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Exchange Depreciation, The Balance of Trade and the Terms of Trade

June Flanders

Hyman P. Minsky Ph.D.

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Exchange Depreciation, The Balance of Trade and the Terms of Trade.

by

June Flanders and Hyman P, Minsky

It is regularly asserted that an exchange-rate depreciation will improve the balance of payments, but only at the expense of a deterioration in the terms of trade.[1] This view persists

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[1] Cf. Gottfried Haberler, A Survey of International Trade Theory, No.1, International Finance Section, Princeton University 1955, pp 42-43 examines this assertion and shows that it is not always valid.

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despite the reconsideration of the theory of exchanges which has taken place during the past quarter of a century.[2] This

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[2] An excellent summary of the various steps in this well-known reconsideration is to be found in Lloyd A. Metzler, "The Theory of Internatinal Trade", A Survey of Contemporary Economics, Vol. 1, H. S. Ellis, Ed., Homewood, Illinois, 1948, pp. 222-233. and in J. Haberler Op. Cit

reconsideration of the theory of exchanges showed how the effects of a depreciation upon the balance of payments depended upon

the home and foreign elasticities of supply and demand for imports and exports. (As this analysis is based upon the existence of stable demand and supply curves for exports and imports we shall call it Marshallian). Even though it was shown that the effects of a depreciation upon the balance of trade depends upon the same supply and demand relations, no systematic examination of the interrelations between various changes in the balance of payments and the terms of trade exists. This paper is an attempt to fill that gap.

It will be shown that there are three possible types of worlds, depending upon the values of the elasticities of supply and demand. In the first world, a depreciation leads to an improvement in both the balance of payments and the terms of trade. In the second world (frequently assumed to be the only possible one) the balance of payments improves while the terms of trade deteriorate. In the third world both the balance of payments and the terms of trade deteriorate. That the world in fact may be of the first or third types has interesting implications for policy.

The paper consists of three parts: First, an examination

of the assumptions underlying the analysis; second, the deriva-

A In this section we will first state the assumptions of the Marshallian reconsideration and then examine briefly the relations between this formulation and a more general approach. It will be argued that the more specific Marshallian set up is to be preferred because it yields results which, at least in principal, are testable. The object of the various Marshallian assumptions is to achieve a small set of stable supply and demand functions which are then the basis for ~~xx~~ analysis. Of course, in applying the results, it is necessary to examine the effect of relaxing these assumptions.

Obviously the Marshallian analysis yields concrete results because it makes a number of heroic assumptions. Two of these are that there are only two countries and that all income effects can be neglected. The two country assumption is standard and its justification is that to any country (or bloc) the rest of the world can be considered as one country. The neglect of all income effects is perhaps more important. As a result of this assumption, the demand for imports, for example, is considered to be independent of any change in income resulting from a change in the value of exports. This neglect of income effects can be linked to the linearity assumption discussed below.

~~which state a relationship between the price and quantity demanded of a given good (or group of goods) is also heroic. This~~ excludes consideration of shifts in the demand curves for the various categories of goods as the result of changing relative prices. ~~It could be argued that~~ As the domestic price of an imported good varies, the resultant change in the quantity demanded will depend on the extent and direction of changes in the prices of various domestically-produced goods. (The same argument can be applied to the supply curves.) International trade is typically carried on, by any one country, in a great many different commodities, and there is no a priori reason to expect the cross-elasticities of demand for these with respect to changes in the prices of competing domestically-produced goods to be negligible. Nevertheless, we arbitrarily assume that such cross-elasticities can be neglected and exclude from our analysis any consideration of "domestic" goods. This truly heroic abstraction leaves us merely two goods, an export good and an import good, for each country.

An implicit assumption of the Marshallian analysis is that both countries have liquid reserves of the means of international payments (including the ability to borrow). If this is not the case, then the demand for imports in one or both of the countries

is constrained by a budget equation, an upper limit to its expenditure on imports imposed by the necessity of balancing its exports with its imports. If there is such a constraint, and if it is in fact operative,[3] then the demand curve for imports must

[3] A constraint of this nature would not be operative if for all exchange rates the value of imports were less than the value of exports. In this case the country would be accumulating a stock of liquid reserves.

be of unit elasticity, total expenditures on imports being limited to the supply of foreign currency. But in this case the supply of foreign currency is precisely the value of the country's exports; and as a change in the value of exports results in a shift in the demand curve for imports (by changing the constraint), the demand for imports is no longer an independent condition.[4] Such a situation may exist, for example, for

[4] If both countries are so constrained there are only two independent functions, the two supply curves of exports. This is essentially the classical barter situation.

a 'bankrupt' country with a sufficiently strong demand for imports, or for a country using direct controls to protect its foreign reserves. However, in general current receipts and expenditures of foreign exchange do not have to be equal in any particular period. This implies that the demand and supply curves for exports and imports to be used in this paper do not include all of the items which enter into the balance of payments for if they did the balance would by definition balance at all times. We shall concern ourselves, therefore, with the demand and supply curves for current trade items and assume that the movements of international reserves, such as capital movements (long and short term) and gold transfers offset whatever disequilibrium in the balance of trade may exist. These abstractions enable us to consider two independent markets: the market for export goods and the market for import goods.

As we are interested here in goods and services we shall also omit interest payments from the analysis. It must be pointed out that in any application of the results the effects of capital movements and interest payments upon both the balance of payments and the terms of trade must be considered. In what

follows however we shall ignore them and spek only of the balance of trade, rather than the balance of payments; and the expression terms of trade should be interpreted to mean commodity terms of trade.[5]

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[5]This refers to net commodity terms of trade in the strict sense, as distinguished from single and double factoral or 'income terms of trade.

In contrast to the Marshallian analysis used here there is the macro-economic-general-equilibrium approach used by Dr G. Stuvel[6] and Professor J.E. Meade[7]. While these works differ

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[6]The Exchange Stability Problem, Leiden, 1950.

[7]The Theory of International Economic Policy, Vo. I, The Balance of Payments, Mathematical Supplement, London, New York, Toronto, 1951.

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in many particulars, they are similar in their basic conceptions. Both involve the simultaneous solution of a fairly large number of equations which are of two types: 1. The national income (Keynesian) relations which define national income and the bal-

ance of payments and state the dependence of total effective demand upon income, and 2. Demand and supply functions which express the relations between quantity demanded (or supplied), income, the price of the commodity in question, and the prices of all other commodities. Even though the analysis is carried out in terms of a few classes of commodities- specifically imports, exports and 'domestic' goods- the solution of the equations for the reaction of the balance of payments or the terms of trade to a change in the exchange rate is a complex expression in terms of the parameters of the equations, which are the various elasticities. As is usual in such general-equilibrium analyses, generalizations as to the reaction of the system to specified changes are impossible, although by assigning particular values to alternative sets of these parameters, a lengthy catalogue of special cases is derived. The Marshallian model is one such special case and both Dr. Stuvel and Professor Meade show how it can be derived from their systems by setting certain of the elasticities equal to zero or infinity.[8]

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[8] Meade op.cit., pp. 133-144; Stuvel op.cit. pp. 167-176 and folding page at the end of the volume. Note that the analysis we have labelled Marshallian is referred to by Stuvel as the 'traditional approach' which he distinguishes from Marshall's own formulation involving only the demand elasticities.

Hence what follows can be interpreted as an exploration of the implications of an interesting special case of Dr. Stuvel's and Professor Meade's more general results.

II The Analysis

Our world consists of two countries and two commodities

~~We shall consider a world consisting of two countries, and but~~

We show that ~~we~~ shall ~~derive our results in terms of the currency of one~~ are independent of which currency

~~of them.~~ It will be obvious from what follows that all the our results are independent of which ~~countries~~ currency is used in the analysis.

In this section we will:

A. Derive the relevant elasticities

B Examine the effect of a depreciation upon

1. the balance of trade

2. the terms of trade

C. Derive joint conditions for changes in the balance of trade and the terms of trade.

A. Derivation of the relevant elasticities

We label the ~~Our~~ two countries ~~are~~, the home and the foreign (or other) country and ~~we consider~~ the two goods, the home country's exports and its imports. Hence we have two markets, the export market and the import market. The supply curve of exports and the demand curve of imports are attributes of the home country and

therefore are naturally defined in the home currency. Symmetrically the demand curve for exports and the supply curve of imports are naturally defined in the foreign currency.

R is the exchange ratio, and we define

1. $p_{x\cdot h} = R\, p_{x\cdot f}$

$p_{m\cdot h} = R\, p_{m\cdot f}$

where p refers to price and the subscripts x refer to exports, m to imports, h to prices measured in the home currency and f to prices measured in the foreign currency. As the result of a depreciation of the home currency we have

2. $p_{x\cdot h} + dp_{x\cdot h} = (R + dR)(p_{x\cdot f} + dp_{x\cdot f})$

$p_{m\cdot h} + dp_{m\cdot h} = (R + dR)(p_{m\cdot f} + dp_{m\cdot f})$

Ignoring second order differentials of the form $dR \cdot dp_{x\cdot f}$ and defining $K = \frac{dR}{R}$ we get

3. $\frac{dp_{x\cdot h}}{p_{x\cdot h}} = K + \frac{dp_{x\cdot f}}{p_{x\cdot f}}$

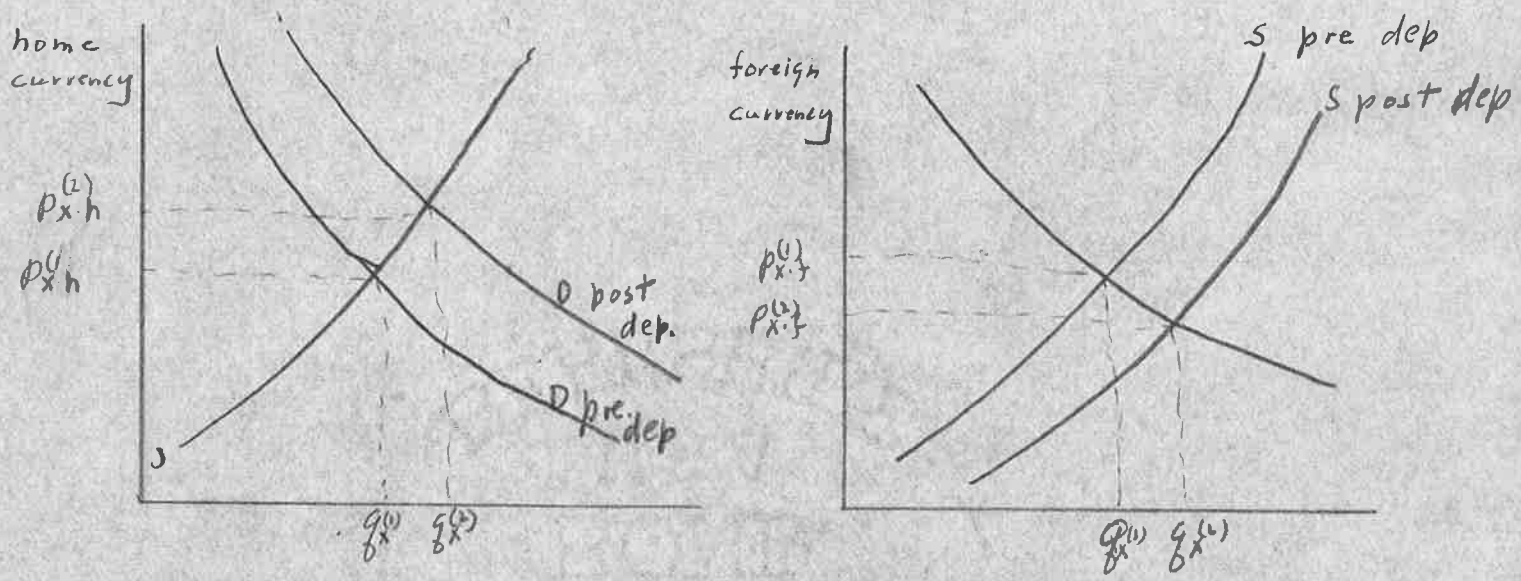
$\frac{dp_{m\cdot h}}{p_{m\cdot h}} = K + \frac{dp_{m\cdot f}}{p_{m\cdot f}}$

Note that as we have defined the conversion formulas (2),

as a result of a depreciation of the home currency R increases, $K = \frac{\Delta R}{R}$, the percentage depreciation, is positive.

Diagram I

Export Market

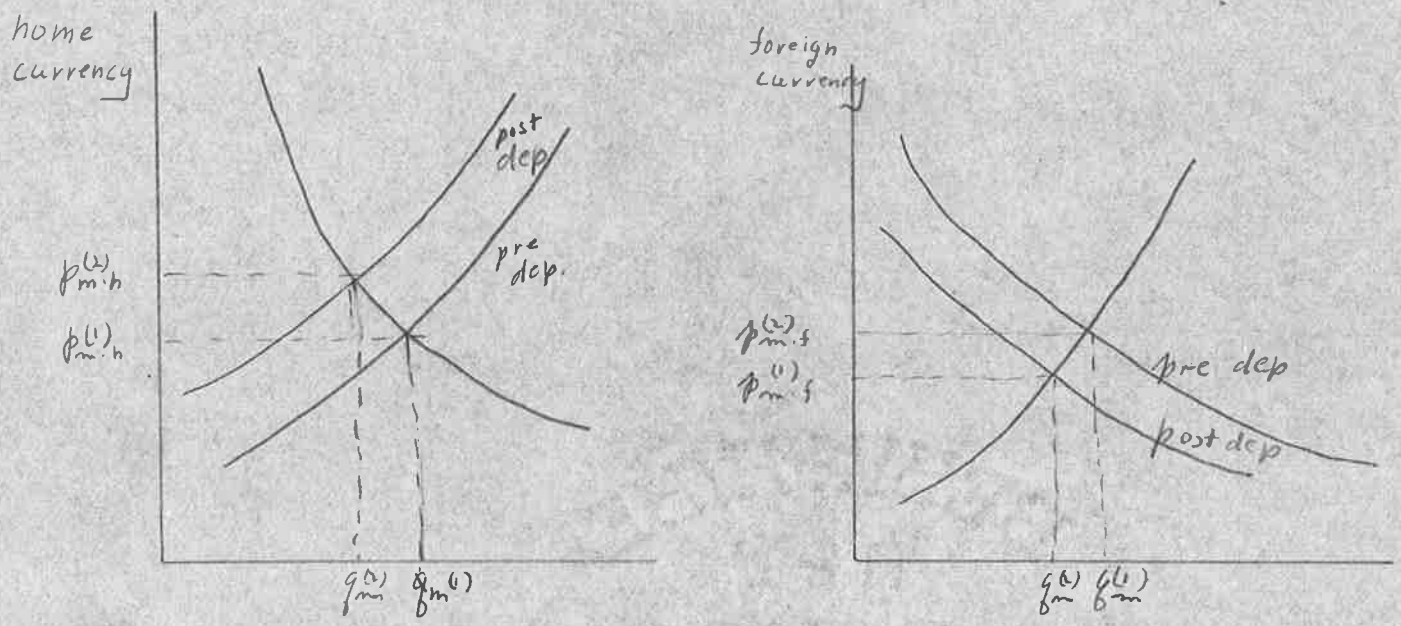


In the export market, as was mentioned earlier, the supply curve is naturally defined in the home currency, and the demand curve is naturally defined in the foreign currency. In order to derive the demand curve for exports in the home currency it is necessary to "translate" the foreign demand curve for exports into the home currency by use of formula 1. As a result of a depreciation of the home currency this demand curve will shift upwards, for each particular quantity will

now be demanded at a higher price in the domestic currency. To derive the supply curve for exports in the foreign currency the domestic supply curve has to be translated into the foreign currency and as a result of a depreciation of the home currency the supply curve of exports in the foreign currency shifts down, for $p_{x\cdot f} = \frac{1}{R} p_{x\cdot h}$ and R increases.

Diagram II

Import Market



In the import market, the demand curve is invariant in the home currency and the supply curve is invariant in the foreign currency. As a result of a depreciation of the home

currency the supply curve for imports translated into the home currency shifts upwards and the demand curve translated into the foreign currencies shifts downward.

As a result of the above relations the elasticity of supply of exports and the elasticity of demand for imports can be defined as usual in the home currency, and the elasticity of demand for exports and the elasticity of supply of imports can be defined naturally in the foreign currency.

We therefore have

4) $$\eta_{x\cdot h} = \frac{\frac{dy_x}{y_x}}{\frac{dp_{x\cdot h}}{p_{x\cdot h}}}, \quad \varepsilon_{x\cdot f} = -\frac{\frac{dy_x}{y_x}}{\frac{dp_{x\cdot f}}{p_{x\cdot f}}}$$

$$\varepsilon_{m\cdot h} = -\frac{\frac{dy_m}{y_m}}{\frac{dp_{m\cdot h}}{p_{m\cdot h}}}, \quad \eta_{m\cdot f} = \frac{\frac{dy_m}{y_m}}{\frac{dp_{m\cdot f}}{p_{m\cdot f}}}$$

where η's are the supply and ε's the demand elasticities.

However by using equations 3, we can translate all four of the elasticities into ~~either~~ both the home and the foreign currency. Note that as the value of each elasticity is the same in the two currencies, we can ~~Therefore~~ whenever it is convenient ~~we can drop the subscripts h and f from the elasticities~~ unless it is necessary drop the subscripts h and f in what follows.

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5. Elasticity of

	Home Currency	Foreign Currency
supply of exports	$\eta_{x \cdot h} = \dfrac{d\xi_x/\xi_x}{dp_{x \cdot h}/p_{x \cdot h}}$	$\eta_{x \cdot f} = \dfrac{d\xi_x/\xi_x}{K + \dfrac{dp_{x \cdot f}}{p_{x \cdot f}}}$
demand for exports	$\varepsilon_{x \cdot h} = \dfrac{d\xi_x/\xi_x}{K - \dfrac{dp_{x \cdot h}}{p_{x \cdot h}}}$	$\varepsilon_{x \cdot f} = -\dfrac{d\xi_x/\xi_x}{dp_{x \cdot f}/p_{x \cdot f}}$
supply of imports	$\eta_{m \cdot h} = -\dfrac{d\xi_m/\xi_m}{K - \dfrac{dp_{m \cdot h}}{p_{m \cdot h}}}$	$\eta_{m \cdot f} = \dfrac{d\xi_m/\xi_m}{dp_{m \cdot f}/p_{m \cdot f}}$
demand for exports	$\varepsilon_{m \cdot h} = -\dfrac{d\xi_m/\xi_m}{dp_{m \cdot h}/p_{m \cdot h}}$	$\varepsilon_{m \cdot f} = -\dfrac{d\xi_m/\xi_m}{K + \dfrac{dp_{m \cdot f}}{p_{m \cdot f}}}$

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9 Aside from notation changes, the elasticities defined in the home currency are the same as those in Joan Robinson, "The Foreign Exchange" Essays in the Theory of Employment, (Oxford, 1947), p.142, (reprinted in Readings in the Theory of International Trade (Philadelphia, 1949) pp 83-103 and the elaticities defined in the foreign currency are the same as those used by Sidney S. Alexander, "Devaluation versus Import Restriction as an Instrument for Improving Foreign Trade Balance", International Monetary Fund Staff Papers, Volume I, pp. 379-396.

B. The Effect of a Depreciation

In this section the conditions, in terms of the elasticities defined by equations 5, for a depreciation in the exchange rate to yield an improvement, deterioration or no change in the balance of trade and the terms of trade will be ~~denied~~ derived. It will be shown that Even though it is possible for the balance of trade in one currency to improve while the balance of trade in the other currency deteriorates when the value of imports is not equal to the value of exports, ~~it turns out that~~ when the value of imports ~~equals the value of exports~~ and exports are equal the conditions for the ~~alternative~~ various changes in the balance of trade ~~is~~ are independent of which currency is used in the analysis. ~~Similarly~~ On the other hand, the condition for an improvement, deterioration, or no change in the terms of trade is independent of the currency used in the analysis regardless of whether the value of exports and imports are equal.

1. The Balance of Trade

The home currency portions of Diagrams I and II illustrate the effect of a depreciation upon the balance of trade measured in the home currency. Before the depreciation the balance of trade is $p_{x \cdot h}^{(1)} q_x^{(1)} - p_{m \cdot h}^{(1)} q_m^{(1)}$ and after depreciation it is $p_{x \cdot h}^{(2)} q_x^{(2)} - p_{m \cdot h}^{(2)} q_m^{(2)}$. The balance of trade will improve, remain unchanged, or

deteriorate according as to whether $p_{x\cdot h}^{(2)} \xi_x^{(2)} - p_{m\cdot h}^{(2)} \xi_m^{(2)} \gtrless p_{x\cdot h}^{(1)} \xi_x^{(1)} - p_{m\cdot h}^{(1)} \xi_m^{(1)}$. That is the balance of trade of the depreciating (home) country will improve, remain unchanged, or deteriorate according as

$$6 \qquad \frac{d}{dR}\left(p_{x\cdot h}\xi_x - p_{m\cdot h}\xi_m\right) \gtrless 0$$

In the foreign currency, the balance of trade of the depreciating (home) country will improve, remain unchanged or deteriorate according as

$$6' \qquad \frac{d}{dR}\left(p_{x\cdot f}\xi_x - p_{m\cdot f}\xi_m\right) \gtrless 0$$

Differentiating 6, and using the definitions of K from the equations for $\xi_{x\cdot h}$ and $\eta_{m\cdot h}$ we get that the balance of trade will improve, remain unchanged or deteriorate according as

$$7 \qquad K p_{x\cdot h}\xi_x\left[\frac{\xi_x(\eta_x+1)}{\xi_x+\eta_x}\right] + K p_{m\cdot h}\xi_m\left[\frac{\eta_m(\xi_m-1)}{\xi_m+\eta_m}\right] \gtrless 0$$

Similarly by differentiating 6' and using the definitions of K from the equations for $\eta_{x\cdot f}$ and $\xi_{m\cdot f}$ the conditions for the various changes in the balance of trade

measured in the foreign currency will be[10]

$$7' \quad K p_x + \xi_x \left[\frac{\eta_x (\varepsilon_x - 1)}{\varepsilon_x + \eta_x} \right] + K p_m + \xi_m \left[\frac{\varepsilon_m (\eta_m + 1)}{\eta_m + \varepsilon_m} \right] \gtrless 0$$

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[10] S.S. Alexander, op.cit., pp. 393-394 gives a well nigh step by step derivation of 7'; and 7 is obtained in a similar manner.

From equations 7 and 7' it is obvious that for the balance of payments in the home currency to deteriorate as the result of a depreciation it is necessary that the elasticity of demand for imports be less than 1; for the balance of trade in the foreign currency to deteriorate as the result of a depreciation it is necessary that the elasticity of demand for exports be less than 1. It is possible that the balance of payments in one currency deteriorates at the same time as the balance of payments in the other currency improves. To the extent that a country depreciates in order to improve its balance of payments in the foreign currency the condition under

which 7' is negative is relevant. If the elasticity of demand for imports is greater than 1, so that the balance of trade in the home currency must improve, then, for the balance of payments in the foreign currency to deteriorate, it is necessary that the value of exports be greater than the value of imports.[11] The depreciating country must be running a surplus in the current trade account.

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[11] Equation 7' can be transformed into

$$\frac{\varepsilon_x - 1}{1 + \frac{\varepsilon_x}{\eta_x}} + \frac{p_m + q_m}{p_x + q_x}\left[\frac{1 + \eta_m}{1 + \frac{\eta_m}{\varepsilon_m}}\right] < 0. \quad \text{As } 0 < \varepsilon_x < 1,$$

$$\left|\frac{\varepsilon_x - 1}{1 + \frac{\varepsilon_x}{\eta_x}}\right| < 1, \text{ with } \varepsilon_m > 1, \ \frac{1 + \eta_m}{1 + \frac{\eta_m}{\varepsilon_m}} > 1 \text{ Therefore}$$

equation 7' can be less than zero only if $\frac{p_m + q_m}{p_x + q_x} < 1$

Even though equations 7 and 7' differ, if we assume that the values of exports equals the value of imports, independently of which currency is used, we get that the balance of trade will improve, remain unchanged or deteriorate according as

5.

$$8.\quad K_{p_x q_x}\left[\frac{\eta_x \eta_m (\varepsilon_x+\varepsilon_m-1)+\varepsilon_x \varepsilon_m (\eta_x+\eta_m+1)}{(\varepsilon_x+\eta_x)(\eta_m+\varepsilon_m)}\right] \gtreqless 0$$

As all of the elasticities are positive, equation 8 yields the well known proposition that a ~~necessary and~~ sufficient condition for a depreciation to improve the balance of trade is for the sum of the elasticities of demand (for exports and imports) be equal to or greater than 1. On the other hand a necessary, but not a sufficient, condition for a depreciation to result in a deterioration in the balance of trade is for the sum of these elasticities to be less than 1.

2. The Terms of Trade

The home currency and foreign currency sides of Diagrams I and II also illustrate the effects of a depreciation upon the terms of trade. In each currency, before the depreciation the terms of trade was $\frac{p_x^{(1)}}{p_m^{(1)}}$, and after depreceation the terms of trade is $\frac{p_x^{(2)}}{p_m^{(2)}}$. The terms of trade will improve, deteriorate or remain

unchanged as $p_x^{(1)}/p_m^{(1)} - p_x^{(0)}/p_m^{(0)} \gtrless 0$ i.e. as

$$9 \quad \frac{d}{dR}\left(p_x/p_m\right) \gtrless 0$$

In the home currency equation 9 yields

$$10 \quad K \frac{p_{x \cdot h}}{p_{m \cdot h}} \left[\frac{\varepsilon_{x \cdot}}{\eta_{x \cdot} + \varepsilon_{x \cdot}} - \frac{\eta_{m \cdot}}{\varepsilon_{m \cdot} + \eta_{m \cdot}}\right] \gtrless 0$$

as the condition for an improvement, no change or deterioration in the terms of trade.

In the foreign currency equation 9 yields

$$10' \quad K \frac{p_{x \cdot f}}{p_{m \cdot f}} \left[\frac{\varepsilon_{m \cdot}}{(\eta_{m \cdot} + \varepsilon_{m \cdot})} - \frac{\eta_{x \cdot}}{(\varepsilon_{x \cdot} + \eta_{x \cdot})}\right] \gtrless 0$$

as the conditins for an improvement, no change or deterioration in the terms of trade.

~~Once again, however,~~ both 10 and 10' reduce to the same condition:

$$11 \quad K \frac{p_x}{p_m} \left[\frac{\varepsilon_x \varepsilon_m - \eta_x \eta_m}{(\varepsilon_x + \eta_x)(\eta_m + \varepsilon_m)}\right] \gtrless 0$$

For the terms of trade to improve as a result of a depreciation it is necessary and sufficient that the product of the demand elasticities be greater than the product of the supply elasticities. Also note that if at least one of the supply

elasticities ~~are~~ ∞ infinite (very large) the terms of trade must deteriorate as a result of a depreciation.

C. Joint Conditions upon the Balance and the Terms of Trade

As all of the elasticities, K,(the depreciation ratio), and $\varphi_x \xi_x$ are positive, the conditions stated in equations 8 and 11 depend solely upon the numerators. That is, the balance of trade will improve, not change or deteriorate according as

12) $\eta_x \eta_m (\varepsilon_x + \varepsilon_m - 1) + \varepsilon_x \varepsilon_m (\eta_x + \eta_m + 1) \gtreqless 0$

and the terms of trade will improve, not change or deteriorate according as

13) $\varepsilon_x \varepsilon_m - \eta_x \eta_m \gtreqless 0$

Assume that the terms of trade improve or remain unchanged, that is

$$\varepsilon_x \varepsilon_m - \eta_x \eta_m \geq 0$$

$$\varepsilon_x \varepsilon_m = \eta_x \eta_m + \lambda \quad (\lambda \geq 0)$$

Substituting this value of $\varepsilon_x \varepsilon_m$ in (12) above we have

$$\eta_x \eta_m (\varepsilon_x + \varepsilon_m - 1) + (\eta_x \eta_m + \lambda)(\eta_x + \eta_m + 1)$$

$$= \eta_x \eta_m (\varepsilon_x + \varepsilon_m + \eta_x + \eta_m) + \lambda (\eta_x + \eta_m + 1)$$

which is always positive. Therefore we have

THEOREM I: If the terms of trade improve or remain unchanged as a result of a depreciation, the balance of

trade will improve.

Now assume that the balance of trade deteriorates, or remains unchanged:

$$\eta_x \eta_m (\varepsilon_x + \varepsilon_m - 1) + \varepsilon_x \varepsilon_m (\eta_x + \eta_m + 1) \leq 0$$

that is $$\varepsilon_x + \varepsilon_m + \frac{\varepsilon_x \varepsilon_m}{\eta_x \eta_m} (\eta_x + \eta_m + 1) \leq 1$$

This implies $\frac{\varepsilon_x \varepsilon_m}{\eta_x \eta_m} < 1$; that is $\varepsilon_x \varepsilon_m - \eta_x \eta_m < 0$,

which means that we have

THEOREM II: If the balance of trade deteriorates or remains unchanged, as a result of a depreciation, the terms of trade will deteriorate.

Theorems I and II state sufficient, but not necessary, conditions for the conclusions of the theorems to be true. There are nine possible combinations of changes in the terms of trade and accompanying changes in the balance of trade; and symmetrically for changes in the balance of trade and in the terms of trade. We can summarize what has been proven in the following table. (We write TT+ for any improvement, TTo for no change, use capital O

and TT- for a deterioration in the terms of trade; similarly changes in the balance of trade are expressed as BT+, BTo and BT-.)

TABLE I

Effects of a Depreciation

Change in terms of trade	implies	Change in balance of trade	True or False	Change in balance of trade	implies	Change in terms of trade	True or False
If TT+	then	BT+	true	If BT+	then	TT+	indeterminate
TT+		BTo	false	BTo		TT+	false
TT+		BT-	false	BT-		TT+	false
TTo		BT+	true	BT+		TTo	indeterminate
TTo		BTo	false	BTo		TTo	false
TTo		BT-	false	BT-		TTo	false
TT-		BT+	indeterminate	BT+		TT-	indeterminate
TT-		BTo	indeterminate	BTo		TT-	true
TT-		BT-	indeterminate	BT-		TT-	true

The table above shows that if, as the result of an exchange depreciation, the terms of trade deteriorate, the balance of trade may improve, not change, or deteriorate and that if the balance of trade improves the terms of trade may improve, not change, or deteriorate. That is, a deterioration in the terms of trade implies nothing about the balance of trade; similarly, an improvement in the balance of trade implies nothing about the

terms of trade.

DIAGRAMIII

Effects of a Depreciation

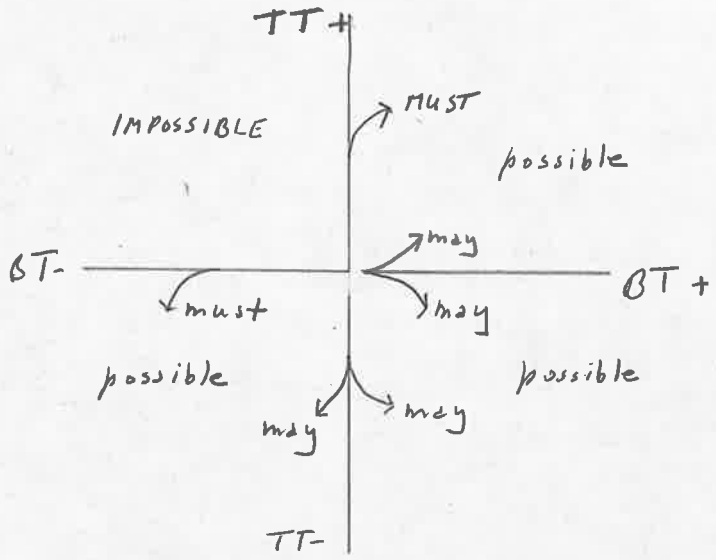

Diagram III illustrates what has been proven by Theorems I and II and the contents of Table I. The four quadrants represent the four possible combinations of improvement and deterioration in the terms and the balance of trade. The terms of trade improvement axis and the balance of trade deterioration axis contains the origin to illustrate the effects of no change in the terms of trade and the balance of trade.

Theorems I and II prove that it is impossible for the combination terms of trade improving and balance of trade deteriorating to exist. The other three quadrants represent possible

combinations. The two arrows ~~with the~~ labeled "must" ~~at their end~~ represent the content of theorems I and II; that a terms of trade improvement must be accompanied by a balance of trade improvement and that a balance of trade deterioration must be accompanied by a terms of trade deterioration. However, an improvement in the balance of trade may be accompanied by either an improvement or a deterioration in the terms of trade and a deterioration in the terms of trade may be accompanied by either an improvement or a deterioration in the balance of payments: the four arrows labeled may illustrate this result.

The first quadrant, where both the terms of trade and the balance of payments of the depreciating country improve, represents a "perverse" result from the point of view of the other country. If a depreciation has this "perverse" result, we can expect the other country to retaliate. The second quadrant represents the "classical" situation where an improvement in the balance of payments is "paid for" by a deterioration in the terms of trade and therefore the "other" country can be expected to

accept the depreciation. The third quadrant, where both the balance of trade and the terms of trade deteriorate is "perverse" from the point of view of the depreciating country. In this case the country with a balance of payments problem will avoid depreciating. (Appreciation, which makes K negative and hence reverses both sets of inequalities, ~~can~~ makes both the terms of

12. With an appreciation $K = \frac{dR}{R} < 0$, which reverses all inequalities in operations 12 and 13, with appreciation the second quadrant result is impossible, a fourth quadrant result is the classical situation. The values of the elasticities which yield a third quadrant result for depreciation yield a first quadrant result for an appreciation etc. The simplest way to think of an appreciation in our two country - two commodity world is to think just what happens to the trading partners balance of payments and terms of trade as a country depreciates.

occur if the supply elasticities are smaller than the demand

accept the depreciation. The third quadrant, where both the balance of trade and the terms of trade deteriorate is "perverse" from the point of view of the depreciating country. In this case the country with a balance of payments problem will avoid depreciating. (Appreciation, which makes K negative and hence reverses both sets of inequalities, ~~can~~ makes both the terms of trade and the balance of trade improve. Once again retaliations can be expected).[12]

If $\varepsilon_x + \varepsilon_m > 1$, a ~~deterioration~~ deterioration in the balance of trade is impossible. The result of a depreciation will lie in the first or second quadrant. The terms of trade will deteriorate if $\eta_x \eta_m > \varepsilon_x \varepsilon_m$ and they will improve if $\varepsilon_x \varepsilon_m > \eta_x \eta_m$. The "classical" result will occur if the product of the supply elasticities is larger than the product of the demand elasticities; ~~hence~~ an infinitely elastic supply of either exports or imports will result in a deterioration of the terms of trade. The perverse situation from the other country's viewpoint will occur if the supply elasticities are smaller than the demand

elasticities or of one of the supply elasticities is sufficiently small to result in the product of the supply elasticities being smaller than the product of the demand elasticities.

If $\varepsilon_x + \varepsilon_m < 1$, then the result of a depreciation can lie in the first, second. or third quadrants. We will examine the conditions which will result in each of the three possible results.

If the balance of trade improves we know from 12 that

$$\frac{\varepsilon_x \varepsilon_m}{\eta_x \eta_m} > \frac{1-\varepsilon_x-\varepsilon_m}{1+\eta_x+\eta_m}$$

and it is always true (aside from the trivial case where all four elasticities are zero) that

$$1 > \frac{1-\varepsilon_x-\varepsilon_m}{1+\eta_x+\eta_m}$$

For the terms of trade to deteriorate it is necessary that

$$1 > \frac{\varepsilon_x \varepsilon_m}{\eta_x \eta_m}.$$

Hence for the classical situation to occur we have that

14) $$1 > \frac{\varepsilon_x \varepsilon_m}{\eta_x \eta_m} > \frac{1-\varepsilon_x-\varepsilon_m}{1+\eta_x+\eta_m}$$

With $\varepsilon_x + \varepsilon_m < 1$, $\varepsilon_x \varepsilon_m < 1/4$, so that if $\eta_x \eta_m < 1/4$ it is possible to get

$$\frac{\varepsilon_x \varepsilon_m}{\eta_x \eta_m} > 1 > \frac{1-\varepsilon_x-\varepsilon_m}{1+\eta_x+\eta_m}$$

in which case both the terms of trade and the balance of trade will improve. This first quadrant result will occur if the supply elasticities are too small, hence there are minimum values of and η_x and η_m for given ε_x and ε_m which yield the classical situation.

On the other hand, with η_x and η_m large, $\eta_x \eta_m$ increases more rapidly than $1 + \eta_x + \eta_m$ and if $\eta_x \eta_m$ becomes too large relative to $\eta_x + \eta_m$ it is possible to get

$$1 > \frac{1 - \varepsilon_x - \varepsilon_m}{1 + \eta_x + \eta_m} > \frac{\varepsilon_x \varepsilon_m}{\eta_x \eta_m}$$

which is the condition for the terms of trade and the balance of payments simultaneously deteriorating. This third quadrant result will occur if the supply elasticities are too large; there are maximum values for η_x and η_m for given ε_x and ε_m which result in the classical situation.

TABLE II

Range of Values of supply elasticities which yield the Classical Situation

Selected values of $\varepsilon_x + \varepsilon_m < 1$

η_x assumed equal to η_m.*

	.1	.25	.33	.4	.7	.8
.1	.1-.125	.16-.24	.18-.30	.2-.4	.26-1.0	.28-2.0
.25	.16-.24	.25-.5	.29-.69	.32-1.1	.42-7.5	x
.33			.33-1.0	.37-1.3	x	x
.4						x

Footnote to Table II

* The lower limit is given by $\eta = \sqrt{\varepsilon_x \varepsilon_m}$. The upper limit is given by $\eta = \frac{\varepsilon_x \varepsilon_m}{1-\varepsilon_x-\varepsilon_m} + \sqrt{\frac{\varepsilon_x \varepsilon_m}{1-\varepsilon_x-\varepsilon_m}\left(\frac{\varepsilon_x \varepsilon_m}{1-\varepsilon_x-\varepsilon_m}+1\right)}$.

Obviously as $\varepsilon_x + \varepsilon_m \to 1$, the upper limit to $\eta \to \infty$.

them both improving. Hence --

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.33	.18-.30	.29-.69	.33-1.0	.37-1.3	x	x
.4	.2-.4	.32-1.1	.37-1.3	.4-2.0	x	x
.7	.26-1.0	.42-7.5	x	x	x	x
.8	.28-2.0	x	x	x	x	x

*

In Table II, for selected values of $\eta_x + \eta_m < 1$, the range of values of $\eta_x = \eta_m$ which will result in the balance of trade improving and the terms of trade deteriorating simultaneously are exhibited. It is obvious that only a restricted range of supply elasticities yields this classical result. Supply elasticities greater than the upper limits result in both the balance and the terms of trade deteriorating: and supply elasticities smaller than the lower limits result in them both improving. Hence with inelastic demand conditions,

the possibility is that one or the other "perverse" results will occur, and in particular, ~~at~~ one large supply elasticity can result in both the balance of trade and the terms of trade deteriorating.[13]

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[13] For example, with $\xi_x \xi_m = 4$ and $\eta_t = 1$, an elasticity of supply greater than 8 will result in both the terms of trade and the balance of payments deteriorating.

III The Implications

We have shown that the adjustment of both the balance of trade and the terms of trade depends upon the supply and demand elasticities for imports and exports. There are three possible types of worlds, worlds in which

I The terms of trade improve or remain unchanged and the balance of trade improves;

II The terms of trade deteriorate and the balance of trade improves;

III The terms of trade deteriorate and the balance of trade deteriorates or remains unchanged as the result of a depreciation.

In this section we will argue that conscious international monetary cooperation is necessary if the world is of type II or III, and that some of the balance of payments difficulties of the post-war world may be due to the world being of a type III world. The argument will show that the effectiveness of a depreciation in correcting a balance of payment difficulty may depend upon the other countries trade policy.

In a type I world a country, by depreciating, can figuratively both "have its cake and eat it"; true beggar-my-neighbor exchange rate policies are possible.[14] As the other

[14] The term beggar-my-neighbor here carries a real income rather than the usual contra-cyclical connotation. The beggar-my-neighbor contra-cyclical devices rest on a different analytical ground: in a depression supply elasticities typically are high so that the world is of type II or III. See J. Robinson, op.cit., pp. 156-170.

country's balance of payments and terms of trade both deteriorate it can be expected to reliate: competitive depreciation would result. A type I world exists when

[illegible] supply

can be free to set its own exchange rate, no overt international cooperation is necessary.

If the world is of type III, the depreciating country receives no benefits. Its optimum policy would be to appreciate but, as an appreciation would result in an improvement in both the terms of trade and the balance of trade, the other country receives no benefits and would be tempted to retaliate. As again

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14/ With an appreciation $K = \frac{dR}{R} < 0$, so that in equations 12 and 13 the inequalities are reversed.

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in a world of Type I, international cooperation on exchange rates is necessary.

It may be that the post-war international monetary difficulties (particularly those of the first half of the past decade) have been attributable to our living in a type III world, in which a depreciation ~~would~~ results in a deterioration of both the terms of trade and the balance of trade. The optimum policy in such a world involves a currency appreciation accepted by the

surplus countries. This was not done and the deficit countries resorted to exchange controls, quotas and similar direct measure.

If we consider our two countries to be the hard-currency and ~~teh~~ the soft-currency countries, a world in which the elasticities of supply are high, the elasticities of demand low may exist. There is no particular need to explain the high supply elasticities of exports and imports. As is evident from table II supply elasticities do not have to be very large in order to result in a type III world, given that the sum of the demand elasticities is appreciably less than 1. As particularly as only one large supply elasticity is necessary.

~~is all that is necessary. the encouragement of exports by the deficit countries is sufficient to yield a type III world.~~

The demand for imports by the soft-currency countries may have been inelastic during this peridd for two reasons. The commodities imported may have been "standard of living" commodities for which demand is naturally inelastic; this would be reinforced by the lack of close substitutes 'domestically' (that is among the soft-currency countries). Secondly, the

direct controls placed upon the import of hard-currency commodities may have reduced the quantity purchased so far below what would have been purchased in the absence of controls, that even at a significantly higher price the quantity demanded would not decline.

The demand for exports (by hard currency countries) may also have been inelastic, and may still be so today, but for a different reason. The elasticity of demand for an export depends upon the elasticity of demand, in the importing country, for the exported good, but is not equal to it. The difference between the two elasticities depends upon the proportion of the final price, in the importing country, accounted for by tariffs, costs of transportation (~~both to and~~ particularly within the importing country) and processing, handling, and selling costs within the importing country. For any given value of elasticity of demand for a particular exported good, the smaller the ratio of the export price to the total domestic price (in the importing country), the smaller is the elasticity of demand facing the

exporting country.[15]

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[15] The elasticity of demand for an export is naturally defined in the foreign ~~country~~ currency. Let us define $\varepsilon_{x.f.g}$ as the elasticity of demand for the exported goods in the foreign currency and $\varepsilon_{x.f}$ as the elasticity of demand for the export. Let $p_f = \frac{1}{R} p_h$ be the price of the export, and $p_f + u = \frac{1}{R} p_h + u$ be the price of the exported good in the foreign countries currency, ~~where~~ u are the costs fixed in the foreign currency which are assumed invariant as the result of a depreciation. We now have that $\varepsilon_{x.f.g} = \frac{dQ_x/Q_x}{dp_x/p_x+u}$ and $\varepsilon_{x.f} = \frac{dQ_x/Q_x}{dp_x/p_x}$ so that

$$\frac{\varepsilon_{x.f.g}}{\varepsilon_{x.f}} = \frac{p_x + u}{p_x}$$

If $p_x = \#1$, $u = \#4.00$, $\varepsilon_{x.f.g} = 5\,\varepsilon_{x.f}$ which is the result in the Scotch Whiskey example, which follows in the text.

As an example we can consider the ~~well-known~~ case of 'Scotch' whiskey. Assume that the British export price of Scotch whiskey

is $1. The final selling price within the United States is, let us say, $5. Let us assume that the entire difference in the two prices consists of costs in dollars, and that these costs are fixed. If Britain depreciates the pound by 20%, and the sterling price of whiskey does not change, the price in the United States will fall to $4.80. If the elasticity of demand for Scotch whiskey in the United States is equal to 2, the amount purchased will increase by 8%. The elasticity of demand for this export commodity to Britain is therefore equal to 8% (the percentage change in quantity) divided by 20% (the percentage change in the export price in dollars), which is .4, considerably less than 2.

Admittedly, the example we have given is extreme and results from the high tax on alcoholic beverages in the United States. However, if the major part of a country's exports consists of commodities sold at retail in the importing country, the effect of the high proportion of domestic costs to the final price is to make the elasticity of demand for the export small, even

though the demand for the commodity in the importing country may be relatively elastic. Similarly, the higher the tariffs in the importing country, the greater the difference between the elasticity of the consumer's demand and the elasticity of demand facing the exporting country.*

* These conclusions are based upon arithmetic not geometric models.

It follows that the effectiveness of the monetary mechanism for adjusting balance of trade disequilibria depends to a considerable extent upon trade policy. The ability of a country to correct an unfavorable balance of payments position by means of exchange rate changes is slight if

1. its trading partners have restrictive trade practice

2. its own demand for imports is inelastic due to the application of direct controls.

As the direct controls of the soft-currency countries can be interpreted as a defensive mechanism adopted in order to survive in an unfavorable world, the initiative in changing the world must come from the hard-currency countries. The changes by the hard-currency countries must be such as to increase

their elasticity of demand for the exports of the soft-currency bloc. Specifically, this would involve, inter alia, an agonizing reappraisal of United States tariff policy.