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1 Exchange Rate Management and Stabilization Policies in Developing Countries

Sweder van Wijnbergen

1.1 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 often administered by the International Monetary Fund.

Until quite recently the consensus among economists was that a devaluation, if it had any real effects at all, was expansionary: the resulting increase in competitiveness would switch foreign and domestic demand toward domestic goods. This switch, in the presence of idle factors of production, in turn would lead to an expansion in output, thus supporting one of the aims of stabilization policy (increasing output and, via output, employment).

In the economic development literature, early doubts were expressed by Hirschman (1949) and, especially, Díaz-Alejandro (1963). Krugman and Taylor lucidly summarized and extended that strand of research in a well-known paper (1978). All these contributions point out various channels (distributional effects, the effects of initial fiscal or current account deficits, and real balance effects) through which contractionary influences on aggregate *demand* may reverse the ex-

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pansionary effects of the expenditure switching a devaluation is intended to achieve.

In this paper I first outline several mechanisms, substantially more likely to be of importance in less developed countries (LDCs) than elsewhere, through which a devaluation has a direct negative impact on *aggregate supply.* I then discuss the influence of a large foreign debt (obviously predominantly an LDC problem), first on the effects of discrete devaluation on output and then on the results to be expected from an anti-inflation policy used exclusively in LDCs—the exchange rate regime of a preannounced crawling peg.

I do not address floating exchange rates because financial institutions in most LDCs are insufficiently developed to make that a viable policy option. Nor do I discuss the interesting question of which "basket" to peg a country's exchange rate to if that country has decided on some sort of a fixed rate; this question has already been addressed in the existing literature (see, for example, Branson and Katseli 1980).

Section 1.2 presents a stylized model of a financial structure typical of many LDCs, one characterized by the absence of markets for primary securities (such as government bonds and equity), but flourishing curb markets. Bank credit and loans taken out on the curb market are used to finance firms' working capital, not consumer expenditure. This model provides a direct link between the financial system and the aggregate supply side of the economy that will play an important role at various stages of the analysis that follows.[1] Section 1.3 then employs variants of this model to illustrate several negative effects of a devaluation on aggregate supply. I discuss, in turn, the role of intermediate imports, real wage indexation based on imported wage goods (namely, food), and the link between the real volume of bank credit and aggregate commodity supply forged by the financing of working capital requirements. All three of these factors are shown to create working capital requirements. All three of these factors are shown to create a channel through which a nominal devaluation has a direct contractionary effect on aggregate supply, as opposed to the Díaz-Alejandro and the Krugman and Taylor contractionary effects on aggregate demand. This paper should therefore be seen as a complement to the work of those authors.[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 contraction à la Díaz-Alejandro and Krugman and Taylor. It will therefore jeopardize the real depreciation a nominal devaluation is intended to achieve, also contrary to a demand-induced contraction.

Section 1.4 introduces private foreign borrowing and illustrates the consequences of the resulting foreign debt on the effects of a discrete devaluation and on the effects of a preannounced crawling-peg regime. Finally, section 1.5 provides a summary and conclusions.

1.2 The Basic Model

The model presented below is similar, though not identical, to the one used in van Wijnbergen (1983a); I will therefore describe it only briefly here. The reader interested in more detail than is provided here should consult that paper.

The model presented here incorporates several stylized characteristics of the financial structure of many LDCs. I assume the absence of markets for government bonds or equity. Intermediation between firms and private wealth holders takes place in the official banking system and in the unofficial money market (UMM), or curb market. Thus, firms finance fixed and working capital requirements by bank loans, by loans taken out at the UMM, or by retained earnings. Since firm owners can (and do) lend on the UMM, the opportunity cost of using retained earnings is the UMM rate. In fact, the use of retained earnings is modeled here as a loan from the owners of the firm to the firm and is lumped together with UMM loans.

Commercial banks are assumed not to hold free reserves. Reserve requirements and credit ceilings are thus mutually dependent instruments. The model assumes the use of credit ceilings. For simplicity, their sources of funds consist of demand deposits only. Although a more sophisticated liability structure can easily be constructed, it would add unneccessary detail to the model.

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 through the UMM, deposits in banks, and cash. The model further assumes a fixed deposit rate and a fixed cash-bank deposit ration in private portfolios.

If a Tobin-type asset model is defined to govern the allocation of wealth or the UMM and other financial assets, a private supply of loans on the UMM, B_p, is created, such that:

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

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); and y is the real output of domestic goods. Since the private sector does not directly hold foreign assets, foreign interest rates and the expected rate of depreciation, θ, do not appear in equation (1).

Firms demand loans for working capital, D, to finance the variable costs of wages and payments for intermediate imports, namely, oil, for the sake of brevity. D depends positively on the real product wage (in terms of domestic goods), w; on 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 on domestic output, y, such that :

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

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. Firms' net demand for loans at the curb market is therefore $D + K - B_b$, where K is the real value of the capital stock and B_b is the real volume of bank credit (deflated by p). This leads to an equilibrium condition for the UMM:

(3) $$D(w, P_O, y) + K = B_b + [1 - m(i, y)]\, W.$$

In what follows, K is suppressed for notational convenience; I will discuss only short-run phenomena, and so will ignore changes in the capital stock. By manipulating various budget constraints, it is straightforward to show that equation (3) also implies money market equilibrium. Equation (3) can be represented in $i - y$ space, or the asset market equilibrium locus, AM, in figure 1.1.

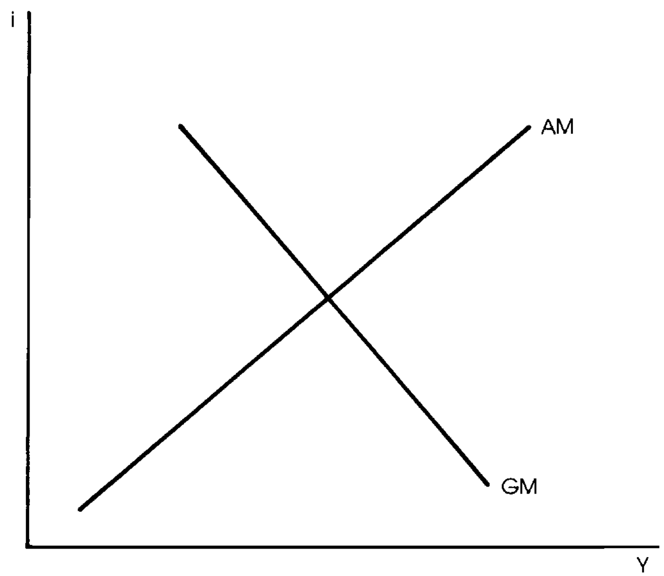

Fig. 1.1 Asset and goods market loci.

Along *AM*, equation (4) (presented below) holds that:

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

Because *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; and at the same time, the demand for loans to finance working capital rises ($D_y > 0$). The resulting excess demand for funds necessitates an increase in the UMM rate, so that *AM* slopes upward.

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

$$D = g(w, P_O)\, y^a K^{(a-1)},$$

where $a = 1/(1 - \alpha)$, where α is a Cobb-Douglas share parameter. Total variable costs and 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:

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

where terms involving K are suppressed.

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 and 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, such that:

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

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 income and MR are expressed in terms of domestic goods).

Finally, the price *level* is assumed to be sticky, and relative prices to change only gradually over time. The *inflation rate,* however, can change instantaneously in response to anticipated foreign inflation; $\hat{p}^*$; to the expected rate of devaluation, θ; or to excess demand for domestic goods, such that:

$$\hat{p} = \theta + \hat{p}^* + \lambda\,(A_d - y).$$

A microeconomic rationale for equations like (5) is presented in Barro (1972) and Sheshinsky and Weiss (1977). Gradual price adjustment implies the possibility of disequilibrium in the goods market. I will assume throughout that the country in question is under a regime of *classical* unemployment (that is, we start out in a position where $\hat{p} > \theta + \hat{p}^*$). This implies that output will be determined by supply. I make this assumption because most of the discussion to follow focuses on aggregate supply effects, which lose much of their relevance under a Keynesian regime. At any rate, the case of Keynesian unemployment has been more than adequately treated in Krugman and Taylor (1978).

The assumption of classical unemployment implies that output will be determined by the aggregate supply function in equation (4). Substituting $\hat{p}$ from equation (5) in equation (4) yields a goods market locus of GM in figure 1.1, such that:

$$\left.\frac{di}{dy}\right|_{GM} =$$

$$-\frac{\lambda\,(1 - C_{dy}) + [1 + \lambda(C_{dy}MR + I_1)]\,\dfrac{(a - 1)}{y}\,(1 + i - \hat{p})}{l + \lambda\, C_{dy}\, MR}\,.$$

The denominator is always positive. The numerator will also be positive if $1 + \lambda\,(C_{dy}MR + I_1) > 0$, but this is not necessarily so, since $I_1 < 0$. The term plays a crucial role in the stability analysis of Keynes-Wicksell growth models, which have similar price dynamics (see Fischer 1972). If the term is positive, those models will have stable dynamics. An intuitive interpretation of the term is given and discussed in Fischer (1972) and in van Wijnbergen (1983a); I follow these two papers in assuming the term is positive. That assumption implies that $\left.\frac{di}{dy}\right|_{GM} < 0$, since there is a minus sign in front of the whole expression; GM slopes downward in figure 1.1. The reason for this is simple: higher production, y, will, other things equal, lead to a lower $\hat{p}$ in equation (5) because it leads to excess supply. Unless the interest rate, i, falls, the real rate will go up, which, from equation (4), can be seen to be incompatible with a higher y. In other words, higher output will, all else equal, lead to less inflation. Since the aggregate supply schedule tells us 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 of i will have to fall even lower than inflation, $\hat{p}$, or GM slopes downward.

1.3 The Contractionary Effects of a Discrete Devaluation on Aggregate Supply

In this section I will discuss three channels through which a devaluation exerts a contractionary effect on aggregate supply, namely, intermediate imports, real wage indexation based on a commodity bundle including foreign goods, and the real volume of bank credit available to the business sector. For the sake of clarity, I will address each channel in turn using slight variants of the model. In reality, of course, all three mechanisms work simultaneously in the economies of the countries in question.

1.3.1 Intermediate Imports

Let us consider the short-run impact of a devaluation within the context of the model outlined in the previous section. To simplify the analysis, assume that nominal wages are indexed on the price of domestic goods. This assumption will allow us to defer discussion of the role of wage indexation to the next subsection, where we will examine proper indexation on the consumer price index (CPI).

Under that assumption a devaluation will disturb two variables. The relative price of domestic goods in terms of foreign goods, q, will fall (and competitiveness increase); and the real price of oil in terms of domestic goods will rise, such that:

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

The effects of these disturbances can be seen in figure 1.2. 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 thus to higher interest rates, and the *AM* curve shifts upward (as shown in the figure), such that:

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

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

$$(8) \qquad \left.\frac{di}{dp_O}\right|_{\substack{GM \\ y=\bar{y}}}$$

$$= \frac{\lambda\,[I_O - Cd_y\,(1 - \epsilon_{p_O}^{O})\,0] - [1 + \lambda(Cd_y\,MR + I_1)]\,\psi_O\,(1 + i - \hat{p})\,/p_O}{1 + \lambda\,Cd_y\,MR} < 0,$$

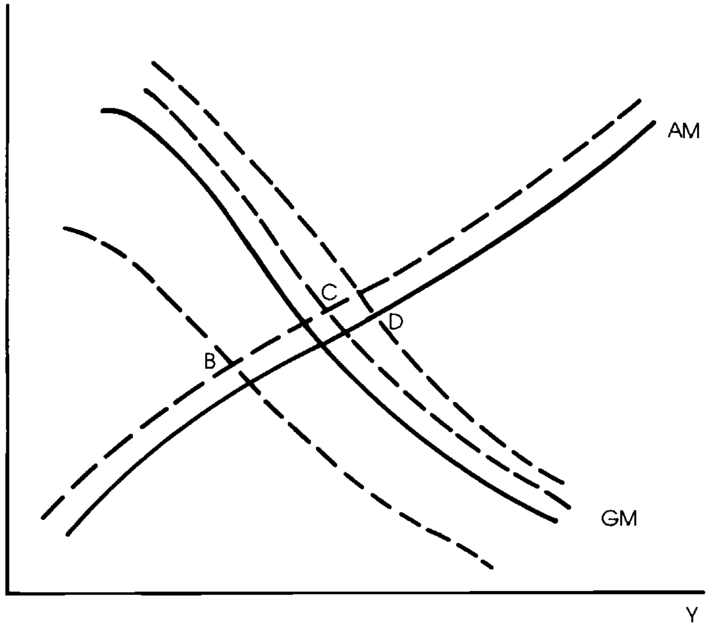

Fig. 1.2 The effects of devaluation through its impact on p_o and q.

where ψ_O is the share of intermediate imports in variable costs. We made the plausible assumption that the short-run price elasticity of energy demand is less than one $(1 - \epsilon^{o}_{pO} > 0)$. Accordingly, the *GM* curve shifts downward, leading to a new short-run equilibrium at point *B*. At *B*, output has fallen but the curb market rate could go up or down (in figure 1.2 it falls); higher working capital requirements push *i* up but lower income pulls it down. The contractionary effect on output is unambiguous, however.

Of course, this is not the end of the story. There is still the standard expenditure-switching effect via $dq/de < 0$. A lower q switches world demand to the domestic goods, which in turn shifts the *GM* curve back up, such that:

$$(9) \qquad \left.\frac{di}{dq}\right|_{\substack{GM \\ y=\bar{y}}} = \frac{\lambda A d_q}{1 + \lambda\, C d_y\, MR} < 0.$$

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

Accordingly, we arrive at a point such as *C* in figure 1.2, with higher output and interest rates than would have resulted without the expenditure-switching effect. Without intermediate imports, *AM* would have stayed put and *GM* would have shifted upward because of expenditure switching, and an equilibrium such as point *D* in the figure would have resulted. It is straightforward to show that $y_C < y_D$:

$$\frac{dy}{de} = \underset{(\mathrm{I};\ +)}{\frac{dy}{dq} \cdot \frac{dq}{de}} + \underset{(\mathrm{II};\ -)}{\frac{dy}{dp_o} \cdot \frac{dp_o}{de}}. \tag{10}$$

Point *D* corresponds to the first term in equation (10), the positive expenditure switching effect. Point *C* results from adding the structuralist effect via intermediate inputs (term II in equation [10], which is always contractionary. Thus, $y_C < y_D$.

In summary, if the prices of final goods adjust only gradually (that is, they cannot "jump"), a devaluation raises the real price of imported inputs in terms of domestic final goods. This result adds a contractionary element to a devaluation. Because intermediate goods typically make up the bulk of most LDC imports (50 to 60 percent is not an unreasonable estimate), the contractionary effect is likely to be more important in LDCs than in developed countries,the bulk of whose imports are typically consumer goods.

1.3.2 Real Wage Indexation

The second contractionary channel, real wage indexation, is in some sense a counterpart of the increase in competitiveness a successful devalation also needs to achieve. Consider again the basic model of section 1.2, with two changes. For a clearer focus I 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 by formal contracts, implicit arrangements, or social pressure. This change introduces a negative relationship between the real domestic product wage, w, and the terms of trade, q, such that:

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

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

Furthermore, under the classical unemployment assumption of the model, real product-wage increases reduce output through two different channels. First, a higher w increases the demand for working capital (some of which is needed to finance wage payments), which in turn results in an upward shift of the *AM* curve, such that:

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

Second, a higher w also raises labor costs and therefore reduces aggregate supply, and the GM curve shifts to the left, such that:

$$\left.\frac{dy}{dw}\right|_{\substack{GM\\ i=\bar{i}}} = \frac{\lambda I_w - [l + \lambda(Cd_y\, MR + I_1)]\, \psi_L\, (1 + i - \hat{p})/w}{\lambda\,(1 - Cd_y) + [1 + \lambda(Cd_y\, MR + I_1)]} < 0,$$

where ψ_L is the labor share in variable costs. The net result can be seen in figure 1.3: output will fall unambiguously. This, combined with the negative link between the 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 domestic goods. This is compatible with an unchanged real consumption wage only if real domestic product wages rise, which adds an aggregate supply shock effect to a devaluation, such that:

$$\frac{dy}{de} = \underbrace{\underset{(-)}{\frac{\partial y}{\partial q}} \cdot \underset{(-)}{\frac{\partial q}{\partial e}}}_{\substack{\text{Expenditure}\\ \text{Switching}\\ \text{Effect}}} + \underbrace{\underset{(-)}{\frac{\partial y}{\partial w}} \cdot \underset{(-)}{\frac{\partial w}{\partial q}} \cdot \underset{(-)}{\frac{\partial q}{\partial e}}}_{\substack{\text{Effect via}\\ \text{Wage Indexing}}} . \tag{12}$$

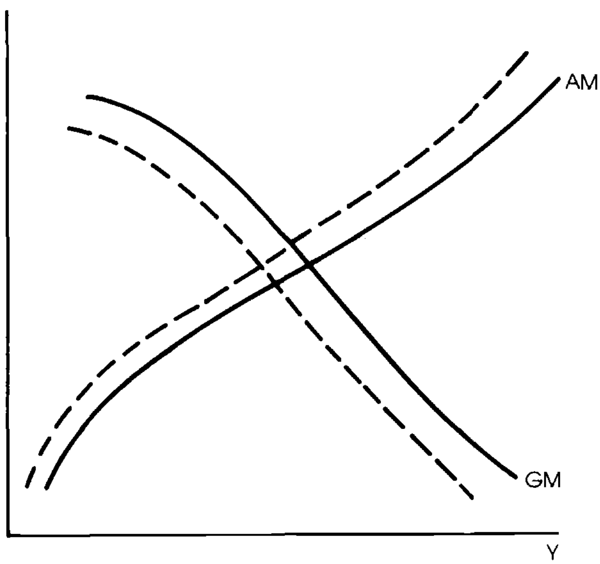

Fig. 1.3 The effects of an increase in w.

1.3.3 The Real Volume of Bank Credit

The final contractionary influence on aggregate supply is the real volume of bank credit, which is an important determinant of aggregate supply because of working capital requirements. Of course, given the sticky price-level assumptions made so far, this influence will come into play only gradually. Rather than engage in a full-fledged dynamic analysis,[3] I once again will slightly modify the model to eliminate the contractionary effects already discussed and focus on the contractionary effects of a decrease in the real volume of bank credit.

In particular, I will assume that through 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 a proportion equal to the percentage increase in e. That in turn implies a reduction in B_p and MR, the real volume of bank credit and the monetary base. The contractionary effects of a lower real monetary base are, of course, well known and will, through standard monetary channels, be counteracted over time by a current account surplus.

Let us now consider the effects of a devaluation-induced reduction in the real volume of bank credit. There is no *direct* effect on the *GM* curve, since the real interest rate is the link between the financial system and the real part of the model, as shown in figure 1.4. The AM curve, however, is affected. A lower B_P means less bank credit for firms, which are therefore forced to rely more on the curb market for funds. This causes an incipient excess demand. To return to financial sector equilibrium, the interest rate on the curb market will have to rise, and the *AM* curve shifts up (as shown in the figure), such that:

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

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

The net effect of $dB_p/de < 0$ on output y is negative, as can be seen in figure 1.4. The cut in B_p pushes up the interest rate for a given rate of inflation, which raises the real rate that will reduce not only aggregate demand through traditional mechanisms, but also aggregate supply through the resulting higher cost of working capital. Whether inflation accelerates or declines depends on whether the aggregate supply effect via the costs of working capital dominates the additional effects reducing aggregate demand, such that:

$$\frac{d\hat{p}}{dB_b} = \frac{I_1(a - 1)(1 + i - \hat{p})/y - \lambda(1 - Cd_y)}{\Delta} \lesseqgtr 0. \tag{14}$$

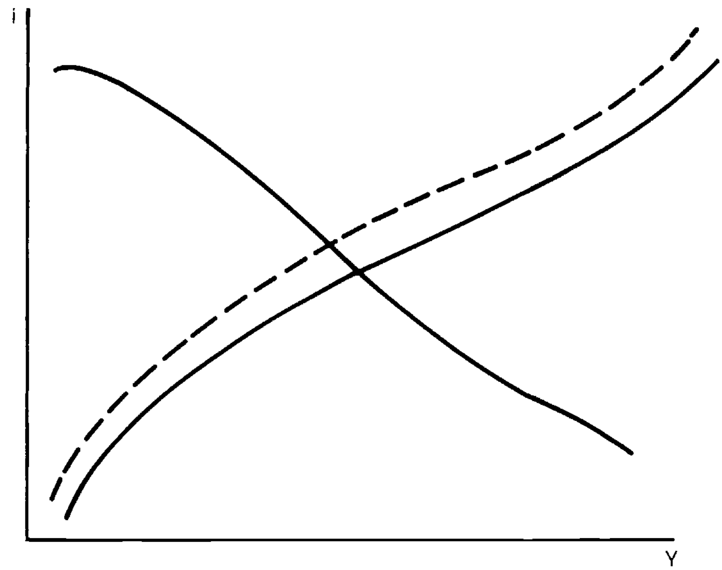

Fig. 1.4 The effects of a devaluation-induced reduction in the real volume of bank credit, B_p.

If $\hat{p}$ rises it will do so less than i does, however, so that the real rate $i - \hat{p}$ increases and, from the 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, leading to the possibility of at least an initial, gradual, real appreciation after a nominal devaluation! Of course, standard deflationary effects on aggregate demand caused by 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.

1.4 Foreign Debt, Devaluation, and the Crawling Peg

In this section I will discuss another issue complicating exchange rate policy: the existence of a substantial foreign debt, bringing with it a debt service burden. This issue is substantially more important in LDCs (not counting most of the oil-exporting nations, of course) than it is in developed countries. To examine foreign borrowing, I first modify the simplest version of the model, that in section 1.2, by removing intermediate imports. I also make the no-immediate-pass-through assumption used in sections 1.3.1 and 1.3.2. Given this modified model I will then briefly discuss the effect of foreign debt on the impact of a devaluation. Finally, I will describe the consequences of foreign debt on an interesting policy experiment recently tried, without much success, in several Latin American countries: an attempt to curb inflation by a preannounced slowdown in the rate of depreciation of the exchange rate.

1.4.1 Foreign Debt Introduced

The bulk of private foreign debt in LDCs consists of the liabilities of commercial firms. That debt is moreover almost exclusively Eurodollar debt, since Western bond markets are by and large closed to LDCs. Thus, contrary to most previous research, I will not model capital mobility as foreign investors buying domestic bonds, or vice versa; this is not the way capital flows in and out of LDCs. Instead, I 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, or:

$$B_f = eB_f^*\,(i - i^* - \theta)/p,\ B_f^{*\prime} > 0.$$

Dependence on y is easily introduced but adds only uninformative algebra. I will use B_f' for $eB_f^{*\prime}/p$ throughout, 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:

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

Note that firms may take out foreign loans, but private wealth holders still do not hold foreign assets. The terms i^* and θ therefore do not appear as arguments of m( ). This assumption about portfolio structure is realistic for all but a few LDCs. Furthermore, MR is redefined to be equal to the real value of the monetary base minus private foreign debt: $MR = MB/P - B_f$. Since capital inflows cannot be sterilized (by assumption), MR in the new definition is fixed at any given time, since increases in B_f lead to one-for-one increases in M/B.

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 home goods). Disposable income now incorporates not only capital losses, $\hat{p}MR$, but also interest payments abroad and anticipated capital losses on foreign debt due to depreciation, such that:

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

The diagrammatic apparatus of figure 1.1 remain intact, although the algebraic expressions for slopes and shifts change somewhat (see the appendix).

1.4.2 Foreign Debt and Devaluation

A discrete devaluation in the presence of foreign debt raises a technical problem in the continuous time-instantaneous loans framework used here. Of course, $de > 0$ does not increase the amount of liquidity provided by existing debt; but the exchange rate at which the debt was contracted, say, e^-, is relevant where e^- is the old rate prevailing just before the devaluation. Accordingly, the AM curve is not affected, as shown in figure 1.5.

(18) $$\left.\frac{di}{de}\right|_{\substack{GM \\ y=\bar{y}}} = \underset{(\mathrm{I};\ -)}{- \lambda Cd_y(i^* + \theta - \hat{p})B_f^*/p} + \underset{(\mathrm{II};\ +)}{\lambda Ad_q \cdot \frac{dq}{de}}$$

The first term, I, gives the contractionary effect of the debt service burden and is negative;[4] this is the shift indicated in figure 1.5. The second term, II, represents the standard expenditure-switching effect via the terms of trade, which was discussed in section 1.3.1.

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:

$$\frac{dy}{de} = (mB_f^{*\prime}/e - m_iMR)\,(\underset{(\mathrm{X};\ +)}{-\lambda A_{dq}q/e} + \underset{(\mathrm{Y};\ -)}{\lambda C_{dy}(i^* + \theta)B_f^*/p}).$$

Because it operates on aggregate demand, this contractionary channel is more in the Krugman and Taylor vein than the three channels analyzed in section 1.3.

1.4.3 Inflation, Output, and the Crawling Peg

In the late 1970s several Latin American countries tried out an innovative policy to bring down inflation: a preannounced slowdown in the rate of devaluing the nominal exchange rate. (For an interesting

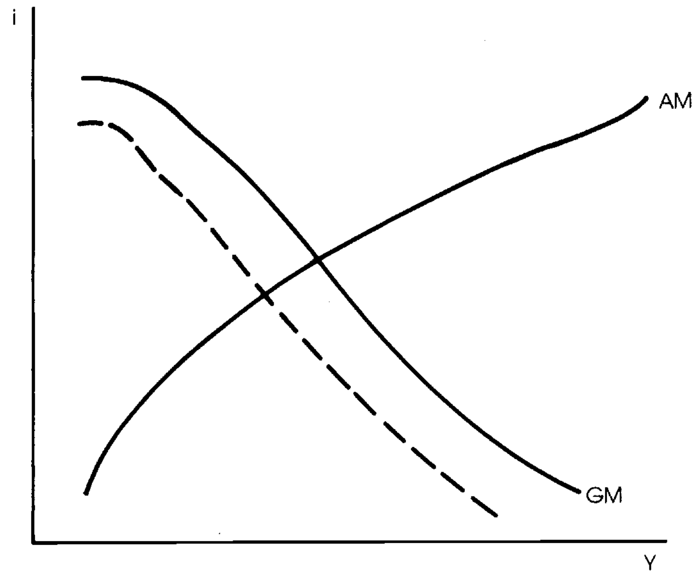

Fig. 1.5 The effects of a devaluation-induced increase in the debt service burden.

discussion of the overall results, see Díaz-Alejandro 1981.) One of the more puzzling outgrowths of these experiments was the huge real appreciation (around 40 percent in one year in Argentina, for example) that resulted from the persistence of domestic inflation at a rate far above foreign inflation plus the rate of crawl. In fact, domestic inflation in Argentina actually accelerated in the first few months after its new policy went into effect.

There is now an extensive literature on this subject (see, for example, Calvo 1981; Obstfeld 1984; or Taylor 1981). The stories are essentially similar: the slowdown in the rate of crawl causes an incipient excess demand for domestic assets, which in turn causes an initial real appreciation that will disappear gradually as balance-of-payments surpluses augment the domestic money stock. The Argentine puzzle remains, however. Why was there an initial acceleration of the inflation rate, rather than less than one-for-one slowdown that would also cause a real appreciation? The following discussion will show that the existence of a large foreign debt may be the clue to solving 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 nontrivial restriction, believed) slowdown of the rate of devaluation, θ, does in the context of the model presented above. As a hypothetical experiment, assume that things would go as they were expected to go, that is, that inflation and the rate of interest would fall one-for-one with the slowdown in θ. Would this be a sustainable equilibrium, with an unchanged real interest rate and inflation down to the new value of $\hat{p}^* + \theta$? As we will see, this clearly would not.

Regarding the asset markets, the experiment would leave the interest differential, $i - i^* - \theta$, unchanged, so that 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, the private sector would cut back on its supply of funds on the unregulated market. As a result, the interest rate would go back up, widening the gap $i - i^* - \theta$, making it more attractive for firms to borrow abroad, and thus leading to an inflow of foreign capital. The incipient excess demand for money would therefore be met partly by higher domestic interest rates (which reduce money demand) and partly by 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, such that:

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

Note that we are reducing θ, and so a positive sign on expression (20) corresponds to a downward shift of the AM curve, as shown in figure 1.6. This part of the story is essentially similar to the analyses performed in Calvo (1981), Obstfeld (1981; 1984), Taylor (1983), and other papers in this volume.

But consider now what happens in the real part of the model. If our hypothetical experiment is followed again, i and $\hat{p}$ would decrease one-for-one with θ, and $i - \hat{p}$ would remain unchanged, as would real output. This case corresponds to a downward shift of GM one-for-one with the reduction in θ (note that i is on the vertical axis, so that dimensions are commensurate). At a lower inflation rate and rate of crawl, however, capital losses on the monetary base, MR, and the debt service burden, $(i^* + \theta) B_f$, would have decreased, which, other things equal, implies an increase in disposable income. That increase would put upward pressure on aggregate demand and shift the GM curve back up, so that this curve too would shift down less than one-for-one with θ. It is even possible that the GM curve would shift up rather than down, such that:

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

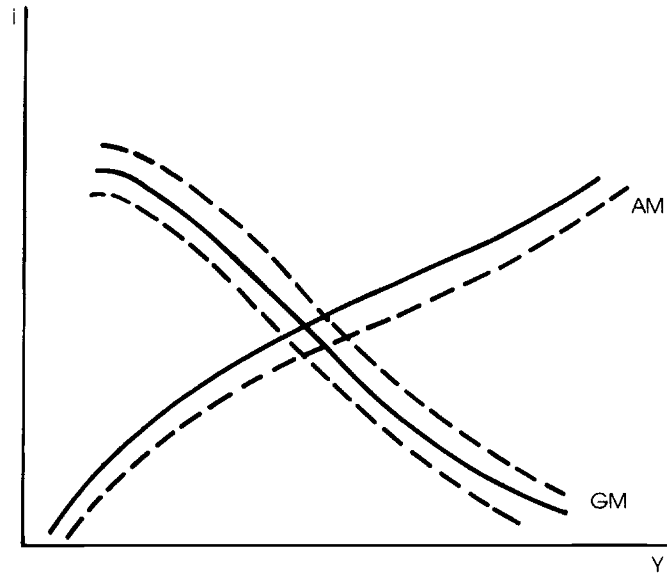

Fig. 1.6 The effects of a reduction in the rate of crawl, $d\theta < 0$, where both curves shift down less than $d\theta$.

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

The appendix shows that what figure 1.6 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 most interesting results, however, are those for 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.

First, consider what would happen if the inflation response fell one-for-one. Since, as we have seen, i will not fall all the way, the real rate, $i - \hat{p}$, would rise. This increase would lead to higher costs of working capital and therefore 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. See Cavallo 1977; van Wijnbergen 1982.)

The second reason why inflation will not decrease one-for-one is the increase in disposable income due to the lower debt service on foreign debt, $(i^* + \theta)\, B_f$, 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 accelerate after the slowdown in θ. The debt service element is what distinguishes this discussion from the existing literature on the crawling peg, in which such an acceleration of inflation cannot occur.

1.5 Conclusions

This paper examined a variety of problems complicating exchange rate management and, especially, the use of the exchange rate as an instrument of stabilization policy in less developed countries. The first part of the paper outlined three channels through which a devaluation has a direct contractionary impact on the aggregate supply side of the economy: the domestic currency costs of intermediate imports; wage indexing (in the form of explicit contracts, implicit arrangements, or social pressure) with foreign goods present in wage earners' consumption bundles (namely, food imports); and a reduced volume of real credit to firms. The last channel has its impact on the supply side of the economy because firms in need of funds to finance working capital are pushed into the curb market if bank credit is reduced; as a result, interest rates increase and the aggregate supply curve shifts back. This last contractionary effect is obviously 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 do most authors, focus on contractionary effects on aggregate demand (and, via Keynesian multiplier effects, only indirectly on aggregate supply). Both types of effects—the Krugman-Taylor demand contractions and the backward shifts in the aggregate supply curve described here—are deplorable, of course, since no country wants to incur unnecessarily the social costs of lost output and employment. Nonetheless, the contractionary effects of a devaluation on the supply side are more damaging than those on aggregate demand because a cut in aggregate supply leads to upward pressure on inflation, while a cut in aggregate demand tends to lower inflation. Over time, upward pressure on inflation may threaten the increase in competitiveness a nominal devaluation is usually also intended to achieve.

The second part of the paper discussed a second issue complicating exchange rate management in LDCs: the presence of a substantial foreign debt. It was demonstrated that if a devaluation succeeds in increasing competitiveness, it will also temporarily raise the real (in terms of domestic goods) burden of servicing that foreign debt, causing a Krugman-Taylor-like contractionary effect on aggregate demand.

The paper then proceeded to analyze the effects of a preannounced slowdown of the rate of depreciation. The analysis supported the evidence in previous work that interest rates and inflation will fall less than one-for-one with a slowdown in the rate of crawl, if at all, so that a real appreciation will emerge. The new point in this analysis is the 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 falls) 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 cunosum; it is exactly what happened in the first few months after Argentina experimented with a slowdown in the rate of devaluation.

All of this 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 because it may cut aggregate supply to an equal if not greater extent in the short run. Another conclusion suggested by the analysis is that if a devaluation is used to increase competitiveness by changing relative prices (to speed up adjustment to more fundamental reforms), special attention should be paid to compensate for the negative effects on aggregated supply, since these, contrary to the negative effects on aggregate demand, will exacerbate inflationary pressures that could well threaten any real depreciation that nominal devaluation might achieve initially.

Appendix

1.The model of section 1.2, without foreign borrowing in differentiated form, is as follows. If equation (4) is used to substitute out $\hat{p}$ $\left[d\hat{p} = di + (a - 1)(1 + i - \hat{p})\dfrac{dy}{y}\right]$, differentiation of the resulting expressions gives:

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

$$\text{A.1} = \begin{pmatrix} [-D_o\,dp_o - D_w\,dw + (1 - m)dMR + dB_f] \\ \{[\lambda(I_O - C_{dy}\,(1 - \epsilon^O_{pO})\,O] \\ \quad - \psi_o\,[1 + \lambda(C_{dy}MR + I_1)\,(1 + i - \hat{p})/p_O]dp_O \\ \quad + (\lambda\,I_w - (1 + \lambda(C_{dy}MR + I_1))\,\psi_L\,(1 + i - \hat{p})\,dw \\ \quad + \lambda A_{dq}\,dq + \lambda(C_{dw} - \hat{p}\,C_{dy})\,dMR\} \end{pmatrix}$$

The expression Δ in equation (14) is the Jacobian of the system A.1:

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

2. The model of section 1.2, without intermediate imports but with foreign borrowing, (as outlined in section 1.4) is as follows.

$$\begin{pmatrix} D_y + m_y MR & m_i MR - mB'_f \\ \lambda(1 - C_{dy}) & 1 + \lambda(C_{dy}(MR + (i^* + \theta)B'_f) \\ + (a - 1)(1 + i - \hat{p}) & + C_{dw}B'_f \\ (1 + \lambda(C_{dy}MR + I_1) & \end{pmatrix} \begin{pmatrix} dy \\ di \end{pmatrix} = \begin{bmatrix} - mB'_f d\theta \\ (1 + \lambda C_{dy}(i^* + \theta) B'_f + \lambda C_{dw} B'_f \\ - \lambda C_{dy} B_f) d\theta \end{bmatrix} \quad \text{A.2}$$

The Jacobian of A.2, Δ_1, equals:

$$\Delta_1 = (D_y + m_y MR)(1 + \lambda C_{dy}(MR + (i^* + \theta)B'_f - (m_i MR - mB'_f) \{\lambda(1 - C_{dy}) + (a - 1)(1 + i - \hat{p})[1 + \lambda(C_{dy}MR + I)]\} > 0.$$

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

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

$$\frac{d\hat{p}}{d\theta} - 1 = \underbrace{(m_i MR(\lambda(1 - C_{dy}) + (a - 1)(1 + i - \hat{p}) (I_1 - \lambda C_{dy}(i^* + \theta)B'_f - \lambda C_{dw} B'_f)}_{\text{(A)}} \underbrace{-(D_y + m_y MR + mB'_f \frac{(a - 1)}{y}(1 + i - \hat{p}))\lambda C_{dy} (MR + B_f)))/\Delta_1.}_{\text{(B)}}$$

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

The term B corresponds to the second reason discussed there. $\left(\frac{di}{d\theta} - 1\right), \left(\frac{d\hat{p}}{d\theta} - 1\right) < 0$ corresponds to the claim in the text that both interest rates and inflation will fall less than one-for-one with a reduction in θ (if at all).

Notes

1. This link has been discussed extensively in recent work on the stagflationary effects of restrictive monetary policy in LDCs (Cavallo 1977; Bruno 1979; van Wijnbergen1982, 1983a, 1983b; Taylor 1981; and Buffie 1984).

2. The first contractionary effect on aggregate supply (via intermediate imports) has been formalized before by van Wijnbergen (1980), Buffie (1983), Gylfason and Schmid (1984), and Gylfason and Risager (1984). The other two effects, although frequently brought up in policy-making circles in LDCs, have not yet found their way into the theoretical literature, as far as I know. Cardoso (1981) presented related work but did not derive the contractionary effects on aggregate supply presented here.

3. The dynamics of a similar model are analyzed, albeit in a different context, in van Wijnbergen (1983a; 1983b).

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

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Comment James A. Hanson

For some time the international finance literature has included arguments that devaluation may reduce aggregate demand and output, depending on the sizes of appropriately defined price elasticities of demand for exports and imports. Recently, a new strand of literature on contractionary devaluations has argued that devaluation reduces ag-

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gregate supply by increasing the cost of imported inputs, including inputs consumed by domestic factors of production. The output effect of a devaluation thus depends on the algebraic sum of the usual expenditure-switching and expenditure-reducing effects, plus any supply-reducing effects.

In addition to examining these supply-reducing effects, the model used in van Wijnbergen's paper permits discussion of the effects of devaluation on the financial side of the economy and their links to the real economy, through both the demand side and the supply side. In the model, devaluation cuts real wealth and the real supply of credit. As a result, output tends to decline because of both the traditional real balance effect (the demand side) and the higher real cost of credit (the supply side).

According to the paper, one implication of the negative effect of devaluation on aggregate supply is that prices may increase proportionately more than a devaluation. The recent Argentine and Korean devaluations are cited as evidence of this possibility, but here I would argue that some care is needed in the interpretation. In many cases devaluations are accompanied by a substantial adjustment of public sector prices and controlled prices, which could easily result in the price index increasing faster than a devaluation, but not because of it. In fact, most empirical studies suggest that devaluation typically does result in a depreciation of the real exchange rate for at least one or two years; that is, the total price rise over that period does not fully offset the devaluation. Of course, immediately after a devaluation, prices typically do increase faster than the exchange rate unless the exchange rate is indexed to maintain purchasing power parity.

My quarrel with the paper is not with its results, but with what is left out. The omissions might lead a casual reader to move from the paper's argument that a devaluation can reduce supply to the conclusion that devaluation is a bad way to cure a payments deficit.

Drawing such a conclusion from the paper would reflect a common error in analyzing a devaluation based on its effect on the initial level of output. Most analyses of devaluation start from goods market and asset market (or money market) positions—output and interest rates—which do not represent a sustainable macroeconomic equilibrium. An economy with a balance-of-payments deficit is, by definition, running down a quite finite stock of international reserves in order to purchase more goods and assets than it can pay for with its current production and borrowing. Because the stocks of international reserves are finite, the flow rates of demand for foreign goods and assets simply cannot be maintained. In particular, the central bank is suffering an unsustainable change in its portfolio, but one that is behind the scenes in the usual models. Put in another, more traditional way, the underlying assumption regarding monetary policy often is not spelled out in models of devaluation; if it were, its unsustainability would be readily apparent.

Since an initial position with a payments deficit is unsustainable, it is difficult to argue that a movement away from it, toward a sustainable position, is bad. In other words, a devaluation may induce a fall in output in the supply-side models because real wages fall or interest rates rise. But if these real wages were excessive relative to the country's endowments or if interest rates were excessively low, it would be hard to argue that a devaluation that corrects these excesses is bad policy.

Once it is admitted that a balance-of-payments deficit cannot be sustained and that the economy therefore must institute a different output–interest rate combination, it becomes apparent that the appropriate way of judging a devaluation is not where it leaves the economy compared to the initial unsustainable position, but just how it does affect the economy in the transition period and how long the transition will last relative to alternative policies that would provide the same improvement in the balance of payments. This criterion is mentioned in the first paragraph of van Wijnbergen's paper, but in fact the paper discusses no alternatives. I would like to attempt one such comparison to give some idea of the difficulties involved.

Suppose monetary growth were allowed to fall to correct the balance-of-payments deficit instead of devaluing. As I understand the model, this policy would move the economy back along its aggregate supply curve because of the implied cut in aggregate demand, as with a devaluation. But a devaluation also has a relative price effect. A cut in monetary growth may or may not have such an effect; it would depend on how the increase in the central bank's domestic credit enters the economy. For example, if the government had been using newly created money to buy nontraded goods, a fall in the rate of money growth would tend to lower the relative price of those goods. This might affect aggregate supply, although just how it would do so is difficult to say.

Moreover, both a devaluation and a cut in money growth would affect the rate of interest and, according to the model, shift the aggregate supply curve backward. The size of the shift might be different, however, because of differences in the effects of the two policies on expectations and interest rates. Thus, a full comparison of these two policies would require a more complex treatment of the determination of expectations and their effect on interest rates than this model contains.

In addition, a proper comparison of the side effects of the two policies cannot be made until the magnitude the policies is adjusted to produce the same impact on the balance of payments. For example, suppose that a unit devaluation cuts real demand by the same amount as a unit cut in the money supply, but has larger negative effects on aggregate supply. Those supply effects would mean that the unit devaluation has a larger effect on the balance of payments than a unit cut in the money supply. Thus, a unit devaluation could be compared only with a larger-than-unit cut in the money stock.

Finally, I would like to add that even the foregoing comparisons may be irrelevant from the standpoint of a policy maker. Devaluation may be the only alternative for resolving a typical balance-of-payments deficit in a developing country; and comparisons with tighter monetary policy may not be germane given the lack of financial markets. The problem is simply that balance-of-payments deficits are often allowed to continue until the stock of international reserves becomes neglible and the required adjustment in the excess demand for foreign exchange is fairly large. As a result, it may be necessary to cut the real money stock to achieve the desired improvement in the balance of payments within the relevant time frame. Without financial markets in which to pursue open market operations, the best a government can achieve is a zero rate of domestic credit growth. This may not produce a very large cut in real money balances, despite the loss of international reserves and the continuance of inflation. Correspondingly, the excess private demand for foreign exchange may not fall to a level at which the stock of reserves at the beginning of the period can sustain the exchange rate for another period. Since the rate can no longer be propped up by the sale of reserves, a depreciation, through a floating rate, will be forced on the country. In sum, a devaluation, forced or not, is often the only feasible solution to a typical balance-of-payments deficit in an LDC. The country may simply have to accept any negative side effects that a devaluation may entail, because of the initial delay in adjustment and the lack of a full range of financial markets.

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