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EFFECT OF MAJOR CURRENCY REALIGNMENT ON PHILIPPINE TRADE FLOWS: A QUANTITATIVE STUDY

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EFFECT OF MAJOR CURRENCY REALIGNMENT ON PHILIPPINE TRADE FLOWS: A QUANTITATIVE STUDY

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Romeo M. Bautista*

This paper presents a preliminary evaluation of the direct effects of the 1971 realignment of major currencies on Philippine foreign trade. Because of the openness of most developing economies, the trade repercussions of exchange rate changes among developed countries on a small country which has strong links in trade with developed countries are of some interest. First, we estimate export supply and import demand functions for various trade commodity groups using annual data in the postwar period; to explore the time dimension of the impact of price changes, alternative lagged responses of exports and imports are considered. Applying relatively simple techniques, we then examine the quantitative effects on Philippine trade flows of the altered sets of domestic currency (peso) export and import prices resulting from the 1971 exchange rate changes among the country's major trade partners.

1. Estimation of Export Equations

By the small country assumption, foreign currency export prices are exogenously determined. We also assume that export supply responds to changes in the peso prices of export commodities. Other things

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remaining constant, higher peso export prices imply higher profits to be realized from exporting. This may not be true, however, if increases in the peso price of exports are accompanied by commensurate increases in the domestic cost level. As argued by Sheahan and Clark (1967), what counts is the relationship between the earnings from exports in domestic currency and the cost in domestic currency of producing them. One relative price variable to use in the export supply function is then the ratio of export price to the domestic wholesale price index.[1/] In cases where the local market is also a significant outlet for the export commodity, its domestic price might be the appropriate deflator to use (provided it is not strongly correlated to the export price.) Thus, *ceteris paribus* producers of exportables will reduce exports if domestic sales show greater profitability.

We shall also investigate the possibility that external demand directly influences the level of exports. A slowdown in economic activity in the destination countries, for instance, may reduce import purchases of a specific commodity independently of the observed price movements. While more elaborate submodels of individual commodity trade would be preferable in such cases, we simply test here for the effect of an "external activity" variable as an additional determinant of the volume of exports. This will be represented by a weighted average index of production (construction, manufacturing or GNP) in the major markets of individual export commodities.

With regard to the timing of the trade effects, the possibility of wide differences in lag pattern among export commodities suggests that the estimation method be a flexible one. We take the view that the response of exports to changes in external activity and to price changes would be essentially complete within one year and at most four years, respectively. This is broadly consistent with recent empirical evidence on lagged trade responses which unfortunately pertain only to developed countries.[2/] A separate issue concerns the determination of the weights w_i^x of the distributed lag in the price effects $\sum_{i=o}^{N} w_i^x P_i^x$ where P_i^x is the price variable lagged i years ($N = 0, 1, 2$ or 3 and $\sum_{i=o}^{N} w_i^x = 1$ as assumed above). Simplifying considerably from the technique developed by Almon (1965), we constrain the weights of the lag distribution to fit the linear form with end-period weights equal zero. More specifically, where the price response of exports extend beyond the current year, the weights are given by

$w_0 = .667,\ w_1 = .333$

$w_0 = .500,\ w_1 = .333,\ w_2 = .167$

and $w_0 = .400,\ w_1 = .300,\ w_2 = .200,\ w_3 = .100$

for the 2-year, 3-year and 4-year lengths of lag, respectively.

The regression equation suggested by the above considerations is therefore of the form

$$(1)\quad X = a_0 + a_1 \sum_{i=o}^{N} w_i^x P_i^x + a_2 Y + \sum_{k} a_{3k} Z_k + u$$

where Z_k denotes any other influences on exports peculiar to individual commodities and u is the error term. The coefficient a_1 captures the full effect of the price variable over time.

We estimate eq. (1) for each of the following "principal" export commodities: copra, coconut oil, logs and lumber, copper concentrates, abaca, tobacco, canned pineapple, desiccated coconut, molasses, plywood and veneer. Each of these commodities has appeared at least once in the annual Central Bank list of ten principal exports in the postwar period; together with sugar they account for 85 to 95 per cent of annual Philippine export earnings. Exports of sugar, consistently one of the top-ranking export products of the Philippines, had been subject to a special quota system in the regulated U.S. market until 1974, "precluding any meaningful attempt at a statistical estimation of an export supply function for sugar" (Bautista and Encarnacion, 1972; p.242).

The "nonprincipal" exports, whose value is obtained residually by subtracting from total export receipts the total value of "principal" exports (including sugar), represent a combination of certain manufactured products, metallic ores and agricultural commodities. Due to lack of a composite export price measure for this group of commodities, the unit export value index published by the Central bank is taken and used to deflate current export values in expressing X in eq. (1) in constant U.S. dollars.

The estimation of (1) entailed initially a total of eight regression trials at least for each of the twelve export categories considered,[3/] the activity variable being introduced or excluded in each of the four alternative specifications on lag lengths of the price effect. If the price ratio is found insignificant, we replaced it with the "ownprice" index, checking whether the general price level or domestic price of the export commodity has no influence on export supply. These OLS results were tested for serial correlation on the basis of the computed values of the Durbin-Watson statistic. In cases where the problem of serial correlation is evident,[4/] we applied the Durbin technique of estimating the autoregressive coefficient (assuming first-order serial properties) from the regression of X on lagged (one year) X and the current and lagged values of the dependent variables (Durbin, 1960) and re-estimated eq. (1) using the appropriate transformation of each variable (with the first observation retained) to correct for serial correlation of the residuals.[5/] Our criterion for the best estimated equation for each export category from among the regression results thus screened is the coefficient of multiple correlation adjusted for degree of freedom.

The price coefficient is found insignificant in the regressions for plywood, veneer and desiccated coconut; hence these commodities (and sugar for reasons explained above) are not entered in Table 1. Annual data from 1953 to 1972 were used except for Copper Concentrates (1961-1972) and Logs and Lumber (1957-1972). The letters and numbers in parentheses immediately following commodity names distinguish the estimation method and measures of the price variable (base year 1963) used as follows: LS - ordinary least squares, DP - two-stage estimation with the autoregressive coefficient obtained using Durbin's procedure; 1 - index of peso export price divided by domestic general wholesale price index, 2 - index of peso export price divided by domestic wholesale price of the commodity, 3 - export price index in peso terms. Also shown in

TABLE 1: Estimated Export Equations

Commodity Group	Length of lag (years)	Const.	P	Y	Z	Price elasticity	$\bar{R}^2$	D.W.	Autoregressive coefficient
Unmanufactured tobacco (DP3)	3	-6.8	.421 (5.01)	-	-	1.46	.560	2.34	.408
Canned pineapple (LS3)	4	20.3	.480 (2.65)	-	-	.64	.232	1.91	0
Copper concentrates DP1)	2	-12.8	3.767 (6.79)	-	-	1.11	.804	1.73	.802
Unmanufactured abaca (LS1)	2	111.4	.114 (1.99)	-	-3.32 (-7.59)	.12	.736	1.84	0
Molasses (DP3)	2	-18.2	.940 (9.78)	-	.019 (1.44)	1.57	.601	1.65	0
Copra (DP2)	2	-93.4	3.360 (2.17)	-	.673 (4.86)	1.33	.756	2.15	.864
Copra meal/cake (DP3)	3	-6.9	2.142 (12.40)	-	-	1.06	.889	2.00	.324
Coconut oil (DP2)	1	-438.0	5.024 (2.07)	-	.234 (4.10)	2.55	.692	1.78	.315
Logs and lumber (LS1)	3	-47.7	35.38 (2.27)	19.38 (2.46)	-	.58	.838	1.88	0
Nonprincipal exports (LS1)	3	-44.4	.363 (5.30)	-	-	1.57	.601	1.65	0

Notes: Numbers in parentheses underneath regression coefficients are their t-values.

Z = trend variable for Abaca

domestic output of coconuts in copra terms (in thousand metric tons) for Copra and Coconut Oil

domestic output of sugar (in thousand metric tons) for Molasses

The dependent variable is expressed in thousand metric tons, except for Logs and Lumber (in thousand cubic meters) and nonprincipal exports (in millions of 1963 U.S. dollars).

the table for each estimated equation are the adjusted coefficient of determination ($\bar{R}^2$), Durbin-Watson statistic, t-values of regression coefficients, autoregressive coefficient, price elasticity of export supply at the mean values and length of the lag distribution.

Except in the equation for Canned Pineapple, more than one-half of the variance of the dependent variable is explained. The values of the price elasticity range from .12 for Abaca to 2.55 for Coconut Oil, four of the ten export groups showing inelastic price effects. Two- and three-year lag lengths are seen to dominate. Only for Logs and Lumber is the activity variable (index of construction in Japan, the United States, Taiwan and South Korea) found significant. Domestic output of sugar is included as a determinant of molasses exports (in addition to the price variable) since molasses is a by-product in sugar manufacture. Coconut being a perrenial crop, exports of Copra and Coconut Oil are made to depend also on domestic harvest of coconuts, a proxy variable for the stock of fruit-bearing coconut trees. The significantly negative coefficient for the trend variable in the estimated equation for Abaca reflects the shift in world demand toward synthetic substitutes over the years.

2. Estimation of Import Functions

With given import prices in foreign currency, total imports of a small country might be explained by considering the demand for each of the import commodity groups as a function of a relative price variable and an income or activity variable. We attempt to estimate here Philippine import demand functions for commodity groups at the one-digit S.I.T.C.

level, the dependent variable expressed in constant U.S. dollars.

Two alternative measures of the price variable are considered, the choice between them dependent on whether domestic and imported goods are substitutable in particular commodity groups: (1) the ratio of domestic wholesale price index of the import group to wholesale price index of locally-produced goods competing with these imports; and (2) the ratio of domestic wholesale price index of the import group to the GNP price index. Depending also on the commodity group under consideration, the activity variable may be represented in the import function in several ways. Imports of consumption goods are related here to real disposable income while producer good imports have real GDP, physical industrial production or real value added in manufacturing as activity variables.

The existence of import controls from 1950 to 1961 suggests that an additional variable be included in the import equation to allow for any shift in the demand function as a result of the removal of controls in 1962. We make use here of a dummy variable taking on a value of one for the years from 1962 onwards and zero for previous years. While the administration of import and exchange controls was characterized by significant changes over the period of their operation, "the basic priorities have remained relatively intact" (Golay, 1961; p.164).

The alternative lag distribution considered in the estimation procedure for each import group are identical to those used for exports as discussed earlier, i.e., the activity variable is assumed operative only for one year while the price effects could last up to four years with linearly declining lag weights.

The typical import demand function to be estimated may then be written

activity imp-control error term

$$(2) \quad M = b_0 + b_1 \sum_{i=o}^{N} w_i^m P_i^m + b_2 A + b_3 D + v$$

where

M = import flow (f.o.b. value in million 1963 U.S. dollars)

A = activity variable (in million 1963 pesos)

D = dummy variable for import control

v = error term

and P_i^m and w_i^m are the price variable and lag weight lagged i years.

In estimating eq. (2) for the different import groups, the same procedure as that employed for the export equations is followed in respect of autocorrelation difficulties as well as in the choice of "best" equations. Table 2 does not have an entry for Crude Materials because no significant price effect is found in the estimated equations for this commodity group. The other import categories show widely varying price elasticity estimates, from -.33 for Animal and Vegetable Oils to -7.52 for Beverages and Tobacco.[8] The GNP price index actually performed better than the domestic price index of locally-produced goods corresponding to the import group in the regressions for Mineral Fuels, Chemicals and Machinery and Equipment, confirming the suspected lack of substitutability between imported and domestic goods within these commodity groups. The price effect in four of the eight import groups is seen from the table to be operative only for one year; however, for Chemicals and

TABLE 2: Estimated Import Equations

Commodity Group	Length of lag (years)	Const.	P	$Ax10^3$	$Dx10^3$	Price elasticity	$\bar{R}^2$	D.W.	Autoregressive coefficient
Food (DP1)	1	185.7	-1.180 (-2.05)	3.08 (1.88)	-	-.88	.182	1.83	-.052
Beverages and tobacco (DP1)	1	28.4	-.412 (-7.02)	1.07 (4.37)	-	-7.52	.772	1.72	-.059
Mineral fuels (LS2)	2	179.2	-1.156 (-5.62)	1.45 (1.21)	-11.62 (-1.83)	-1.54	.741	2.08	0
Animal and vegetable oils (LS1)	1	2.0	-.616 (-1.37)	.78 (4.55)	-	-.33	.733	2.02	0
Chemicals (LS2)	4	71.3	-.580 (-1.43)	17.62 (5.91)	-	-.75	.833	1.93	0
Manufactured goods (LS1)	1	791.3	-7.026 (-7.60)	-	21.83 (2.14)	-3.55	.809	1.96	0
Machinery and equipment (LS2)	4	-88.5	-1.525 (-1.72)	24.92 (11.57)		-.52	.920	2.06	0
Miscellaneous imports (LS1)	2	52.3	-.538 (-5.21)	1.45 (5.70)	-	-2.28	.704	2.16	0

Notes: Numbers in parentheses underneath regression coefficients are their t-values.

A = disposable income for Food, Beverages and Tobacco, and Miscellaneous Imports, gross domestic product for Mineral Fuels and Machinery and Equipment, value added in manufacturing for Animal and Vegetable Oils and Chemicals.

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Machinery and Equipment the lag length is four years.

The import group Manufactured Goods, which consists largely of industrial consumer goods competitive to those locally produced, do not show significant activity effect in the estimated equation; the positive coefficient for the dummy variable indicates that the import control policy of the 1950s effectively curbed imports of such commodities. On the other hand, imports of Mineral Fuels, for which the coefficient of the dummy is negative, seem to have been favored during the period of controls relative to the decontrol years. The lack of significance of the dummy variable for the other import groups might be interpreted to mean that domestic prices of such imported goods reflected fully the scarcity premia engendered by the operation of the import control system.

3. Effect of the 1971 Currency Realignment

The coefficients a_1 and b_1 in eqs. (1) and (2) represent the unit price effects in export supply and import demand, respectively. With unchanged domestic prices, the price variables $\sum_i w_i^x P_i^x$ and $\sum_i w_i^m P_i^m$ would reflect the movement of peso prices of exports and imports for any specified commodity group. Denoting either variable by P for convenience, we may also write [7/]

$$(3) \quad c.P = \sum_j s_j r_j P_{fj}$$

where

s_j = share in Philippine exports (imports) of partner country j

r_j = peso exchange rate of j's currency

P_{fj} = commodity export (import) price in terms of j's currency

c = either unity or the relevant domestic price deflator to the export (import) price.

Currency realignment among the country's trade partners will affect P as follows:

$$(4) \quad c.dP = \sum_j (s_j P_{fj} dr_j + r_j P_{fj} ds_j)$$

the two terms in the R.H.S. representing the direct effect of the exchange rate change and the induced share effect. The latter arises from the shift in export sales (import purchases) to more profitable destination markets (less expensive suppliers) and can be evaluated only under certain assumptions on the degree of substitutability among export (import) markets by commodity group. Following Armington (1969), we postulate independence across commodities and a geographical distribution function of the constant elasticity of substitution type, in which case the export (import) share of trade partner j is determined by j's export (import) price relative to the average price:

$$(5) \quad s_j = k (P_j/P)^e$$

where e is the elasticity of substitution among export (import) markets and k is a constant. Therefore, the effect on s_j of a currency realignment of trade partners is given by

$$(6) \quad ds_j = s_j e \frac{d(P_j/P)}{(P_j/P)} = s_j e (g_j - g)$$

where

g_j = proportionate increase in the peso exchange rate of j's currency

g = proportionate increase in the weighted average of the peso exchange rates of all partner country currencies.

Based on the findings in Bautista and Tecson (1975), $e = .5$ seems reasonable for Philippine exports; for imports we shall use $e = -.5$ in the absence of empirical estimates on market substitution possibilities in Philippine import trade.

The policy action taken by the Central Bank as a response to the 1971 realignment of the world's major currencies was to keep the peso exchange rate with the U.S. dollar fixed, in effect devaluing the peso vis-à-vis the currencies of major trade partners of the Philippines (except the United States). Table 3 gives the quantitative increases in their peso exchange rates from April to December 1971, which together with available information on the geographic distribution of Philippine trade flows in 1970 will enable us to make use of the estimated export and import equations in evaluating the trade effects of the 1971 currency realignment.

For each trade commodity group, we calculate (by eqs. (4) and (6)):

$$(7)\quad dP = \frac{1}{c}\sum_j s_j r_j P_{fj} \left[g_j + e(g_j - g) \right]$$

multiplication of which by the corresponding a_1 or b_1 estimated earlier gives the induced change in trade flows (in quantity or constant U.S. dollar terms). By dividing this product by the corresponding 1970 trade values, we obtain the estimated proportionate changes in Philippine export and import flows induced by the currency realignment, as presented in Table 4. Also shown in the table are the associated changes in trade flows expressed in thousands of constant (1963) U.S. dollars. These

TABLE 3: Percentage Increases in the Peso Exchange Rate of Trade Partner Currencies, April-December 1971

Australia	5.73	Iran	0	South Korea	15
Belguim	11.57	Japan	16.88	South Vietnam	0
Canada	0.79	Kuwait	8.57	Spain	-1.
Denmark	7.45	Malaysia	-5.54	Sweden	7.
France	8.57	Mexico	0	Switzerland	13.
Hongkong	-6.16	Netherlands	11.57	Taiwan	0
Italy	7.48	New Zealand	5.93	United Kingdom	8.
India	-2.89	Saudi Arabia	-8.00	United States	0
Indonesia	10.00	Singapore	5.54	West Germany	13.

Source of basic data: IMF, International Financing Statistics, various issues.

TABLE 4: Effect of 1971 Currency Realignment on Philippine Trade

EXPORTS			IMPORTS		
Commodity group	Percentage change	Absolute change (const. million $)	Commodity group	Percentage change	Absolute change (const. million
Unmanufactured tobacco	.98	.19	Food	-3.18	-3.02
Canned Pineapple	2.64	.60	Beverages and tobacco	-.51	-.04
Copper concentrates	26.98	21.55	Mineral fuels	-1.02	-1.12
Unmanufactured abaca	1.61	.25	Animal and vegetable oils	-2.44	-.12
Molasses	3.32	.42	Chemicals	-1.97	-2.27
Copra	4.59	3.33	Manufactured goods	-14.74	-31.89
Copra meal/cake	16.95	2.74	Machinery and equipment	-1.52	-5.59
Coconut oil	2.92	2.37	Miscellaneous	-5.99	-1.50
Logs and lumber	8.17	16.57			
Nonprincipal exports	10.42	12.13			

results indicate that the 1971 currency realignment, jointly with the policy decision fixing the peso exchange rate with the U.S. dollar, has had a discernible impact on the magnitude of Philippine trade flows. The absolute changes in exports and imports amount to roughly 60.2 and -45.5 million U.S. dollars (in 1963 prices), respectively, implying and induced improvement in the trade balance of $105.7 million.

What is perhaps more interesting from a policy viewpoint is the wide dispersion of trade effects among the commodity groups. Those characterized by high elasticity values and high "effective" devaluation rates of the domestic currency such as copper concentrates and copra meal/cake among exports, and manufactured goods and miscellaneous imports are seen to be greatly affected. On the other hand, exports of unmanufactured tobacco and abaca, and imports of beverages/tobacco and mineral fuels show no significant relative effects. The distribution of gains and losses from exchange rate policy measures adopted in response to external disturbances such as currency realignments of major trade partners would be a matter of concern to policymakers. Given the greater flexibility in exchange rates among developed countries initiated in the early part of this decade, the repercussions of major currency realignments need to be studied in terms not only of the magnitude ~~by~~ but also the distribution of their trade effects.

4. Concluding Remarks

The above findings should be interpreted at best to provide indication rather than conclusive evidence of the trade flow changes occasioned by the 1971 realignment of the world's key currencies and the official policy decision keeping the peso-dollar exchange rate fixed. We have not experimented sufficiently with alternative lag patterns and with alternative ways of dealing with the observed problem of serial correlation in the estimation of our export and import equations. There is also a need to estimate these equations using the trade and price data of partner countries, considering the normally high level of inaccuracy of official recordings of trade flows and commodity prices in the less developed countries. Finally, it should be emphasized that the estimates presented in this paper represent only the direct trade effects of the exchange rate changes, since domestic prices and the activity variables have been assumed to remain unchanged. It will require a complete model of the Philippine economy to obtain feedbacks to these variables and work out the indirect effects on export and import flows of the external disturbance due to the realignment of trade partner currencies.

F O O T N O T E S

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[1] Sheahan and Clark (1967) made use of the consumer price index (CPI) in computing "effective" exchange rates. While wage increases may be reflected in CPI movements with some lag, raw materials and other producer goods are not represented in the CPI commodity basket. Since Philippine export industries are not highly labor-using (Bautista, 1975a) and observed CPI movements do not correlate well with money wage rate changes (Bautista, 1975b), the wholesale price index is used in the present study.

[2] Cf. Junz and Rhomberg (1973), Officer and Hurtubise (1969) and Marston (1971), the first one describing the various elements underlying the overall delay in export response.

[3] Preliminary regressions using concurrent and lagged price variables generally produced statistically inferior results (even for the two-period lag) because the successive values are too highly correlated.

[4] As is well known, OLS estimation in the presence of serial correlation of residuals, although consistent, is inefficient and yields standard errors that understate the true values.

[5] The Monte Carlo findings of Rao and Griliches (1969) suggest that this procedure is likely to do best among the various estimation techniques they examined. It is computationally less expensive than the more commonly used Hildreth-Lu method (1960) which involves scanning the admissible range of values of the (first-order) autoregressive coefficient and obtaining estimates of the regression parameters such that the standard error of estimate of the transformed equation is minimized.

[6] It is assumed that domestic wholesale prices of imported goods reflect fully changes in the exchange rate of foreign currencies. For exports, eq. (3) applies exactly since unit value data were used.

[7]It is possible that this rather high estimate of the price elasticity of import demand for Beverages and Tobacco is due to inaccuracy in import data recording, in view of the smuggling of foreign-produced liquor and cigarettes into the country which varied in intensity over the years. Use of corresponding partner country export data in the estimation of the import equation for this commodity group, as well as for others where significant discrepancies exist in bilateral trade recordings, is advisable in examining such hypothesis.

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