Staff Paper Series

Staff Paper P76-35 November 1976

EFFECTS OF CURRENCY ADJUSTMENTS GIVEN FREE TRADE, TRADE RESTRICTIONS AND CROSS COMMODITY SUBSTITUTION

By:
Maury E. Bredahl

Department of Agricultural and Applied Economics

University of Minnesota
Institute of Agriculture, Forestry, and Home Economics
St. Paul, MN 55108

Staff Paper P76-35 November 1976

EFFECTS OF CURRENCY ADJUSTMENTS GIVEN FREE TRADE, TRADE RESTRICTIONS AND CROSS COMMODITY SUBSTITUTION

by

Maury E. Bredahl

ABSTRACT

Comparative static models are developed which measure changes in equilibrium prices and quantities traded of an exchange rate change. Effects are determined for a free trade model and compared with that incorporating trade restrictions similar to those employed by the European Community. Quantity changes are found to exceed price changes. Exchange rate effects are found to be greater if trade is restricted.

KEY WORDS: Exchange Rate, Free Trade, European Community

EFFECTS OF CURRENCY ADJUSTMENTS GIVEN FREE TRADE, TRADE RESTRICTIONS AND CROSS COMMODITY SUBSTITUTION

Maury E. Bredahl

Since 1970 the value and quantity of U.S. agricultural exports have increased dynamically. In a recent article Schuh argues the devaluation of the dollar played a significant role in the expansion of exports and the resulting increase in agricultural prices. Schuh concludes

> If this interpretation is correct, an important share of the rise in agricultural prices in mid-1973 is a result of monetary phenomena . . . and in the case of agriculture, increased the foreign demand for U.S. output. . . .

In contrast, Kost in a recent article concludes

> In summary then, we can only expect a small impact on agricultural trade due to any change in exchange rates. And what effect there is will be primarily a price effect rather than a quantity effect. The maximum change in either price or quantity traded will be equal to the same percentage change as the exchange rate change . . . to the extent that there are conditions that restrict the free flow of goods internationally, the impact on agricultural trade will be substantially less than this maximum.

This article shows that the free trade model does not provide the theoretical basis for concluding that the price effect of an exchange rate change will exceed the quantity effect. Moreover, when trade restrictions are considered the price and quantity effects of an exchange rate change may exceed the effects in a free trade model. The modification of the simple free trade model to encompass trade restrictions,

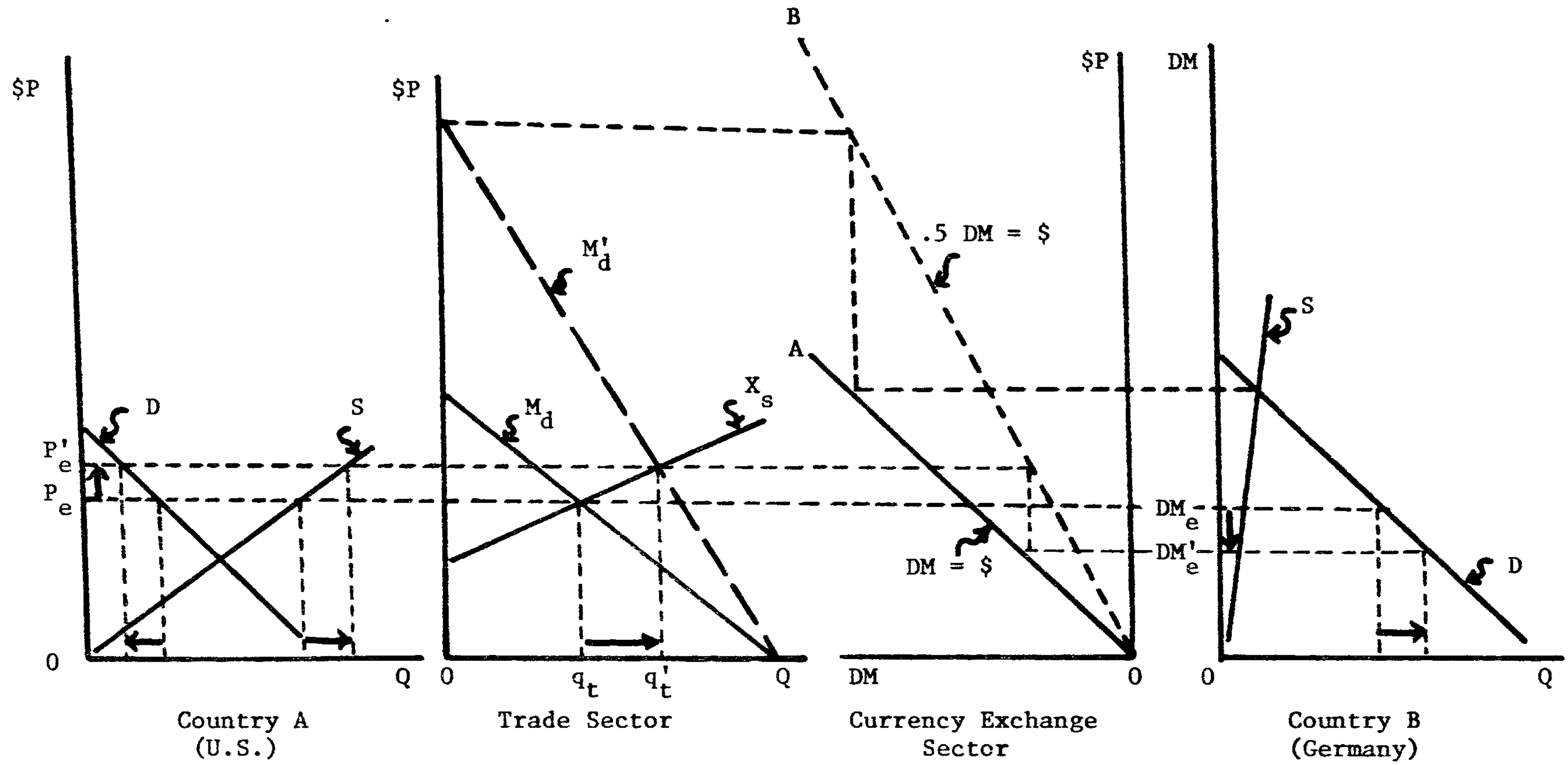
similar to those employed by the European Community, indicates that devaluation of the dollar may not affect equilibrium prices or quantities. However, the revaluation of the currency of a country with these trade restrictions is shown to have a dramatic impact on equilibrium price and an even larger impact on equilibrium quantities. Finally, the model is expanded to allow cross commodity substitution with the result that a devaluation of the dollar may increase exports of one commodity at the expense of exports of a second commodity.

Exchange rate changes and free trade.--The effect of an exchange rate change on equilibrium prices and quantities will be illustrated using the traditional two country-one commodity closed system utilized in many international trade textbooks.[1/] The graphical analysis is modified by the addition of a currency exchange sector which facilitates rotation of excess demand or supply relationships in response to exchange rate changes. The trade sector will be measured in dollars; changes in the export supply (U.S.) and import demand (Germany) will be depicted as viewed by the U.S.

Initially, the value of one dollar will be assumed equal to that of one deutschemark, i.e., an exchange rate (γ) of one. In this case, the export supply and export demand curves may be measured directly in dollars as the difference between the domestic supply and demand curves at each price. The curves labeled M_d and X_s in figure I indicate the import demand and export supply curves.

The devaluation of the dollar (the exchange rate decreases from 1 to 0.5) rotates the import demand curve upward to the right. This rotation around the intercept represents a proportional change in that curve. The

Figure I. The Effect of a Currency Readjustment*



* The case depicted holds for a devaluation by the exporting country or a revaluation by the importing country. Arrows indicate the magnitude and direction of changes.

construction of the linear import demand curve requires only two price-quantity points. Because the intersection of the curve with the quantity axis is unchanged by currency adjustments only one additional point is needed. The logical point is the price in DM at which import demand is zero, DM_o. This (German) price is translated into dollars by tracing the dotted line originating at the intersection of supply and demand in the foreign country through the currency exchange sector to the 45 degree line (OA) and moving perpendicular (up) to the ray representing the appropriate exchange rate (OB). In this manner the shift in the import demand curve from M_d to M_d' is determined.

The effect of the devaluation of the dollar is depicted in figure I. The equilibrium price in the exporting country increases ($\$P_e$ to $\$P_e'$), quantity traded increases (Q_t to Q_t') and the equilibrium price in the importing country decreases (DMP_e to DMP_e'). (Changes in quantities supplied and demanded in the two countries are indicated by arrows.)

The relationship between the exchange rate and the equilibrium price may be defined utilizing the linear excess supply and demand relationship depicted in figure I. Translating the importing country's excess demand function into the currency units of the exporting country entails multiplying the slope of the excess demand curve by the appropriate exchange rate. The trade sector is expressed in dollars; therefore, the appropriate exchange rate (γ) translates deutchemarks to dollars.[2/] The excess demand and supply relationships measured in dollars are

$$(1) \qquad Q_{ed} = \alpha_2 + [\beta_2 \gamma]\ \$P \qquad (\beta_2 \leq 0)$$

$$(2) \qquad Q_{es} = \alpha_1 + \beta_1\ \$P \qquad (\beta_1 \geq 0)$$

$$(3) \qquad Q_{ed} = Q_{es}$$

The effect of an exchange rate change is determined by totally differentiating each equation and solving for the appropriate expression of each total differential. The total differential of the price in dollars is

$$d\$P = \frac{\beta_2}{\beta_1 - \gamma\beta_2} \$P d\gamma \ .$$

The devaluation of the exporting country's currency is expressed by a decrease in γ, i.e. from $\gamma = 1$ to $\gamma = .5$. Therefore, a devaluation must increase the dollar price of the commodity.

The effect of the exchange rate change may be quantified by expressing the total differential as an elasticity. The net or reduced form elasticity of the equilibrium price with respect to the exchange rate is

$$E_{\$P,\gamma} = - \frac{1}{1 - \frac{\eta_{es}}{\eta_{ed}}}$$

where η_{ed} is the own price elasticity of the excess demand and η_{es} is the own price elasticity of the excess supply. The percent change in the equilibrium price is bounded by 0 and -1, therefore, the price change in equilibrium price will be at most equal to the percent change in the exchange rate.

The excess supply curve (measured in dollars) does not shift due to the exchange rate change, therefore the elasticity of the equilibrium quantity with respect to the exchange rate is

$$E_{q,\gamma} = E_{\$P,\gamma} \cdot \eta_{es} \ .$$

The multiplication of the net elasticity of the equilibrium price with respect to the exchange rate and the own price elasticity of the excess supply function yields the elasticity of the equilibrium quantity with respect to the exchange rate. Logically, this elasticity, which is negative, is bounded on the upper end by zero but has no lower bound.[3/] Depending on the elasticities of the excess supply and demand relationships, this net elasticity may be less than a minus one; the percent change in equilibrium quantity may exceed the percent change in the exchange rate.

The crucial question in determining the elasticity of the equilibrium quantity with respect to the exchange rate is the elasticities of the excess supply and demand relationships. Kost argues that agricultural commodity supply and demand relationships are inelastic, therefore the quantity effect of an exchange rate change must be small. However, noting that the underlying domestic supply and demand relationships are inelastic is not sufficient evidence to conclude that excess supply and demand relationships are inelastic. The own price elasticity of the excess supply relationship may be written

$$\eta_{es} = \eta_s \cdot (Q_s/Q_x) - \eta_d(Q_d/Q_x)$$

where η_d and η_s represent the own price elasticities of domestic demand and supply, Q_d and Q_s represent domestic quantities supplied and demanded and Q_x represents the quantity exported. (Note that $Q_s - Q_d$ equals Q_x and that η_d is necessary negative for downward sloping demand curves.) The excess supply elasticity may be elastic even if the underlying supply and demand relationships are inelastic. For example, assume the absolute value of both elasticities is .5, quantity demanded and supplied are 75

and 150 respectively; and the elasticity of the excess supply function is 1.5. In all cases the elasticity of the excess supply curve will never be smaller than the elasticity of the domestic supply function. They will be equal if $Q_s = Q_x$. Note also as the percent of supply exported decreases, the elasticity of the excess supply function increases.

To the extent that the simple free trade model represents "real world" agricultural trade, one may evaluate the conclusions reached in earlier articles. The maximum percent change in price is found to be equal to the percent change in the exchange rate. The change in the equilibrium quantity is found to be unbounded, therefore the percent change in the equilibrium quantity may exceed the percent change in the exchange rate.

Principal importers of U.S. agricultural commodities, notably the EEC, restrict imports of some commodities (corn, sorghum and wheat) while others (soybeans) are unrestricted. The simple free trade model must be modified to encompass these policies and the effect of an exchange rate change determined.

Exchange Rate Changes and EEC Policies

Initially the effect of EEC trade policies assuming stable exchange rates is developed. The effects of exchange rate changes are determined and the effects of exchange rate changes given EEC type policies are compared with those of the free trade model.

The EEC trade policies are explicitly intended to restrict imports by the application of variable levies to most imported agricultural products. The trade policies are motivated by the desire to maintain relatively high farm income by supporting high domestic farm prices. The minimum import

price is termed the threshold price; the variable levy is calculated as the residual between the threshold price and the c.i.f. price of imported grains delivered to Rotterdam.

For commodities in which the Community is not self-sufficient, the internal market prices will tend toward the threshold price. In other commodities, internal market prices will be bounded on the lower side by the intervention price (guaranteed minimum price) and on the upper side by the threshold price. The Community is not self-sufficient in corn or grain sorghum.

In a modeling framework the application of EEC trade policies is straightforward. Consider the simple model developed earlier; the excess demand equation of the importing country is treated as a function of exogenous variables.

$$Q_{es} = \alpha_1 + b_1 \$P \qquad (b_1 > 0) \tag{4}$$

$$Q_{ed} = \alpha_2 + b_2 \overline{DMP} \qquad (b_2 < 0) \tag{5}$$

$$Q_{ed} = Q_{es} \tag{6}$$

Since equation 5 is based on exogenous variables, trade is not affected by price changes. The trade sector in terms of dollars is shown in figure II. As indicated, the equilibrium price in the exporting country will be $\$P_e$. The equilibrium in the importing country will be $\gamma \cdot \$P_T$ with the variable levy (in dollars) equal to $\$P_T - \$P_e$.

The effect of currency adjustments given a threshold price depends on the source of the currency adjustment. The effect of a devaluation by the exporting country may be different from the effect of a revaluation by an importing country.

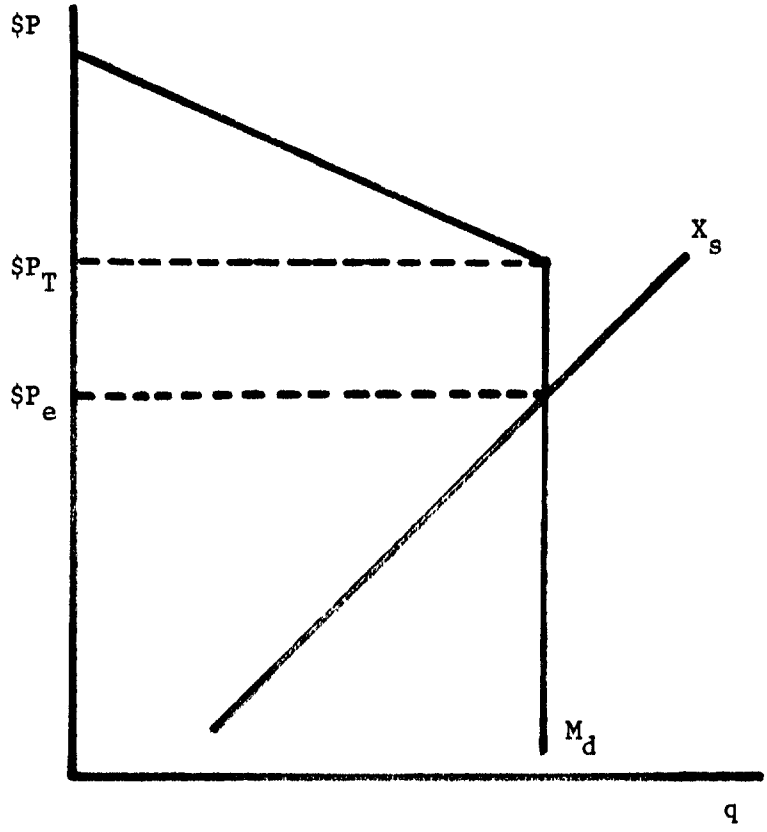


Figure II. The Trade Sector with EEC Trade Restrictions

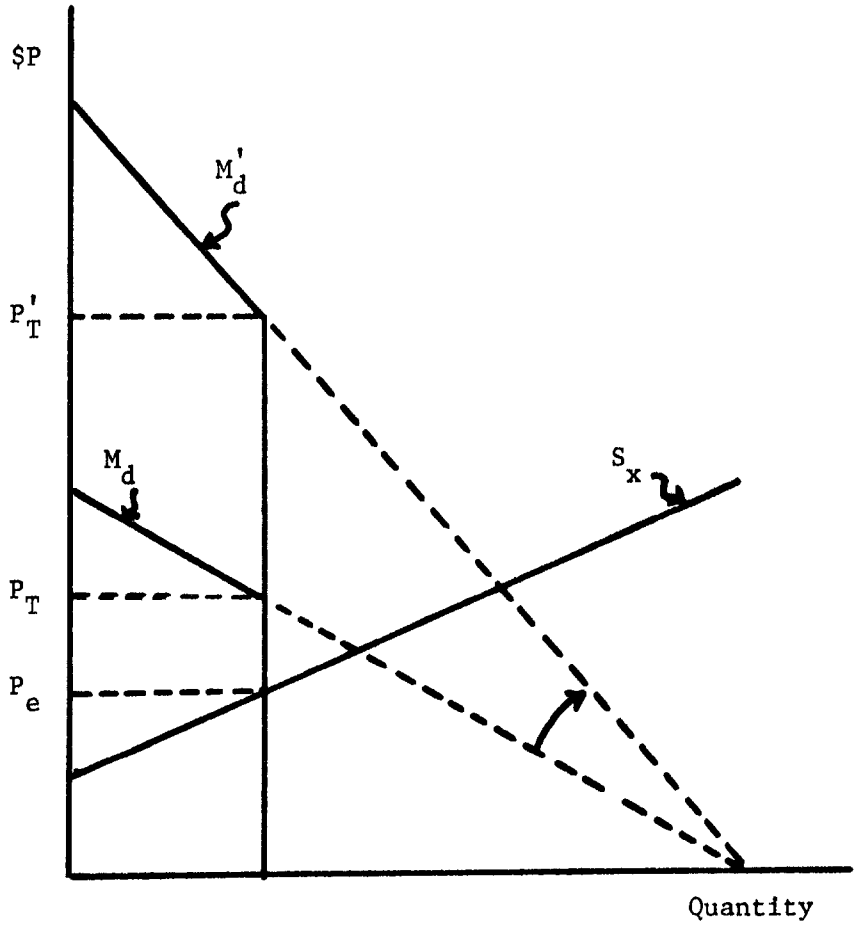
The diagram of the effect of a currency devaluation by the exporting country (figure III) indicates the equilibrium prices and quantities will be unchanged. The devaluation shifts the excess demand curve vertically along the perfectly inelastic portion of that curve. The effect of devaluation is automatically offset by the increase in the variable levy (in dollars) from ($P_T - $P_e) to ($P'_T - $P_e). The rotation of the excess demand curve is offset by increases in the dollar threshold price. The excess demand function may be written

$$(5.a) \qquad Q_{ed} = \alpha_2 + \gamma b_2 \left(\frac{\overline{DMP}}{\gamma}\right)$$

illustrating the offsetting effects. The exchange rates (γ) cancel; the exchange rate has no effect on equilibrium prices and quantities.

The mechanism establishing Community-wide threshold prices must be explained briefly in order to illustrate the effect of a currency adjustment by non-EEC countries. These prices are quoted in units of account; the unit of account is defined in terms of gold. The threshold prices are translated into the currency of member countries by fixed exchange rates. Assume a devaluation of the dollar from equality with the unit of account to 1.25$ = U.A. Assume one unit of the commodity is offered by the U.S. at $50; initially 50 U.A. and after devaluation 40 U.A. If the threshold price is 100 U.A., the variable levy will increase from 50 U.A. to 60 U.A. Assume that the German currency is valued at 4 deutschemarks to one unit of account. Before devaluation, an importer would pay 200 DM for one unit of the commodity plus a 200 DM levy. After devaluation, one unit of the commodity would cost 160 DM plus a 240 DM levy.

Figure III. The Effect of a Currency Adjustment by the Exporting Country Assuming a Threshold Price



Trade Sector

Therefore, the devaluation would not reduce the cost (effective price) to the importer.

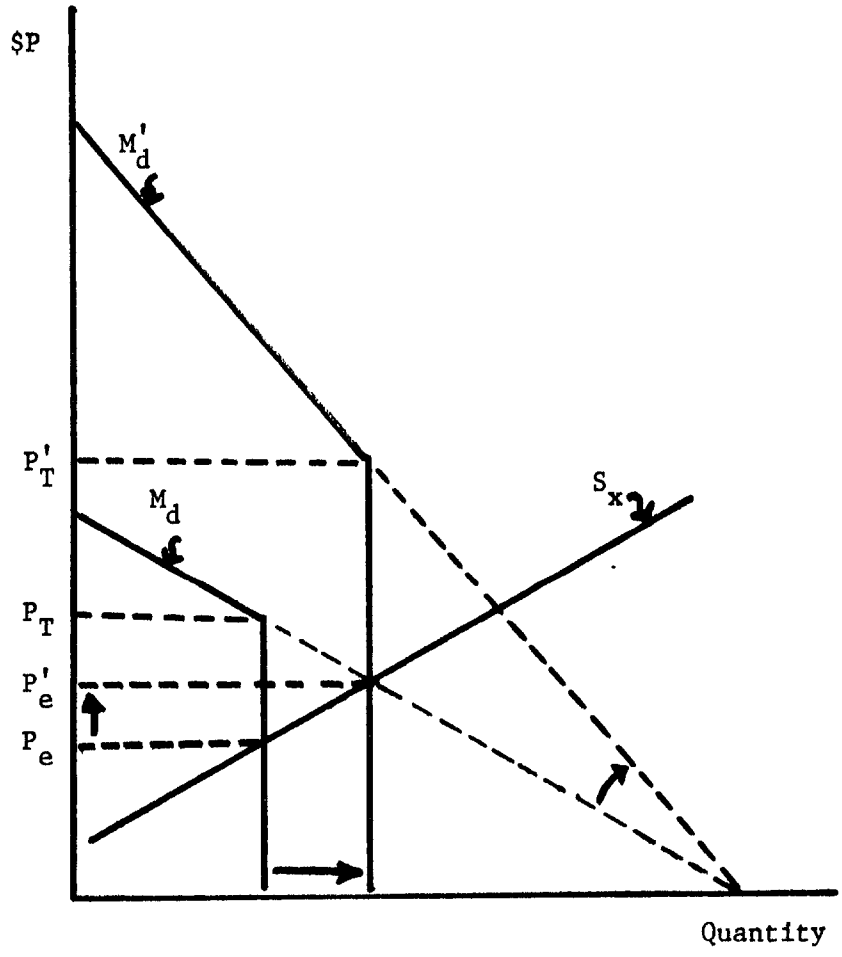
If the exchange rate between the unit of account and a member country's currency changes, all domestic prices which are set by the EEC Commission must change. The following example illustrates the change in domestic prices following the October 1969 revaluation (by 9.3 percent) of the German deutschemark.

	Before		After	
	U.A.	DM	U.A.	DM
Corn threshold price	93.69	374.76	93.69	342.91
Corn variable levy	34.71	138.84	34.71	127.04
Corn import price	58.98	235.92	58.98	215.87

The effective corn import price was reduced to German importers. Initially, to offset this reduction, compensatory import taxes were placed on German agricultural imports. The threshold prices were increased the following year and the compensatory import taxes eliminated. In addition to the reduction in the threshold prices, the purchasing power of the deutschemark increases (vis-a-vis U.S. dollar), shifting the import demand curve. The new equilibrium prices and quantities are indicated in figure IV.

The following example illustrates the case shown graphically. Consider a revaluation of the deutschemark from 4.0 DM = 1 U.A. = 1$, to 3.0 DM = 1 U.A. = 1$. Initially, from the example developed earlier, one levy-paid commodity unit cost 400 deutschemarks. After revaluation, the commodity

Figure IV. The Effect of a Currency Adjustment by the Importing Country Assuming a Threshold Price



Trade Sector

would cost 150 deutschemarks and the variable levy would cost 150 deutschemarks, a total cost (price) of 300 deutschemarks. In the absence of any measures by the EEC country, the devaluation represents a reduction in the cost of imported commodities.

In order to quantify the reduced form effects of a revaluation, two cases will be considered. First, the deutschemark will be revalued against the dollar and the unit of account. Second, the deutschemark will be revalued against the dollar but not against the unit of account.

In order to determine the reduced form effects in case I, the revaluation of the deutschemark against the dollar and the unit of account, the excess demand relationship will be rewritten to reflect the fixed import price quoted in units of account (UAP) and the DM-UA exchange rate (δ).

$$(5.b) \qquad Q_{ed} = \alpha_2 + b_2\gamma \left(\frac{UAP \cdot \delta}{\gamma}\right) \qquad (b_2 \leq 0)$$

Differentiating equations 4 and 5.b yields

$$dQ_{es} = b_1 \, d\$P$$

$$dQ_{ed} = b_2 \, UAP \, d\delta \; .$$

The excess supply function plays no role in the determination of equilibrium quantity; the differential of the excess demand equation determines the change in the equilibrium quantity

$$dQ = b_2 \, PUA \, d\delta$$

which may be expressed as a net elasticity

$$E_{q,\delta} = \eta_{ed}$$

Therefore, the net elasticity of the equilibrium quantity with respect to the exchange rate equals the elasticity of the excess demand relationship.

The change in the equilibrium dollar price may subsequently be determined from the differential of the excess supply function

$$d\$P = \frac{1}{b_1} dQ$$

which may be expressed as a net elasticity

$$\frac{d\$P}{\$P} = \frac{1}{\eta_{es}} \cdot \frac{dQ}{Q}$$

$$E_{\$P,\gamma} = \frac{\eta_{ed}}{\eta_{es}} .$$

The net elasticity of the equilibrium price with respect to the exchange rate equals the ratio of the excess demand function to the elasticity of the excess supply function.

The second situation, revaluation of the deutschemark against the dollar, is numerically illustrated and reduced from effects determined. Assume one unit of the commodity is offered at $50, a threshold price of 100 UA and a unity exchange rate between the dollar and the unit of account. The $-UA exchange rate will decrease from 4 to 3; the DM-UA exchange rate will be 4. The offer price is converted into units of account and the variable levy determined; in this case the variable levy will be 50 UA. The table below indicates the DM effective import price (cost) before and after the revaluation.

	Threshold price	Commodity price	Variable levy	Import price
Before	400	200	200	400
After	400	150	200	350

After revaluation the effective import price declines and is less than the official threshold price.

The excess demand relationship must be rewritten to reflect the fixed variable levy.

$$(5.c) \qquad Q_{ed} = \alpha_2 + b_2\gamma \left[\$P + \frac{VL_{ua} \cdot \delta}{\gamma}\right] \qquad (b_2 \leq 0)$$

and totally differentiating the equations 4 and 5.c yields

$$dQ_{ed} = b_2\gamma d\$P + b_2\$P d\gamma$$

$$dQ_{es} = b_1\, d\$P$$

which is exactly the same result derived if trade was not restricted.

In order to illustrate the larger effects of an exchange rate change if trade is restricted, the net elasticities of price and quantity will be computed (1) assuming the excess demand and supply functions are elastic (absolute value of the elasticities equals 1.5) and, (2) assuming inelastic excess relationships (elasticities equal 0.5). A third case illustrates that with restricted trade the quantity change may be greater than the price change even with very inelastic excess supply and demand curves.

Net Elasticity	Free Trade	Restricted Trade
$\eta_{es} = \lvert\eta_{ed}\rvert = 1.5$		
Price	-.50	-1.00
Quantity	-.99	-1.50
$\eta_{es} = \lvert\eta_{ed}\rvert = 0.5$		
Price	-.50	-1.00
Quantity	-.33	-0.50
$\eta_{es} = .50,\ \eta_{ed} = -.25$		
Price	-.66	-0.13
Quantity	-.17	-0.25

The net elasticity of quantity with respect to the exchange rate in the restricted trade case is significantly larger than those of the free trade case. Trade restrictions of the type applied by the EEC will usually result in greater reduced form effects of an exchange rate change in comparison to free trade. Depending on the elasticities of the excess supply and demand relationships, either of the two referenced articles may be correct. The conclusions must be verified (or refuted) by carefully structured empirical research.

The maximum changes in equilibrium values given free trade or EEC type policies are quite different. The net elasticities of equilibrium prices and quantities with respect to the exchange rate for the two models are

Elasticity	Free Trade	Restricted Trade
$E_{\$P,\gamma}$	$-\frac{1}{1-\frac{\eta_{es}}{\eta_{ed}}}$	$\frac{\eta_{ed}}{\eta_{es}}$
$E_{q,\gamma}$	$E_{\$P,\gamma} \cdot \eta_{es}$	η_{ed}

The net elasticity of equilibrium price with respect to the exchange rate is bounded by -1 in the free trade case; it is unbounded in the restricted trade case but limited by the ratio of the product of the elasticities of the excess supply and demand relationships to their sum. The net elasticity of the equilibrium quantity with respect to the exchange rate is unbounded in either model.

Exchange Rate Change and Cross Commodity Effects

The price of levy-free commodities (such as soybeans) will respond to exchange rate changes. The discussion in the previous section illustrates the isolation of the internal price of levy-paid commodities (such as corn) from external exchange rate changes. Therefore, to the extent that the levy-free commodity substitutes for the levy-paid commodity, the equilibrium price and quantity traded of the levy-paid commodity will be affected by the devaluation of the exporting country's currency.

The effect of a devaluation of the dollar is illustrated in figure V. The changes in equilibrium values may be conceptualized by partitioning the instantaneous changes into the following sequence:

(1) The devaluation rotates the soybean excess demand curve to the right (M_s to M_s'), increasing the equilibrium dollar price (P_e to P_e') and quantity traded (q_e to q_e').

(2) Because the devaluation reduces the importer's soybean price, the corn excess demand curve shifts to the left (M_c to M_c'), reducing the price (P_e to P_e') and quantity traded (q_e to q_e') of corn.

(3) The increased soybean dollar price shifts the corn excess supply curve to the left (X_c to X_c'), tending to increase corn price from that which would have obtained if corn excess supply was not subject to cross commodity effects (P_e' to P_e'').

(4) The decrease in the price of corn shifts the soybean excess supply curve to the right (X_s to X_s'), tending to limit the increase in soybean price (P_e' to P_e'') and increase the quantity traded (q_e' to q_e'').

The maximum decline in corn price and maximum increase in soybean price occur when cross commodity effects are limited to the corn excess demand function. This also indicates the minimum change in soybean and corn quantity traded. If cross commodity effects are large, the soybean price may be unchanged while the quantity traded may increase significantly.

A generalized linear excess supply-demand model encompassing two countries and two commodities as graphically shown in figure V is represented in equations 7 to 12.

$$(7) \qquad Q_s^c = \alpha_1 + b_1\$PC + b_2\$PS \qquad (b_1 \geq 0,\ b_2 \leq 0)$$

$$(8) \qquad Q_s^s = \alpha_2 + b_3\$PC + b_4\$PS \qquad (b_3 \leq 0,\ b_4 \geq 0)$$

$$(9) \qquad Q_d^c = \alpha_3 + b_5\overline{DMP} + b_6\gamma\$PS \qquad (b_5 \leq 0,\ b_6 \geq 0)$$

$$(10) \qquad Q_d^s = \alpha_4 + b_7\gamma\$PS + b_8\overline{DMP} \qquad (b_7 \leq 0,\ b_8 \geq 0)$$

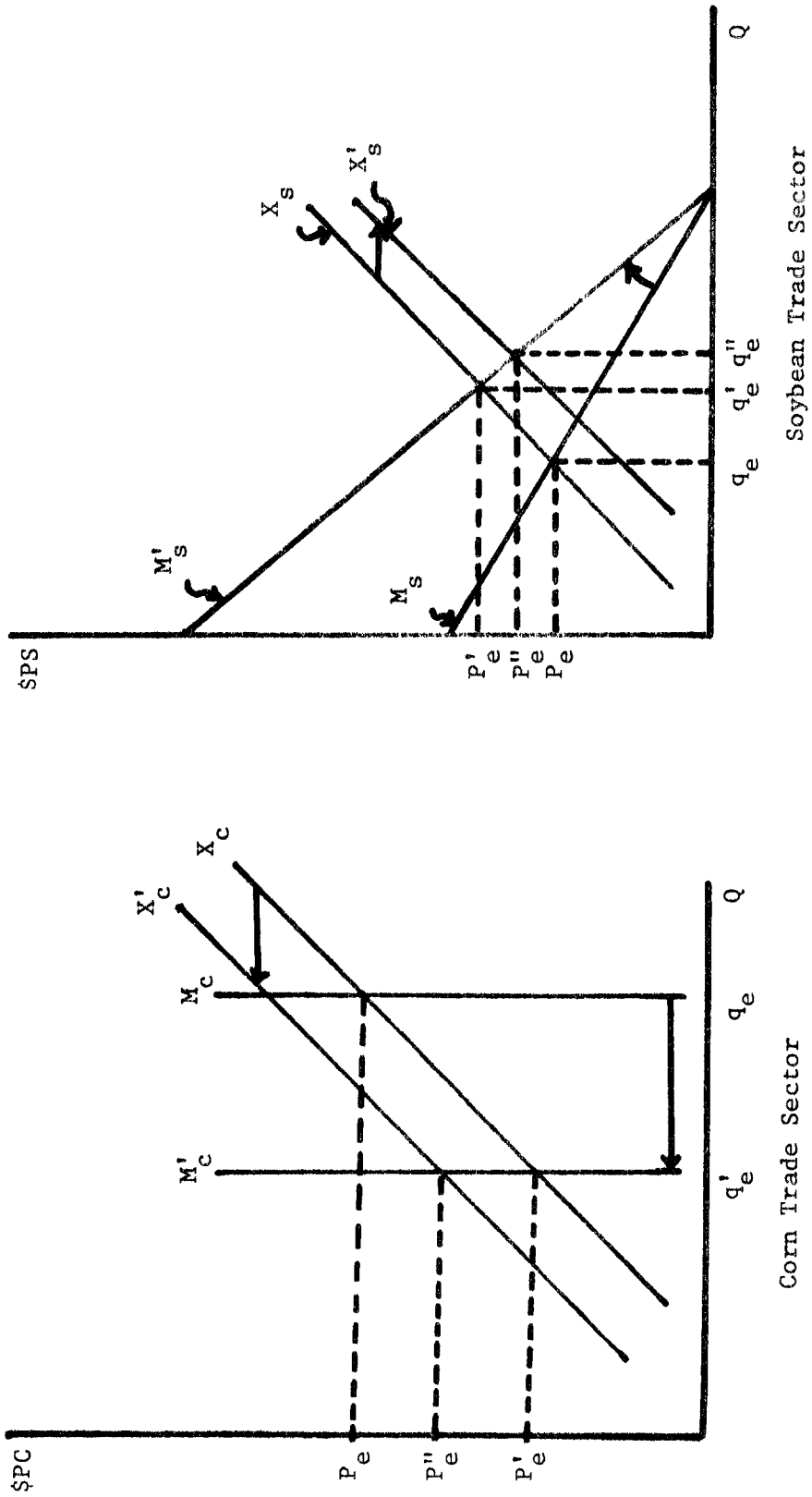


Figure V. Effects of a Devaluation on Corn and Soybean Price and Quantity with Cross Commodity Effects and Trade Restrictions

(11) $$Q_s^c = Q_d^c$$

(12) $$Q_s^s = Q_d^s$$

where superscripts denote commodity type (c = corn, s = soybeans), and subscripts denote excess supply(s) and demand(d). Price of corn and soybeans (in dollars) are \$PC and \$PS respectively; γ is the exchange rate and $\overline{DMP}$ is the fixed corn threshold price. Soybeans and corn are assumed to be substitutes in the excess supply and demand functions.

The analysis evaluates the effects of a devaluation of the exporting country's currency. Totally differentiating equations 7 to 10, solving for the appropriate expression of each price differential, and expressing as a net elasticity yields

$$E_{\$PC,\gamma} = \frac{-\psi_{ces}\,\eta_{sed} + \eta_{ses}\,\psi_{ced}}{H}$$

$$E_{\$PS,\gamma} = \frac{-\psi_{ses}\,\psi_{ced} + \eta_{ces}\,\eta_{sed}}{H}$$

where ψ indicates a cross price elasticity, η indicates an own price elasticity; the subscripts indicate the commodity (first letter) and the behavioral relationship (second and third letter). For example, ψ_{ces} is the cross price elasticity of soybean price of the corn excess supply function. The denominator, H, is a collection of elasticities which must be positive if equilibrium price and quantity are restricted to the positive values.[4/]

The direction of change of both prices depends on the sign of the numerator. A decrease in the equilibrium corn price in response to a devaluation requires

$$\eta_{ses}\ \psi_{ced} > \psi_{ces}\ \eta_{sed} .$$

An increase in the equilibrium soybean price requires

$$\eta_{sed}\ \eta_{ces} > \psi_{ses}\ \psi_{ced} .$$

If the own price elasticity exceeds the cross price elasticity in the corn excess supply equation, the implication is

$$\eta_{sed}\ \eta_{ces} > \psi_{ces}\ \eta_{sed}$$

and if the same condition holds in the soybean excess supply equation, then the implication is

$$\eta_{ses}\ \psi_{ced} > \psi_{ses}\ \psi_{ced} .$$

Therefore, if own price elasticities exceed cross price elasticities in the excess supply equations, the equilibrium price of corn must decline ($E_{\$PC},\gamma > 0$) while that of soybeans must rise ($E_{\$PS},\gamma < 0$) if the exporting country's currency is devalued.

The change in the equilibrium soybean price becomes larger as the cross price elasticity of the soybean excess supply function becomes smaller. The net elasticity ($\psi_{ses} = 0$)

$$E_{\$PS,\gamma} = \eta_{sed}/(\eta_{ses} - \eta_{sed})$$

is bounded by zero and minus one. The maximum change in the equilibrium corn price is found as ψ_{ces} goes to zero,

$$E_{\$PC,\gamma} = \eta_{ses}\ \psi_{ced}/\eta_{ces}(\eta_{ses} - \eta_{sed}) .$$

As the cross price elasticity of the corn excess demand increases, the change in the equilibrium corn price becomes larger. The net elasticity is bounded on the lower end by zero but has no upper bound.

The substitution of soybeans for corn will shift the corn excess demand toward the origin reducing the equilibrium quantity of corn traded. The net elasticity is

$$E_{qc,\gamma} = \frac{\psi_{ced}(\eta_{ses}\,\eta_{ces} - \psi_{ces}\,\psi_{ses})}{H} \quad .$$

If the own price elasticities exceed cross price elasticities, the net elasticity must be positive. The maximum change occurs when ψ_{ces} goes to zero, in which case the net elasticity is

$$E_{qc,\gamma} = \eta_{ses}\,\psi_{ced}/(\eta_{ses} - \eta_{sed}) \quad .$$

As ψ_{ced} increases, the change in equilibrium quantity increases.

The net elasticity of soybean quantity with respect to the exchange rate is

$$E_{qs,\gamma} = \frac{\eta_{sed}(\eta_{ses}\,\eta_{ces} - \psi_{ces}\,\psi_{ses})}{H}$$

which is negative if own price effects exceed cross price effects. The change in equilibrium soybean quantity increases as ψ_{ses} increases.

The complexity of the net elasticities precludes developing meaningful numerical examples which compare net elasticities, i.e., a comparison of underlying relationships if elastic versus inelastic. The decline in corn price and quantity traded is an important result which indicates the

perverse effect of trade restrictions on the effect of an exchange rate change. The percent change in equilibrium soybean quantity may well exceed that of equilibrium soybean price.

Summary and Conclusions.--The role of the devaluation of the dollar in the significant increase in agricultural prices and exports must be determined by careful empirical research. However, if agricultural trade is characterized by free trade, the percent increase in equilibrium prices cannot exceed the percent change in the exchange rate. The percent change in equilibrium quantity is dependent on the elasticities of the excess supply and demand relationships but may be greater than the percent change in the exchange rate.

The devaluation of the dollar has no effect on equilibrium quantity or price of a commodity subject to trade restrictions of the European Community. However, the mechanism by which minimum import prices are determined in the Community enables member countries to benefit from a revaluation of their currency. The percent change in trade restricted equilibrium values may be greater than that if trade restrictions did not exist.

Moreover, when cross commodity effects are considered, the devaluation of the dollar will reduce exports of commodities subject to the variable levy. Exports of levy-free commodities will increase. Therefore, depending on own and cross price elasticities, a devaluation of the dollar may increase soybean exports at the expense of corn exports.

These results do not provide the theoretical evidence to accept uncritically, Schuh's conclusions. One, however, finds much support for the contention that monetary phenomena may have played a significant role in increased prices and exports.

FOOTNOTES

1/ The model assumes zero transportation costs; competitive, unrestricted markets; and a homogeneous commodity. For a more complete discussion, see Kindleberger.

2/ The exchange rate measures the number of DMs which may be purchased by $1 or DM/$. The value of the exchange rate, expressed in this manner, will decline if the foreign currency is revalued or the dollar devalued.

3/ The net elasticity of the equilibrium quantity may be written in terms of the excess supply and demand elasticities

$$E_{q,\gamma} = \frac{\eta_{ed}\,\eta_{es}}{\eta_{ed} + \eta_{es}}$$

and will exceed one for all combinations of elasticities in which the product of the elasticities exceeds their sum.

4/ The denominator equals

$$\eta_{ces}(\eta_{ses} - \eta_{sed}) + \psi_{ses}(\psi_{ced} - \psi_{ces}) \ .$$

REFERENCES

Kost, William E. "Effects of an Exchange Rate Change on Agricultural Trade." Agr. Econ. Res., Vol. 28, No. 3, July 1976.

Kindleberger, Charles P. International Economics. Homewood, Ill.: Richard D. Irwin, Inc., 1968.

Schuh, G. Edward. "The Exchange Rate and U.S. Agriculture." Am. Jour. Agr. Econ., Vol. 56, No. 1, February 1974.

Vellianitis-Fidas, Amalia. "The Impact of Devaluation on U.S. Agricultural Exports." Agr. Econ. Res., Vol. 28, No. 3, July 1976.