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Abstract

The emergence of the portfolio balance approach 1 has led to a reformulation of the causes of balance-of-trade and payments disequilibria. According to this approach, balance-of-trade deficits and surpluses reflect discrepancies between desired and actual wealth holdings; while balance-of payments deficits and surpluses reflect discrepancies between desired and actual money holdings. Thus, balance-of-trade and payments disequilibria are viewed as representing disequilibria within the asset markets. Using this framework several authors2 have examined the self-correcting nature of disequilibria within the balance of-payments accounts and the ability of a devaluation to reduce the magnitude of a disequilibrium.

Disciplines

Economic Theory | International Economics | Other Economics

REFERENCES

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Devaluation, Wealth Effects, and Relative Prices

By Harvey Lapan and Walter Enders[*]

The emergence of the portfolio balance approach[1] has led to a reformulation of the causes of balance-of-trade and payments disequilibria. According to this approach, balance-of-trade deficits and surpluses reflect discrepancies between desired and actual wealth holdings; while balance-of-payments deficits and surpluses reflect discrepancies between desired and actual money holdings. Thus, balance-of-trade and payments disequilibria are viewed as representing disequilibria within the asset markets. Using this framework several authors[2] have examined the self-correcting nature of disequilibria within the balance-of-payments accounts and the ability of a devaluation to reduce the magnitude of a disequilibrium.

Two recent examples of this approach that have appeared in this *Review* are a paper by Rudiger Dornbusch and a paper by Jacob Frenkel and Carlos Rodriguez. The Dornbusch paper analyzes a two-country world in which each country issues a fiat money, while the Frenkel and Rodriguez paper develops a small country, two-asset model.[3] In both papers, a devaluation is successful because it reduces real wealth in the devaluing nation and increases real wealth in the appreciating nation. In terms

of the absorption approach, the devaluation reduces absorption via the cash balance effect.

While both of these papers are important contributions to the examination of the impact of a devaluation on trade balances, they leave some important questions unanswered. Neither paper is concerned with the efficacy of a devaluation when residents of a country hold assets denominated in terms of the foreign unit of account. In assuming that individuals only hold domestic currency denominated assets, each paper demonstrates that a devaluation will be successful if it acts to decrease real wealth in the devaluing nation. However, when residents of a country hold assets denominated in the foreign currency, an exchange rate change will impose capital losses on residents of the revaluing nation while residents of the devaluing nation will experience capital gains. Since a successful devaluation must reduce (increase) wealth in the devaluing (revaluing) nation, the efficacy of a devaluation is directly related to the extent to which domestics hold foreign currency denominated assets.

Another problem not addressed in these papers is how changes in the terms of trade affect the balance of trade. The prevailing view (see articles by S. C. Tsiang, Arnold Harberger, and Svend Laursen and Lloyd Metzler) is that, if a devaluation causes a nation's terms of trade to deteriorate, the efficacy of a devaluation is reduced. A reduction in the terms of trade leads to a decrease in the marginal propensity to save as individuals attempt to maintain their real standard of living. As individuals cannot maintain this standard of living forever, it is still necessary to clarify the impact of terms-of-trade changes when balance-of-trade disequilibrium is viewed as representing disequilibrium in the asset markets. An emerging view is that relative price changes have little significance in determining the

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[1] See Ronald McKinnon or Harry Johnson for the seminal articles on the portfolio or monetary approach.

[2] See Bijan B. Aghevli and George Borts, Enders or Donald Mathieson for an analysis of the self-correcting nature of balance-of-payments disequilibria.

[3] One of the assets in the Frenkel and Rodriguez paper is physical capital which is immobile. Claims on physical capital are, however, perfectly mobile across national boundaries such that the domestic and foreign interest rate must be equal. Further, their paper is restricted to the "small country" case, so that domestic prices rise by the amount of the devaluation.

size of the balance of trade. For example, Frenkel and Harry Johnson state:

> The accumulation or decumulation of assets depends on the aggregate relationship between domestic expenditure and income and does *not* depend on the composition of expenditure between exportables and importables, or between goods that, given the price structure, are classifiable into tradeable and nontradeable goods. Consequently, though relative price changes do influence the composition of expenditures, they play a secondary role in the monetary approach.... [p. 23]

Section I considers the case in which there are two traded goods and examines the roles of relative price changes and capital gains and losses in a devaluation. It is shown that relative price changes may be the only way a devaluation can improve the balance of trade when domestic holdings of foreign currency denominated assets are large. Section II considers the case of non-traded goods and, in contrast to the standard result, demonstrates that the efficacy of a devaluation is inversely related to the absolute values of the changes in the prices of nontraded goods. Our conclusions are presented in Section III. The Appendix of the paper considers the stability properties of the model.

I. Devaluation in a Two-Traded-Good World

A. The Model

The model we analyze is identical to that of Dornbusch, except we assume that there are two traded goods (X_1, X_2), and that residents of each country may desire to hold assets denominated in terms of the foreign unit of account (one asset is denominated in dollars, the other in pounds). Following Dornbusch, we assume that the U.S. (U.K.) demand for nominal wealth is a constant fraction of U.S. (U.K.) nominal income:

$$(1) \quad \overline{W} = kY = kP_1\tilde{Y};$$
$$\overline{W}^* = k^*Y^* = k^*P_1^*\tilde{Y}^*$$

where P_i (P_i^*) = dollar (pound) price of good i

Y (Y^*) = dollar (pound) value of U.S. (U.K.) income

$\tilde{Y}$ $(\tilde{Y}^*)$ = real income in terms of good 1

$\overline{W}$ $(\overline{W}^*)$ = desired wealth holdings in dollars (pounds)

k (k^*) = desired ratio of wealth to income in the United States (United Kingdom)

Assuming the dollar price of pounds is e, commodity arbitrage implies

$$(2) \quad P_i = eP_i^* \quad i = 1, 2$$

Under the assumption that each country produces both goods,

$$(3) \quad Y = P_1Q_1(\rho) + P_2Q_2(\rho);$$
$$Y^* = P_1^*Q_1^*(\rho) + P_2^*Q_2^*(\rho)$$
$$\tilde{Y} = Q_1(\rho) + \rho Q_2(\rho);$$
$$\tilde{Y}^* = Q_1^*(\rho) + \rho Q_2^*(\rho)$$

where $\rho \equiv P_2/P_1 = P_2^*/P_1^* =$ relative price of good 2

$Q_i(Q_i^*)$ = output of good i by the United States (United Kingdom)

and production in each country takes place along a concave production possibility frontier on which the output of each good depends only on relative prices.

Desired nominal expenditures (E, E^*) equal money income minus nominal desired saving (S, S^*):

$$(4) \quad E = P_1\tilde{Y} - S; \quad E^* = P_1^*\tilde{Y}^* - S^*$$

Following Dornbusch, we assume that desired saving is proportional to any discrepancy between desired and actual wealth:

$$(5) \quad S = \pi[kP_1\tilde{Y} - W];$$
$$S^* = \pi^*[k^*P_1^*\tilde{Y}^* - W^*]$$

where π (π^*) = adjustment parameter

W (W^*) = actual U.S. (U.K.) dollar (pound) value of wealth

Assuming no net wealth creation by either government, the dollar value of the U.S. balance of trade is equal to U.S. wealth accumulation:[4]

(6) $DW = B = -eDW^*$

where B = U.S. balance of trade
          $Dx = dx/dt$

In short-run equilibrium total income must equal total expenditures, a condition which will be fulfilled if desired world saving equals zero. Further, actual wealth accumulation must equal desired saving in each country:

(7) $S + eS^* = 0$

(8) $B = S = DW$

As equation (7) does not preclude the possibility of an excess demand in one of the commodity markets and an equivalent excess supply in the other, equilibrium requires

(9) $Q_2(\rho) + Q_2^*(\rho) =$
$$D_2(\rho, E/P_1) + D_2^*(\rho, E^*/P_1^*)$$

where $D_2(D_2^*)$ is U.S. (U.K.) demand for good 2, which by standard assumptions is homogeneous of degree zero in prices and expenditures.

Given that total world saving equals zero (equation (7)) and that equilibrium prevails in the market for good 2, then total world demand for good 1 must necessarily equal the total world supply. Thus, given e, W, and W^*, equations (7) and (9) determine the equilibrium values of P_1 and ρ.

[4]We abstract from the interest rate effects due to the yield on assets. It is assumed that governments sterilize interest payments by imposing lump sum taxes (subsidies) equal in magnitude to the net interest receipts of domestics from abroad. Further, the amount of tax which any individual pays is not commensurate with that individual's asset holdings. Thus, income is equal to the value of domestic production and the change in wealth is equal to the balance of trade. Note that the sign of dB/de refers to the balance of trade and not the balance of payments. Footnote 10 discusses the effects of a devaluation on the balance of payments.

Substitute the two relations in (5) into equation (7) in order to solve for P_1 in terms of W, W^*, $\tilde{Y}$, $\tilde{Y}^*$. Substitute this expression into equation (8) to yield

(10) $B = \pi\pi^*[k\tilde{Y}(eW^*) - k^*\tilde{Y}^*W]$
$$\cdot [s\tilde{Y} + s^*\tilde{Y}^*]^{-1}$$

where $s = k\pi(s^* = k^*\pi^*)$ is the marginal propensity to save out of income

As can be seen from equation (10), a U.S. balance-of-trade deficit is a wealth phenomenon, that is, the United States will experience a trade deficit if the ratio of U.S. desired wealth to actual U.S. wealth is greater than the corresponding ratio for the United Kingdom.

B. The Effects of a Devaluation

From equation (10) it is readily seen that a devaluation of the dollar will alter the U.S. balance of trade only insofar as it a) redistributes wealth among countries, or b) alters the ratio of U.S. to U.K. real income (i.e., $\tilde{Y}/\tilde{Y}^*$). If, as Dornbusch assumes, no individual holds foreign denominated assets, it immediately follows that the devaluation redistributes wealth away from the devaluing country, thereby improving the balance of trade. Since a U.S. devaluation increases (decreases) the outstanding dollar (pound) value of private wealth, it will lead to increases in dollar prices and decreases in pound prices. The extent to which prices actually rise will depend upon the percent of world wealth denominated in dollars, as well as the propensities to consume out of income and wealth. In any event, the rise (fall) of prices in terms of dollars (pounds) decreases real wealth in the United States and increases real cash balances in the United Kingdom. This redistribution of wealth acts to increase U.S. saving, decrease U.K. saving, and improve the U.S. balance of trade.

To the extent that residents of a country hold assets denominated in terms of the foreign unit of account, the preceding anal-

ysis of a devaluation is faulty. The initial effect of a devaluation of the dollar will cause U.S. residents holding pound denominated assets to experience capital gains, while U.K. residents holding dollar denominated assets experience capital losses. Thus, a devaluation of the dollar may redistribute wealth towards the United States and away from the United Kingdom. The possibility of a perverse redistribution of wealth means that the proportion of foreign asset holdings in domestic portfolios will be an important determinate of the efficacy of a devaluation.

We assume that residents of each country hold some of their wealth in assets denominated in terms of the foreign currency. Denote the proportion of these holdings to total nominal wealth by m and m^*. Then the change in nominal wealth measured in local currency due to an exchange rate change is

$$(11) \quad \frac{dW}{de} = \frac{mW}{e} \qquad \frac{dW^*}{de} = -\frac{m^*W^*}{e}$$

Correspondingly, the change in nominal wealth measured in terms of foreign currency due to an exchange rate change is

$$(12) \quad \frac{d(W/e)}{de} = -\frac{(1-m)W}{e^2}$$

$$\frac{d(eW^*)}{de} = (1-m^*)W^*$$

From equations (11) and (12), it is seen that the percentage change in U.S. wealth is m when measured in dollars and $-(1-m)$ when measured in pounds. For U.K. residents, the percentage change in nominal wealth is $(1-m^*)$ when measured in dollars and $(-m^*)$ when measured in pounds. Thus U.S. wealth, measured in terms of either dollars or pounds, will fall relative to U.K. wealth only if $1-m-m^* > 0$. If $1-m-m^* < 0$, U.S. wealth will increase relative to U.K. wealth; and if $1-m-m^* = 0$, there will be no relative change in wealth. Recalling from equation (10 that $B \gtreqqless 0$ as $k\tilde{Y}/k^*\tilde{Y}^* \gtreqqless W/eW^*$, a devaluation of the dollar will redistribute wealth in the

"wrong" direction if $1-m-m^* < 0$.[5]

Thus, if $1-m-m^* \leq 0$, a devaluation of the dollar must raise $\tilde{Y}$ relative to $\tilde{Y}^*$ if it is to be successful in increasing the balance of trade. Notice that $\tilde{Y}$ and $\tilde{Y}^*$ are both functions of only one variable (ρ), so that the devaluation can only be successful if it produces a change in relative prices and the nations have different supply or demand conditions.

Specifically, $d(\tilde{Y}/\tilde{Y}^*)/d\rho \gtreqqless 0$ as $Q_2/\tilde{Y} \gtreqqless Q_2^*/\tilde{Y}^*$. Thus, an increase (decrease) in the relative price of good 2 will act to improve (worsen) the U.S. balance of trade if the ratio of U.S. production of good 2 to U.S. real income is greater than the corresponding ratio for the United Kingdom. In the important special case in which it is possible to identify the exporter of a particular good as the nation which produces the largest amount of that good relative to its total production, a deterioration (improvement) in the terms of trade of the devaluing nation will act to worsen (improve) the balance of trade. In general, it should be clear that the impact of a relative price change on the ratio $\tilde{Y}/\tilde{Y}^*$ (and hence the balance of trade) depends upon the pattern of production (i.e., how much of each good a nation produces) and not upon the pattern of trade (i.e., the particular good a nation exports).[6]

The crucial point is that for a U.S. devaluation to be successful, it must increase U.S. saving. One method to increase U.S.

[5] Individuals are assumed to have static expectations so that m and m^* can be treated as constants. If individuals expect a devaluation of the dollar m will increase and m^* will fall, so that $(1-m-m^*)$ may change in either direction.

[6] Note that this is not simply an index number problem which arises from our having defined real incomes in terms of good 1. As $d(\tilde{Y}/\tilde{Y})/dp \gtreqqless 0$ as $Q_2/\tilde{Y} \gtreqqless Q_2^*/\tilde{Y}^*$, $d[Y/P_2 \div Y^*/P_2^*]/d(P_1/P_2) \gtreqqless 0$ as $Q_2/\tilde{Y} \gtreqqless Q_2^*/\tilde{Y}^*$. Thus, an increase in the relative price of good 2 will increase U.S. income relative to U.K. income—when measured in terms of either good 1 or good 2—if the ratio of U.S. production of good 2 relative to its total production is greater than the corresponding ratio for the United Kingdom. How the terms-of-trade effect alters the balance of trade then depends upon the pattern of production, and not upon the choice of numeraire.

saving is through a relative transfer of wealth between nations. The other method is to increase the *U.S.* demand for wealth relative to that of the United Kingdom by increasing *U.S.* real income relative to *U.K.* real income. Relative price changes will act to increase *U.S.* income relative to *U.K.* income if the relative price change favors the good which the United States produces in a relatively greater proportion to its total income.

The relationships between the devaluation, the trade balance, and the terms of trade are formally obtained by differentiating equation (10) with respect to the exchange rate. Utilizing the relationships in (11) and (12), simplification yields

$$(13) \quad \frac{dB}{de} = \frac{mB}{e} + \frac{\pi^* W^*(s\tilde{Y})(1 - m - m^*)}{(s\tilde{Y} + s^*\tilde{Y}^*)}$$

$$+ a_0 \left[\frac{Q_2}{\tilde{Y}} - \frac{Q_2^*}{\tilde{Y}^*} \right] \frac{d\rho}{de}$$

where a_0 is a positive number.[7] From equations (7) and (9),

$$(14) \quad sgn \left[\frac{d\rho}{de} \right] =$$

$$sgn \, [1 - m - m^*][C_2^* - C_2]$$

where $C_2(C_2^*)$ is the *U.S.* (*U.K.*) marginal propensity to consume good 2. Equation (13) demonstrates that the terms of trade has an ambiguous effect on the trade balance (since $Q_2/\tilde{Y} - Q_2^*/\tilde{Y}^*$ may be positive or negative) while equation (14) demonstrates that the relative price of good 2 may increase or decrease. The latter follows as: if $1 - m - m^* > 0$ ($1 - m - m^* < 0$), wealth is redistributed towards the United Kingdom (United States). If wealth is transfered towards the United Kingdom, real *U.K.* expenditures will rise while real *U.S.* expenditures will fall. If the *U.K.* marginal

propensity to consume good 2 is greater (less) than that of the United States, the relative price of good 2 will rise (fall). In the case in which the devaluation both redistributes wealth towards the country whose currency increases in value and in which countries tend to produce a large proportion of the good for which they have a high marginal propensity to consume, the change in relative prices will act to worsen the trade balance.

It can unambiguously be said that the greater the degree to which domestics hold assets denominated in terms of the foreign currency, the less effective is the devaluation.[8] To the extent that the holding of assets denominated in terms of the foreign unit of account is associated with the degree of capital mobility, the efficacy of a devaluation will be negatively related to the degree to which individuals view domestic and foreign assets as substitutes. If individuals view domestic and foreign assets as perfect substitutes, the expected values of m and m^* will be equal to $1/2$ so that a devaluation will have no effect on the trade balance or on relative prices. In the case in which residents of a country only hold assets denominated in terms of their own unit of account, a devaluation always improves the trade balance: setting $m = m^* = 0$, we also find that in this special case, the devaluation always works. Lastly, if $1 - m - m^* < 0$, the devaluation will be counterproductive.

The crucial point to note is that when m and m^* are greater than zero, the initial gains (losses) of an exchange rate change act to offset the effects of price increases or decreases on wealth. This result implies that the impact of a devaluation cannot be divorced from the degree of asset substitutability. Those factors which induce

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[7] The magnitude of a_0 depends upon supply and demand elasticities, but we are only interested in the direction of change.

[8] The condition that $1 - m - m^* > 0$ is not sufficient to guarantee that the devaluation improves the trade balance if the devaluing nation initially has a deficit. The larger the deficit, and the greater $m + m^*$, the less likely it is that the devaluation will succeed in improving the balance of trade, as measured in domestic currency units.

residents of a country to hold assets denominated in terms of a foreign unit of account—such as a large volume of trade or expectations of a devaluation by residents of the devaluing nation—act to work against using the exchange rate as a policy instrument.

The discussion above relates only to the impact effect of a devaluation, and has no bearing upon the stability of the system or the effects of a devaluation on the long-run values of the endogenous variables. In order to conserve space, we defer discussion of these problems to the nontraded goods case. In the nontraded goods case we demonstrate that a devaluation does not alter the real value of any endogenous variable in the long run. In the Appendix, we show that the system (in the nontraded goods case) is stable regardless of the sign of $1 - m - m^*$. Identical results hold for the traded goods case.

II. Devaluation and Nontraded Goods

A. *The Model*

In this section we investigate the role of nontraded goods in a devaluation. We continue to assume that each country produces two goods, but we impose the additional condition that transport costs prevent trade in Q_2 and Q_2^*. As in Section I the production-possibility frontier for each country is assumed concave. Thus, the domestic supply of any good remains solely a function of the domestic relative price of that good. Of the first ten equations in Section I, only equations (2) and (9) need modification. Since the markets for the nontraded goods are independent, P_2 need not equal eP_2^*. Furthermore, two equilibrium conditions are needed to replace equation (9) since the market for nontraded goods must clear in each country. Thus, we replace equation (2) with

$$(2') \qquad\qquad P_1 = eP_1^*$$

In place of equation (9), the conditions for the nontraded goods markets to clear

are

$$(15) \qquad\qquad Q_2(\rho) = D_2(\rho, E/P_1)$$

$$(16) \qquad\qquad Q_2^*(\rho^*) = D_2^*(\rho^*, E^*/P_1^*)$$

where $\qquad \rho\,(\rho^*) = P_2/P_1(P_2^*/P_1^*)$

By Walras' Law, if equations (15), (16), and (7) hold, the market for traded goods must be in equilibrium. Thus, to adapt the model from the traded goods case to the nontraded goods case, equation (9) and the commodity arbitrage condition for good 2 are replaced by the conditions that the market in each country (for good 2) must be in equilibrium.

While equation (10) represents the trade balance for both the traded and nontraded goods cases, it is now more convenient to work with the real balance of trade measured in terms of the traded good (i.e., (B/P_1)). In the case of two traded goods, the meaning of the real balance of trade is somewhat ambiguous for it is possible to measure this balance in terms of importables or exportables. As the presence of only one traded good removes this ambiguity, and as it is desirable to work with real—as opposed to nominal—variables, we consider the effects of a devaluation on the real trade balance (B/P_1). Dividing equation (10) by P_1, and substituting $\pi W + \pi^* e W^*$ for $P_1(s\tilde{Y} + s^*\tilde{Y}^*)$, the balance of trade in terms of the traded good is

$$(17) \quad B/P_1 = \pi\pi^*[k\tilde{Y}eW^* - k^*\tilde{Y}^*W]$$
$$\cdot [\pi W + \pi^* e W^*]^{-1}$$

Equation (17), like equation (10), shows that a *U.S.* trade deficit is caused by an excess supply of wealth in the United States relative to the United Kingdom.

B. *The Effects of a Devaluation*

As in Section I, the impact effect of a devaluation depends upon its ability to redistribute wealth. If a devaluation of the dollar increases *U.K.* wealth relative to *U.S.* wealth ($1 - m - m^* > 0$), real *U.K.* expenditures will rise while real *U.S.* expendi-

tures fall. From equations (15) and (16), it is seen that the relative prices of nontraded goods are positively related to real expenditures. Thus, if $1 - m - m^* > 0$, the relative price of the nontraded good will rise in the United Kingdom and fall in the United States. However, if $1 - m - m^* = 0$, no relative redistribution of wealth occurs so that real expenditures and relative prices are unaltered. Finally, if $1 - m - m^* < 0$, the devaluation redistributes wealth *towards* the devaluing country, increasing real expenditures and the relative price of the nontraded good in that country, thereby producing perverse results. The critical factor to keep in mind is that the changes in relative prices are the effect of the devaluation, and in no sense can this relative price change be said to be the cause of the improvement or worsening of the balance of trade. The determining factor of the impact effect of the devaluation will always be how the devaluation redistributes wealth.

These results can be obtained formally by totally differentiating equations (7), (15), and (16). Substitute equations (5), (11), and (12) into the above three to yield[9]

$$(18) \quad \frac{dP_1}{de} \frac{e}{P_1} = \left[\frac{Q_2 Q_2^*}{\Delta} \right] [\pi m W(\epsilon_2 - \eta_2)$$
$$(\epsilon_2^* - \eta_2^* + s^* C_2^*) + \pi^*(1 - m^*)(eW^*)$$
$$(\epsilon_2^* - \eta_2^*)(\epsilon_2 - \eta_2 + sC_2)] > 0$$
$$\text{if } m > 0 \text{ or } m^* < 1$$

$$(19) \quad \frac{d\rho}{de} \frac{e}{\rho} = -C_2 Q_2^* \pi \pi^* W(eW^*)(\epsilon_2^* - \eta_2^*)$$
$$(1 - m - m^*)/[\Delta P_2] \lessgtr 0$$
$$\text{as } 1 - m - m^* \gtrless 0$$

$$(20) \quad \frac{d\rho^*}{de} \frac{e}{\rho^*} = C_2^* Q_2 \pi \pi^* W(eW^*)(\epsilon_2 - \eta_2)$$
$$(1 - m - m^*)/[\Delta P_2^* e] \gtrless 0$$
$$\text{as } 1 - m - m^* \gtrless 0$$

where ϵ_2 (ϵ_2^*) = price elasticity of supply of good 2; $\epsilon_2, \epsilon_2^* > 0$

[9]The actual derivation is omitted in order to save space.

η_2 (η_2^*) = income compensated price elasticity of demand for good 2; η_2, $\eta_2^* < 0$

C_2 (C_2^*) = marginal propensity to consume good 2; C_2, $C_2^* > 0$

and

$$(21) \quad \Delta = Q_2 Q_2^* [\pi^* e W^* (\epsilon_2^* - \eta_2^*)$$
$$(\epsilon_2 - \eta_2 + sC_2) + \pi W(\epsilon_2 - \eta_2)$$
$$\cdot (\epsilon_2^* - \eta_2^* + s^* C_2^*)] > 0$$

As previously argued, the devaluation affects relative prices only if it causes a wealth transfer ($m + m^* \neq 1$). In particular, the relative price of the nontraded good decreases in the devaluing country (assuming both goods are normal) only if $m + m^* < 1$. Dornbusch's results hold since he assumes $m = m^* = 0$.

The impact of the devaluation on the balance of trade in terms of the traded good is found by differentiating (17), and substituting in for (18)–(20):

$$(22) \quad \frac{d(B/P_1)}{de} = \left[\frac{\pi \pi^*}{\pi W + \pi^* e W^*} \right]$$
$$\cdot \left[\frac{W W^*(1 - m - M^*)}{P_1} \right.$$
$$\left. + k Q_2(eW^*) \frac{d\rho}{de} - k^* Q_2^* W \frac{d\rho^*}{de} \right]$$

where $sgn\ (d\rho^*/de) = -sgn\ (d\rho/de) = sgn\ (1 - m - m^*)$

Substituting for $(d\rho/de)$, $(d\rho^*/de)$ from (19) and (20):

$$(23) \quad \frac{d(B/P_1)}{de} = [\pi \pi^* W W^*(\epsilon_2 - \eta_2)$$
$$\cdot (\epsilon_2^* - \eta_2^*)(1 - m - m^*)]$$
$$\div P_1[\pi^* e W^*(\epsilon_2^* - \eta_2^*)(\epsilon_2 - \eta_2 + sC_2)$$
$$+ \pi W(\epsilon_2 - \eta_2)(\epsilon_2^* - \eta_2^* + s^* C_2^*)]$$

For $m = m^* = 0$, (23) is equivalent to the result derived in Dornbusch (his equation (27)).

First, from (23) we see that a devalua-

tion will improve the real balance of trade if and only if $(1 - m - m^*) > 0$. Thus, the necessary and sufficient condition for the devaluation to work in the nontraded good case (and in the traded good case when the terms of trade effect is ignored) is that it effectively transfers wealth away from the devaluing country.[10]

Next consider the role of changes in the relative prices of nontraded goods. From equations (19) and (20), it is seen that if the two relative prices of nontraded goods change $(1 - m - m^* \neq 0)$, they must move in opposite directions. This result follows from equations (15) and (16) in which the relative prices of nontraded goods are positively related to real expenditures. As real expenditures must rise in one country and fall in the other, the two relative prices move in opposite directions. Since the impact effect of a devaluation on real expenditures depends solely on $1 - m - m^*$, the direction of the changes in the relative prices of nontraded goods—in contrast to the traded goods case—depend solely upon the sign of $1 - m - m^*$. As the change in relative prices *is caused by changes in real expenditures*, it cannot be claimed that it is the change in relative prices which translates changes in real expenditures (absorption) into changes in the balance of trade. Rather, it is the desired change in expenditures which acts to alter relative prices.[11]

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[10]It should be pointed out that the dollar value of the trade balance may worsen even if $1 - m - m^* > 0$, and the pound value may increase even if $1 - m - m^* < 0$. Also notice that the sign of dB/de refers only to the balance of trade and not to the balance of payments. The balance of payments will equal the change in the demand for dollar denominated assets. If m and m^* are constant, the change in the demand for dollar denominated assets is $(1 - m)DW + m^*eDW^*$. As $DW + eDW^* = 0$, the balance of payments can be represented by $(1 - m - m^*)DW = (1 - m - m^*)B$. As the sign of dB/de depends upon the sign of $(1 - m - m^*)$, a devaluation of the dollar will always act to improve the U.S. balance of payments, whether or not it improves the balance of trade.

[11]Note that the whole emphasis of the elasticities approach is to determine how relative price changes improve the balance of trade, thereby increasing income relative to absorption. Further, both Dornbusch and

Further, the changes in relative prices act to offset part of the impact effect of a devaluation. From equation (22), it is clear that the improvement in the U.S. trade balance is positively related to $d\rho/de$ and negatively related to $d\rho^*/de$. However, if the devaluation is to be successful (i.e., if $1 - m - m^* > 0$), the relative price of the nontraded good will fall in the United States and rise in the United Kingdom. Alternatively, if $1 - m - m^* < 0$, the relative price change will mitigate any deterioration in the U.S. trade balance due to a devaluation of the dollar. In short, the greater the change in relative prices, the *less* effective is the devaluation. The underlying explanation for this is clear—the U.S. trade balance can only be improved by increasing saving in the United States and correspondingly decreasing saving in the United Kingdom. A decrease in real wealth in the devaluing nation and a corresponding increase in real wealth in the revaluing nation (when $1 - m - m^* > 0$) serves this purpose. A decrease in real income in the devaluing nation, and an increase in real income in the revaluing nation, act to increase saving in the revaluing nation and reduce saving in the devaluing nation. Again, it should be pointed out that this is not simply an index number problem. The nominal U.S. trade balance can only be improved by increasing nominal U.S. saving. The greater the reduction in the relative price of the U.S. nontraded good, the smaller will be the rise in nominal U.S. income and correspondingly the smaller the rise in nominal U.S. saving.

From the discussion above, it follows that if $1 - m - m^* > 0$, those factors which act to mitigate the size of relative price changes will act to increase the efficacy of a devaluation. Specifically, equation (23) demonstrates that if $1 - m - m^* > 0$, then the efficacy of a devaluation is negatively related to the marginal propensities to consume the nontraded good (C_2 and C_2^*)

Ronald Jones and W. M. Corden, imply that a relative price change acts to improve the trade balance. We find that the relative price change acts to worsen the trade balance of the devaluing nation.

and positively related to the absolute values of the supply and demand elasticities of nontraded goods ($\epsilon_2, \epsilon_2^*, |\eta_2|, |\eta_2^*|$). As expenditures fall (rise) in the devaluing (revaluing) nation, the greater will be the reduction (increase) in the price of the nontraded good if the marginal propensity to consume the nontraded good is large. Obviously, large supply and demand elasticities mitigate price changes so that the greater these elasticities, the greater the efficacy of a devaluation.

C. Long-Run Effects of a Devaluation

The discussion above analyzes the impact effect of a devaluation, and as such provides little information concerning the long-run effects of a devaluation or the stability of the system. In this section we first demonstrate that a devaluation does not alter the long-run equilibrium values of the real variables in the system. In the Appendix, we show that a fixed exchange rate system is stable regardless of the magnitude of $1 - m - m^*$.

Long-run equilibrium is obtained by setting the time derivatives $DW = DW^*$ equal to zero. Substituting these conditions into equations (5), (15), and (16):

$$(24) \qquad Q_2(\rho) = D_2(\rho, \tilde{Y}(\rho))$$

$$(25) \qquad Q_2^*(\rho^*) = D_2^*(\rho^*, \tilde{Y}^*(\rho^*))$$

$$(26) \qquad W = kP_1\tilde{Y}(\rho)$$

$$(27) \qquad eW^* = k^*P_1\tilde{Y}^*(\rho^*)$$

Equations (24)–(27), plus the condition that $W + eW^*$ is constant (as governments do not pursue an active monetary policy), determine the long-run values of ρ, ρ^*, W, W^*, and P_1. The nature of the steady-state solution of the model is that commodity markets are in equilibrium at each point in time. In addition, desired and actual saving in each of the countries are equal to zero. Given the equilibrium values of W and W^*, the amount of foreign assets held by U.S. (U.K.) residents is mW (mW^*).[12] With no net saving in either country, equa-

[12]The equilibrium conditions for the desired composition of assets to equal actual asset composition are

tion (6) indicates that the real balance of trade is equal to zero.

On inspection, it is immediately seen that equation (24) alone determines ρ and equation (25) alone determines ρ^*. Thus, long-run relative prices, real income, and commodity outputs are invariant to changes in the exchange rate or the outstanding supplies of dollar and pound denominated assets. Holding ρ and ρ^* constant, equations (26) and (27) can be used to solve for dP_1/de, dW/de, and $d(eW^*)/de$ once it is recognized that

$$(28) \qquad \frac{dW}{de} + \frac{d(eW^*)}{de} = \bar{P}$$

where $\bar{P}$ $(\bar{D})$ = the total amount of assets which are denominated in pounds (dollars) when the devaluation takes place.[13]

Totally differentiating equations (26) and (27) with respect to the exchange rate, and using equation (28):

$$(29) \qquad \frac{1}{P_1}\frac{dP_1}{de} = \frac{\bar{P}}{D + eP}$$

$$\frac{1}{W}\frac{dW}{de} = \frac{\bar{P}}{\bar{D} + e\bar{P}}$$

so that $d(W/P_1)/de = 0$. Given that $d(eW^*)/de = P - dW/de$, it follows that $d(eW^*/P_1)/de = 0$.

Thus, the exchange rate is neutral in the sense that the long-run magnitudes of all the real variables in the system are invariant with respect to a change in the exchange rate. In the Appendix, we demonstrate that the system has one characteristic root which

---

$$W_{\mathsf{S}} = (1 - m)W + m^*eW^*$$
$$eW_P = mW + (1 - m^*)eW^*$$

where W_{S} = supply of dollar denominated assets
W_P = supply of pound denominated assets

[13]We assume that the central banks react passively in response to a deficit or surplus in that they neither sterilize nor accommodate the balance of payments. Further, central banks undertake no net wealth creation (except via devaluation), but stabilize exchange prices by making asset supplies perfectly elastic at the desired exchange rate.

is negative regardless of the value of $1 - m - m^*$. Thus, the equilibrium is stable and the approach to equilibrium is direct. Since the system has a single characteristic root, if the impact effect of a devaluation is to improve the real balance of trade, the devaluation will also act to increase the cumulative sum of the real trade balance. Consequently, a devaluation will serve to increase the central bank's holdings of foreign reserves (if $1 - m - m^* > 0$), even though the devaluation has no long-run effects on outputs and relative prices.

The discussion above indicates that a devaluation does not work through changing the long-run values of the real variables of the system, but rather through altering the time path of the system. In the short-run version of the model (Section IIA and IIB), desired and actual asset accumulations are equal, but desired portfolio size is not equal to actual portfolio size. In an attempt to equilibrate desired and actual wealth holdings, equation (5) indicates that individuals will save or dissave. As total world saving equals zero (since we assume total asset supplies are fixed) prices adjust such that if one nation has an excess demand for wealth, the other has an excess supply. The nation with an excess demand (supply) of wealth will experience a balance-of-trade surplus (deficit). The surplus (deficit), representing an increase (decrease) in the stock of wealth, serves to equilibrate desired and actual wealth holdings. The trade balance, then, is a temporary phenomenon which will persist until desired and actual wealth holdings are equal. Although the balance of trade is self-correcting (since the system is stable), the monetary authorities may desire to change the size of a deficit or surplus. As an exchange rate change does not alter the long-run equilibrium values of the real variables in the system, a successful devaluation must act to increase desired saving in the devaluing nation. We have shown that a devaluation will increase saving in the devaluing nation if $1 - m - m^* > 0$; the devaluation will redistribute wealth away from the devaluing nation

towards the revaluing nation. It is this redistribution effect which determines whether saving will increase or decrease in the devaluing nation. Whether or not $1 - m - m^* > 0$, after the exchange rate change, the system will approach long-run equilibrium in which the trade balance is zero. The devaluation, then, only moves the system closer to, or further from, long-run equilibrium.

III. Conclusions

The approach taken in this paper is that balance-of-trade disequilibrium is caused by wealth imbalances between nations. Therefore, the primary effects of a devaluation must act to create an excess demand for wealth in the devaluing nation and an excess supply of wealth in the revaluing nation. To the extent that individuals view domestic and foreign assets as substitutes, the redistributive effects of a devaluation will be reduced so that exchange rate policies will be of little value in correcting deficits or surpluses in the trade accounts. As the volume of trade is one of the major determinants of the degree of asset substitutability between equally risky assets, we would expect that the degree of openness of an economy and the efficacy of a devaluation within that economy are negatively related.

We have also examined the effects of relative price changes on the efficacy of a devaluation. Relative price changes will act to alter a trade balance to the extent that they change the demand for wealth. However, in the case of nontraded goods, relative prices always change in such a way that they offset part of the effects of the devaluation. In the case in which both goods are traded, the terms-of-trade effect may act to either increase or decrease the trade balance. In both cases, however, the relative price change cannot be said to be the cause of the change in the trade balance. Rather it is the effects of changes in desired expenditures which induce the change in relative prices.

APPENDIX

In this Appendix we consider the stability conditions for fixed and flexible exchange rate regimes in the nontraded good case. We demonstrate that either exchange rate regime is stable regardless of the sign of $1 - m - m^*$.

Equations (15) and (16) can be written as

$$(A1) \quad Q_2(\rho) = D_2\left(\rho, \tilde{Y}(\rho) - \frac{1}{P_1}(DW)\right)$$

as $E/P_1 = \tilde{Y} - (1/P_1)DW$ and $\tilde{Y} = Y(\rho)$

$$(A2) \quad Q_2^*(\rho^*) = D_2^*\left(\rho^*, \tilde{Y}^*(\rho^*)\right.$$
$$\left. - \frac{e}{P_1}DW^*\right)$$

as $E^*/P_1^* = \tilde{Y}^* - (1/P_1^*)DW^*$ and $P_1/e = P_1^*$.

From equations (5), (7), and (8),

$$(A3) \quad DW = kP_1\tilde{Y}(\rho) - W$$

where the adjustment parameters π and π^* have been set equal to unity

$$(A4) \quad eDW^* = k^*P_1\tilde{Y}^*(\rho^*) - eW^*$$

The U.S. and U.K. residents hold both dollar and pound denominated assets in their portfolios. The dollar value of their portfolios can be represented by

$$(A5) \qquad W = W^\$ + eW^P$$

$$(A6) \qquad eW^* = W^{*\$} + eW^{*P}$$

where $W(eW^*) = $ dollar value of wealth held by U.S. (U.K.) residents

$W^\$(W^{*\$}) = $ dollar denominated assets held by U.S. (U.K.) residents

$W^P(W^{*P}) = $ pound denominated assets held by U.S. (U.K.) residents

As in the text, it is assumed

$$(A7) \qquad W^\$ = (1 - m)W$$

$$(A8) \qquad W^{*P} = (1 - m^*)W^*$$

Asset market equilibrium requires that the demand for dollar (pound) denominated assets equals the amount outstanding:

$$(A9) \qquad W_\$ = W^\$ + W^{*\$}$$

$$(A10) \qquad W_P = W^P + W^{*P}$$

where $W_\$(W_P) = $ outstanding amount of dollar (pound) denominated assets

The system can be simplified by combining equations (A5)–(A10) to yield

$$(A5') \quad W_\$ = (1 - m)W + m^*eW^*$$

$$(A6') \quad W_P = m\frac{W}{e} + (1 - m^*)W^*$$

Equations (A1)–(A4), (A5'), and (A6') represent six independent equations containing eight unknowns: ρ, ρ^*, W, W^*, P_1, e, $W_\$$, and W_P. Under flexible exchange rates, $W_\$$ and W_P can be treated as constants since central banks do not attempt to alter asset supplies. With a fixed exchange rate, e is constant; and as it is assumed that governments only alter money supplies in response to the balance of payments: $DW_\$ = -eDW_P$. Thus, when it is known whether the exchange rate is fixed or flexible, two unknowns are eliminated from the system.

The dynamic model which we postulate is quite different from that used by Aghevli and Borts. The nature of our model is such that commodity markets are in equilibrium at each point in time. Given the existing stocks of wealth within countries, desired and actual portfolio compositions are also equal. The dynamic nature of our model is due to the fact that desired asset accumulations change over time. Asset accumulation acts to partially eliminate the discrepancy between desired and actual wealth, thereby reducing desired saving.

A. *Fixed Exchange Rates*

Equations (A1)–(A4) and the equation $DW = -eDW^*$ constitute five equations containing five unknowns. Substitute equations (A3) and (A4) into equations (A1) and (A2). Then linearize the resulting two equations as well as equations (A3) and (A4) around the point of long-run equi-

$$
\text{(A11)}\quad
\begin{bmatrix}
\dfrac{Q_2}{\rho}(\epsilon_2 - \eta_2 + sC_2) & 0 & \dfrac{1}{\rho}\left(\dfrac{C_2 W}{P_1^2}\right) & \dfrac{-1}{\rho}\left(\dfrac{C_2}{P_1}\right) & 0 \\[2ex]
0 & \dfrac{Q_2^*}{\rho^*}(\epsilon_2^* - \eta_2^* + s^*C_2^*) & \dfrac{1}{\rho^*}\left(\dfrac{C_2^* e W^*}{P_1^2}\right) & 0 & \dfrac{1}{\rho^*}\left(\dfrac{-C_2^*}{P_1}\right) \\[2ex]
0 & 0 & 0 & D & D \\[1ex]
sP_1 Q_2 & 0 & s\tilde{Y} & -(1+D) & 0 \\[1ex]
0 & s^* P_1 Q_2^* & s^* \tilde{Y}^* & 0 & -(1+D)
\end{bmatrix}
\begin{bmatrix}
\rho \\[1ex] \rho^* \\[1ex] P_1 \\[1ex] W \\[1ex] eW^*
\end{bmatrix} = K_0
$$

librium. The resulting four equations and the relation $DW = -eDW^*$ can be represented by (A11), where $K_0 = 5 \times 1$ column vector of constants, and $\pi = \pi^* = 1$ so that $s = k$ and $s^* = k^*$.

The characteristic equation takes the form $D(a_1 D + a_2)$. Thus, the system has a single nonzero characteristic root equal to $-a_2/a_1$. The system will be stable if a_1 and a_2 are of the same sign. Solving for a_1 and a_2:

$$
a_1 = \frac{\Delta}{\rho\rho^* P_1}, \qquad \text{where } \Delta \text{ is defined in equation (21); } a_1 > 0
$$

$$
a_2 = \frac{Q_1 Q_2}{\rho\rho^*}(\epsilon_2 - \eta_2)(\epsilon_2^* - \eta_2^*)
$$
$$
\cdot (k\tilde{Y} + k^*\tilde{Y}^*) > 0
$$

As both a_1 and a_2 are unambiguously positive, the system is stable regardless of the sign of $1 - m - m^*$.

B. Flexible Exchange Rates

Equations (A7)–(A4), (A5'), and (A6') represent six equations in six unknowns. Again, substitute equations (A3) and (A4) into equations (A1) and (A2). Linearizing

the resulting two equations, plus equations (A3), (A4), (A5'), and (A6') around the point of long-run equilibrium yields (A12), where $K_1 = 6 \times 1$ column vector of constants.

As the differential operator appears twice—in position a_{35} and a_{46}—the system will have two nonzero characteristic roots at most, that is, the characteristic equation will take the form $\alpha_1 D^2 + \alpha_2 D + \alpha_3 = 0$. On setting the determinant of the coefficient matrix equal to zero, the characteristic equation actually takes the form $a_4 D + a_5 = 0$. Thus, the system has only one nonzero root which is equal to $-a_5/a_4$. The system will be stable if a_5 and a_4 are of the same sign.

On setting the initial values of e, P_1 and P_1^* equal to unity, we find:

$$
a_5 = \frac{Q_2 Q_2^*}{\rho\rho^*} C_2 C_2^*(\epsilon_2 - \eta_2)(\epsilon_2^* - \eta_2^*)
$$
$$
\cdot m^* W^*[W^*(1 - m^*) + mW]
$$

$$
a_4 = \frac{Q_2 Q_2^*}{\rho\rho^*} C_2 C_2^*\{(\epsilon_2 - \eta_2 + sC_2)k^*\tilde{Y}^*
$$
$$
\cdot (\epsilon_2^* - \eta_2^*)m^*[(1 - m^*)W^* + mW]
$$
$$
+ (\epsilon_2^* - \eta_2^* + s^*C_2^*)k\tilde{Y}(\epsilon_2 - \eta_2)
$$
$$
\cdot m[(1 - m)W + m^* W^*]\}
$$

$$
\text{(A12)}\quad
\begin{bmatrix}
\dfrac{Q_2}{\rho}[\epsilon_2 - \eta_2 + sC_2] & 0 & \dfrac{1}{\rho}\left(\dfrac{C_2 W}{P_1^2}\right) & 0 & -\dfrac{1}{\rho}\left(\dfrac{C_2}{P_1}\right) & 0 \\[2ex]
0 & \dfrac{Q_2^*}{\rho^*}[\epsilon_2^* - \eta_2^* + s^*C_2^*] & \dfrac{1}{\rho^*}\left(C_2^* e\dfrac{W^*}{P_1^2}\right) & \dfrac{-1}{\rho^*}\left(C_2^*\dfrac{W^*}{P_1}\right) & 0 & -\dfrac{1}{\rho^*}C_2^*\dfrac{e}{P_1} \\[2ex]
-sP_1 Q_2 & 0 & -s\tilde{Y} & 0 & (1+D) & 0 \\[1ex]
0 & -s^*\dfrac{P_1}{e}Q_2^* & -s^*\dfrac{\tilde{Y}^*}{e} & S^* P_1^*\dfrac{\tilde{Y}^*}{2} & 0 & (1+D) \\[2ex]
0 & 0 & 0 & m^* W^* & (1-m) & m^* e \\[1ex]
0 & 0 & 0 & -\dfrac{mW}{e^2} & \dfrac{m}{e} & (1-m^*)
\end{bmatrix}
\begin{bmatrix}
\rho \\[1ex] \rho^* \\[1ex] P_1 \\[1ex] e \\[1ex] W \\[1ex] W^*
\end{bmatrix} = K_1
$$

Since m and m^* are both positive fractions, a_4 and a_5 are both positive.

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