THE SPILLOVER MONETARY EFFECT OF DEVALUATION: A DISEQUILIBRIUM INTERPRETATION OF THE COOPER PARADOX AND THE "REVERSED"

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摘　要

本文要建立一個具有可分離外溢效果的總體失衡 IS-LM-BT 模型，來分析滙率貶值的效果。文中引進了貶值的外溢貨幣效果，因而導致本文對貶值之效果，有一些新的發現。

本文發現貶值所導致之 Cooper 矛盾性，除了可由 Chen (1973, 1975), Krugman and Taylor (1978), 與 Shieh and Mai (1979) 等之均衡分析法來加以解釋之外，亦可由失衡分析法來詮釋之。此外，本文更發現貶值會導致「倒」Cooper 矛盾現象，這是國經文獻上尚未有人曾提出過的。因此，本文在學術價值與理論創新上，或許有值得參考之處。

ABSTRACT

This paper attempts to build a separable spillover disequilibrium IS-LM-BT framework similar to Lai (1980) to interpret the Cooper paradox and the "reversed" Cooper paradox produced by devaluation.

Our formulation allows false trading to take place in diseqilibrium prices such that the discrepancy between the notional (planned, expected) and effective (realized, actual) demand or supply will exist, and spillover effects may propagate the whole economy through intermarket relationships. This characteristic can be modelled to revise the conventional general equilibrium IS-LM-BT devaluation macromodel.

The main result shows that although devaluation, whether the Marshall-Lerner condition is satisfied or not, may improve the trade balance, the domestic economy is still contractionary. Moreover, when the Marshall-Lerner Condition is satisfied, devaluation may also lead to both the deterioration of the trade balance and the expansionary domestic economy which I tentatively name the "reversed" Cooper paradox

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of devaluation. This contrasts sharply with the arguments of Meade-Tsiang (1951, 1961), and differs theoretically from models of Chen (1973, 1975), Chen and Tsaur (1981), Krugman and Taylor (1978), Shieh (1981), Shieh and Mai (1979).

I. The Cooper Paradox and the "Reversed"

Having studied the actual experience of devaluation in developing countries, Cooper (1971) observed: "The initial impact of devaluation on the domestic economy of a developing country is likely to be deflationary. . . This may be so, paradoxically, even when the trade balance improves in terms of foreign currency" (P. 6). This finding contrasts sharply with the arguments of Meade-Tsiang (1951, 1961). More recently, Chen (1973, 1975), Chen and Tsaur (1981) have succeeded in providing a monetarist interpretation of the Cooper paradox by integrating the tight money effect of devaluation into the open-economy IS-LM framework. That devaluation gives rise to a tight money effect is a basic proposition of the monetary approach to devaluation: devaluation is equivalent to a decline in the money supply measured in foreign currency or, what is the same thing, an increase in the demand for money measured in domestic currency[1]. In another respect, Krugman and Taylor (1978), Shieh and Mai (1979) have respectively presented the institutional model and the Wage-push model of devaluation to interpret Cooper's observation.

The purpose of this paper is to build a separable spillover disequilibrium IS-LM-BT framework to interpret the Cooper paradox and the "reversed" Cooper paradox; both of these paradoxes are likely to arise when a country undertakes currency devaluation. Our formulation allows false trading to take place in disequilibrium prices so that the discrepancy between the notional and effective demand or supply will exist, and thus spillover effects may propagate the entire economy through intermarket relationships. This disequilibrium force can be incorporated into the conventional general equilibrium IS-LM-BT model to reexamine the devaluation effect.

Our result shows that whether the Marshall-Lerner Condition is satisfied or not, the domestic economy will contract even though devaluation may improve the trade balance. Moreover, when the Marshall-Lerner condition is satisfied, develuation may also lead to both the deterioration of the trade balance and the expansion of the domestic economy; an effect which we will tentatively name the "reversed"

1. Komiya (1969); Mundell (1968); Cooper (1971); Chen (1973, 1975).

Cooper paradox of devaluation. This not only contrasts with the arguments of Meade-Tsiang, but also differs theoretically from those of Chen, Chen and Tsaur, Krugman and Taylor, and shieh and Mai.

II. Mathematical Model

The small open economy under investigation is a familiar Keynesian fixed-price type. Its disequilibrium macroeconomic relationships are described by the following system of simultaneous aggregate excess demand functions:

$$ED_C = [I(r) - S(y) + eB(y; e)] \tag{1}$$

$$ED_L = [L(y,r) - M] + L^t(r;e) \tag{2}$$

$$ED_B = [-B(y;e)] + B^t(r;e) \tag{3}$$

Where ED_C, ED_L, and ED_B are the excess demands for commodities, money, and foreign exchange, respectively, and I = investment, S = saving, B = balance of trade valued in foreign currency, L = money demand, M = fixed supply of money, r = rate of interest, y = income, e = foreign exchange rate, defined as the price of foreign currency in terms of domestic currency. In each equation above, bracketed terms [ ] on the right-hand side represent the primary excess demand, and the last terms L^t and B^t indicate spillover excess demands transferred from the commodity market to the money market and the foreign exchange market, respectively, until the system arrives at its general equilibrium. The difference between the conventional equilibrium model and the disequilibrium model is this last term in the excess demand equations. The spillover forces are explicitly introduced in the model as a function of price variables because we assume for simplicity that disequilibrium occurs only as a result of false prices.

We further assume the arguments of Tucker (1971, 1972), Ott-Ott-Yoo (1975, Chap. 20), and Lai (1980), viz., households' decisions about money holdings are always notional, and are always carried out. Thus, no spillover pressures are generated from the money market. Finally we assume that the balance of payments disequilibrium is prevented from affecting the money supply by the government's sterilization operation, and that capital is immobile internationally, so that the balance of payments is reduced simply to the balance of trade, and the foreign exchange market generates no sillover pressures either.

Devaluation means an increase in e. Without loss of generality, assume that before devaluation, $B=0$, $e=1$, initially, so that $\frac{d(eB)}{de}=\frac{dB}{de}$. Total differentiation of (1) – (3) with $DM=0$ gives

$$\begin{bmatrix} -(s+m) & I_r & 0 \\ L_y & L_r+L_r^t & 0 \\ -m & -B_r^t & -1 \end{bmatrix} \begin{bmatrix} dy \\ dr \\ dB \end{bmatrix} = \begin{bmatrix} -B_e de \\ -L_e^t de \\ -(B_e-B_e^t)de \end{bmatrix} \tag{4}$$

where s and m are marginal propensities to save and import, I_r, L_y and L_r are the partial derivatives of investment and the demand for money with respect to the variables appearing in the subscript. B_e is the change in the balance of trade due to a depreciation of the domestic currency, and can be explicitly expressed as $V(E+E'-1)$, with V standing for initial foreign value of imports, and E and E' standing for home and foreign import demand elasticities. It will be assumed, as customary, that $m>0$, $s>0$, $L_y>0$, $L_r<0$, $I_r<0$, and $B_e \gtrless 0$.

The sign properties of each spillover demand with respect to the price variables are

$$L_r^t = \frac{\partial L^t}{\partial r} = \underset{(+)}{\frac{\partial L^t}{\partial EDc}} \underset{(-)}{\frac{\partial EDc}{\partial r}} < 0 \tag{5}$$

$$L_e^t = \frac{\partial L^t}{\partial e} = \underset{(+)}{\frac{\partial L^t}{\partial EDc}} \underset{(+)}{\frac{\partial EDc}{\partial e}} > 0 \tag{6}$$

$$B_r^t = \frac{\partial B^t}{\partial r} = \underset{(+)}{\frac{\partial B^t}{\partial EDc}} \underset{(-)}{\frac{\partial EDc}{\partial r}} < 0 \tag{7}$$

$$B_e^t = \frac{\partial B^t}{\partial e} = \underset{(+)}{\frac{\partial B^t}{\partial EDc}} \underset{(+)}{\frac{\partial EDc}{\partial e}} > 0 \tag{8}$$

(5)–(8) imply that if there exists the aggregate excess demand (supply) for the commodity, then we will have the excess demands (supplies) realized in the money and foreign exchange markets.

Solving (4) for $\frac{dy}{de}$ and $\frac{dB}{de}$, we have

$$dy/de = [B_e(L_r+L_r^t)-L_e^t I_r]/\Delta \tag{9}$$

$$dB/de = \{L_e^t[(s+m)B_r^t + mI_r] + B_e[L_y(I_r+B_r^t)+s(L_r+L_r^t)]$$

$$-B_e^t[(s+m)(L_r+L_r^t)+L_yI_r]\}/\Delta \qquad (10)$$

where $\Delta = (s+m)(L_r+L_r^t)+L_yI_r < 0$

Assume, for the moment, there exists no spillover pressures so that $L_r^t = L_e^t = B_r^t = B_e^t = 0$. It follows from (9) and (10)

$$dy/de > 0,\ dB/de > 0,\ \text{if}\ B_e > 0 \qquad (11)$$

$$dy/de < 0,\ dB/de < 0,\ \text{if}\ B_e < 0 \qquad (12)$$

Thus, a devaluation is expansionary if it improves the trade balance, and deflationary if it worsens the trade balance. In the absence of disequilibrium forces it is inconsistent and impossible that a devaluation should depress the economy while improving the trade balance, or stimulate the economy while deteriorating the trade balance.

But if it is assumed that each spillover demand or supply exists, then it possibly follows that

$$dy/de \gtrless 0,\ dB/de \lesseqgtr 0,\ \text{if}\ B_e > 0 \qquad (13)$$

$$dy/de < 0,\ dB/de > 0,\ \text{if}\ B_e > 0 \qquad (14)$$

It is clear from (13) and (14) that a devaluation may improve the trade balance while depressing the domestic economy regardless of the sign of B_e, or deteriorate the trade balance while stimulating the domestic economy in the case of $B_e > 0$. A comparison of the results in (11) and (12) with those in (13) and (14) leads us to conclude that the "Cooper paradox" and the reversed Cooper paradox are easily interpreted by the disequilibrium spillover effect of devaluation. However, it seems worth specifying more precisely the exact conditions under which these spillover effects will reverse the conventional results of devaluation.

Condition 1: (a) $B_e > 0$, $B_e > B_e^t$, and $L_e^t < H < B_e(L_r+L_r^t)/I_r$, or

(b) $B_e > 0$, $B_e < B_e^t$, and $L_e^t < B_e(L_r+L_r^t)/I_r < H$.[2,3]

2. To simplify the notation, let H represent $\{B_e^t[(s+m)(L_r+L_r^t)+L_yI_r]-B_e[L_y(I_r+B_r^t)+s(L_r+L_r^t)]\}/[(s+m)B_r^t+mI_r]$

3. We can prove that inequalities (a) and (b) must hold, respectively.

In the case of condition 1, a devaluation of domestic currency is bound to deteriorate the trade balance, because the spillover demand for the foreign exchange expands, $B_e^t > 0$, and dominates the favorable impact of the spillover tight money effect, L_e^t, and successful devaluation, $B_e > 0$. This can be seen from (10) where, with $B_e > 0$, $L_e^t[(s+m)B_r^t + mI_r]$ and $B_e[L_y(I_r + B_r^t) + s(L_r + L_r^t)]$ have the same signs, but $-B_e^t[(s+m)(L_r + L_r^t) + L_y I_r]$ have the opposite sign. From (10) we know that this will happen when

$$B_e^t > \frac{L_e^t[(s+m)B_r^t + mI_r] + B_e[L_y(I_r + B_r^t) + s(L_r + L_r^t)]}{(s+m)(L_r + L_r^t) + L_y I_r}, \text{ or} \tag{15}$$

$$L_e^t < H \tag{16}$$

However, the spillover tight money effect denoted by (16) may not depress the economy to the extent that it becomes outweighted by the expansionary impact of the successful devaluation. From (9) we know that this will happen when

$$L_e^t < \frac{B_e(L_r + L_r^t)}{I_r} \tag{17}$$

Thus, in the case of condition 1, we arrive at the "reversed" Cooper paradox of devaluation, i.e., devaluation leads to both the deterioration of the trade balance and the expansion of the domestic economy.

Condition 2: $B_e > 0$, $B_e > B_e^t$, and $L_e^t > B_e(L_r + L_r^t)/I_r > H$

In the case of condition 2, a devaluation of domestic currency in bound to be deflationary, because the spillover tight money effect of devaluation may depress the economy to the degree where that it outweighs the expansionary impact of the successful devaluation. From (9) we know that this arises when

$$L_e^t > \frac{B_e(L_r + L_r^t)}{I_r} \tag{18}$$

However, the trade balance may still improve, because the spillover demand for the foreign exchange effect is now less than the critical value denoted by (15), and is outweighed by the favorable impact of the spillover tight money effect and successful devaluation. From (10) we know that this will occur when

$$B_e^t < \frac{L_e^t[(s+m)B_r^t + mI_r] + B_e[L_y(I_r + B_r^t) + s(L_r + L_r^t)]}{(s+m)(L_r + L_r^t) + L_y I_r}, \text{ or} \tag{15'}$$

$$L_e^t > H \tag{16'}$$

Thus, in the case od condition 2, we obtain the Cooper paradox of devaluation, i.e., devaluation leads to both the improvement of the trade balance and the contraction of the domestic economy.

Condition 3: $B_e < 0$, and $L_e^t > H$

In the case of inelastic import demands, i.e. $B_e < 0$, a domestic currency devaluation is bound to be deflationary, because both the trade balance effect $(B_e(L_r + L_r^t)/\Delta)$ and the spillover tight money effect $(-L_e^t I_r/\Delta)$ work in the same direction, as can be seen from (9). However, the trade balance may still improve in spite of inelastic import demands, because the improvement in the trade balance produced by the reduction in expenditure due to the spillover tight money effect may outweigh the deterioration in the trade balance produced with inelastic import demands as well as the spillover demand for the foreign exchange effect. From (10) we know that this will arise when

$$L_e^t > H \tag{16'}$$

which can be rewritten as

$$E + E' > 1 - \frac{L_e^t[(s+m)B_r^t + mI_r] - B_e^t[(s+m)(L_r + L_r^t) + L_y I_r]}{V[L_y(I_r + B_r^t) + s(L_r + L_r^t)]} \gtreqless 1,$$

$$\text{as } \frac{L_e^t}{B_e^t} \gtreqless \frac{(s+m)(L_r + L_r^t) + L_y I_r}{(s+m)B_r^t + mI_r} \tag{19}$$

In equality (19) tells us that the spillover tight money effect has a favorable impact on the trade balance, while the spillover demand for the foreign exchange effect has an unfavorable impact on the trade balance, so that whether the critical value of the sum of import demand elasticities is reduced to less than unity or not depends on the relative magnitude of L_e^t and B_e^t.

III. Graphic Depiction

The analysis in the preceding section can be illustrated graphically with the help of three diagrams. In figures 1, 2 and 3, each of the three lines graphs one of the equations (1) – (3): IS for (1); LM for (2); and BT for (3), with B set at zero. The equilibrium is established at Q, with an appropriate exchange rate that will

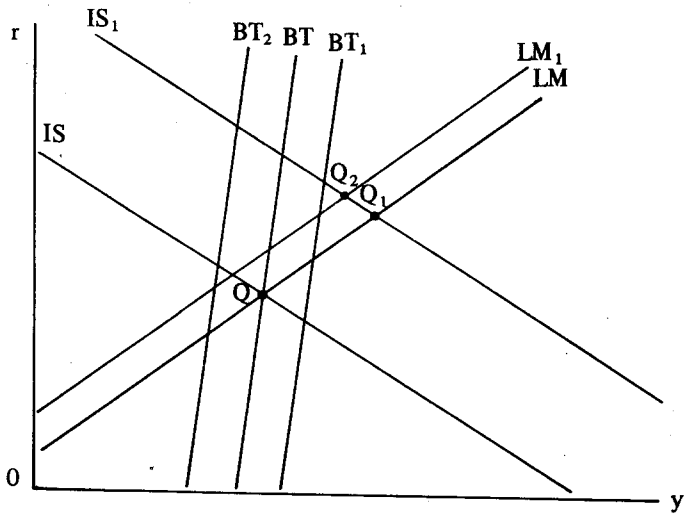

Figure 1

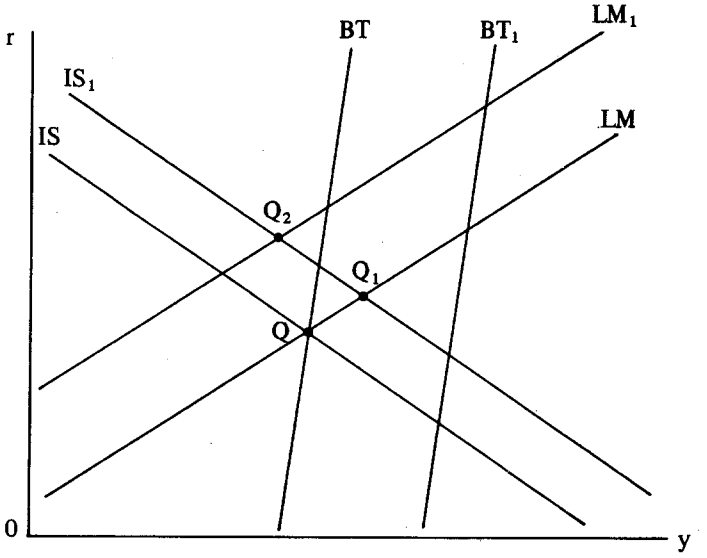

Figure 2

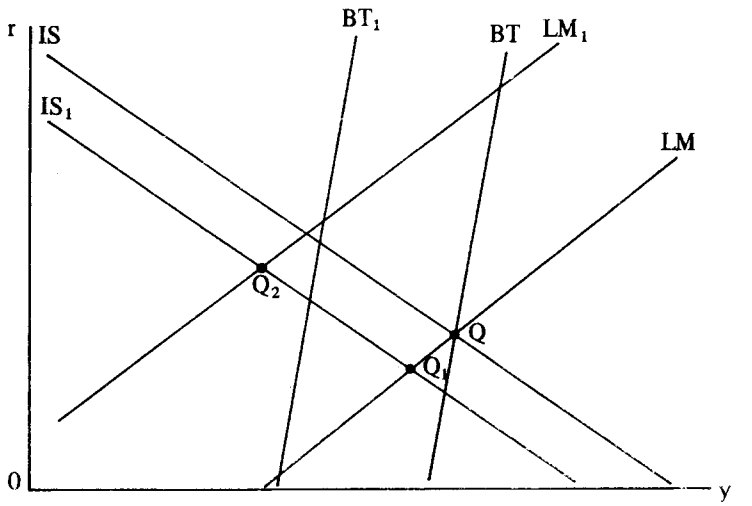

Figure 3

make BT pass through the intersection of IS and LM. Notice that any point to the right (left) of BT represents a point of balance of trade deficit (surplus).

The case of condition 1 is depicted in figure 1. Under the condition that $B_e > 0$ and $B_e > B_e^t$, and devaluation shifts both IS and BT rightward to IS_1 and BT_1[4]. If $B_e < B_e^t$, then a devaluation will shift BT leftward to BT_2. If the spillover tight money effect of devaluation is ignored or not significant, LM will stay put or just shifts leftward slightly to LM_1[5] and the new equilibrium will be established at Q_1 or Q_2, which lies to the right of BT_1, BT_2 and Q. Thus, income rises while the trade balance deteriorates which is characterized by the "reversed" Cooper paradox.

Figure 2 depicts condition 2. Under the condition that $B_e > 0$ and $B_e > B_e^t$, a devaluation shifts both IS and BT rightward to IS_1 and BT_1. If the spillover tight money effect of devaluation is ignored, LM will stay put and the new equilibrium will be established at Q_1, which lies to the left of BT_1 and to the right of Q. Thus, income rises and the trade balance improves as a result of devaluation.

But if devaluation does give rise to a significant spillover tight money effect ($L_e^t > 0$), LM will shift upward and to the left. And if this spillover effect is substantial, the new equilibrium Q_2 may lie to the left of BT_1 as well as Q. Thus, income declines while the trade balance improves.

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4. From (4) We know that IS_1 shifts horizontally be $[B_e/(s+m)]$ de while BT shifts horizontally by $[(B_e - B_e^t)/m]$de.
5. From (4) We know that LM_1 shifts horizontally by $(-L_e^t/L_y)$de.

The case of condition 3 is presented in figure 3. Under the condition that $B_e < 0$, devaluation shifts both IS and BT leftward to IS_1 and BT_1, but BT_1 shifts to the left by more than IS_1. If the spillover demand for money is independent of the level of exchange rate, LM stays put, and the new equilibrium is established at Q_1, which lies to the right of BT_1 and to the left of Q. Thus, income declines and the trade balance deteriorates.

However, if devaluation gives rise to the spillover demand for money, LM will shift upward and to the left. And if the leftward shift of LM_1 is substantial, the new equilibrium Q_2 may lie to the left of BT_1. Thus, a devaluation may improve the trade balance while depressing the domestic economy even if imports demand are highly inelastic.

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