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Can Devaluation Cause Perverse Effects if the Macroeconomy is Stable?

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1. INTRODUCTION

The theoretical literature on devaluation has involved an appeal to the Correspondence Principle for many years. In the early work, it was noted that a devaluation would improve the trade balance only if the Marshall-Lerner condition held, and this restriction was also necessary and sufficient for stability in the foreign exchange market. Thus, the presumption of economic stability precluded the perverse outcome. More recently, analysts have viewed this early work as limited in that it considered only the aggregate demand effects of the exchange rate, and it did not consider more general specifications of dynamics. The more recent work for example, Buffie (1986) and Lizondo and Montiel (1989) involves intermediate imports and a fully specified aggregate supply sector, and this work recognises that there are at least two kinds of perverse results that can follow from devaluation: the balance of payments can worsen, and the level of employment can fall. (This latter outcome is the so-called contractionary devaluation possibility.)

Some authors have returned to the Correspondence Principle issue and posed the question: does the presumption of economic stability preclude the possibility of contractionary devaluation? Both Buffie (1986) and Lizondo-Montiel (1989) answer this question in the negative. In their survey article, Lizondo and Montiel conclude (p. 221) that "the relevance of the Correspondence Principle is inescapably model specific. A presumption of stability does not in general rule out the possibility that devaluation could be contractionary on impact." Nevertheless, Buffie has presented one strong conclusion that has not been challenged, and which reasserts the relevance of the Correspondence Principle for ruling out certain perverse outcomes in devaluation analysis. In a model with a very general specifica-

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tion of technology, Buffie has derived that with the presumption of economic stability, devaluation *cannot both* contract employment *and* worsen the payments balance. The purpose of this note is to assess this claim. In general, sensitivity testing is desirable, but in this case, a further assessment is particularly necessary since Buffie's comparative static analysis (which involves the derivation of the impact multipliers on employment and the balance of payments) is not logically compatible with his stability analysis, so that no consistent "correspondence" is possible, Ali (1991) has shown that in the corrected version of Buffie's model the presumption of stability is not sufficient to remove the sign ambiguities of the impact multipliers of devaluation on employment and on the balance of payments. However, if two (rather uncontroversial) additional restrictions are imposed (that the Marshall-Lerner condition holds and that the country's aggregate demand curve in price-output space is negatively sloped) then it is true that devaluation cannot both contract unemployment and worsen the payments balance. Concerning Buffie's specific model, then, our conclusion is that additional restrictions (beyond the presumption of stability) must be invoked to defend his conclusion, but since these restrictions seem uncontroversial, from a practical point of view, Buffie's claim has survived our correction of the internal consistency problem.

The remainder of the note is organised as follows. In Section 2 we have presented a very simple model. In Section 3 we have derived the reduced form of the model and discuss the stability condition of the model. In Section 4 we have derived the short-run and long-run effects of devaluation on employment and on the payments balance. We found that in this model, devaluation is necessarily contractionary, and it can easily lead to a worsening of the balance of payments, despite the model being stable. Our concluding remarks are offered in Section 5: we note that the answer to the question that forms the title of this note is "yes".

2. A SENSITIVITY TEST

As mentioned above we accepted the basic structure of Buffie's model, since it was that study which raised the proposition that devaluation cannot both contract employment and worsen the payments balance (if the economy is stable). In this section, we consider a somewhat different structure, to provide a sensitivity test on this general issue. The model is defined by the following equations:

$$Y = C + A + X \qquad \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \quad (1)$$

$$C = \alpha Y^d \qquad \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \quad (2)$$

$$Y^d = (1-\phi)\,Y - rD \quad \ldots \quad (3)$$

$$\frac{M}{p} = \beta Y - \gamma r \quad \ldots \quad (4)$$

$$\frac{M}{p} = X - \phi Y + D - rD \quad \ldots \quad (5)$$

$$D = \lambda\,(1-\phi)Y \quad \ldots \quad (6)$$

The variables are defined as follows:

A = *autonomous expenditure*
C = consumption expenditure;
D = real value of foreign debt;
M = nominal money supply ($\dot{M}$ is the balance of payments);
p = price of domestically produced goods;
r = interest rate;
Y = real output = GDP ($(1-\phi)Y = GNP$);
Y^d = real disposable income; and
X = exports.

All parameters (Greek letters) are positive, and α and ϕ are fractions. The structure of the model is now explained.

The country depicted by this set of equations is best thought of as a small developing country, with a relatively rudimentary financial sector. "Small" means that this country is an insignificant part of the world market for the good that it produces (and exports). This assumption implies that the level of exports is determined residually (by the goods market clearing condition), and that the model involves purchasing power parity. With constant foreign prices, the domestic price level changes one-for-one with the exchange rate. Thus, we take p as the exogenous variable and interpret an increase in p as devaluation.[1] Like Buffie, we assume an undeveloped financial sector, and this implies that both investment spending and the capital account in the balance of payments are determined by external agents. The interest rate is an exogenous variable, and investment spending is simply embedded in the (exogenous) autonomous expenditure variable. D is the amount of external debt that the country is permitted, and according to Equation (6), it is proportional to the country's ability to pay (that is, its GNP). All imports are intermediate products, and ϕ is a fixed technical requirements coefficient (the

[1]Purchasing power parity means that $p = Epf$ where E is the domestic price of the foreign currency and P^f measure the foreign price of the domestic good. If the foreign price is constant and equal to 1 then $p = E$.

amount of intermediate imports that is needed to produce each unit of output). Output and employment are demand-determined, since it is presumed that there are surplus workers available.

The behavioural functions on the demand side of the economy are the consumption function Equation (2) and the money demand function Equation (4). Consumption is proportional to disposable income, and the latter is simply GNP minus the country's foreign debt service obligations. Money demand depends positively on the overall level of transactions (GDP), and negatively on the interest rate. Since a fixed exchange rate is involved, the country's central bank intervenes in the foreign exchange market. Thus, Equation (5) defines the balance of payments as $\dot{M}$. A surplus exists whenever the sum of exports less imports, $X-\phi Y$, and the net capital inflows, $\dot{D}$, exceeds the foreign debt service payments, rD.

The model determines six endogenous variables at each point in time: *Y, C,* Y^d*, X, D, and* $\dot{M}$*,* as functions of the exogenous variables: *A, P,* and *r,* and the predetermined (at each point in time) value for the money supply, *M*. $\dot{D}$ is also endogenous, but it can be substituted out using the time derivative of some of the equations, as is explained below.

3. PRELIMINARIES AND STABILITY ANALYSIS

Solving equations (1), (2), (3) and (6) gives:

$$X = (1-\alpha\,(1-\phi)\,(1-\alpha\bar{r}\lambda))\,Y-A \qquad \ldots\ \ldots\ \ldots\ \ldots\ \ldots \quad (7)$$

Substituting (6) and (7) into (5) we get

$$\dot{M}/p = (1-\phi)\,(1-\alpha)\,(1-\bar{r}\lambda))\,Y-A+\dot{D} \qquad \ldots\ \ldots\ \ldots\ \ldots\ \ldots \quad (8)$$

Time derivatives of (4) and (6) (given that $\dot{p}$ and $\dot{r}$ are zero) yields

$$\dot{M}/p = \beta\dot{Y} \qquad \ldots\ \ldots\ \ldots\ \ldots\ \ldots\ \ldots\ \ldots\ \ldots\ \ldots \quad (9)$$

$$\dot{D} = \lambda(1-\phi)\,\dot{Y} \qquad \ldots\ \ldots\ \ldots\ \ldots\ \ldots\ \ldots\ \ldots\ \ldots\ \ldots \quad (10)$$

Substituting (9) into (10) gives

$$\dot{D} = \frac{\lambda(1-\phi)\,\dot{M}}{\beta p} \qquad \ldots\ \ldots\ \ldots\ \ldots\ \ldots\ \ldots\ \ldots\ \ldots\ \ldots \quad (11)$$

Substituting (4) and (11) into (8) gives

$$\dot{M} = \theta_1 M + \theta_2 p \qquad \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \quad (12)$$

where

$$\theta_1 = \frac{(1-\phi)(1-\alpha)(1-r\lambda)}{\beta - \lambda(1-\phi)} \gtrless 0$$

$$\theta_2 = \frac{r\lambda(1-\phi)(1-\alpha)(1-r\lambda) - A\beta}{\beta - \lambda(1-\phi)} \gtrless 0$$

Equation (12) is the first order differential equation, whose solution is given by

$$M = (M(0) + \frac{\theta_2}{\theta_1^2} p) \exp\{\theta_1 t\} - \frac{\theta_2}{\theta_1} p \qquad \ldots \ldots \ldots \ldots \ldots \quad (13)$$

Substituting (13) into (4) and (5) gives

$$Y = \left(\frac{M(0)}{p\beta} + \frac{\theta_2}{\beta\theta_1}\right) \exp\{\theta_1 t\} - \frac{\theta_2}{\beta\theta_1} + \frac{\gamma r}{\beta} \qquad \ldots \ldots \ldots \ldots \ldots \quad (14)$$

$$\dot{M} = (\theta_1 M(0) + \theta_2 p) \exp\{\theta_1 t\} \qquad \ldots \ldots \ldots \ldots \ldots \quad (15)$$

From (13), (14) and (15) it is evident that system will be stable if and only if $\theta_1 < 0$.

4. SHORT-RUN AND LONG-RUN EFFECTS OF DEVALUATION

From Equation (14) it can be seen that

$$\lim_{t=0} \frac{dY}{dP} = \left(\frac{-M(0)}{p^2\beta}\right) < 0 \qquad \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \quad (16)$$

Equation (16) says that devaluation must be contractionary in the impact period. The reason is the usual supply-side effect of the exchange rate. With a devaluation, intermediate imports are more expensive, so the price level rises. The resulting lower level of real money balances represents a contractionary influence.

Using Equations (12) and (15) we can derive the effect of devaluation on payments balance:

$$\lim_{t=0} \frac{d\dot{M}/M}{dp/p} = \left(\frac{\dot{M}}{M} - \theta_1\right) \gtrless 0 \qquad \ldots \ldots \ldots \ldots \ldots \ldots \ldots \quad (17)$$

where $\dot{M}/M$ measures the initial value of the balance of payments surplus (expressed as a proportion of the money supply).

The presumption of stability implies that $\theta_1 < 0$, and if the impact multiplier for the balance of payments is evaluated from an initial condition of a zero balance of payments ($\dot{M}/M = 0$), we see that stability implies that a devaluation *must* improve the balance of payments. Many analysts assume $\dot{M}/M = 0$ as an initial condition, so the reader may feel comfortable following this practice. If so, this analysis can be viewed as supporting Buffie's claim; in this model, the devaluation *cannot* worsen both the level of employment and the payments balance. But readers may have good reason to be uncomfortable with following the practice of assuming an initial equilibrium in the balance of payments see, for example, Robinson (1947). After all, devaluations usually take place (or are advised by the World Bank) when the initial condition is a large balance of payments deficit. With this initial condition ($\dot{M}/M < 0$), our model is quite consistent with a devaluation worsening the payments balance, even when stability is assumed. Thus, we do not find it convincing to argue that it is impossible for a devaluation to both lower employment and worsen the payments balance.

We can illustrate the "perverse" balance of payments effect by referring to some plausible parameter values. For example, consider the consumption propensity, α, equal to 0.8; the imports requirements coefficient, ϕ, equal to 0.3; the interest rate, r, equal to 0.06; the income elasticity of money demand, $\beta pY/M$, equal to 1.0; the velocity of circulation, pY/M, equal to 5; the balance of payments deficit as a proportion of GDP, $\dot{M}/pY$, equal to 0.15; and λ, equal to 5. These representative parameter values imply both stability, and that a devaluation worsens the balance of payments.

From Equations (14) and (15) the reader can readily derive that:

$$\lim_{t\to\infty} \frac{dy}{dp} = \lim_{t\to\infty} \frac{d\dot{M}}{dp} = 0 \quad \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \quad (18)$$

which show that in the long-run devaluation is neutral in respect to change in output/employment and the payments balance.

5. CONCLUSION

Devaluation analysis has involved an appeal to the Correspondence Principle for many years. The most recent analysis in this vein is Buffie's claim that the presumption of macroeconomic stability is sufficient to preclude devaluation from

both contracting employment and worsening the balance of payments. Buffie's study is marred by the fact the he made different assumptions within the static and dynamic parts of his analysis see Ali (1991) so that his appeal to the Correspondence Principle involves an inconsistency. To avoid this problem in our analysis, we have specified a simpler model than Buffie's. We have used this model as a vehicle for testing the applicability of Buffie's proposition in a related setting.

Two interpretations of our study are possible. First, if analysts are comfortable with restricting their attention to initial conditions involving a zero balance of payments position, then they will view our analysis as supporting Buffie's proposition. On the other hand, if analysts prefer to examine devaluations with an initial condition involving a significant balance of payments deficit, then they should view the analysis as showing that the effects of devaluation can be perverse on both fronts; that is, that devaluation can both lower employment and worsen the payments balance. We conclude that the concerns of those that criticise the World Bank should not be readily dismissed.

REFERENCES

Ali, S. Z. (1991) Currency Devaluations and the Implications of the Correspondence Principle. Unpublished Ph. D. Thesis, McMaster University.

Buffie, E. F. (1986) Devaluation and Imported inputs: The Large Economy Case. *International Economic Review* 27:123–140.

Lizondo, J. S., and P. Montiel (1989) Contractionary Devaluation in Developing Countries: Analytical OverView. *IMF Staff Papers* 36.

Robinson, J. (1947) Essays in the Theory of Employment. Oxford: Basil Blackwell.

Comments on "Can Devaluation Cause Perverse Effects if the Macroeconomy is Stable?"

Bill Scarth was my teacher in graduate macroeconomics course in Fall 1974 at McMaster University. At that time he was fond of using the Correspondence Principle in determining the signs of comparative static results in cases where they were ambiguous. Also I remember doing exercises in the course that required us to determine conditions under which perverse cases could arise such as, the aggregate demand curve being positively sloped, the Hicksian IS curve being positively sloped, people saving less as prices rose, etc. This paper is essentially an exercise in a similar vein. It attempts to show that in a model of the economy which is *presumed* to be stable, it is possible for a devaluation to lead to contracting output (employment) and a worsening of the balance of payments in the short-run.

The results go against conventional wisdom and have startling implications for developing countries' use of exchange-rate policies to promote growth and payments balance. However I would not get too excited and would suggest that the authors examine their model and its implications carefully before rushing this paper off to the World Bank or the IMF with a view to making these institutions rethink their policy prescriptions.

The model depicts a small open economy where the absolute version of Purchasing Power Parity (PPP) prevails implying that domestic prices are flexible and change one-for-one with changes in the exchange rate. The domestic interest rate is the same as the world interest rate and has no role to play except to determine interest payments on foreign debt. An infinite demand for this country's exports is assumed. In other words, any amount of output that is not demanded locally is readily bought by foreigners.

The first question that arises is that given that exports are bought residually at unchanging prices, what keeps this economy away from full employment? Second, if the economy is not operating at full employment then what determines its actual output? Strange enough, we find that real output is determined not in the goods market (where exports are determined) but rather in the money market. Output depends directly on real balances Equation (4)! I do not think that even Milton

Friedman would agree with such a strong version of monetarism. This implies that the country can choose to have as much real GDP and employment as it wants by simply paying attention to its printing press. No wonder then that a devaluation, which through PPP is the same thing as domestic inflation, leads to lower real balances and lower output. The authors go through a lot of painful substitutions to derive the comparative static result Equation (16). This is unnecessary as can be seen by comparing Equations (4) and (16). This is *not* the "usual supply-side effect of the exchange rate" as the authors state but rather Equation (4), the Keynesian demand for money function (normalised on Y), performing its wonders.

If the readers can live with these problems in the model then they can enjoy this paper, as it proceeds through elegant substitutions to get to the reduced form Balance of Payment Surplus Equation (12). Solving this first order differential equation provides the solution equation for the nominal money supply Equation (13) which through Equation (4) produces the solution equation for output as indicated above. The authors correctly point out that dynamic stability has to be negative. There are generally two ways that the dynamic stability of equilibrium can be analysed. First, parameter values could be restricted to ensure dynamic stability. Second, plausible parameter values could be provided and then the system checked for stability.

The authors conduct both types of stability analysis. Let me focus first on the second type. Specifically, are the authors' parameter values plausible? While the other parameter values seem to be plausible, I think a value of 5 for the allowed foreign debt to GNP ratio (λ) is extremely high, in fact out of this world. As an example consider the case of Pakistan. It has a GNP of roughly $ 35 billion. For the model to be applicable to Pakistan, among other things it should have a debt of $ 175 billion. However it has a foreign debt of approximately $ 12 billion implying a debt to GNP ratio of 0.34. Now keep in mind that not many countries have such a high debt ratio. Moreover, the model's stability depends crucially on the value of this parameter. To illustrate, even if a high value of 1 were allowed for λ, θ_1 would be positive implying that the model is unstable.

Notwithstanding plausible parameter values, if the model is presumed to be stable (the first type of stability analysis), the authors show that it is possible for a devaluation to initially worsen the balance of payments but in the long run to have no effect. No economic rationale is provided for these results. This is not the J Curve working since there are no price or exchange-rate effects in the model. Presuming stability and then using the implied parameter values in signing a comparative static result is an example, par excellence, of the use of the Correspondence Principle.

However this exercise also demonstrates, though not intended by the authors, why many researchers think the Principle is a hoax. How can stability be presumed when no plausible parameter values would ensure it?

Finally, if the authors do believe that a devaluation can have perverse effects on both employment and trade, would they recommend that the country revalue its currency? The findings in this paper imply that the country should be better off as a result since it would enjoy higher employment and an improving trade account.

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