when a devaluation is used to increase competitiveness, to change relative prices (to speed up adjustment to more fundamental reforms), special attention should be paid to moderation of the negative effects on aggregate supply, since these, contrary to negative effects on aggregate demand, will exacerbate inflationary pressures that could well threaten any real depreciation that nominal devaluation might achieve initially.

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Footnotes

(1) This link has been discussed extensively in recent work on stagflationary effects of restrictive monetary policy in LDCs (Cavallo (1977), Bruno (1979), van Wijnbergen (1982, 1983a,b), Taylor (1983) and Buffie (1984)).

(2) The first contractionary effect on aggregate supply (via intermediate imports) has been formalized before (van Wijnbergen (1980), Buffie (1983)). The other two, although frequently brought up in policy making circles in LDCs, have not yet found their way in the theoretical literature as far as I know. Cardoso (1983) presents related work but does not derive the contractionary effects on aggregate supply presented here.

Appendix

1. The model of section 2, without foreign borrowing in differentiated form:

If (4) is used to substitute out $\hat{p}$ $\left(d\hat{p} = di + (a-1)(1+i-\hat{p})\frac{dy}{y}\right)$, differentiation of the resulting expressions gives

$$\begin{matrix} (2) \\ \\ (4,\ 5) \end{matrix} \begin{bmatrix} D_y + m_y\ MR & m_i\ MR \\ & \\ \lambda(1-C_{dy}) + & 1+ C_{dy}\ MR \\ (a-1)(1+i-\hat{p})(1+\lambda(C_{dy}\ MR+I_1) & \end{bmatrix} \begin{bmatrix} dy \\ \\ di \end{bmatrix} = \quad A.1$$

$$\begin{bmatrix} \left[-D_O\ dp_O - D_w\ dw + (1-m)dMR + dB_f\right] \\ \left[(\lambda(I_O - C_{dy}\ (1-\epsilon p_O^{O})\ O - \psi_O\ (1+\lambda(C_{dy}\ MR + I_1)(1+i-\hat{p})/p_O)dp_O \right. \\ + (\lambda\ I_w - (1+\lambda(C_{dy}\ MR + I_1))\ \psi_L\ (1+i-\hat{p})\ dw \\ \left. + \ \lambda A_{dq}\ dq + \lambda(C_{dw} - \hat{p}\ C_{dy})\ dMR\right] \end{bmatrix}$$

The expression Δ in the text (p. 15) is the Jacobian of the system A.1:

$$\Delta = (D_y + m_y\ MR)(1+ \lambda\ C_{dy}\ MR) - m_i\ W(\lambda(1-C_{dy}) + (1+\lambda(C_{dy}\ MR + I_1))\ \frac{(a-1)}{y}\ (1+i-p)$$

2. The model without intermediate imports but with foreign borrowing (cf. section 4).

$$\begin{bmatrix} D_y + m_y MR & m_i MR - mB_f' \\ \lambda(1-C_{dy}) + & 1+\lambda(C_{dy}(MR+(i^*+\theta)B_f') \\ (a-1)(1+i-\hat{p})(1+\lambda(C_{dy}MR + I_1) & + C_{dw}B_f' \end{bmatrix} \begin{bmatrix} dy \\ di \end{bmatrix} =$$

$$\begin{bmatrix} -mB_f'\,d\theta \\ (1+\lambda C_{dy}(1^*+\theta)B_f' + \lambda C_{dw}B_f' \\ -\lambda C_{dy}B_f)\,d\theta \end{bmatrix} \qquad \text{A.2}$$

The Jacobian of A.2, Δ_1, equals:

$$\Delta_1 = (D_y + m_y MR)(1+\lambda C_{dy}(MR + (i^* + \theta)B_f') -$$

$$(m_i MR - mB_f')\ (\lambda(1-C_{dy}) + (a-1)(1+i-\hat{p})(1+\lambda(C_{dy}MR+I_1))) > 0$$

After some algebra the assertions in the text can easily be seen to be true:

$$\frac{di}{d\theta} - 1 = (-(D_y+m_y MR)\ \lambda C_{dy}(B_f + MR)$$
$$+ m_i MR(\lambda(1-C_{dy}) + (a-1)(1+i-\hat{p})(1+\lambda(C_y MR+I_1))))/\Delta_1 < 0$$

$$\frac{d\hat{p}}{d\theta} - 1 = (m_i MR(\lambda(1-C_{dy}) + (a-1)(1+i-\hat{p})(I_1 - \lambda C_{dy}(i^*+\theta)B_f'$$
$$- \lambda C_{dw}B_f')$$

(A)

$$-(D_y + m_y MR + mB_f' \frac{(a-1)}{y} (1+i-\hat{p}))\lambda C_{dy}(MR+B_f))/\Delta_1$$

(B)

The term A corresponds to the first reason for $\frac{d\hat{p}}{d\theta} < 1$ given in the text on p. 22, and is indeed negative if aggregate supply effects of real interests rates via cost of working capital ("Cavallo effect") dominate aggregate demand effects of higher real rates.

The next term B corresponds to the second reason discussed there.

$\left(\frac{di}{d\theta} - 1\right), \left(\frac{d\hat{p}}{d\theta} - 1\right) < 0$ correponds to my claim in the text that both interest rates and inflation will go down less than one for one with the reduction of θ (if at all).