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The Effects of Devaluation of the British Pound in 1967

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THE EFFECTS OF DEVALUATION OF THE BRITISH POUND IN 1967

(TITL)

BY

SHOJI KIMURA

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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PREFACE

It is the purpose of this paper to determine if the effects of the devaluation of the British pound in 1967 could be foreseen by using the elasticity approach of Joan Robinson and the more complete approach of Sidney Alexander, which takes into account both income and price effects.

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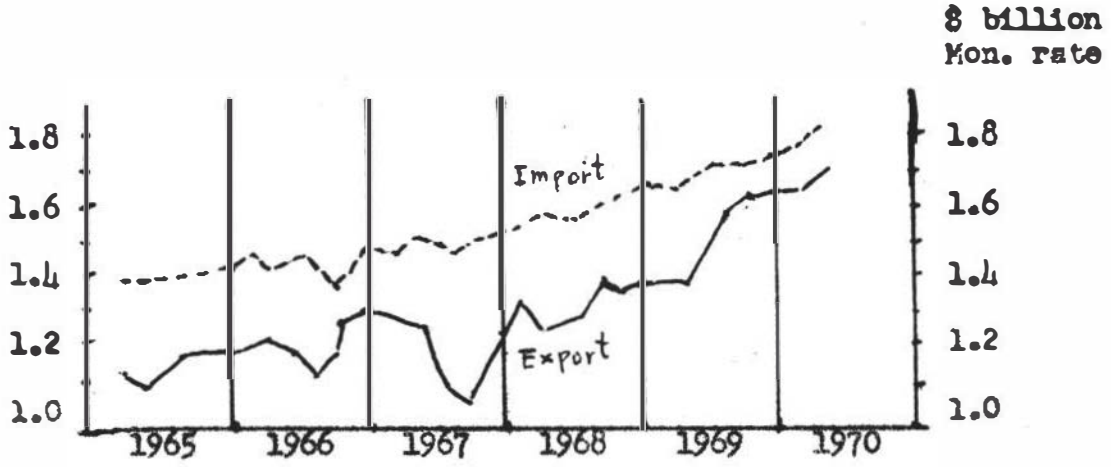
INTRODUCTION

The British trade balance showed a deficit every year since World War II and the gap widened drastically, as shown in Figure I, toward the end of 1967 in spite of governmental efforts to save the pound.

FIGURE 1

FOREIGN TRADE OF THE UNITED KINGDOM



Source: Main Economic Indicators, (August, 1970), p47.

Hence, on the 18th of November, 1967, the British government announced a cut in the pound's exchange value from $2.80 to $2.40---a 14.3% devaluation.[1]

Only six countries followed the devaluation.[2] These countries represented less than 4 per cent of the rest of the world's exports, only 2 per cent of the industrial countries' exports, and only 16.5

---

[1] Time, (November 24, 1967), p. 29.

[2] These countries were Spain (14.3%), Israel (14.3%), Hong Kong (14.3%), New Zealand (20%), Denmark (8%), Ireland (14.3%), Economist, (November 25, 1967), pp. 864-65.

per cent of the U.K.'s customers.[1] Therefore, devaluation should have worked well, since there was comparatively little retaliatory devaluation from England's major trade partners. But devaluation does not always improve the balance of payments. It is the purpose of this paper to estimate the effect of devaluation separately from the effect of other instruments used to improve the trade balance and to determine by use of the Alexander and Robinson formulas if the effects of the devaluation of the British pound in 1967 could have been forcast.

First, J. Robinson's formula, which expresses only the price effect of devaluation, will be used. Second, Alexander's formula which in addition to the price effect takes account of the income effect will be considered. However, the British government adopted several expenditure-reducing policies as well as the expenditure-switching policy (devaluation) in order to make the devaluation work more effectively.[2,3] Therefore, the actual improvement in trade balance should be higher than the stated improvement from the Robinson-Alexander formula.

---

[1] International Financial Statistics, (January, 1968) p. 53.

[2] The nature of the expenditure reducing policy is explained in H. G. Johnson's book International Trade and Economic Growth, Studies in Pure Theory (Cambridge, Harvard University Press, 1961), pp. 153-68. Generally, the balance of payments may be expressed as R - P, where R is aggregate receipts by residents and P is aggregate payments by residents. Moreover,

$$R = R_f + R_r$$

and

$$P = P_f + P_r$$

where R_f is the aggregate receipts by residents from foreigners, R_r is the aggregate receipts by residents from residents, P_f is the aggregate payments by residents to foreigners, and P_r is the aggregate payments by residents to residents. It follows that a policy to improve the balance of payments must either reduce P, in which case it would be termed an expenditure-reducing policy, or increase R, in which case it would be termed an expenditure-switching policy. An expenditure-reducing policy includes such devices as monetary restriction, changes in fiscal policy by raising taxes or reducing government spending, and direct controls

over consumption. An expenditure-switching policy includes such expedients as devaluation, in order to switch both domestic and foreign expenditure towards home goods, and direct trade control.

[3]The austerity program laid out by Prime Minister Wilson contains the following elements. (a) A reduction in defense spending by more than $240 million in 1968. (b) Reduction in other public spending, including capital investments by nationalized industries, totaling $240 million. (c) Curbs on bank loans, except to such "priority borrowers" as exporters. (d) Withdrawal of certain tax rebates for manufactures, except in economically depressed areas, saving more than $240 million. (e) Raising the installment requirement on auto purchases to a one-third minimum down payment and the balance within 27 months. (f) A "strict watch" to prevent excessive dividend payouts by companies. (g) An increase in the bank rate to 8%. (Source: Newsweek, November 25, 1967, p. 37).

CHAPTER I

ELASTICITY APPROACH

The argument of the elasticity approach is expressed in terms of four elasticities: the foreign elasticity of demand for exports, the home elasticity of supply (which is influenced by the home elasticity of demand for exportable goods), the foreign elasticity of supply of imports, the home elasticity of demand for imports (which is influenced by the home elasticity of supply of rival commodities). These four elasticities determine the effect of devaluation on the balance of trade.

Foreign Demand for and Home Supply of Exports

Let the export side of the balance sheet be considered first.[1] A fall in the exchange rate leads to an increase in the quantity and value of exports in terms of home currency.[2] The size of the increase depends upon the elasticity of foreign demand. The increase in the value of exports will be smaller, the smaller the foreign elasticity of demand (given the home elasticity of supply). In the limit, if the foreign demand is perfectly inelastic there will be no increase in the volume of exports and consequently no increase in their value. The relationships are shown graphically in Figure 2-1, 2-2 and 2-3. D_x is a demand curve for exports of the devaluing country. S_x is a supply

---

[1]The following discussion leans heavily on the article of Joan Robinson, "The Foreign Exchange", Essays in the Theory of Employment, (London: Macmillan, 1937), pp. 134-47.

[2]The exchange rate is expressed in amount of foreign currency per 1 unit of domestic currency.

curve of exports of the devaluing country. Here the prices are designated in the domestic currency of the devaluing country.

FIGURE 2-1

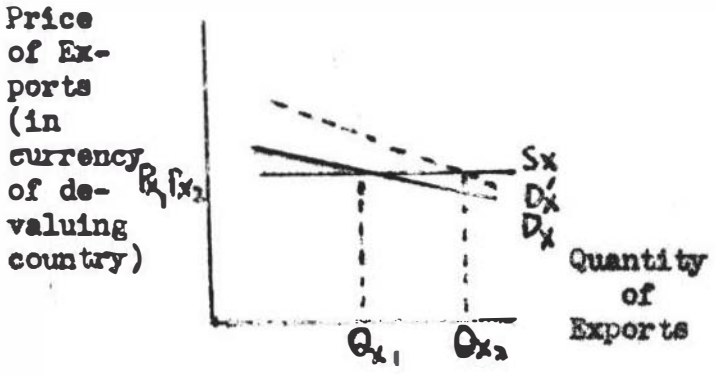
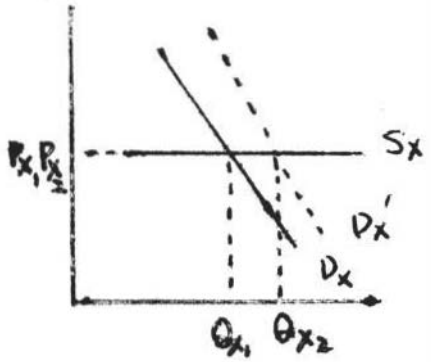


FIGURE 2-2



Exports of Devaluing Country

A fall in the exchange rate (devaluation) will be shown by dashed demand curves. Since prices in the diagram prices are denominated in the currency of the devaluing country, for any given quantity of exports demanded foreign consumers must pay more by the amount of devaluation percentage in terms of the devalued currency; the curve of foreign demand for exports of the devaluing country shifts upward by the devaluation percentage.[1] In Figure 2-1, the value of exports before a fall in the exchange rate and the value of exports after the fall in the exchange rate are $P_{x1} \cdot Q_{x1}$ and $P_{x2} \cdot Q_{x2}$, respectively. From the figures, it is apparent that the increase in the total value of exports will be smaller the smaller the foreign elasticity of demand for exports (with the home elasticity of supply infinite).

Next consider the influence of home elasticity of supply. If home supply is perfectly inelastic, the volume of exports does not alter, their foreign price is unchanged and the value of exports increases in proportion

---

[1] M. C. Clement, Richard L. Pfister and Kenneth J. Rothwell, Theoretical Issues in International Economics, (Boston: Houghton Mifflin Company, 1967), pp. 299-300.

to the fall in the exchange rate (Figure 2-4).

FIGURE 2-3

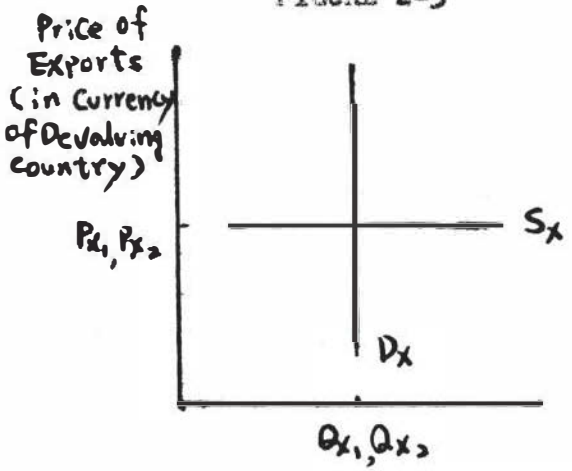
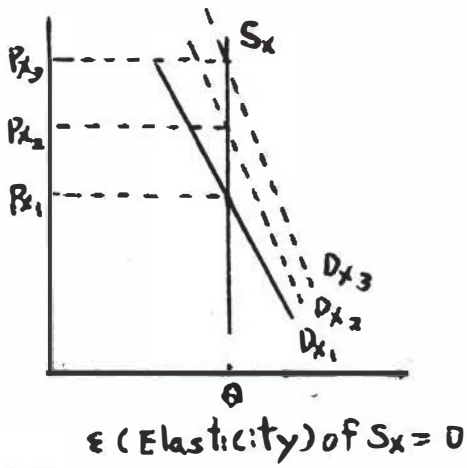


FIGURE 2-4



Exports of Devaluing Country

If home supply is perfectly elastic, the home price is constant and the price to foreigners falls in proportion to the fall in the exchange rate (Figure 2-5). If the elasticity of home supply lies between zero and infinity, the home price of exports is raised by an increase in their volume, and their price to the foreigner consequently falls less than in proportion to the fall in the exchange rate.

FIGURE 2-5

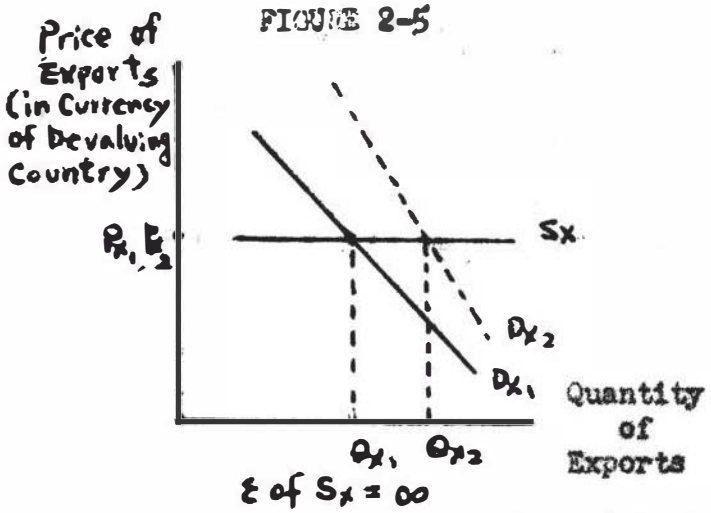
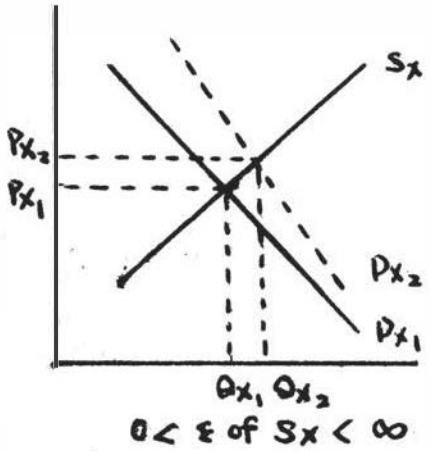


FIGURE 2-6



Exports of Devaluing Country

If the foreign elasticity of demand is equal to unity, so that expenditure is constant in terms of foreign currency, the value of exports is independent of the home elasticity of supply and increases in proportion to the

fall in the exchange rate (Figure 2-7).

If the foreign demand has less than unit elasticity, the increase in the value of exports will be greater the smaller is the increase in their physical volume, that is, the smaller is their elasticity of supply. Thus, when the foreign demand has less than unit elasticity, the maximum possible rise in the value of exports is that which is brought about when their elasticity of supply is zero (Figure 2-8). The value of exports then increases in proportion to the fall in the exchange rate. So long as the foreign demand has less that unit

FIGURE 2-7

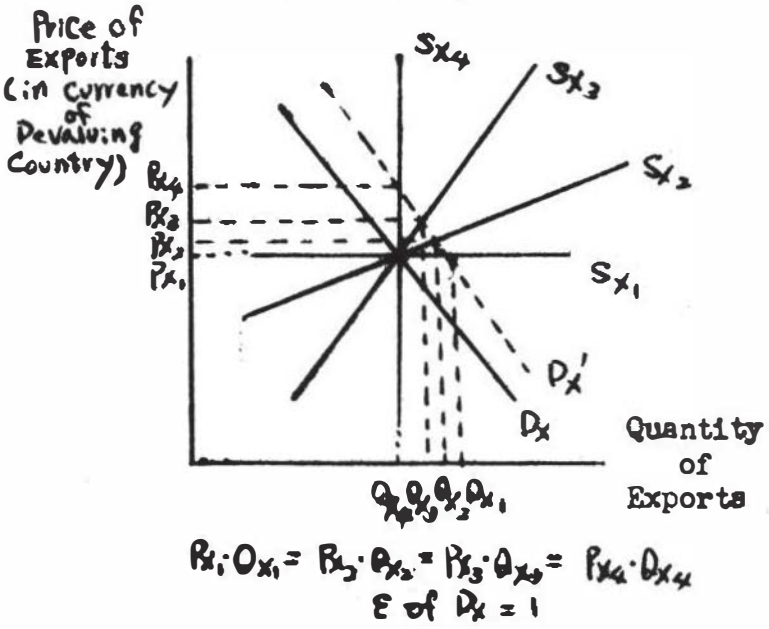
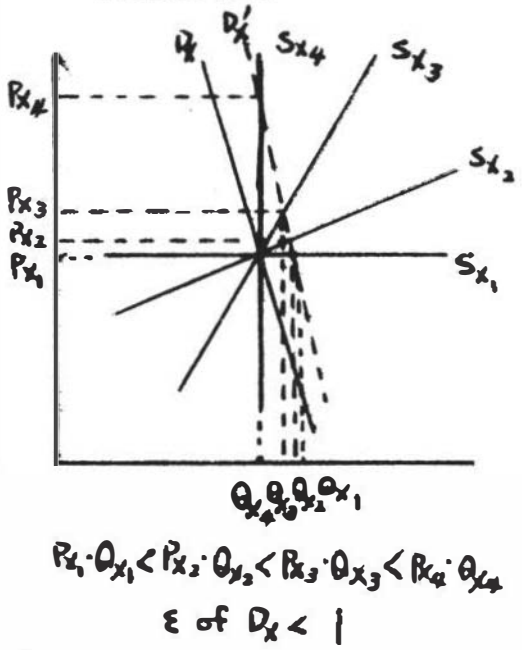


FIGURE 2-8



Exports of Devaluing Country

elasticity any increase in the physical volume of exports means that their value increases less than in proportion to the fall in the exchange rate.

On the other hand, when the foreign demand has an elasticity greater than unity, an increase in the volume of exports leads to an increase in the foreign expenditure upon them, and the value of exports increases more than in proportion to the fall in the exchange rate. The

increase in the value of exports is then greater the greater is the elasticity of home supply (Figure 2-9). In short, a high elasticity of home supply tends to reduce or to enhance increases in the value of exports induced by a fall in the exchange rate according to whether the foreign elasticity of demand is less or greater than unity, respectively.

The minimum effect of a fall in the exchange rate upon the value of exports occurs when the foreign demand has zero elasticity (Figure 2-3. There is then no increase in exports.

The maximum effect is produced when a perfectly elastic foreign demand is combined with a perfectly elastic home supply. The increase in the value of exports is then infinitely great (Figure 2-10). Since this condition can not be expressed graphically, D_x is drawn as a very elastic demand.

FIGURE 2-9

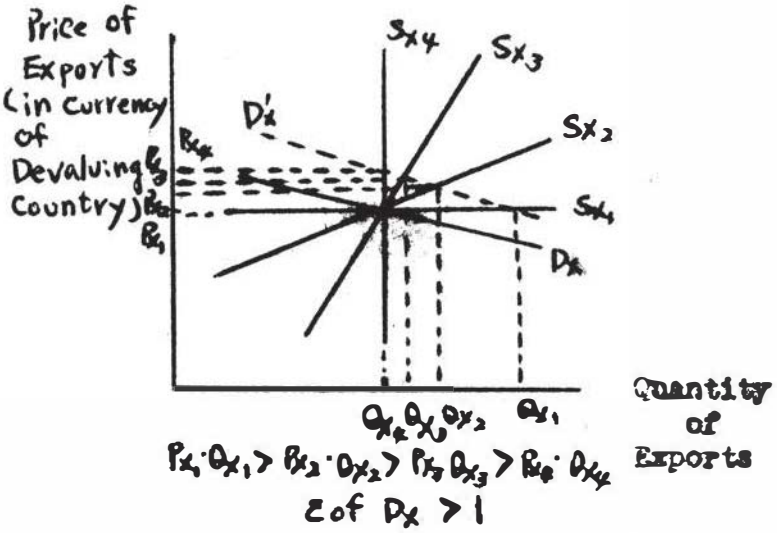
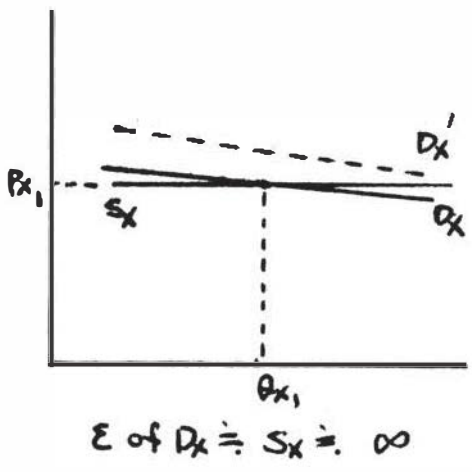


FIGURE 2-10



Exports of Devaluing Country

Home Demand for and Foreign Supply of Imports

The import side of the balance sheet will be considered. The value of imports in terms of home currency will increase or diminish depending on whether the elasticity of demand is less or greater than unity. Graphically, the effect of a fall in the exchange rate on the

import side can be shown by an upward shift of the supply curve. Since in the diagram the prices are denominated in the currency of the devaluing country, for any given quantity of imports supplied, the foreign producers are able to realise a higher price by the percentage of the fall in the exchange rate in terms of the devalued currency. The higher the fall in the exchange rate, the greater the upward shift of the supply curve of imports.[1]

If the foreign supply is perfectly elastic, so that the foreign price of imports is constant, then their home price will rise in proportion to the fall in the exchange rate (Figure 3-1); while if the foreign supply is less than perfectly elastic a curtailment of output

FIGURE 3-1

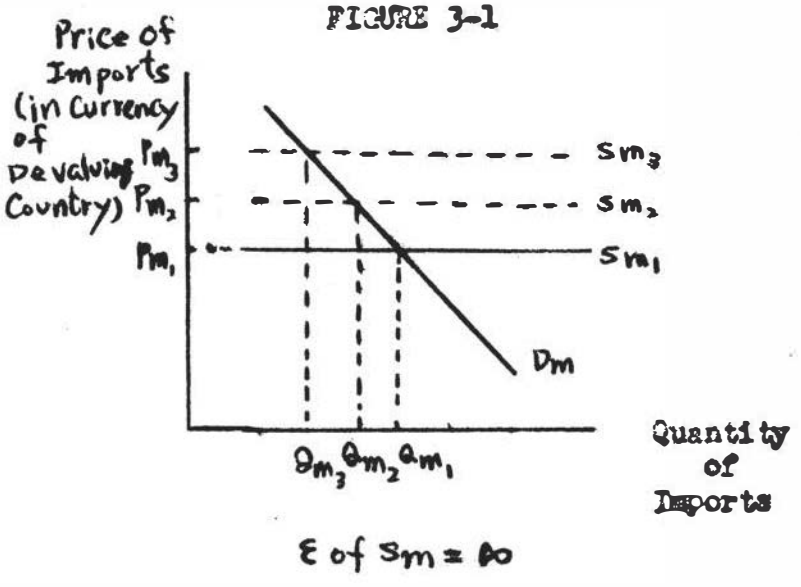
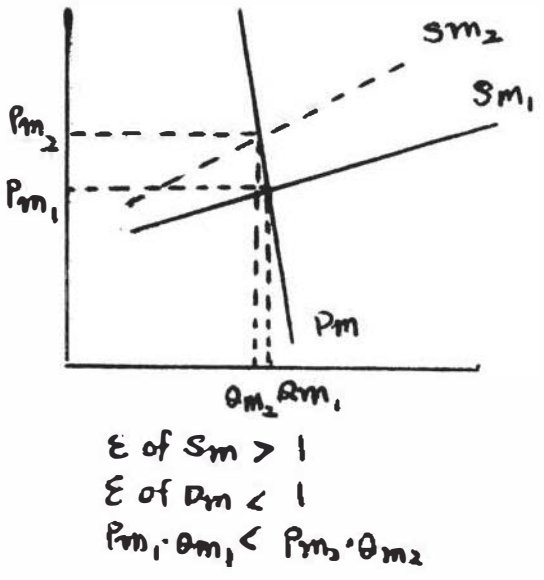


FIGURE 3-2



Imports of Devaluing Country

will cause a fall in the foreign price, so that the home price rises by less than the fall in the exchange rate. It can be seen, therefore, that in comparison to unit elasticity when the home demand has less than unit

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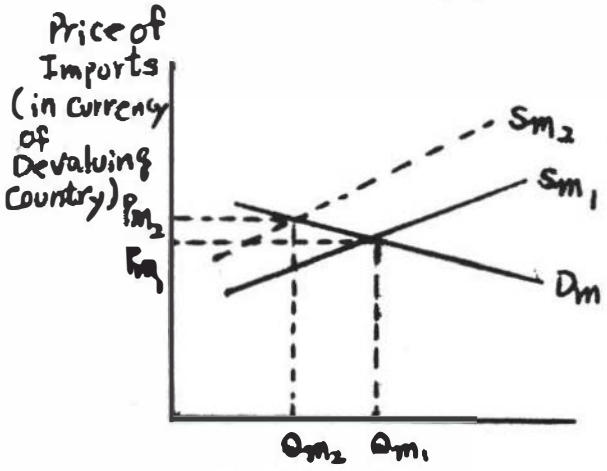
[1] M. C. Clement, pp. 299-300.

elasticity, the value of imports will rise by more (Figure 3-2), and when it has greater than unit elasticity, will fall by more (Figure 3-3), the greater is the foreign elasticity of supply.

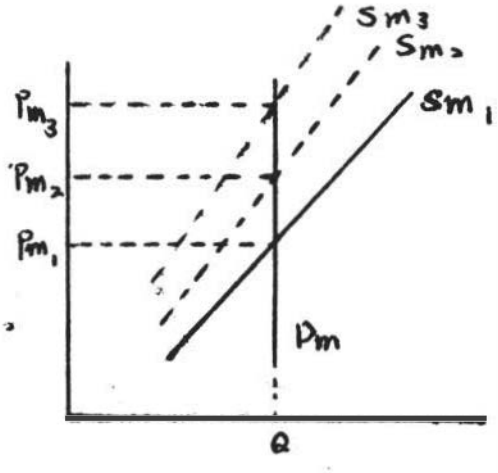
A fall in the exchange rate produces the maximum increase in the total value of imports when home demand is perfectly inelastic. In this case the physical volume of imports is constant, their foreign price is unchanged, and both their price and their value in home currency are increased in proportion to the fall in the exchange rate. (Figure 3-4).

FIGURE 3-3



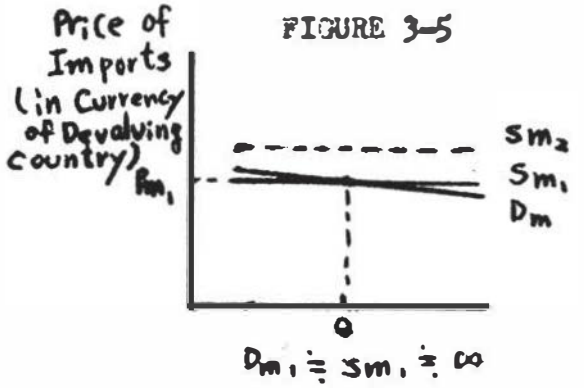
Imports of Devaluing Country

FIGURE 3-4



The maximum decrease is produced when a perfectly elastic home demand is combined with a perfectly elastic foreign supply. In this case imports are reduced to zero (Figure 3-5).

FIGURE 3-5



Imports of Devaluing Country

The Four Elasities and the Effect of Devaluation

The two sides of the balance sheet must now be combined. The relations between the various factors in the problem are complicated, but some simple generalizations can be made. So long as the home demand for imports has more than unit elasticity, a fall in the exchange rate must improve the balance of trade, for the value of imports falls, while the value of exports is, at worst, constant. If the home demand for imports has less than unit elasticity, the net effect on the balance of trade will still be positive if there is a sufficient increase in the value of exports. If the elasticity of foreign demand for exports is not sufficient to compensate for a low elasticity of home demand, then a fall in the exchange rate will actually aggravate the balance of trade.

Mathematical Expression

These relationships may be expressed mathematically.[1] Let I be the quantity of imports, E of exports, p the home price of imports, and q the home price of exports. Let ϵ_h and ϵ_f be respectively the elasticities of home demand for imports and of foreign demand for exports. Also, let η_h and η_f be the elasticities of home supply of exports and of foreign supply of imports, respectively. Consider the effect of a small fall in the rate of exchange in the proportion of k. Let the home price of exports rise by δq. Then the fall in the foreign price of exports is,

$$(1 - k)(q + \delta q) \quad kq - \delta q \quad (k \text{ being small})$$

By definition

$$\eta_h = \frac{\delta E}{E} \Big/ \frac{\delta q}{q} \qquad \epsilon_f = \frac{\frac{\delta E}{E}}{k - \frac{\delta q}{q}}$$

$$\eta_f = \frac{-\frac{\delta I}{I}}{k - \frac{\delta p}{p}} \qquad \epsilon_h = -\frac{\delta I}{I} \Big/ \frac{\delta p}{p}$$

The net effect on the balance of trade is

$(E\,\delta q + q \cdot \delta E) - (I \cdot \delta p + p \cdot \delta I)$, which can be expressed as

---

[1] Joan Robinson, p. 142.

(1)[1] $\quad \Delta B = K \left\{ E_g \frac{\epsilon_f (1+\eta_h)}{\epsilon_f + \eta_h} - I_p \frac{\eta_f (1-\epsilon_h)}{\eta_f + \epsilon_h} \right\}$

(Since the $\delta E \cdot \delta q - \delta I \cdot \delta P$ is very small, they are neglected.)

Critical Value Theorem

As a special case of this formula, if the elasticity of supply of the home country (η_h) and the elasticity of supply of the foreign countries (η_f) are infinitely elastic and if the initial trade balance is in equilibrium ($I_p = E_g$), the so called Marshall-Lerner condition results. That is, since

$$\Delta B = K \left\{ E_g \frac{\epsilon_f (1+\eta_h)}{\epsilon_f + \eta_h} - I_p \frac{\eta_f (1-\epsilon_h)}{\eta_f + \epsilon_h} \right\}$$

then, $$\Delta B = K \left\{ E_g \frac{\epsilon_f \left(\frac{1}{\eta_h} + 1\right)}{\frac{\epsilon_f}{\eta_h} + 1} - I_p \frac{(1-\epsilon_h)}{\frac{\epsilon_h}{\eta_f}} \right\}$$

However, since $\eta_h, \eta_f = \infty$

$$\Delta B = K (E_g \cdot \epsilon_f + I_p \cdot \epsilon_h - I_p)$$

Moreover, since, $E_g = I_p$

then, $$\Delta B = K E_g (\epsilon_f + \epsilon_h - 1).$$

Abba P. Lerner expresses this condition in the following manner in his book of the Economics of Control.[2]

> If the elasticity of demand for exports is less than unity, say one third, the quantity purchased will increase only one third as much as the price falls and then the total value of the exports will fall. Suppose the price of exports falls 3 per cent. This will result in an increase in exports of 1 per cent so that total value of exports will fall about 2 per cent. Now suppose the elasticity of demand for imports to be

---

[1] See Appendix 1.

[2] A. P. Lerner, The Economics of Control. (New York: The Macmillan Company, 1959), pp. 378-79.

> two thirds (so that the sum of the two elasticities is equal to one). Then the decrease in income and in domestic prices of 3 per cent is equivalent to a 3 per cent increase in the price of imports (for that is their relative increase) and will lead to a decrease in the amount bought, and in their value of 2 per cent (two thirds of the change in their relative prices because the elasticity of demand for imports is two thirds). The value of imports and exports move together and the imports balance is unchanged. If the sum of the two elasticities is less than unity, there will be a preverse movement of the import balance. If the sum of the two elasticities is greater than unity the devaluation will always improve the trade balance.

Since the numerical sum of Britain's two demand elasticities is 1.1 (which will be shown soon), Britain's devaluation in 1967 should have improved her trade balance according to this theorem. Lerner's assumption of infinite elasticity of supply of exports and imports may be justified when there exists many idle resources in the exporting country and where constant cost conditions prevail.[1] However, the Lerner condition is only applicable to goods whose production is continuous, such as manufactures. The imports of the United Kingdom contain a large amount of agricultural goods with inelastic supply curves due to the difficulty of expansion of production and increasing cost. Hence, the more general case of Robinson's formula must be discussed.

---

[1] Paul T. Ellsworth, The International Economy, (London: Macmillan, 1969), pp. 355-56.

CHAPTER II

APPLICATION OF ROBINSON'S FORMULA TO THE ACTUAL DEVALUATION OF THE UNITED KINGDOM

Robinson's formula is repeated for convenience.

$$\Delta B = k\left\{ E_q \frac{\epsilon_f(1+\eta_h)}{\epsilon_f+\eta_h} - I_p \frac{\eta_f(1-\epsilon_h)}{\eta_f+\epsilon_h} \right\}$$

Although there are seven variables in this formula, three of them (k, Eq, Ip) are easily found.

k (ratio of devaluation per one pound) ... 0.143[1]

Eq (value of exports before devaluation) ... £5,214 millions[2]

Ip (value of imports before devaluation) ... £6,434 millions[3]

Although the devaluation was in November of 1967, the figures include values for December, 1967. Trade in December should not be included in the value of exports and value of imports before devaluation, but its inclusion will not affect the result.

Several statistical studies have been made by Tse Chun Chang on elasticity of demand for imports (ϵ_h) and elasticity of demand for exports (ϵ_f). He estimated the elasticity of demand for exports of the United Kingdom to be -0.40.[4]

---

[1] Economist, (November 25, 1967) p. 827.

[2] International Financial Statistics, (September 1970), p. 70.

[3] Ibid, p. 324.

[4] T. C. Chang, "A Statistical Note on World Demand for Exports", Review of Economics & Statistics, (May 1948), pp. 106-7.

The period covered in his calculation is from 1924 to 1938. He also estimated the elasticity of demand for imports of the United Kingdom as -0.28 in another work "International Comparison of Demand for Imports."[1] Since more than 20 years have passed, the figure must be revised to correspond to the present trade structure of the United Kingdom.

A comparison of patterns of imports and exports of the United Kingdom in 1930 and 1968 is shown in Tables 1 and 2.

TABLE 1

THE PATTERN OF IMPORTS INTO THE UNITED KINGDOM

Year	Food, Drink and Tobacco	Raw material and Semi-manufactured	Manufactures and Miscellaneous
1930	45.5	-%- 25.1	29.4
1968	23.0	29.9	47.1

Note: Table 1 is calculated from Table 9 and 10 of British Economic Growth, by Phyllis Dean, (Cambridge: Cambridge University Press), pp. 31-33 and Board of Trade Journal (May 1970), p. 1235.

TABLE 2

THE PATTERN OF EXPORTS OF THE UNITED KINGDOM

Year	Food, Drink and Tobacco	Raw material and Semi-manufactured	Manufactures and Miscellaneous
1930	2	-%- 30.4	67.6
1968	6	5	89

Note: Table 2 is calculated from the same table 9 and 10 as those used in Table 1.

---

[1] T. C. Chang, "International Comparison of Demand for Imports", Review of Economic Studies, (June 1946), pp. 64-65.

Chang estimated the elasticity of demand for imports separately according to commodity groups, as shown in Table 3.

TABLE 3

ELASTICITY OF DEMAND FOR IMPORTS

Total Imports	-0.28
Food Stuff (Manufactured / Crude	-0.31
Crude Material	-0.24
Semi-manufactures Finished-manufactures	-1.12

Source: T. C. Chang "International Comparison of Demand for Imports", Review of Economic Studies, (June 1946), pp. 64-65

Table 1 shows that the relative amount of food and drink, with elasticity of demand as shown in Table 3, has declined to 23 per cent in 1968 from 45.5 per cent in 1930. On the other hand manufactured goods with elasticity of demand of -1.12 have moved from 29.4 per cent to 47.1 per cent of imported value. This appears to imply that the United Kingdom's elasticity of demand for imports should have increased from the -0.28 which T. C. Chang estimated during the 1930's to something more elastic. The elasticity of demand for exports is assumed to be unchanged, because the exports of the United Kingdom in 1968 have the same pattern as that in 1930: manufactured goods are dominant and primary goods are scarce. Hence it will be assumed that ϵ_f and ϵ_p are -0.40 and -0.70, respectively.

Although there is no statistical research on the elasticity of supply of exports and imports of the United Kingdom, J. M. Fleming gives

generalizations of elasticities of supply and demand according to the size and the degree of industrialization.[1] According to Fleming, industrial countries tend to have a more elastic export supply than do primary producing countries of the same size.

On the other hand, industrial countries tend to encounter a less elastic world supply of imports than do primary producing countries, because both the supply and the demand for primary products abroad tend to be less elastic than for industrial goods. According to Fleming's first generalization above and the fact that 89 per cent of the United Kingdom's exports is manufactured goods, it is apparent that England should have an elastic supply of exports.

Although the relative amount of imports of food stuffs and beverages decreased over the past 20 years, the sum of food and raw material imports of the United Kingdom still exceeds 50 per cent of her imports. This fact and the second generalization of Fleming imply that the United Kingdom has an inelastic supply of imports.[2] It will be assumed that η_e (elasticity of supply of exports) is 2 and η_f (elasticity of supply of imports) is 0.7. Since the range of elastic supply of exports and inelastic supply of imports is wide, several cases are examined for η_e and η_f.

Such elastic values as 1.5 and 3 were substituted for η_e in the formula. And also such inelastic values as 0.4 and 0.9 were put into the formula for η_f. All these results yield substantially the same results as the combination of 2 and 0.7. This indicates that Robinson's

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[1] J. M. Fleming, "Exchange Depreciation, Financial Policy and the Domestic Price Level", I.M.F. Staff Papers (April 1958), p. 300.

[2] Ibid., p. 300.

formula is not very sensitive to changes in η_h and η_f. Therefore, the combination above is chosen for η_h and η_f of the United Kingdom. Now it is possible to calculate the change in trade balance of the United Kingdom after devaluation. Recapitulating,

k	... 0.143	ϵ_f	... -0.4	η_f	... 0.7
Eq	... £ 5,214 Million	ϵ_h	... -0.7	η_h	... 2
Ip	... £ 6,434 Million				

Using the quantities above, Robinson's formula gives

$$\Delta B = 0.143 \left\{ 5,214 \times \frac{0.4(1+2)}{0.4+2} - 6,434 \frac{0.7(1-0.7)}{0.7+0.7} \right\} = £\ 235 \text{ million}$$

Therefore, according to the elasticity approach, the trade balance of the United Kingdom should have improved by £235 millions. This approach does not indicate the time period in which the adjustment of exports and imports works out. However, it has been held in this approach that the most significant responses to price changes would become effective in the course of several months.[1] So the time period for the complete effect of the British devaluation should not be more than a few years after the devaluation.

Robinson's formula does not take income effects into account, however, To consider the results of income effects, as well as price effects, Alexander's approach will be considered in the following section.

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[1] Fritz Machlup, "Elasticity Pessimism", International Payments, Debts, and Gold, (New York: Charles Scribner's Sons, 1964), p. 66.

CHAPTER III

ALEXANDER'S APPROACH

Before describing completely Alexander's approach three revisions which he made in the elasticity approach should be noted.[1] He agrees that the initial effect of devaluation depends on the four elasticities which underlie Robinson's approach. Hence, Alexander incorporates Robinson's formula (ΔB) discussed above into his own as E_A.

He insists that this initial effect must be corrected (positively or negatively) for (1) reversal factors due to income changes after devaluation; (2) the direct effects of price changes on absorption; and (3) the scale-up or scale-down effect coming from trade imbalance before devaluation.[2] These will be discussed in turn.

The Reversal Factors

In the discussion of the elasticity approach, it was assumed that money incomes were held constant in both country 1 (Home country) and county 2 (the rest of the world) while the prices and quantities of exports and imports were permitted to vary as a result of a change in the exchange rate.

However, if income is allowed to vary, it generally reduces the effects of the devaluation, because any rise in real income of country

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[1] The entire discussion here is dependant upon S. S. Alexander's: "Effects of a Devaluation, A Simplified Synthesis of Elasticities and Absorption Approaches," American Economic Review, (March, 1959).

[2] A country's net foreign trade balance is equal to the difference between the total goods and services produced in that country and the total goods and services taken off the market domestically. The amount taken off the market domestically if referred to as absorption. (S. S. Alexander, "Effects of a Devaluation on a Trade Balance", I.M.F. Staff Papers, April 1952, pp. 263-78.)

1 as a result of the devaluation's stimulating effect on domestic production is likely to lead to increased demand for imports which will tend to reduce the initial effect of devaluation. Similarly, rises in prices of domestic products in country 1 as a result of increased expenditure out of increased money incomes will tend to cut down the price differentials initially set up by the devaluation and thus reverse, in part, the initial effects of the devaluation.[1] Corresponding results in the opposite direction in country 2 will also tend to reverse in part the initial effects of devaluation.[2] Accordingly, a pair of initial reversal factors, R_1 for country 1, and R_2 for country 2, are defined such that $(R_1 - 1)$ and $(R_2 - 1)$ measure the ratio of the reversal, through the income reactions in the corresponding country of the initial change in the foreign balance. That is, if there is an initial improvement of E_f in the foreign balance of country 1 as a result of the devaluation, income reactions in country 1 will tend to reduce that improvement by $E_f(R_1-1)$ to R_1E. In general R_1 and R_2 will each be less than unity. When these two coefficients both operate, they set up a series of adjustments and readjustments to the initial effects. The general formulas for the result of this type of sequence of adjustments and readjustments are the following, as shown in Appendix 6, provided the predevaluation balance is zero (this assumption will be dropped later) and $-1 < (R_1 - 1)(R_2 - 1) < 1$

$$(2)^3 \qquad (a)\quad dB_f = \frac{R_1 R_2 E_f}{1 - (R_1 - 1)(R_2 - 1)}$$

$$(b)\quad dB_R = \frac{R_1 R_2 E_f}{1 - (R_1 - 1)(R_2 - 1)}$$

Alexander expresses this formula in another way adopting multiplier

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[1] Ibid., p. 26.

[2] See Appendix 2.

[3] Ibid., p. 27.

analysis. Suppose that in country 1 increased money income of one dollar per income period induces, within that income period, hoarding in the amount of h_1. It will also increase demand for imports thereby deteriorating the foreign balance by f_1. By the familiar multiplier analysis, total money income in the country will ultimately have increased by

$$1 / (h_1 + f_1).$$

Moreover, aggregate induced hoarding per dollar of original increment in expenditure H_1 is $H_1 = \frac{h_1}{h_1 + f_1}$.

The aggregate induced deterioration of the foreign balance F_1 will be

$$F_1 = \frac{f_1}{h_1 + f_1}.$$

And $H_1 + F_1 = 1$. Since initial increase in expenditure equals total induced leakages. When there is an increase in foreign balance by E_h, the increase in income would be

$$\frac{E_h}{h_1 + f_1}.$$

An increase of income of this amount will include a deterioration of the foreign balance by:

$$f_1\left(\frac{E_h}{h_1 + f_1}\right) = F_1 E_h.$$

Therefore, the foreign balance after the first reaction of country 1 is

$$E_h - F_1 E_h = E_h(1 - F_1) = H_1 E_h.$$

But by definition of R_1 this quantity equals $R_1 E_h$. Therefore, $R_1 = H_1$, and $1 - R_1 = F_1$. Similarly, $R_2 = H_2$.

Substituting $R_1 = H_1$ and $1 - R_1 = F_1$ in (2) gives.

$$(3) \quad (a)\ dB_f = \frac{H_1 H_2 E_f}{1 - F_1 F_2} \qquad (b)\ dB_h = \frac{H_1 H_2 E_h}{1 - F_1 F_2}$$

Alexander simplifies this formula further.

Let $v_1 = \frac{f_1}{h_1}$ $v_2 = \frac{f_2}{h_2}$. Then $H_1 = \frac{1}{v_1 + 1}$ and, $F_1 = \frac{v_1}{v_1 + 1}$

and similarly for H_2 and F_2. Substituting these values in (3).

$$(4)^1 \quad (a)\ dB_f = \frac{E_f}{1 + v_1 + v_2} \qquad (b)\ dB_h = \frac{E_h}{1 + v_1 + v_2}$$

Therefore, the reversal factors depend only on the rarios of f_1 to h_1 and f_2 to h_2.

$f > h$, Initial effect (E_h) will be reduced more.

$f = h$, Initial effect will become 1/3 E_h.

$f < h$, Initial effect will be reduced relatively less or unchanged.

In summary, first, the initial effect of devaluation depends on the four elasticities. Second, the degree that the initial effect "sticks" depends on the relative strength in each of the two countries of the impact of additional money income on money hoarding on the one hand, and on imports and exports on the other (the ration of f to h).

The Case of Predevaluation Imbalance

Formula (4) assumes the predevaluation trade balance is equal to zero. Alexander drops this simple assumption at this point however. If the predevaluation trade balance is not equal to zero, the change in the balance measured in one currency will not be equal to the change in the balance measured in the other currency converted by the postdevaluation rate of exchange.[2] But the foreign balance itself in one currency always equals that in the other currency converted at the going rate of exchange. Thus,

$$(5) \quad (a)\ B_{f_o} = r B_{h_o} \qquad (b)\ B_{f_a} = r_a B_{h_a}$$

Where B_{f_o} and B_{f_a} are the balance in foreign currency before and after

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[1] Ibid., p. 30.

[2] Ibid., p. 34.

devaluation respectively; B_{fo} and B_{fa} are the corresponding balances in domestic currency; and r and $r_a = r(1-k)$ are the pre- and postdevaluation rates of exchange, respectively. Subtracting (5a) from (5b) $\Delta B_f = r_a \Delta B_f - rk B_{fo}$, where $\Delta B_f = B_{fa} - B_{fo}$ and $\Delta B_f = B_{fa} - B_{fo}$.

Since $r > r_a + kr$, B_f may be expressed in terms of r_a, ΔB_f, k and B_{fo}; and ΔB_f in terms of r_a, ΔB_f, k and B_{fo}:

$$(6)^1 \quad (a) \quad \Delta B_f = r_a \Delta B_f - rk B_{fo} = r_a \Delta B_f - k B_{fo}$$

$$(b) \quad \Delta B_f = \frac{\Delta B_f}{r_a} + \frac{k}{1-k} B_{fo}$$

Thus, the change in the balance in one currency will not equal the change in the balance in the other currency multiplied by the post-devaluation rate of exchange, but will differ by a factor which is essentially the devaluation proportion multiplied by the initial balance in the appropriate currency. That is, k is the devaluation proportion when the rate of exchange is expressed in number of units of foreign currency for one unit of domestic currency while k/1-k is the devaluation proportion when the rate of exchange is expressed the other way around. Alexander refers to $\frac{k}{1-k} B_{fo}$ as the scale-up effect and $-k B_{fo}$ as the scale down effect. Let us denote the scale-down and scale-up effects as D_f and D_f, respectively. Then

$$D_f = -k B_{fo} \quad \text{and} \quad D_f = \frac{k}{1-k} B_{fo},$$

so that $D_f = -\frac{D_f}{r_a}$. If the predevaluation balance was a deficit (B_{fo} and $B_{fo} < 0$), then D_f will be positive and D_f will be negative. It is shown in appendix 2 after the full sequence of adjustments and readjustments, that the final change in the trade balance, starting from an initial imbalance, will be:

$$(7) \quad (a) \quad dB_f = \frac{E_f + U_1 D_f}{1 + U_1 + U_2}$$

$$(b) \quad dB_f = \frac{E_f + U_2 D_f}{1 + U_1 + U_2}$$

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[1] Ibid., p. 35.

The Direct Effect on Absorption

Alexander now suspends the assumption that the entire amount of the initial improvement in the foreign balance in domestic currency, E_h, is thrown on the domestic market as net additional expenditure in country 1. He assumes instead that there is some direct effect, positive or negative, of the relative price changes initially brought by the devaluation on the money amount of absorption forthcoming at a given money income. This direct effect of the devaluation on absorption out of a given money income in country 1 may be denoted by d_1. Thus, the total initial effect on expenditure in country 1 is $Eh-d_1$. This will lead to a net change of d_1/r_1+f_1 in aggregate money income in country 1 from that previously considered, and a further change of F_1d_1 in the foreign balance at a given rate of exchange measured in domestic currency. This further change will, however, be scaled down by country 2 to $H_2F_1d_1$ and then adjusted back and forth in the now familiar process to $H_2F_1d_1/1-F_1F_2$, or in terms of the $v's$, to

$$\frac{v_1 d_1}{1+v_1+v_2}$$

in domestic currency. The net change in the foreign balance in foreign currency associated with d_1 is, therefore,

$$\frac{v_1 d_1 r_a}{1+v_1+v_2}.$$

Similarly, if in country 2 there is a direct effect, d_2, of the devaluation on absorption out of a given income, the resulting change in the foreign balance in foreign currency will be

$$\frac{H_1 F_2 d_2}{1-F_1F_2} \quad \text{or} \quad \frac{v_2 d_2}{1+v_1+v_2}$$

In domestic currency of country 1 the corresponding amount is

$$\frac{v_2 d_2 / r_a}{1+v_1+v_2}$$

There the final generalized expressions for the effects of a devaluation on the trade balance are:

(8)[1] (a) $$dB_f = \frac{E_f + \eta_2 d_2 + \eta_1(D_f + d_1/\eta_2)}{1 + \eta_1 + \eta_2}$$

(b) $$dB_e = \frac{E_e + \eta_1 d_1 + \eta_2(D_e + d_2/\eta_1)}{1 + \eta_1 + \eta_2}$$

[1] Ibid., p. 37.

CHAPTER IV

THE APPLICATION OF ALEXANDER'S FORMULA

Since this paper is concerned with the effect of the devaluation of the British pound, formula (8b) from Chapter V will be employed to determine the change of trade balance in domestic currency.

(8b) $$dB_h = \frac{E_h + v_1 d_1 + v_2 (D_h + d_2/r_a)}{1 + v_1 + v_2}$$

$$= \frac{E_h + \frac{f_1}{h_1} d_1 + \frac{f_2}{h_2} \left(\frac{k}{1-k} B_{hc} + d_2/r_a \right)}{1 + \frac{f_1}{h_1} + \frac{f_2}{h_2}}$$

The Initial Effect

The initial effect of devaluation in Alexander's formula is the result of Robinson's formula. That is,

$$E_h = £ 235 \text{ millions.}^1$$

The Marginal Propensity to Import of Country 1 (f_1)

The f_1 and f_2 include not only the income-induced increased demand for imports but also for export substitutes which deteriorate the foreign balance. So, f_1 is not exactly equal to the marginal propensity to import. Nevertheless, the difference is so small that the marginal propensity to import is used.

As will be recalled, f_1 is defined as

$$f_1 = \frac{\Delta M}{\Delta Y} .$$

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[1] See p. 18.

TABLE 4

G.N.P. and Imports of Ten Countries.

(Money Amounts in Millions U. S. Dollar.)

Country	Year	G.N.P.	Δ G.N.P.	Import	Δ Import
U.K.	1964	93,268		15,949	
	1965	100,100	6,832	16,103	154
	1966	106,512	6,412	16,651	548
	1967	112,028	5,516	17,694	1,043
U.S.	1964	632,400		20,286	
	1965	684,900	52,500	23,186	2,900
	1966	747,600	62,700	27,745	4,559
	1967	793,900	46,300	28,745	1,000
Germany	1964	103,425		14,618	
	1965	113,175	9,750	17,482	2,864
	1966	120,200	7,025	18,036	554
	1967	121,275	1,075	17,365	- 671
Canada	1964	45,798		7,554	
	1965	50,508	4,710	8,713	1,159
	1966	56,506	5,998	10,170	1,457
	1967	60,361	3,855	10,966	796
Netherland	1964	17,261		7,055	
	1965	19,269	2,008	7,460	405
	1966	20,948	1,679	8,016	556
	1967	23,048	2,100	8,336	320
South Africa	1964	5,123		2,356	
	1965	5,602	479	2,699	343
	1966	6,095	493	2,526	- 173
	1967	6,755	660	2,948	422
France	1964	87,040		10,070	
	1965	92,940	5,900	10,343	273
	1966	100,100	7,160	11,843	1,500
	1967	114,421	14,321	12,381	538
Australia	1964	15,948		3,313	
	1965	17,595	1,647	3,765	452
	1966	18,468	873	3,636	- 129
	1967	20,196	1,728	3,913	277
Belgium	1964	15,642		5,930	
	1965	16,984	1,342	6,502	572
	1966	18,284	1,300	7,182	680
	1967	19,500	1,216	7,176	- 6
Italy	1964	55,127		7,252	
	1965	59,384	4,257	7,378	126
	1966	64,240	4,856	8,589	1,211
	1967	70,246	6,006	9,827	1,238

Source: G.N.P. International Financial Statistics (September 1970) p. 46, 54, 70, 138, 140, 184, 230, 280, 324 and 330.
Imports: Ibid. p. 35.

As shown in Table 4, the change in G.N.P. and imports of the United Kingdom are such that the marginal propensities to import in the three year period from 1964 to 1967 were as follows.

$$\frac{\Delta M}{\Delta Y} = \frac{154}{6,832} = 0.023 \ (1964\text{-}65) \quad \frac{548}{6,412} = 0.086 \ (1965\text{-}66) \quad \frac{1,043}{5,516} = 0.189 \ (1966\text{-}67)$$

Since, as may be seen, there are considerable fluctuations in magnitude, an average of the marginal propensities will be taken. The same general method will be used in calculations of all the marginal propensities after this point.

$$f_1 = \frac{154 + 548 + 1,043}{6,832 + 6,412 + 5,516} = 0.093$$

The Marginal Propensity to Import of Country 2 (The Rest of The World) (f2)

The data in Table 5 shows the nine largest trading partners of the United Kingdom in terms of exports plus imports. In total these countries account for 45.8 per cent of trade. It will be assumed that these nine countries are the "rest of the world".

Hence the statistic needed to compute the marginal propensities in Alexander's formula which is spent on imports resulting from a one unit increase in world income would be the change in imports divided by the change in G.N.P. of the world.

TABLE 5

NINE MAJOR TRADE PARTNERS OF THE U.K.[a]
(Money Amounts in Millions of U. S. Dollars)

Trade with	Export	Import	Total	%
U.S.A.	1,592	1,982	3,574	12.9
Germany	711	797	1,508	5.4
Canada	566	937	1,503	5.4
Netherland	509	746	1,255	4.5
South Africa	514	621	1,135	4.1
France	562	568	1,130	4.1
Australia	570	426	996	3.6
Belgium	513	326	839	3.0
Italy	366	419	785	2.8
Other	6,887	8,059	14,946	54.2
Total	12,790	14,881	27,671	100

Source: Direction of Trade, (February 1970). pp. 54-58.
[a]Exports and Imports are the total amount traded from January 1969 to September 1969.

The information in Table 4 showed the change in imports and the change in G.N.P. for the nine countries over a three year period. Let f_2' denote the change in imports divided by the change in G.N.P. of the rest of the world. Combining the three year averages for each of the nine countries gives,

$$f_2' = \frac{(2,900+4,559+1,000)+(2,864+554-671)+(1,159+1,457+796)}{(52,500+62,700+46,300)+(9,750+7,025+1,075)+(4,710+5,998+3,855)}$$

$$- - \frac{(405+556+320)+(343-173+422)+(273+1,500+598)}{(2,008+1,679+2,100)+(479+493+660)+(5,900+7,160+14,221)}$$

$$- - \frac{(452-129+277)+(572+680-6)+(126+1,211+1,238)}{(1,647+873+1,728)+(1,342+1,300+1,215)+(4,257+4,856+6,006)} = 0.092$$

TABLE 6

WORLD TOTAL EXPORT AND U.K.'S EXPORT
(in Millions of U.S. Dollars)

Year	1964	1965	1966
World Total Export	152,700	165,400	181,300
U.K.'s Export	12,785	13,722	14,676

Source: International Financial Statistics, (September 1970), p. 34

From Table 6 the U.K.'s share of world exports during the 1964 - 1966 period was:

$$\frac{12,785 + 13,722 + 14,676}{152,700 + 165,400 + 181,300} = 0.082 \text{ or } 8.2\%.$$

Thus, the United Kingdom should receive 8.2 per cent of the 0.092 increase in imports of the rest of the world resulting from a one unit increase in income. Consequently, the marginal propensity to import of the rest of the world will be:

$$f_2 = 0.092 \times 0.082 = 0.0075$$

The Marginal Propensity to Hoard (h)

Although Alexander does not define clearly the marginal propensity to hoard in the article of 1959; in his 1952 article the marginal propensity to hoard is defined as 1-c where c is the propensity to absorb. c is determined by combining the marginal propensity to consume and the marginal

propensity to invest.[1] Therefore, the marginal propensity to hoard is synonymous with the marginal propensity to save. Since there are no figures for saving readily available, the following national income identities will be used to derive total saving. From the definition of the national income accounting,[2]

$$G.N.P \equiv C + G + (X - M) + I_r + D \text{ - - - - - (1)}$$

$$G.N.P \equiv C + S_p + G + T_f + S_g + S_b + D \text{ - - - (2)}$$

Equating (1) and (2) we have

$$(X - M) + I_r + D \equiv S_p + S_g + T_f + S_b + D$$

$$\therefore S_p + S_g + S_b \equiv (X - M) + I_r - T_f \text{ - - - (3)}$$

Where

C . . . Consumption

G . . . Government spending

X . . . Export

M . . . Import

I_r . . . Net Domestic Investment

T_f . . . Transfers to Foreigners

S_p . . . Personal Saving

S_g . . . Government Saving

S_b . . . Business Saving

Thus using equation (3) the total saving of a country can be calculated from the figures of trade balance, net domestic investment and transfers to foreigners. The results are shown in Table 7. From Table 7 and Table 4, h_1 and h_2 can be calculated. Since

$$h = \frac{\Delta S}{\Delta Y},$$

the marginal propensity to save of the United Kingdom (h_1) is

$$h_1 = \frac{1,983 + 1,553 + 193}{6,832 + 6,412 + 5,576} = 0.199 \text{ and}$$

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[1] S. S. Alexander, "Effects of a Devaluation on a Trade Balance", I.M.F. Staff Paper, (April 1952), pp. 266-67.

[2] For the entire process of derivation of this identity see T. F. Dernburg and D.M. McDougall, Macroeconomics, (New York: McGraw-Hill, 1968), pp. 69-72.

the marginal propensity to save of the rest of the world (h_2) is

$$h_2 = \frac{(8,000 + 6,973 + 2,342) + (1,047 + 2,404 - 615)}{(52,500 + 62,700 + 46,300) + (9,750 + 7,025 + 1,075)} - - -$$

$$- - - \frac{(1,393 + 2,068 + 441) + (672 + 473 + 675) + (82 + 329 - 18)}{(4,710 + 5,998 + 3,855) + (2,008 + 1,679 + 2,100) + (479 + 493 + 660)}$$

$$- - - \frac{(2,104 + 1,234 + 6,853) + (217 + 738 + 205) + (454 + 80 + 524)}{(5,900 + 7,160 + 14,321) + (1,647 + 873 + 1,728) + (1,342 + 1,300 + 1,216)}$$

$$- - - \frac{(516 + 320 + 1,156)}{(4,257 + 4,856 + 6,006)} = 0.161.$$

TABLE 7

Savings of ten countries

Country	Year	S	ΔS	Country	S	ΔS
U.K.	1964	14,407		South Africa	803	
	1965	16,390	1,983		885	82
	1966	17,943	1,553		1,214	329
	1967	18,136	193		1,196	- 18
U.S.	1964	93,143		France	18,441	
	1965	101,143	8,000		20,545	2,104
	1966	108,116	6,973		21,779	1,234
	1967	110,458	2,342		28,632	6,853
Germany	1964	27,321		Australia	4,044	
	1965	28,368	1,047		4,261	217
	1966	30,772	2,404		4,999	738
	1967	30,157	- 615		5,204	205
Canada	1964	10,821		Belgium	3,334	
	1965	12,214	1,393		3,788	454
	1966	14,282	2,068		3,868	80
	1967	14,723	441		4,392	524
Netherland	1964	3,518		Italy	11,593	
	1965	4,190	672		12,109	516
	1966	4,663	473		12,429	320
	1967	5,338	675		13,585	1,156

Source: International Financial Statistics (I.M.F. September 1970) pp. 46, 54, 70, 138, 140, 184, 230, 280, 324 and 330. (Except France)

France: International Financial Statistics (I.M.F. May 1968) p. 140.

These exchange rates are used here: $1 = 3.977 Deutsche Mark, (as of October 1967)
1.0838 Canadian dollar. 3.614 Dutch Guilder. 1.389 Rand (South Africa)
4.952 French Franc. 1.110 Australian dollar. 50.05 Belgium Franc 624.45 Italian Lira. (International Financial Statistics May 1967 p. 25).

Predevaluation Rate of Exchange (r)

Since the United Kingdom is trading with more than a hundred countries, the rate of exchange should not be a single rate but should be the weighted average of all of the exchange rates. The exchange rates of the five largest trading partners of the U.K. as of May 1967 are shown in Table 8.

TABLE 8

FIVE LARGEST TRADE PARTNERS OF THE U.K.

Country	1 pound equals	% of (X+M) of U.K. with
U.S.A.	2.80 Dollar	12.9
Germany	11.14 D.M.	5.4
Canada	3.03 Canada $	5.4
Netherland	10.12 Guilder	4.5
South Africa	2.02 Rand	4.1
	Total	32.3

Source: International Financial Statistics, (May 1967) p. 25.

From Table 8:

$$r = \frac{\frac{12.9}{100} \times 2.8 + \frac{5.4}{100} \times 11.14 + \frac{5.4}{100} \times 3.03 + \frac{4.5}{100} + 10.12 + \frac{4.1}{100} \times 2.02}{\frac{32.3}{100}}$$

$$= 5.15$$

From the above result:

$$r_a = r(1-k) = 5.15(1-0.143) = 4.41.$$

Direct Effect on Absorption (d)

The total money supply of the United Kingdom at the end of 1967 was £ 14,691 millions.[1] The consumer price indexes for 1967 and 1968 were 115 and 121, respectively, using 1963 as the base period.[2] Therefore, the price level rose by 6 per cent a year after the devaluation. This price increase reduces the real value of cash balances by about 6 per cent or £ 881 million (14,691x0.06). Assume that cash balances were previously in adjustment with the level of real incomes and that for each £ 10 that cash balances are out of adjustment there is a cut decrease in expenditure of £ 1 to rebuild them. There would then be a cash balance effect of about £ 88 million per year. This figure is only an approximation of the cash balance effect because the Keynesian instantaneous adjustment upon which Alexander's analysis is based does not tell the time period for which the devaluation works. Nevertheless, this figure can be used as an approximation to the actual figure.

Suppose that both the redistribution of income and money illusion effect worked favorably for the trade balance improvement.

Assume: d_1 = £ 200 million

d_2 = £ 150 million

The consumer price level rose by 6 per cent again between the 1968 and 1969 period. It follows that the cash balance might have increased by the same amount as that of the previous year (£ 88 million). But the effect may be considered to dwindle after the devaluation. Since Alexander emphasized the cash balance effect most, the other two effects

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[1] International Financial Statistics, (September 1970), p. 324.

[2] Ibid., p. 324.

can not be expected to be as influential as the cash balance effect. Thus £ 200 million would be the most feasible assumption. Since the direct effect of the devaluation in the rest of the world (d_2) is caused by the devaluation of country 1, it is quite reasonable to assume the smaller amount of £ 150 million for d_2.

The Trade Balance before Devaluation (B_{h_0})

B_{h_0} = (−) £ 1,220 Million[1]

Result of Alexander's Formula

The calculation of variables:

E_h	. . . £ 235 million	r	. . . 5.15
k	. . . 0.143	r_a	. . . 4.41
f_1	. . . 0.093	d_1	. . . £ 200 million
f_2	. . . 0.0075	d_2	. . . £ 150 million
h_1	. . . 0.199	B_{h_0}	. . . (−) £ 1,220 million
h_2	. . . 0.161		

Substituting into Alexander's formula gives,

$$dB_h = \frac{E_h + \frac{f_1}{h_1} d_1 + \frac{f_2}{h_2}\left[\left(\frac{K}{1-K}\right) B_{h_0} + \frac{d_2}{r_a}\right]}{1 + \frac{f_1}{h_1} + \frac{f_2}{h_2}}$$

$$= \frac{235 + \frac{0.093}{0.199} \times 200 + \frac{0.0075}{0.161}\left[\left(\frac{0.143}{1-0.143}\right)(-1,220) + \frac{150}{4.41}\right]}{1 + \frac{0.093}{0.199} + \frac{0.0075}{0.161}}$$

= £ 214 million.

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[1] See p. 18, $E_q - I_p = -1,220 = B_{h_0}$.

This is the improvement of the British trade balance resulting from the devaluation of 1967 according to the above analysis. The actual figures of trade balance after the devaluation were (-) £ 1,505 million in 1968, (-) £ 1,017 million in 1969 and (-) £ 514 million in the first half of 1970.[1]

For several years the pound has been overvalued in relation to the main trading currencies of continental Europe and Japan.[2] Since the devaluation eliminated the overvaluation of pound, the deficit in the balance of trade should have decreased. However, the deficit in the trade balance in 1968 increased by £ 285 million compared to that of 1967. This surprising result is attributable to (1) the time for the devaluation to work itself out in income and price changes, and (2) the closure of the Suez Canal due to the Middle East War which increased Britain's oil import bill by £ 400 million annually.[3] The deficit of 1969 is smaller than that of 1967 by £ 203 million. The figure of the first half of 1970 also shows approximately £ 200 million over the previous year. Thus it can be said that the trade balance did improve after the devaluation. This result corresponds to the conclusion of this study.[4]

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[1] International Financial Statistics, (September, 1970) p. 70.

[2] Economist, (November 25, 1967), p. 865.

[3] Business Week, (November 27, 1967), p. 74.

[4] See Figure 1 of page 1.

CONCLUSION

Lest this study be assumed conclusive, emphasis must be made that these formulas contain several shortcomings which make even their use to obtain rough estimates subject to question. In securing the values of the elasticities several studies were used. In these studies the elasticities usually were determined by correlation. However, a bias toward underestimation of demand elasticities due to the excessive weight which goods with large price variations had in the correlation has been recognized by Guy H. Orcutt.[1] He exposed numerous errors following from the assumptions which underlie the method of deriving statistical demand curves for imports or exports and of estimating their elasticities. Moreover, the marginal propensities used in Alexander's approach were also subject to considerable error because of the large fluctuations in the magnitudes from year to year. Finally, the difficulty of estimation of direct effects of devaluation reduces the reliability of Alexander's formula -- particularly since it plays such an important role in the approach.

Although it cannot be assumed that devaluation always improves the balance of trade situation, it was discovered by the elasticity approach that devaluation should have improved Britain's trade balance. Even if the income effect and direct effect are taken into account, by means of the Alexander's formula, a favorable effect remains. It is interesting to note that the two very approximate results at least agree that the direction of change would be favorable. This was born out by

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[1]Guy H. Orcutt. "Measurement of Price Elasticities in International Trade". Review of Economics and Statistics, (May 1950), pp. 117-32.

the experience of the United Kingdom. Hence, this study supports the idea that the Alexander and Robinson approaches should be used as part of information to make a decision concerning devaluation.

APPENDIX

APPENDIX 1

A PROOF OF THE ROBINSON FORMULA

The definition of the change in the trade balance:

① $\Delta B = (E \cdot \partial q + q \cdot \partial E) - (I \cdot \partial p + p \cdot \partial I)$

② $\eta_k = \dfrac{\dfrac{\partial E}{E}}{\dfrac{\partial q}{q}} = \dfrac{\partial E \cdot q}{E \cdot \partial q}$; $\epsilon_f = \dfrac{\dfrac{\partial E}{E}}{k - \dfrac{\partial q}{q}} = \dfrac{\dfrac{\partial E}{E}}{\dfrac{kq - \partial q}{q}}$

$= \dfrac{\partial E \cdot q}{E(kq - \partial q)}$

③ $\dfrac{\epsilon_f(1+\eta_k)}{\epsilon_f + \eta_k} = \dfrac{\dfrac{\partial E \cdot q}{E(kq - \partial q)}\left(1 + \dfrac{\partial E \cdot q}{E \cdot \partial q}\right)}{\dfrac{\partial E \cdot q}{E(kq - \partial q)} + \dfrac{\partial E \cdot q}{E \cdot \partial q}} = \dfrac{\left(\dfrac{\partial E \cdot q}{E \cdot kq - E \cdot \partial q}\right)\left(\dfrac{E \cdot \partial q}{E \cdot \partial q}\right)}{\dfrac{\partial E \cdot q \cdot E \partial q + \partial E \cdot q \cdot E(kq - \partial q)}{E^2 \partial q (kq - \partial q)}}$

$= \dfrac{\partial E q (E \cdot \partial q + \partial E q)}{\partial E \cdot q \cdot E k q} = \dfrac{E \partial q + \partial E q}{E k q}$

④ Since $E \partial q + \partial E q = (E \partial q + q \partial E)$ of ①

$\therefore E k q \left(\dfrac{E \partial q + \partial E q}{E k q}\right) = (E \partial q + q \partial E)$ of ①

$\therefore E k q \left\{\dfrac{\epsilon_f(1+\eta_k)}{\epsilon_f + \eta_k}\right\} = E \cdot \partial q + \partial E \cdot q$

And we can substitute in

$$\textcircled{5} \quad \Delta B = Eqk\left\{\frac{\epsilon_f(1+\eta_h)}{\epsilon_f+\eta_h}\right\} - (I\partial p + p\partial I)$$

Similar treatment of gives,

$$\textcircled{6} \quad \Delta B = Eqk\left\{\frac{\epsilon_f(1+\eta_h)}{\epsilon_f+\eta_h}\right\} - Ipk\left\{\frac{\eta_f(1-\epsilon_h)}{\eta_f+\epsilon_h}\right\}$$

Factoring out k,

$$\textcircled{7} \quad \Delta B = K\left\{Eq\left(\frac{\epsilon_f(1+\eta_h)}{\epsilon_f+\eta_h}\right) - Ip\left(\frac{\eta_f(1-\epsilon_h)}{\eta_f+\epsilon_h}\right)\right\}$$

Notations are,

E . . . Exports

I . . . Imports

p . . . Home Price of Imports

q . . . Home Price of Exports

ϵ_h . . . ε of Home Demand for I

ϵ_f . . . ε of Foreign Demand for E

η_h . . . ε of Home Supply of E

η_f . . . ε of Foreign Supply of I

∂ . . . Change in

k . . . A Small Fall in Exchange Rate.

APPENDIX 2

PROOF OF FINAL REVERSAL FORMULAS[1]

Given a series of adjustments by countries 1 and 2 such that Δ_{ji} is the change made by the jth country at stage i, and for the second and all successive stages:

$$(B1)\quad \begin{aligned} &(a)\ \Delta_{1i} = (R_1 - 1)\cdot \Delta_{2(i-1)}/r_a && i > 1 \\ &(b)\ \Delta_{2i} = (R_2 - 1)\cdot \Delta_{1i}\cdot r_a && i > 1 \end{aligned}$$

where the Δ_{1i} are measured in domestic currency and the Δ_{2i} in foreign currency. These formulas apply only to the second and successive stages because at the first stage country 1 will adjust, not to the change made by country 2 but to the change brought about by the devaluation, so that $\Delta_{11} = (R_1 - 1)E_h$. Similarly, $\Delta_{21} = (R_2 - 1)(E_f + \Delta_{11} r_a)$. The assumption that country 1 adjusts first is purely arbitrary. The final expressions would be unchanged if it were assumed that country 2 adjusts first. Let

$$\Delta_1 = \sum_{i=1}^{\infty} \Delta_{1i} \quad \text{and} \quad \Delta_2 = \sum_{i=1}^{\infty} \Delta_{2i}.$$

These sums will be finite provided, as will be assumed, that

$$-1 < (R_1 - 1)(R_2 - 1) < 1.$$

Then the final change in the foreign balance measured in the respective currencies, dB_h and dB_f, starting out from initial changes E_h and E_f,

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[1] Alexander, pp. 40-46.

will be the sum of the initial changes plus the subsequent adjustments:

$$(B2)\quad \begin{aligned} (a)\quad & dB_h = \bar{E}_h + \Delta_1 + \Delta_2/r_a \\ (b)\quad & dB_f = \bar{E}_f + \Delta_1 r_a + \Delta_2 \end{aligned}$$

Δ_1 which is the sum of all adjustments made by country 1 will be the adjustment in response to the initial change E_h plus the sum of the adjustments in response to the adjustments of country 2, which in the aggregate are Δ_2/r_a measured in domestic currency:

$$(b3)\quad \begin{aligned} (a)\quad & \Delta_1 = (R_1 - 1)(E_h + \Delta_2/r_a) \quad \text{, and similarly} \\ (b)\quad & \Delta_2 = (R_2 - 1)(E_f + \Delta_1 \cdot r_a). \end{aligned}$$

Substituting (B3b) in (B3a), and (B3a) in (B3b) and defining

$$g \equiv (R_1 - 1)(R_2 - 1):$$

$$(B4)\quad \begin{aligned} (a)\quad & \Delta_1 = (R_1 - 1)E_h + g\frac{E_f}{r_a} + g\Delta_1 \\ (b)\quad & \Delta_2 = (R_2 - 1)E_f + g E_h r_a + g\Delta_2 , \end{aligned}$$

or, transposing the final term and dividing by 1-g, which by previous assuming cannot be zero:

$$(B5)\quad \begin{aligned} (a)\quad & \Delta_1 = \frac{1}{1-g}\left[(R_1 - 1)E_h + g\frac{E_f}{r_a}\right] \\ (b)\quad & \Delta_2 = \frac{1}{1-g}\left[(R_2 - 1)E_f + g E_h r_a\right] \end{aligned}$$

If the predevaluation balance was zero, $E_h = E_f/r_a$, so:

$$(B6)\quad \begin{aligned} (a)\quad & \Delta_1 = \frac{1}{1-g}(R_1 - 1 + g)E_h \\ (b)\quad & \Delta_2 = \frac{1}{1-g}(R_2 - 1 + g)E_h r_a \end{aligned}$$

Substituting (B6) in (B2a):

$$(B7) \qquad \begin{aligned} dB_h &= E_h\left[1+\frac{1}{1-g}(R_1+R_2-2+2g)\right] \\ &= E_h\left[\frac{1}{1-g}(R_1+R_2-1+g)\right] \end{aligned}$$

Since, from the definition of g, $R_1+R_2-1+g = R_1R_2$, and

$$1-g = 1-(R_1-1)(R_2-1):$$

$$(B8) \qquad (a) \quad dB_f = \frac{R_1R_2E_f}{1-(R_1-1)(R_2-1)} \quad \text{and similarly:}$$

$$(b) \quad dB_h = \frac{R_1R_2E_h}{1-(R_1-1)(R_2-1)}.$$

The General Case

Allowing for direct effects d_1 and d_2, (B3) and (B4) must be modified as follows:

$$(B3)' \qquad (a) \quad \Delta_1 = (R_1-1)(E_h-d_1+\Delta_2/r_a)$$

$$(b) \quad \Delta_2 = (R_2-1)(E_f-d_2+\Delta_1\cdot 1/r_a).$$

Then (B4) becomes:

$$(B4)' \qquad (a) \quad \Delta_1 = (R_1-1)(E_h-d_1)+g/r_a(E_f-d_2)+g\Delta_1$$

$$(b) \quad \Delta_2 = (R_2-1)(E_f-d_2)+g r_a(E_h-d_1)+g\Delta_2.$$

Dropping the assumption that the predevaluation balance was zero,

$E_h = (E_f/r_a) + D_h$ and $E_f = E_h r_a + D_f$. Also, $D_h = -D_f/r_a$.

By operations similar to those used in obtaining (B5) and (B6):

(B6)′

$$(a)\quad \Delta_1 = \frac{1}{1-g}\left[R_1(E_h - d_1) + d_1 - g\left(D_h + \frac{d_2}{r_a}\right)\right] - E_h$$

$$(b)\quad \Delta_2/r_a = \frac{1}{1-g}\left[R_2\left(E_h - D_h - \frac{d_2}{r_a}\right) + \frac{d_2}{r_a} + D_h - g\,d_1\right] - E_h$$

Substituting (B6)′ in (B2a):

(B7)′

$$dB_h = \frac{1}{1-g}\left[E_h(g - 1 + R_1 + R_2) - d_1(g + R_1 - 1) - \left(D_h + \frac{d_2}{r_a}\right)(g + R_2 - 1)\right].$$

Let $$v_1 = \frac{1-R_1}{R_1}, \quad v_2 = \frac{1-R_2}{R_2}.$$

Then:

$$\frac{g-1+R_1+R_2}{1-g} = \frac{1}{1+v_1+v_2}, \quad \frac{g+R_1-1}{1-g} = \frac{-v_1}{1+v_1+v_2},$$

$$\frac{g+R_2-1}{1-g} = \frac{-v_2}{1+v_1+v_2}.$$

Substituting these values in (B7)′

(B8)′

$$(a)\quad dB_h = \frac{E_h + v_1 d_1 + v_2(D_h + d_2/r_a)}{1 + v_1 + v_2}$$

$$(b)\quad dB_f = \frac{E_f + v_3 d_2 + v_1(D_f + d_1 r_a)}{1 + v_1 + v_2}.$$

APPENDIX 3

THREE DIRECT EFFECTS ON ABSORPTION[1]

a. Cash balance effect

If the money supply is inflexible and money holders desire to maintain cash holdings of a certain real value, as prices rise, accumulate more cash. This will require a reduction in their real expenditures relative to their incomes. Thus it helps the improvement of the trade balance, because according to the absorption approach, b (change in trade balance) = y (change in output) - a (change in absorption).

b. Redistribution Effect

There may be a long lag of wages behind prices, and profits might therefore gain at the expense of wages as a result of the devaluation. Rising prices will transfer income from fixed money income groups to the rest of the economy. To the extent that income is shifted from those with a high marginal propensity to absorb to those with a low propensity, the foreign balance will be improved by the devaluation.

c. Money Illusion Effect

The money illusion may contribute a favorable effect to a devaluation if it actually leads people to pay more attention to money prices than to money incomes. Because it will reduce the consumption by people.

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[1] S. S. Alexander, "Effects of a Devaluation on a Trade Balance", I.M.F. Staff Papers, (April 1952), pp. 276-78.

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