Devaluation Decisions for Small Developing Countries: A Simplified Approach Applied to the Philippine Devaluation of 1962

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Predicting the effects of a proposed devaluation on the balance of payments or the balance of trade normally involves estimating the elasticities of supply and demand for foreign exchange. In the best of circumstances this can present difficulties; for a less developed country with inadequate data or questionable aggregate statistics, the difficulties may often appear insurmountable. In this latter case, a method developed by Vanek can be helpful. Vanek has demonstrated that the effects of a devaluation on the balance of trade can be expressed as a weighted average of the elasticity of supply and demand for a country's exports and imports. For a small developing country with relatively few exports and imports, Vanek's approach simplifies the task of predicting the outcome of devaluation on the balance of trade. For an emerging nation with troublesome aggregate data, it allows estimates of foreign exchange elasticities to be made in terms of key individual exports and imports, where the data are often more reliable.

The present article will demonstrate the theoretical basis for Vanek's approach, apply it to the Philippines situation prior to the devaluation of 1962, and evaluate the results in the light of econometric testing of the actual outcome. The Philippines devaluation of 1962 was chosen as a case study because the Philippines is typical of a small developing country with export concentration in a few commodities and the author had firsthand experience of the event during his stay in the Islands from 1960-66. More important, its predevaluation statistics posed serious problems for ordinary estimation techniques because of widespread smuggling and

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the relatively brief span of years in the postwar recovery period on which to run a regression. Three of the four regressions on Philippines exports cited by Baldwin from a study of Bautista and Encarnacion, and referred to as the best equations, exemplify the problem.[1] Two of the regressions are limited to the postdevaluation period (1962-68), and thus simply avoid the problem of smuggling. This careful selection of years, however, severely limits the number of observations and precludes testing of the Durbin-Watson statistic for autocorrelation. The third equation, which covers 1950-69, includes the period of export smuggling prior to devaluation, but the value of the Durbin-Watson statistic is .321, which indicates positive autocorrelation and thus inefficient estimation. Vanek's method offers a means of circumventing these problems, as we shall see in Part II. Then from the vantage point of history we shall test these alternate estimates against regression results obtained from longer time series data (Part III).

I. The Logic of the Approach

In his book Vanek has shown that the elasticity of supply and demand for foreign exchange can be expressed directly in terms of the elasticities of supply and demand for exports and imports in general:

$$E_{S\$} = \frac{1 + e_{dx}}{\frac{e_{dx}}{e_{sx}} - 1}, \quad E_{D\$} = \frac{1 + e_{sm}}{\frac{e_{sm}}{e_{dm}} - 1}, \qquad (1.1A), (1.1B)$$

where $E_{S\$}(E_{D\$})$ represents the elasticity of supply of (demand for) foreign exchange ($); e_{sx} (e_{dx}), the elasticity of supply of (demand for) exports; and e_{sm} (e_{dm}), the elasticity of supply of (demand for) imports.[2] In his lectures he has shown how the relationship can be broken down further and expressed in terms of the elasticities for individual exports and imports. The change in the supply of foreign exchange ($dS_\$$) will be equal to the summation of the changes in the foreign exchange earnings of the different exports.

$$dS_\$ = dS^1_\$ + dS^2_\$ + \ldots + dS^n_\$ \qquad (1.2)$$

1 See Baldwin (1975) pp. 134-36.
2 Vanek (1962) p. 70.

where the superscript refers to a particular export and n equals the number of exports. Multiplication of both sides of the equation by $\frac{r}{dr \cdot S}$, where r = the exchange rate expressed in terms of the peso price of dollars (P/$), and dr = the change in the exchange rate, gives

$$\frac{dS_\$}{dr} \cdot \frac{r}{S} = \frac{r}{dr \cdot S} \left(dS_\$^1 + dS_\$^2 + \ldots + dS_\$^n \right) . \tag{1.3}$$

Here the left-hand side is the familiar elasticity of supply of foreign exchange ($E_{S\$}$). Multiplying each i^{th} element of the right-hand side by $S_\$^i / S_\$^i$ gives

$$E_{S\$} = \frac{r}{dr} \left(\frac{dS_\$^1}{S_\$^1} \cdot \frac{S_\$^1}{S_\$} + \ldots + \frac{dS_\$^n}{S_\$^n} \cdot \frac{S_\$^n}{S_\$} \right) \tag{1.4}$$

where the first part of every element on the right-hand side is the elasticity of supply of foreign exchange arising from a particular export and the second part is the relative weight or importance of that export. Substituting W^i for $S_\$^i / S_\$$ or the weight, we can write (1.4) as

$$E_{S\$} = \sum_{i=1}^{n} E_{S\$}^{\,i} \cdot W^i \tag{1.5}$$

By a similar process it can be shown that

$$E_{D\$} = \sum_{i=1}^{n} E_{D\$}^{\,i} \cdot W^i \tag{1.6}$$

Finally, by incorporating (1.1), (1.5), and (1.6) into the familiar formula for the balance of trade.

$$dBT_\$ = \frac{dr}{r} \left(X_\$ \cdot E_{S\$} - M_\$ \cdot E_{D\$} \right) \tag{1.7}$$

we obtain

$$dBT_\$ = \frac{dr}{r} \left[X_\$ \cdot \sum_{i=1}^{n} \left(\frac{1 + e_{dx}{}^i}{\frac{e_{dx}{}^i}{e_{sx}{}^i} - 1} \right) \cdot W^i - M_\$ \cdot \sum_{i=1}^{n} \left(\frac{1 + e_{sm}{}^i}{\frac{e_{sm}{}^i}{e_{dm}{}^i} - 1} \right) \cdot W^i \right] \tag{1.8}$$

II. Application of the Theory

As seen in (1.8), if a country's statistical problems are concentrated on an aggregate level, while the statistics for key individual exports and imports are generally more reliable, Vanek's method offers an immediate and safe alternative for estimating the effects of devaluation through ordinary estimation techniques. The Philippines situation prior to devaluation, however, was far more complex. As mentioned above, smuggling and the limited size of time series data (1950-61) made normal estimation techniques unfeasible, even on a disaggregated level. In this section, therefore, we will be constrained to use institutional estimates, which we will later test against regression results for the longer period 1950-69. Vanek's method is particularly invaluable in a situation like this when ordinary estimation techniques fail. In allowing derivation of the overall elasticities from analysis of a few key areas, it facilitates more realistic institutional estimates.

In the six years prior to the Philippines devaluation in 1962, four commodities accounted for more than two-thirds of all the Philippines' trade-related foreign exchange earnings, while none of the other exports accounted for more than 4% of export earnings and the overwhelming majority accounted for less than 1%. A weighted average of the elasticities of the four leading exports, then, should provide a generally reliable estimate of the overall elasticity of supply of foreign exchange. With coconut products accounting for 28.4% of export earnings during the six years prior to devaluation; sugar accounting for 21.6%; logs, 12.7%; and abaca, 7.2%; the relative weight for coconuts becomes 40.6%; sugar, 30.9%; logs, 18.2%; and abaca, 10.3%.[3]

Coconut Elasticities

In the international coconut market, the Philippines is clearly a dominant force, providing between 50-60% of all copra and coconut oil exports. Ordinarily this would mean a relatively inelastic demand for Philippines coconuts but coconut oil is a relatively small part of the overall vegetable oil market, and in that market many oils are close substitutes for each other. Of the total world production of fats and oils, coconut oil accounts for only 6%. Since the

3 Coconut products are limited in this context to copra and coconut oil because together the two comprise 90% of the coconut market and they can reasonably be handled together when speaking in terms of elasticities, copra being the unprocessed form of coconut oil.

Philippines is a relatively small exporter in an overall market where there is a good deal of substitutability among products, one may argue that the Philippines faces a high degree of elasticity in the demand for its coconut products. It is clear from (1.1) that the closer the elasticity of demand (e_{dx}) approaches infinity, the more the elasticity of supply of foreign exchange ($E_{S\$}$) depends on the elasticity of supply of exports (e_{sx}). If we assume the elasticity of demand is infinite, the elasticity of supply of foreign exchange will reduce to the elasticity of supply of exports.

Under ordinary circumstances the short-run elasticity of supply of coconut is close to zero because seedlings take seven years to mature. At the time of devaluation, however, it was estimated that 30% of copra exports were being smuggled out of the country due to the overvaluation of the peso and foreign exchange controls.[4] With devaluaton these covert exports could be expected back in official channels, thus adding to the short-run elasticity of recorded supply.

Production statistics show that coconut output levels had also fallen under the overvalued exchange rate. While coconut hectarage remained constant throughout the fifties, production levels fell from an avearge of 1,310,000 metric tons of 1956-1958 to an average of 1,131,000 metric tons in 1959-1961. The stimulus of devaluation could be expected to bring about a resumption of former production levels. Higher export prices would warrant greater expense in cultivating, harvesting, and marketing the crop. With longer peso returns, higher recovery rates in processing would also be likely. If production rose to former levels, there would be an increase of 14% in the supply of coconuts.

Theoretically, diversion of coconuts from the domestic market to the international market could also increase short-run availability. But since the Philippines consumes relatively little of its coconut crop, not much of an increment to supply could be expected from this quarter. All told, with a projected 30% increase from the demise of smuggling and a 14% increase from more intensive cultivation, and with an effective devaluation of approximately 75%, the elasticity of supply of coconuts would be .59.[5]

Log Elasticities

4 See Hicks (1967) pp. 155 ff.

5 While the peso was officially devalued from 2:1 to 3.90:1, exporters were required to surrender 20% of their earnings at the old rate, thus providing an effective rate of 3.51:1.

In the six years prior to devaluation Philippines exports of hardwood logs accounted for approximately 25% of all hardwood logs sold internationally. As theory makes clear, the larger of country's share of a particular export, the less likely the country is to face a perfectly elastic demand. Since the demand for hardwood logs is a derived demand and there are few genuine substitutes, one would expect a relatively inelastic demand for Philippines hardwood logs.

Price elasticity is measued under the assumption of "other things being held constant," however, and in the late fifties and early sixties other variables were changing rapidly, causing the demand for logs to shift out dramatically over time. The chief markets for Philippines hardwood--Japan, Korea, and Taiwan--all experienced remarkable growth rates in the fifteen years or so surrounding devaluation. Japanese hardwood imports nearly trebled from 1956-62 and all but trebled again by 1969. Korean and Taiwanese imports each grew from barely 100,000 cubic meters in the late 50's to over 1,000,000 cubic meters by 1968. On a worldwide basis, hardwood imports more than doubled between 1956 and 1962, and more than doubled again by 1969. With a rapidly expanding market, increased Philippines exports would not reduce prices and in this sense the Philippines faced a perfectly elastic demand. The elasticity of export supply once again becomes the crucial variable.

From relatively small beginnings the Philippines logging industry was expanding by as much as 20-30% a year at the time of devaluation. With devaluation, earnings would double in peso value but so would the cost of capital that was the major constraint on growth in the industry. With costs and receipts increasing almost proportionately, one would not expect a major change in the availability of logs. The elasticity might increase somewhat as a result of the possible diversion of logs from the domestic market but the overall elasticity of supply would likely fall between .4 and .6.

Sugar Elasticities

At the time of devaluation Philippines sugar exports were directed almost exclusively to the American market under the U.S. Sugar Agreement. Under the agreement the Philippines was assigned a quota, the final terms of which were determined by world conditions. The effects of devaluation would have no direct bearing on sugar's foreign exchange earnings, therefore. Devaluation would double the peso profits of sugar producers selling on the american market but it would not of itself influence the price or lead to an in-

crease in the quota. The elasticity of supply of foreign exchange coming from sugar under these circumstances would be zero, therefore.

Abaca Elasticities

Abaca is the least important of the four major exports that accounted for the highest percentage of sales at the time of devaluation. Once a considerable earner of foreign exchange, abaca went into a steady and serious decline in the postwar period. There were problems with domestic production and increased competition internationally from sisal and synthetic fibers. Because of the competition, abaca faces a kinked demand curve that is more elastic for price increases than price decreases. Price increases will cause considerable cuts in the quantity of abaca demanded, while a decrease in price will not increase demand appreciably. As long as there remains some substitutability between abaca and competing products, however, the elasticity of demand can be expected to be longer than one. In light of the domestic problems with supply, the elasticity of supply is in all probability less than one. If we take as a hypothetical but not unreasonable estimate of .5 for the elasticity of supply and -2 for the elasticity of demand, the elasticity of supply of foreign exchange would be .2:

$$E_{S\$} = \frac{\frac{-2+1}{-2-1}}{.5} = \frac{-1}{-5} = .2$$

An estimate of the overall elasticity of supply of foreign exchange can now be constructed according to (1.5) where n = 4 and includes coconuts (C), sugar (S), logs (L), and abaca (A).

$$E_{S\$} = E_{S\$C} \cdot W^C + E_{S\$S} \cdot W^S + E_{S\$L} \cdot W^L + E_{S\$A} \cdot W^A$$

$$E_{S\$} = .59\ (.41) + 0\ (.31) + .6\ (.18) + .2\ (.10)$$

$$E_{S\$} = .37$$

By a perfectly analogous process we can estimate the elasticity of demand for foreign exchange. While import statistics were not as problematic as export statistics prior to devaluation,[6] perhaps because of the greater government supervision during the period of controls, the short-cut method should prove informative. In other

6 Hicks and McNicoll (1971) pp. 45-6.

circumstances or other countries, the problem with trade statistics could come from the import sector. In the Philippine case, since no specific commodities dominated imports, we shall speak in terms of general elasticities.

Philippine imports account for less than 1% of world imports, with the overwhelming proportion coming from the United States and Japan. Consequently, the elasticity of supply of Philippine imports is perfectly elastic. The elasticity of demand for foreign exchange will, therefore, depend entirely on the elasticity of Philippine demand for imports.

By exchange control restrictions, the use of tariffs, special import taxes, time deposit requirements and special exemptions for basic industries, the Philippines managed during controls to curtail low priority imports.[7] By the time of devaluation, imports of food, intermediate goods, and capital goods accounted for ninety per cent of all Philippine imports. Since the same tariff structure remained in effect after devaluation and was butteressed by further protective amendments, in addition to the higher peso price on which the tariff was based, there was little likelihood of a change in import structure. Attention centers, therefore, on the imports of food, intermediate goods, and capital goods.

Philippine food imports are for the most part essential in nature and have an inelastic demand. Intermediate goods, prerequisites for industrial operations, similarly have an inelastic demand. Of the three major categories of imports, capital goods likely possess the most elasticity but even here the demand tends towards inelastic. First, the demand for capital goods is partly a derived demand, stemming from the needs for replacement, upkeep, and completion of earlier investment plans. Second, import-substitution would be more profitable after devaluation and with government help likely in the interest of fostering industrialization, capital goods would in all probability remain strong. Third, the Philippines had not developed the capacity to produce capital goods. The demand for imports, therefore, is relatively inelastic. It could conceivably range from slightly more than zero to slightly less than one, with more probability that it is between .5 and 1. We will set our estimate at .6.

Having estimated the elasticities of supply and demand for foreign exchange, we can now estimate the likely effect of devaluation on the balance of trade. Two slight modifications must first be made with equation (1.8), however. Because of conditions prior to

7 Baldwin (1975) pp. 84-106.

devaluation and certain riders attached to the devaluation itself, the change in the Philippine exchange rate could not be expected to have the same proportional effect on exports and imports. Because Philippine exports are heavily dependent on agricultural products, the export reponse would be delayed by one year, and the full effect on the balance of trade from the devaluation in 1962 would not be realized until 1963. Equation (1.8) must be altered in these circumstances to:

$$dBT_{\$} = (dr/r)_X \ (X_t \cdot E_{S\$}) - (dr/r)_M \ (M_{t-1} \cdot E_{D\$}) \qquad (1.9)$$

where $(dr/r)_X$ and $(dr/r)_M$ are the effective relative change in the exchange rate for exports and imports respectively, and t = 1963.

Under the system of exchange controls imports were admitted to the Philippines under considerable restrictions and sold to the public at whatever prices the market would bear. As a result, prior to devaluation, the domestic price of imports (90% comprising essential goods) closely reflected their free market value and correction of the exchange rate would not raise final consumer prices appreciably. Importers' windfall profits would disappear but even with a devaluation of 95%, the final prices of imports would not rise by more than 10-15%. We will, therefore, estimate the effective change in the exchange rate for imports $(dr/r)_M$ as 10%.

Export earnings, on the other hand, were more closely attuned to the official exchange rate in the predevaluation years. Concessions were granted to exporters in the last few years of controls, but they had little positive impact. With a special rider attached to devaluation requiring exporters to surrender 20% of their proceeds at the old rate, the exchange for exports in effect moved from 2.1 to 3.51:1, or approximately 75%. Our *ex ante* estimation of the change in the balance of trade over a two year period is, therefore, according to (1.9).

$$dBT_{\$} = .75 \ [\$556{,}000{,}000 \ (.37)] - .10 \ [\$611{,}000{,}000 \ (-.6)]$$

$$dBT_{\$} = \$190{,}000{,}000$$

III. Testing the Theory

The actual improvement in the balance of trade from an immediate response in imports and a delayed response in exports was

$193 million: a $24 million immediate improvement in imports and a $169 million improvement a year later in exports. While the total effect is astonishingly close to the mark, it is in part the result of a mutual cancellation of errors. We overestimated the import improvement by $12 million ($36 million vs. $24 million), but we underestimated the export improvement by $15 million ($154 vs. $169). The individual estimates are obviously the more important. Taken separately, they are not as close as the overall estimate but they are nevertheless good and warrant further consideration.

The cause of the discrepancy in the import estimate will most likely be found in our evaluation of the effective change in the exchange rate for imports or in our estimate of the elasticity of demand for imports. We estimated the effective change in the exchange rate for imports would not be more than 10-15%, because under the system of exchange controls imports had been restricted for years and sold to consumers at competitive prices. The actual change in the price of imports, as indicated by the wholesale (peso) price index of imports, however, was even smaller than we anticipated. The price of imports on the domestic market rose by only 9% in 1962 and two of the nine percentage points can be explained in terms of exogenous dollar price increases on the world market. We overestimated the effective change in the exchange rate for imports, therefore, and this explains in part why our estimate of the likely import improvement was larger than the actual improvement.

Our estimate of the elasticity of demand for imports was also slightly off the mark but obviously not by much. Earlier, circumstances compelled reliance in institutional estimates because smuggling and limited time series data barred application of normal estimation techniques. In this section, from the hindsight of history, longer time series data are available, which should obviate part of the difficulties. Since the supply of imports for a small country like the Philippines is almost certainly perfectly elastic, it should not be difficult to check our *ex ante* estimate of the elasticity of demand for imports econometrically. With a perfectly elastic supply function, changes in import spending should accurately reflect changes in import demand. Accordingly, we ran a regression expressed in logs, using ordinary least squares and assuming that the demand for imports is a function of income, relative prices, and exchange controls. The results for the years 1950-69 were:

$$M_D = 3.46 - .67D + .91Y - .78P$$
$$(-2.9385)\ (5.4429)\ (-1.7871)$$

R^2 (adjusted) = .9172
F-Test (3, 16) = 67.2138
Durbin-Watson = 1.99

where M_D is the demand for imports expressed in constant (1955) pesos; D is a dummy variable estimating the effects of controls, with 1 used for the period of controls (1950-60) and 0 for the decontrol period (1961-1969); Y is real income expressed in constant (1955) pesos; and P is the relative price of imports obtained by deflating the peso price of imports by an index of the price of domestically produced goods for the domestic market, again with a base of 1955. T-Test values are given directly below the regression coefficients. The regression coefficients are all significant, and with a value of 1.99 for the Durbin-Watson statistic, we can safely reject the hypothesis that serial correlation exists in the error term.

The regression reveals that the price elasticity of demand for imports in the Philippines is .78. It is a relatively inelastic demand, less than unitary as we predicted, but more elastic than our *ex ante* estimate of .6. The regression also shows that the income elasticity of demand for imports is relatively low (.91), with an elasticity closely approaching unitary. This is not surprising in the Philippine context. Stringent import duties on luxury items keep such goods fairly much under control. The goods that do gain entrance to the Philippine economy are basic foodstuffs or items that are in one way or another connected with the industrialization program. With Philippine industrial plans still heavily dependent on foreign imports for implementation, and industrial development high in Philippine aspirations, the Philippines naturally tends to spend much of its incremental income on imports. We can conclude that theory and Vanek's elasticity formulae hae served us well in estimating the initial change in import spending that could be expected from devaluation.

Our *ex ante* estimate of the change in export earnings fell short of the mark by $15 million. Since the estimate was derived from an overall elasticity based on the four leading exports, it would be profitable to examine the overall elasicity and the components of that elasticity to compare the *ex ante* predictions with the *ex post* results. We will start with the components and conclude with the aggregate statistic.

We estimated .59 as the elasticity of supply of foreign exchange from coconuts. Ideally it should be possible to check this estimate

against the *ex post* measurement by running a regression on coconut exports. Unfortunately, however, the data for coconuts, as for several other individual export commodities, do not lend themselves to quantitative analysis. As Hicks discovered, it is almost impossible to obtain accurate export figures for the exchange control period.[8] Despite various adaptations of the dummy to capture the effect of smuggling, all regression attempts yielded insignificant results.

If we can assume that smuggling essentially stopped with the devaluation in 1962, however, we can calculate the elasticity of supply of foreign exchange that prevailed between 1962 and 1963. Foreign exchange earnings from coconuts increased by 40% from 1962 to 1963. Allowing for exogenous price changes on the world market, the real change is export earnings was closer to 31%. We have already argued that the effective change in the exchange rate for exports was in the order of 75%. By the formula, $E_{S\$} = \frac{dS/S}{dr/r}$, the elasticity of supply of foreign exchange originating in the coconut sector in 1963 was approximately .41. This figure conforms with the relatively inelastic response we predicted but is lower than the elasticity of .59 that we estimated. Contrary to expectation, part of the coconut response turned out to be immediate. Since a portion of the short-run elasticity of supply of coconuts came about simply by diverting smuggled goods back into official channels and did not involve a reallocation of resources, the coconut response was actually spread over two years, with approximately equal responses in both years. Taking this into consideration, our original quantitative estimate slightly underestimated the actual response but it was not far off the mark.

Our earlier analysis predicted that the elasticity of supply of foreign exchange in the sugar industry would be zero. Actual trade statistics show that sugar earnings increased by $27 million in 1963, improving by 23% in monetary terms and 10% in real terms. The recorded statistics do not contradict our earlier prediction, however. The improved earnings were the result of exogenous price increases on the world market and an increase in the American quota that was totally unrelated to the devaluation. Because several members of the United States sugar agreement were

8 Hicks (1967) p. 155. Hicks tried to reconstruct more accurate export figures. Use of Hicks' corrected figures also failed to yield significant results. The successful Bautista and Encarnacion equations on coconuts, it should be noted, omit the smuggling period and start in 1962. Cf. Baldwin (1975) pp. 134-36.

unable to meet their quotas, the Philippines received a one-year additional quota of 200,000 tons. Thus part of the improvement in the balance of trade in 1963 was due to exogenous world forces independent of devaluation, and this further explains why the actual improvement in the overall balance of trade was greater than our original estimate.

The elasticity of the supply of logs was estimated as .6. Unfortunately, as in the case with coconuts, we could not test this *ex ante* estimate successfully econometrically. We therefore follow the same procedure with logs as we did with coconuts. The change in foreign exchange earnings for logs in 1963 was 37% in real and monetary terms. With a change in the exchange rate of 75%, the elasticity of supply of foreign exchange for logs in 1963 was .49. We slightly overestimated the elasticity of supply of foreign exchange coming from logs but the estimate was reasonably close.

The elasticity of supply of foreign exchange from abaca, the least important of the four major exports at the time of devaluation, was the hardest to predict *ex ante* and is the hardest to measure *ex post*. Since we cannot fully specify the demand or supply, a regression on abaca exports would be futile. By following the previous procedure, however, we can again obtain an estimate of the elasticity of supply of foreign exchange for 1963. Dollar earnings from abaca increased nominally by 28% in 1963; by 22% in constant prices. Taking .75 as the effective change in the exchange rate, the elasticity of supply of foreign exchange for abaca in 1963 was .29. The elasticity is slightly larger than our *ex ante* estimate of .2, but because of the indeterminacy of the supply and demand conditions, we cannot tell where we erred.

Although econometric analysis failed to provide significant results for several of the individual exports, we decided to try an ordinary least-squares regression on the aggregate statistics. Attempting to do so, of course, depends on the rather heroic but not completely implausible assumption that the demand for Philippine exports is nearly perfectly elastic. This assumption is not as well-founded as our earlier assumption of the infinite elasticity of supply of Philippine imports, however, and all conclusions must therefore be qualified.

Originally we planned to use a dummy to capture the effects of smuggling. All attempts to incorporate a dummy for smuggling failed, however. We tried a dummy of 1 for the years of smuggling and zero for the years after devaluation, similar to the dummy used for exchange controls in the import regression; a dummy that grew

geometrically towards one as it approached devaluation and then changed to zero after it; a dummy of 1 limited to the years in which Hicks found smuggling most intensive. All were insiginficant and frequently affected the sign of the price coefficient adversely. Finally, using ordinary least squares, we ran a regression of export earnings on time and price alone, incorporating a one-year lag for price, and obtained the following results:

$$X_S = \underset{(3.41)}{2.8} + \underset{(7.07)}{.035T} + \underset{(4.07)}{.66P_{t-1}}$$

R^2 (adjusted) = .9472
F-Test (2, 16) = 162.69
Durbin-Watson = 1.37

where Xs is the amount of exports supplied expressed in constant (1955) pesos; T is time; and P_{t-1} is the lagged peso price of exports deflated by an index of the price of domestically produced goods for the domestic market. The numbers in parentheses below the coefficients are the t-values and all the variables except time are expressed in logs to provide direct measurement of the price elasticity. The results are highly significant. Only the Durbin-Watson statistic is disturbing, falling in the indeterminate range where we can neither accept nor reject the hypothesis of serial correlation in the error term.

While surprisingly good, the results should be interpreted with caution for reasons given earlier. The coefficient for time suggests that exports were growing over the twenty-year period at a rate of 3.5% independent of other incentives. This conforms with the general observation that exports managed to maintain modest growth despite considerable disincentives during the thirteen-year period of exchange controls.

The coefficient for price indicates that the overall price elasticity of the supply of exports for the economy over the twenty-year period was .66. It is less than one and relatively inelastic, as we have maintained, but higher than the .37 we estimated from our analysis of the four major exports. Two reasons may be given to explain the discrepancy between the two estimates. First, our estimate is lower because we included zero elasticity for sugar. The present econometric equation does not take the sugar quota into account and would therefore explain the variations in earnings caused by sugar in terms of price. Since the Philippines is most likely to receive

an extra sugar quota when conditions in the rest of the world are bad and prices high, one might naturally expect some positive correlation between changes in price and changes in sugar exports. This would tend to add to the overall price elasticity of the export sector in the present equation.

Second, the estimating equation, as constructed, fails to make allowances for the effects of smuggling because of difficulties mentioned previously. With this variable omitted, the price coefficient picks up some of the variability caused by smuggling and so is naturally somewhat higher. The important point, however, is that both estimates show that the elasticity of supply of Philippine exports is less than one and relatively inelastic. Because of this the elasticity of supply of foreign exchange for the Philippines also tends to be relatively inelastic.

In conclusion, Vanek's method has served well in estimating the effects of the Philippine devaluation of 1962 on the balance of trade. It should prove equally helpful for other small developing countries with similar troubles in their trade statistics.

References

Baldwin, Robert E., 1975, *Foreign Trade Regimes and Economic Development: The Philippines,* New York: Columbia University Press.

Hicks, George L., 1967, "The Philippines Coconut Industry: Growth and Change: 1900-1965," Washington, D.C.: National Planning Association, Center for Development Planning, Mimeograph.

Hicks, George L. and McNicoll, Geoffrey, 1971, *Trade and Growth in the Philippines,* Ithaca: Cornell University Press.

Vanek, Jaroslav, 1962, *International Trade: Theory and Economic Policy,* Homewood: Irwin.