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THE RESPONSE OF COLOMBIAN EXPORTS TO
VARIATIONS IN EFFECTIVE EXCHANGE RATES

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And

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Center for Development Economics

Williams College

Williamstown, Massachusetts

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Few North American economists ever quite outgrow the belief that a country's exports are determined by what that country does to produce and sell useful goods and services. Few South American economists take this notion seriously. Most of them are convinced that earnings from the primary products which constitute their major exports are determined by external market conditions, and that any extraordinary zeal in trying to increase the volume of exports would reduce earnings by driving down prices.

Perhaps the most impressive statistical study of the Colombian economy now available, done originally for AID by Jaroslav Vanek, led him to an extreme version of the "South American" position. "For reasons most of which are quite obvious to an economist, exports of a developing country such as Colombia are predominantly determined by forces other than the economic conditions in the developing country."* On the other hand, a subsequent study for AID by Robert Aliber concluded that Colombian exports, other than coffee, were highly responsive to changes in incentives. For minor exports, "The data available suggest that the supply elasticity is in the range of 2.2-2.5--that is, a 1 percent improvement in Colombian export prices relative to the world level leads to a 2.5 percent increase in minor exports."** If correct, this would mean that Colombia could do

* "A Case Study in Development Analysis: Future Foreign Resource Requirements of Colombia," AID/SRP, 1964, revised as "The Role of Foreign Resources in the Next Decade of Economic Development of Colombia," Cornell University Conference on the Next Decade in Latin American Economic Development, April 1966.

** "Economic Policies and the Pattern of Colombian Trade and Development," SPS-TR-3, 1965, p. 34.

a lot to raise its own exports by exchange rate variations or alternative policies having similar effects on incentives. Aliber and Vanek cannot both be right.

1. The Structure of Colombian Exports

As of 1965, total exports of commodities were \$539 million. Coffee accounted for \$344 million of this, and crude oil for \$88 million.* This paper is chiefly concerned with the remainder, usually referred to as the "minor exports." This term ought to be changed. They could, and should, become more important than coffee within the next decade. What they consist of, and the way individual items have changed since 1950, are indicated in table 1.

As far as coffee is concerned, there is very little that Colombia can do to raise its earnings. Its exports constitute a large fraction of world coffee imports, demand elasticity is low, and an international commodity agreement is at present operating to hold prices above equilibrium through administrative controls. Earnings from coffee could not be improved, and might easily be reduced, by a decision to take the wraps off supply.

The second largest export, petroleum, is in a slightly different position. It can be marginally affected by domestic tax and price decisions operating to change the rate of growth of domestic consumption, and thereby to change the volume available for export. Exports of oil might also respond to

* International Monetary Fund, International Financial Statistics.

TABLE I: EXPORTS OTHER THAN COFFEE AND CRUDE OIL, 1950-66 (billion dollars)

	<u>1950</u>	<u>1959</u>	<u>1960</u>	<u>1961</u>	<u>1962</u>	<u>1963</u>	<u>1964</u>	<u>1965^a</u>	<u>1966^a</u>
<u>Primary foods and materials</u>	20.7	17.6	32.7	39.0	44.8	43.5	41.3	(59.0)	(50.3)
bananas	15.5	13.7	13.7	14.0	10.6	13.3	12.4	13.6	20.0
cattle for consumption	--	--	--	--	--	--	0.4	6.3	6.0
cotton	--	--	12.7	10.6	15.8	9.5	6.3	0.0	2.3
lumber, wood	1.3	1.3	2.1	2.2	2.7	2.0	3.9	3.2	2.9
meat	--	--	--	--	--	--	--	2.4	1.4
sugar	--	--	--	5.2	7.4	5.5	3.3	7.6	3.3
tobacco	2.0	2.0	2.4	4.0	5.7	7.2	9.4	7.2	5.6
<u>Petroleum products</u>	10.1	0.7	7.7	5.2	7.2	4.1	7.2	7.3	9.7
<u>Manufactured products</u>	5.7	7.0	7.0	10.2	14.4	16.2	27.7	(39.1)	(45.1)
chemicals, pharmaceuticals	1.0	1.0	1.3	1.4	2.7	2.4	4.4	10.2	9.6
textiles, yarns	--	--	0.3	1.5	4.6	4.0	0.4	11.2	9.6
cement	1.2	2.3	2.0	2.4	2.0	1.6	2.3	2.2	2.1
leather	0.7	0.6	0.2	0.6	1.6	1.0	3.4	2.9	3.6
machinery, transport equipment	0.5	1.0	2.1	2.0	1.1	1.7	1.9	2.1	3.6
paper packaging materials	--	--	--	--	--	--	--	--	5.7
<u>Total exports other than coffee and crude oil</u>	39.6	30.5	52.3	58.4	70.8	66.5	34.8	105.0	107.6

(Table I continued)

(Table 1 continued)

Note (a): data for 1965 and 1966 from original tabulations, arranged to correspond as closely as possible to classifications used in United Nations' Yearbook of International Trade Statistics. Totals for primary and for manufacturing groups should be regarded as approximations; they add up to \$1.2 million too much for 1965, and fall short by \$2.5 million for 1966. Overall totals are those given in International Monetary Fund, International Financial Statistics.

Sources: United Nations, Yearbook of International Trade Statistics, 1960, 1963, and 1964, New York, 1962, 1965, and 1966, for data for 1950-1964; Departamento Administrativo de Estadística, Boletín de Estadística and original tabulations for 1965-66.

changes in taxes or in the administrative treatment of the companies, altering expected rates of return or the degree of security with which the firms can plan future operations. But these are rather elusive considerations, and their effects may easily be swamped by sheer accidents of new discoveries or depletion. It is not easy to prescribe conventional monetary, tax, or price policies by which the country could count on raising its earnings from this export.

If earnings from coffee and oil are taken as given by events largely beyond the control of Colombian economic policy, it would seem that a generally fatalistic attitude is warranted. These two products together accounted for 89 percent of total exports as of 1960, and 80 percent in 1965. But expressing the same two facts in a different way suggests that something else must be moving. All other exports rose from 11 to 20 percent of the total in just five years. This was no accident, except in so far as a favorable change in exchange rate policy toward the end of the interval may be considered to have been an accident.

The evidence below indicates that exports other than coffee and oil do respond to changes in incentives, and that Colombia does have considerable scope for taking steps that will raise them significantly in a relatively short period of time.

II. Effective Exchange Rates

Other things equal, a higher price for foreign exchange means that the profits to be realized from exporting will be increased. But if the exchange

rate simply moves in parallel with a rising domestic cost level, then incentives may not be improved at all. What counts is the relationship between the value in domestic currency of a dollar's worth of exports and the cost in domestic currency of producing it.

In all of the following discussion, changes in the cost of living index are taken as indicators of changes in domestic costs. This is a doubtful device for a number of reasons. The rate of change in wage costs is surely related to the rate of change in the cost of living, but there may be important lags in wage adjustments, and there will certainly be important year-to-year variations in the relationship between these factors. Changes in wage rates will be the main cost consideration for some firms, but for others the crucial determinant may be the price of some material input which does not follow the cost of living index at all closely. The indicator of input costs used here is thus decidedly imprecise, though it should at least move in the same direction as the level of costs for most producers.

It should in general be expected that an increase in the cost of living, with a fixed exchange rate, would act to discourage interest in exporting, and that an increase in the price of foreign exchange which significantly outdistanced the rate of increase in the cost of living would encourage such interest. The variable used to test the significance of exchange rate changes for behavior of exports is therefore the ratio between the official exchange rate and the cost of

living index. This gives a deflated, or "effective" rate of exchange relative to domestic costs.

Four principal exchange rates were regularly reported for Colombia in the years studied. These were the main selling rate for imports, a second applied to coffee exports, a third applicable to other exports, and the free rate used for most invisibles and capital transactions. The problem is that earnings of exports other than coffee and oil have sometimes been converted at the free rate applied for capital transactions, sometimes at the rate designated as applying to "other exports," and sometimes at special rates set for particular commodities.

Use of a single rate for all these commodities is a good approximation for the period since 1962, when rates except that for platinum were unified.* For purposes of statistical testing, it is desirable to go further back than 1962, and this does run into difficulties with the multiple rate problem for some commodities, particularly bananas and hides. The tests reported below go back to 1950, and thus include four years in which bananas and hides were given less favorable export rates than the other commodities.

In the period covered, from 1958 through the first half of 1966, exports other than coffee and oil were shifted twice from a fluctuating to a fixed rate basis and back again. The applicable rate moved upward in response to market forces from 1958 until December 1962. It was then reduced and fixed

* Robert Z. Aliber, "Economic Policies and the Pattern of Colombian Trade and Development," AID/SPS-TR-3, mimeo, 1965, Table 3, page 12a.

at 10 pesos per dollar until October 1964. This was nominally a free rate, actually pegged by central bank intervention. From October 1964 to June 1965 the rate was allowed to move freely again, and went up to the range of 16 to 18 pesos per dollar. In the latter month, it was fixed again, once more at a level below that indicated by the market. Table 2 following gives the quarterly average rate, the cost of living index, and the effective rate for the period 1958-1966.

The most important fact about the effective exchange rate shown in column 3 is that it has absolutely no upward trend. From the first half of 1950 to the first half of 1966 the actual rate in pesos per dollar more than doubled, but the cost of living went up slightly faster.* In these eight years of almost continuous foreign exchange difficulties, with import shortages repeatedly acting to hamper economic growth, nothing was accomplished through use of exchange rate policy to establish any lasting improvement in incentives for development of non-traditional exports.

III. Effects of Exchange Rate Variations on Exports

Although there was no upward trend in effective exchange rates applied to non-traditional exports, the many short-term variations recorded in table 2 make it possible to test statistically the association between changes in rates and in export performance. The hypothesis is that exports should respond to higher

* For these exports, the effective exchange rate in 1953 was, at 5.09, better than the average for the first half of 1966. All of these rates were distinct improvements over the averages for 1951-52, but there has been no favorable trend since.

TABLE 2: EXCHANGE RATES APPLIED TO EXPORTS OTHER THAN COFFEE AND OIL,
COST OF LIVING INDEX, AND RATIO BETWEEN EXCHANGE RATE AND
COST OF LIVING INDEX, 1958-1966.

		(1) Exchange Rate Pesos per dollar	(2) Index of Cost of living (1958 = 100)	(3) Effective Exchange Rate (col. 1) ÷ (col. 2/100)
1958	I	5.94	96	6.19
	II	5.93	102	5.86
	III	6.93	101	5.92
	IV	5.93	102	5.86
1959	I	8.03	106	7.58
	II	7.32	110	7.11
	III	7.36	106	6.94
	IV	7.09	107	6.63
1960	I	6.65	109	6.10
	II	6.66	112	5.95
	III	6.79	111	6.12
	IV	6.99	114	6.13
1961	I	7.44	117	6.36
	II	8.10	126	6.43
	III	8.52	121	7.04
	IV	8.58	120	7.15
1962	I	8.63	122	7.07
	II	8.72	124	7.03
	III	8.45	124	6.81
	IV	10.10	126	8.02
1963	I	10.09	143	7.06
	II	9.99	163	6.13
	III	9.99	168	5.95
	IV	9.99	180	5.55

(continued)

(Table 2 continued)

		(1) Exchange Rate Pesos per dollar	(2) Index of Cost of living (1956 = 100)	(3) Effective Exchange Rate (col. 1) \div (Col. 2/100)
1964	I	9.99	106	5.37
	II	9.93	205	4.87
	III	9.98	191	5.23
	IV	11.74	100	6.24
1965	I	13.42	192	6.99
	II	16.61	190	8.39
	III	13.50	193	6.82
	IV	13.50	209	6.46
1966	I	13.50	227	5.95
	II	13.50	244	5.53

Source: International Monetary Fund, International Financial Statistics.

Note: exchange rates are averages of the three end-month rates for each quarter; the cost of living index given is the average for the three included months.

rates, but not necessarily that this should be any exclusive determinant. It would seem particularly useful to test jointly the effect of changes in external demand and in exchange rates.

The variable chosen to measure changes in external demand is the total value of world exports. The data are at actual value, uncorrected for price changes, as are those for Colombian exports themselves. It is not expected that there is any direct causal link between total world exports and those of Colombia, but rather that any acceleration of world trade should be linked with demand conditions favorable for Colombian exports.

It will be immediately apparent from Table 3 that there are marked upward trends in both the series of world export values and that of Colombian exports other than coffee and oil. This raises familiar problems of statistical interpretation, considered below. There is also a problem with respect to seasonal variation in Colombian exports. They are systematically highest in the second quarter and lowest in the fourth. One solution for this might be to correct the basic data for seasonal variation, and apply regression analysis to the corrected figures. The alternative chosen was to use the actual data without correction, but to introduce seasonal variables to measure the deviations attributable to each quarter. The simplest hypothesis tested is that Colombian exports other than coffee and oil should vary directly in response to changes in the effective exchange rate and in world demand. This was tested in three steps: first without any correction for time trends or seasonal variation, secondly with seasonal correction,

TABLE 3: COLOMBIAN EXPORTS OTHER THAN COFFEE AND OIL, AND TOTAL WORLD

EXPORTS, 1958 - 1966

	(1) Colombian exports other than coffee and oil, million dollars quarterly total	(2) Total world exports, billion dollars, annual rate	(3) Ratio (col. 1) ÷ (col. 2/10)	
1958	I	9.6	94.5	1.02
	II	9.2	94.6	.97
	III	6.7	92.7	.72
	IV	7.2	102.4	.70
1959	I	9.1	93.2	.98
	II	10.3	101.3	1.07
	III	9.3	100.2	.98
	IV	7.3	112.3	.70
1960	I	12.9	111.3	1.16
	II	12.3	112.5	1.14
	III	13.3	109.3	1.22
	IV	11.9	119.2	1.00
1961	I	12.7	115.3	1.10
	II	16.7	113.5	1.41
	III	13.4	115.9	1.16
	IV	14.3	125.2	1.14
1962	I	21.0	120.8	1.74
	II	17.9	125.3	1.42
	III	12.9	120.5	1.07
	IV	19.1	130.7	1.46
1963	I	18.1	124.4	1.45
	II	21.2	136.0	1.56
	III	16.5	133.4	1.24
	IV	11.1	143.1	.75

(continued)

(Table 3 continued)

		(1)	(2)	(3)
		Colombian exports other than coffee and oil, million dollars quarterly total	Total world exports, billion dollars, annual rate	Ratio (col. 1) ^a (col. 2/10)
1964	I	13.7	145.5	.94
	II	17.3	151.7	1.14
	III	21.1	145.7	1.45
	IV	27.0	164.5	1.64
1965	I	21.2	152.7	1.39
	II	30.4	166.2	1.83
	III	30.4	160.5	1.89
	IV	23.6	179.5	1.31
1966	I	21.5	172.3	1.25
	II	30.5	100.0	1.69

Source:

International Monetary Fund, International Financial Statistics.
 Column 1 was derived as a residual, subtracting coffee and
 petroleum from the published total for all exports.

and thirdly with correction for both seasonal variation and trend. The regression equations are those numbered 1 through 3 in Table 4.

Equation 1 indicates a highly systematic relationship between the effective exchange rate and the level of Colombian exports, and a relatively good basis of prediction from the two factors of exchange rates and world demand to the level of exports.

Equation 2 brings in a correction for seasonal variation. The correction raises both the absolute value of the regression coefficient for the exchange rate variable and its statistical significance.

Equation 3 introduces the time trend as an additional independent variable, without very helpful results. The percentage of explained variance remains almost exactly the same as in equation 2, and the F value drops. For the exchange rate variable, the regression coefficient increases slightly and its level of significance remains practically unchanged, adding support to the presumption that this is a dependable relationship not distorted by trend factors. For the variable relating world demand to Colombian exports, the significant association shown in equation 2 is destroyed. The problem is the high degree of multicollinearity between X_3 and X_4 . Used separately, the variable representing world demand picks up the trend relationship. Used together, world demand and time trend interact in a way that makes it difficult to attach any statistical significance to either of them. The regression coefficient for world demand is quite stable, regardless of the inclusion or exclusion of time trend.

TABLE 4: REGRESSION EQUATIONS RELATING COLOMBIAN EXPORTS TO EFFECTIVE EXCHANGE RATES AND TOTAL WORLD EXPORTS, 1958-1966.

Quarterly data; 34 observations.

Variables

X_1	Colombian exports other than coffee and oil, quarterly total in million dollars.
X_2	Effective exchange rate: average of month-end rates for quarter, divided by average cost of living index for the same period.
X_3	World exports; annual rate in billion dollars.
X_4	Time trend, in quarterly steps.
$Q_1 Q_2 Q_3$	Quarterly variations for first three calendar quarters (fourth quarter serves as reference base from which variations are measured).
X_5	Ratio of Colombian exports other than coffee and oil to world exports. (column 3 in table 3).
ΔX_i	First differences in Series X_i .

Regression equations (Standard errors of regression coefficients indicated in parentheses)

$$1. \quad X_1 = -27.97 + 2.28 X_2 + 0.23 X_3$$

$$\quad \quad \quad (0.71) \quad (0.02)$$

$$R^2 = .79; \text{ F value } 59.42$$

$$2. \quad X_1 = -32.04 + 2.48 X_2 + 0.24 X_3 + 2.55 Q_1 + 4.40 Q_2 + 3.70 Q_3$$

$$\quad \quad \quad (0.64) \quad (0.02) \quad (1.37) \quad (1.36) \quad (1.42)$$

$$R^2 = .85; \text{ F value } 32.77$$

$$3. \quad X_1 = -32.78 + \frac{2.52 X_2}{(0.67)^2} + \frac{0.26 X_3}{(0.10)^3} - \frac{0.10 X_4}{(0.52)^4} + \frac{2.68 Q_1}{(1.57)^1} + \frac{4.47 Q_2}{(1.43)^2} + \frac{3.91 Q_3}{(1.81)^3}$$

$$R^2 = .05; \text{ F value } 26.37$$

$$4. \quad X_{1(t)} = -34.41 + \frac{2.36 X_{2(t)}}{(0.84)^2} + \frac{0.20 X_{2(t-1)}}{(0.05)^2} + \frac{0.24 X_{3(t)}}{(0.02)^3} + \frac{2.25 Q_1}{(1.43)^1} +$$

$$\frac{4.35 Q_2}{(1.41)^2} + \frac{3.70 Q_3}{(1.47)^3}$$

$$R^2 = .95; \text{ F value } 25.38$$

$$5. \quad X_5 = -1.21 + \frac{0.16 X_2}{(0.05)^2} + \frac{0.04 X_4}{(0.01)^4} + \frac{0.16 Q_1}{(0.10)^1} + \frac{0.29 Q_2}{(0.10)^2} + \frac{0.17 Q_3}{(0.10)^3}$$

$$R^2 = .66; \text{ F value } 10.98$$

$$6. \quad \Delta X_1 = -4.94 + \frac{1.78 \Delta X_2}{(1.00)^2} + \frac{0.34 \Delta X_3}{(0.19)^3} + \frac{7.06 Q_1}{(4.06)^1} + \frac{6.02 Q_2}{(2.23)^2} + \frac{4.07 Q_3}{(3.70)^3}$$

$$R^2 = .32; \text{ F value } 2.58$$

Perhaps the central point to be noted from the three equations is the high degree of consistency in the relationship between effective exchange rates and Colombian exports. The regression coefficient increases when seasonal and trend corrections are introduced, but the range between the lowest and highest estimates is only 10 percent. The coefficient is statistically significant at the 1 percent level in all three cases. There is no problem of multicollinearity affecting this variable.

Using equation 2 as the basis of reference, the regression indicates that an increase of 1 peso in the effective exchange rate should raise these exports by an annual rate of \$9.9 million dollars. An increase of 10 percent in the effective exchange rate is associated with an increase of 9.0 percent in total exports of goods other than coffee and oil.

One question that might be raised about this result concerns the timing of reactions. The three equations relate exports to exchange rates and world demand in the same quarter, without any lags. It would be plausible to assume that reactions take longer than this, that they should show up more in the following quarters than in the one during which the exchange rate changes. The hypothesis of a lagged relationship was tested by three sets of regressions parallel to equations 1-3. One set related exports to exchange rates and world demand in the preceding quarter, a second to exchange rates in the preceding quarter and demand in the present, and the third to a combination of present and preceding exchange rates. Only the last of these seemed to have any validity. The best of

them is given as equation 4 in table 3. It is similar to equation 2, except for the addition of the exchange rate in the preceding quarter as a new independent variable.

It will be seen that the proportion of explained variance is no higher for equation 4 than for equation 2, and that the F value is lower. The regression coefficient for the current exchange rate remains significant at the 1 percent level. The coefficient for the current quarter is reduced from 2.48 to 2.36. The regression coefficient for the exchange rate in the preceding quarter turns out to be 0.23, so the two combined seem to have more effect on exports than the current rate considered alone. Suggested interpretation: there is some lag effect in the quarter following exchange rate changes but it is dominated by the effect of the current rate. Reactions are quick.*

A more technical question that might be raised about the relationships indicated concerns the possibility of autocorrelation in the residuals. It does not seem to be a serious problem, though it comes close. The Von Neumann ratio for equation 2 is 1.32, just barely clear of the ratio of 1.80 which would indicate significance at the 5 percent level.**

* See Section IV below for a possible explanation.

** Cf. H. Theil and A. L. Nagar, "Testing the Independence of Regression Disturbances," American Statistical Association Journal, Dec. 1961, table 2, p. 902. The relevant test is for 34 observations and 6 adjusted coefficients.

Two alternative approaches were tested to bring out any possibility of spurious relationships due to trend factors. The first was to change the dependent variable, using the ratio between Colombian exports (other than coffee and oil), and total world exports. This is in the nature of a measure of market share, used in a form which multiplies the Colombian share by 250. The resulting ratio has some effect in reducing the influence of the trend factor, because both numerator and denominator are strongly rising series. It does not eliminate trend entirely, as may be seen from equation 5 in table 4.

Equation 5 is the best-behaved of the regressions established between exchange rates and Colombia's share of world exports.* It is distinctly less impressive than the more direct equation 2, but it still supports the principal point under investigation. The relationship between exchange rates and market share is significant at the 1 percent level. This regression suggests that an increase of 10 percent in the effective exchange rate will be associated with an increase of 0.3 percent in the ratio between Colombia's exports and total world exports.

Another point indicated by equation 5 is that there is a persistent upward trend in these Colombian exports relative to total world trade. This is consistent with the preceding equations, but perhaps clearest in this one. It might mean that the gradual diversification of domestic production, or a learning process by exporters, or the persistent administrative-psychological efforts of the

* Both R^2 and F are lower than for any of the four preceding regressions. The Von Neumann ratio for the residuals is 1.86, a slight improvement as compared to equation 2.

government to promote exports, are paying off slowly. Quantitatively considered, an increase of one peso in the effective exchange rate is about equal in effect to one year of trend improvement at a fixed exchange rate.

Finally, the same set of relationships was tested by using first differences for all variables. The main result is shown as equation 6 in Table 3. It is decidedly poor. Introducing lags does not seem to help at all. The conclusion is inescapable that marginal quarter-to-quarter changes in exports cannot be explained satisfactorily by quarterly differences in the variables used. This is hardly astonishing in view of all the other factors operating on these data. Despite the generally poor fit, the role of the exchange rate variable does not disappear; its regression coefficient is significant at the 10 percent level.

IV. Possible Interpretations

The evidence is strong that exports can be raised by exchange rate policy, but there are several interpretive questions that need consideration. One of them is that exports did not in general perform well after major devaluations. A second is that when they did respond well, the reaction came surprisingly fast. A third is that the trend element, independent of exchange rate variations, is so strong. A fourth, discussed in section V below, is that the results for the combined total of these exports may have been biased by independent variations--not associated with current incentives-- in the exports of particular primary products.

As shown in table 3, these exports grew rapidly from 1950 through 1962, then stopped growing. The change came immediately after a major devaluation.

They picked up again strongly in the fourth quarter of 1964, without a general devaluation. Then they levelled off once more after the first half of 1965, following a devaluation.

The key explanation is that a devaluation, in the sense of a change of the basic exchange rate, always stimulates domestic price increases. This leads promptly to higher costs of production, discouraging exports. The effective exchange rate applied to minor exports, shown in table 2, deteriorated after the end-1962 devaluation, and again after the more complicated semi-devaluation of 1965.* The effective exchange rate went up abruptly in 1964, and led to a major rise in exports, because the rate applied to these exports was raised separately, without touching that for imports. If export stimulation is a central target, it is better accomplished by separate variation of the rate for exports.

All the evidence indicates that these exports respond swiftly, rising in the same quarter in which the effective exchange rate improves. This does not seem to fit the normal presumption that it takes a fairly long time to readjust production decisions and implement them. It almost suggests that the export response comes about through sales from inventory, perhaps by letting stocks run down when export incentives improve and building them up again when the reverse happens. This is probably a part of the explanation, especially for agricultural products. But this does not seem to be the main factor.

* Cf. John Sheahan, "Imports, Investment and Growth: Colombian Experience Since 1950," AID Research Memorandum No. 4, Williams College (mimeo), September 1966.

Much of the short-term variation in exports appears to be associated with industrial rather than primary products. Published data do not give quarterly totals for manufactured products, though it might be possible, and should be illuminating, to construct such a series. Clues from the behavior of those individual exports which are reported on a monthly basis suggest that manufactured goods responded almost immediately to the sharp improvement of effective exchange rates in the last quarter of 1964. The rate had deteriorated throughout 1963 and the first three quarters of 1964, then went up fast when the official rate applied to minor exports was released in October. For primary goods as a whole there was no marked reaction; the total for the year ended up below that for 1963. But for many manufactured goods, and for total manufactures, the reaction was quick. Comparing December 1964 to December 1963, exports of cotton fabrics more than tripled, tire exports came from nothing to \$207 thousand for the single month, and exports of pharmaceuticals doubled.* Total exports of manufactures has a strong growth trend, and even rose 15 percent in 1963 with worsening exchange rates, but the upsurge in response to better rates in the last quarter of 1964 carried the total for the year fully 70 percent above 1963.

The sudden rise in exports of particular industrial products in the last quarter of 1964 might be explained by sales out of inventories, or diversion from domestic markets, or activation of previously idle capacity. Since export sales stayed above earlier levels through the next six months, it does not seem

* Departamento Administrativo Nacional de Estadística, Boletín Mensual de Estadística, April 1965, p. 51.

likely that selling out of inventories was the principal explanation. Since domestic prices remained more than usually stable in the first half of 1965, it does not seem probable that there was any great diversion of supplies from the home market to exports. The remaining possibility, that the exports were provided by putting idle capacity to work, happens to fit quite well the logic of the way producers might be expected to behave in a situation in which they face two separated markets: the protected market at home, and a highly competitive one abroad.

Diagram 1 following indicates the situation of a producer who can set a non-competitive price in the home market, and who could conceivably export but does not do so because the peso equivalent of the external price is too low. Assuming that the home market is limited in size relative to the scale of the firm, and that there is not a high degree of internal competition, the domestic demand curve is shown as sloping downward, with the best possible price at (a) and optimum rate of production at (x). This leaves the firm with idle capacity which it does not pay to activate for the home market. In the extreme situation depicted in the diagram, the external price, when converted into pesos, falls below marginal costs. There is no incentive to export, so the capacity is simply not used. (The external demand schedule is drawn as a horizontal line, indicating infinite elasticity, on the assumption that Colombian exporters of manufactured goods are not in a position to set or to affect world prices.)

Diagram 1: profit maximization when the exchange rate places a low value on earnings of foreign exchange.

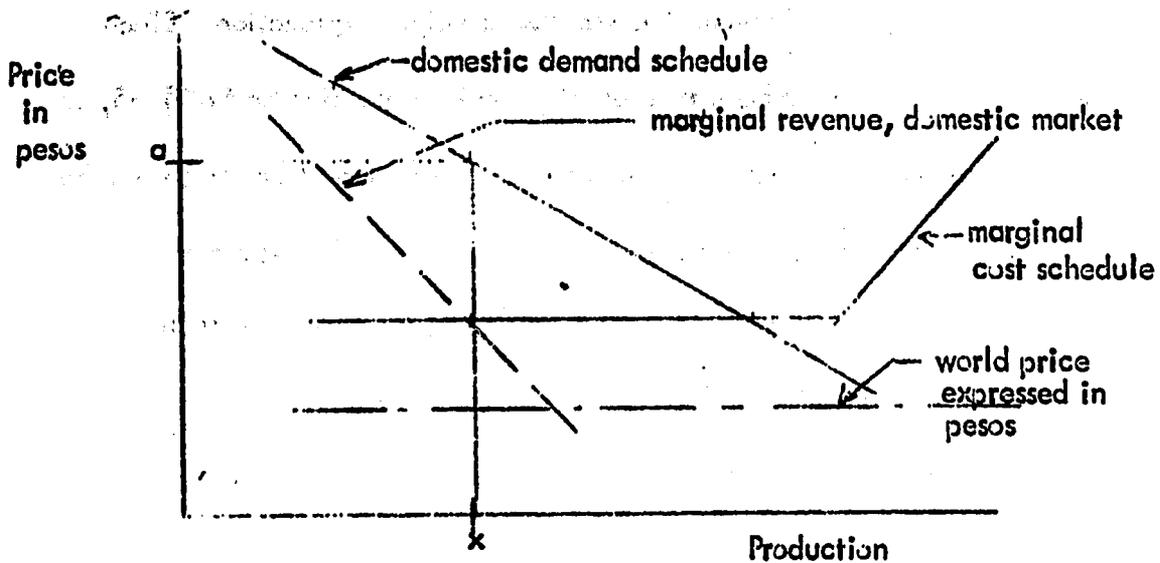
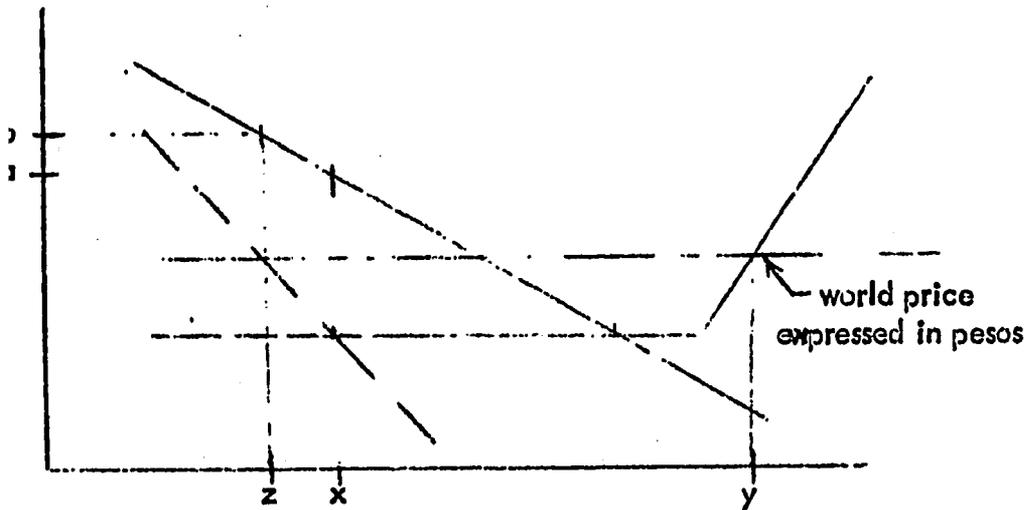


Diagram 2: profit maximization when the exchange rate places a higher value on earnings of foreign exchange.



The optimum rate of production moves up from x to y when the exchange rate shifts upward (in pesos), the demand schedule for exports. Sales in the domestic market fall from x to z , but the main form of adjustment is the increase in production rather than the shift between markets. See text for discussion.

When the exchange rate applied to the commodities produced by this firm is increased, the peso equivalent of the external market price goes up. This is shown in diagram 2 as a shift upward in the export price, bringing it above the firm's marginal cost at the original rate of output. If nothing else changed, the firm could now raise profits by increasing production for sale to the export market. On the premise of pre-existing idle capacity, which is both a logical possibility and a frequently observed fact in many Colombian industries, exports could be raised very quickly. This would be a one-shot effect: production and exports would continue at the higher rates as long as the new exchange rate remained, but would not go on increasing. This fits the statistical results above quite closely.

The process depicted would imply higher domestic prices for the export good. The increase in prices would result from rising marginal costs as output is increased. In effect, marginal costs would be adjusted to the world price (expressed in pesos), and marginal revenue in the domestic market would in turn be adjusted to the world price. The increase in the domestic price might be infinitesimal or might be very large, depending on the elasticity of demand in the domestic market and the degree to which marginal costs increased as the firm raised its output. There is no necessary connection between the degree of change in the effective exchange rate and the change in the domestic price. As depicted in diagram 2, which simply illustrates the directions of change implied, the net result would be a major increase in production from (x) to (y), and a slight increase in the domestic price, from (a) to (b).

Perhaps the most important point to emphasize in all this is that such changes in the effective exchange rate stimulate production and export earnings. They do not simply switch sales from the domestic to external markets. More than that: by raising export earnings and permitting higher imports, the process could release production bottlenecks and raise aggregate production for the domestic market.

The strength of the trend for these exports, particularly for manufactured goods, calls for an explanation distinct from the impact of exchange rate variations. To a minor degree the trend may be attributed to rising external demand, but the more important part of the explanation cannot be on this side: these exports rose 2.7 times in eight years, and exports of manufactured goods quadrupled from 1961 to 1966.

Two factors that may have been of particular importance for this performance were the gradual reduction of import barriers in other countries within the Latin American Free Trade Association, and the adoption by Colombia in 1962 of an incentive system which grants exporters favored access to imports of materials, free of tariffs, for the production of export goods. These and other measures affecting Colombian exports are being analyzed in a forthcoming study by Richard D'Alton and Antonio Urdinola.* These factors may turn out

* Policies to Promote Exports of Colombian Manufactures," to be presented at the Sorrento Conference of the Harvard Development Advisory Service, September 1967.

explain a large part of the trend for exports of manufactures, and thereby to account for the level of exports much more completely than exchange rates can. There is no necessary conflict between the two approaches. Improvement of incentives to export is likely to get results whether accomplished by administrative techniques or by exchange rate variation, and both together could be a more powerful force than either alone.

V. Considerations Affecting Particular Exports

Regardless of the values for the statistical indicators of significance given above, it is clear that a great many factors other than exchange rates and external demand operate to determine export earnings. Weather variations, shifts in domestic consumption patterns, speculative withholding or selling from stocks, special tax considerations, price controls or the threat of them, and literally countless other considerations bear on export earnings. The miracle is that such simple regressions as those discussed above come so close to explaining the path of the total. To go into the details of individual exports would be an interesting long-run research project, but within the limits of the present inquiry the most that can be attempted is a brief review of the possibility that some individual commodity behavior may have been such as to distort the meaning of the preceding regression analysis.

Exports of individual primary products vary in relative importance for many reasons, but the most significant in the early 1960's were usually bananas,

cotton, sugar and tobacco. Banana exports ^{changed} with little reference to exchange rates, and with no pronounced trend, throughout the period 1958-64. Their fluctuations seem to be more nearly determined by climate, storms, disease, and world prices. Like coffee and oil, they do not fit in the category of exports readily responsive to incentives provided through exchange rates.

Cotton exports have varied much more widely, for reasons more connected with economic policy. Throughout most of the 1950's, a major effort to stimulate cotton production by setting favorable domestic prices and limiting imports paid off in the sense of raising output faster than demand. By the end of the 1950's, supply had overshot the domestic market and substantial exports began.* Cotton was the largest single export after coffee and oil by 1962. But this achievement was associated with use of a free exchange rate for such exports, a rate considerably more favorable than that being applied to imports.

At the end of 1962, the import rate was raised (from 6.4 to 9.0 pesos per dollar), and the export rate was fixed at 10.0, down from that prevailing in the last quarter of 1962. Cotton producers balked at planting in 1963 until guaranteed a higher domestic price to compensate for the inflation expected to result from higher import prices. The new domestic price proved higher than the world price as converted at the new export rate. Considerable cotton was exported through use of subsidies and special tax incentives, but the total fell from

* Cf. Lauchlin Currie, El algodón en Colombia, Problemas y oportunidades, Federación Nacional de Algodoneros, Bogotá, 1963.

\$15 million in 1962 to \$9.5 million in 1963 and \$6.3 million in 1964. This downswing was associated with deteriorating effective exchange rates for exports, as shown in Table 1 .

The commodity is thus one of those which helped bring out a positive relationship between effective exchange rates and exports, and this remained true in 1965 when better exchange rates were associated with a new upswing in cotton exports. Still, it may well be considered that these swings in cotton were not in any simple sense a function of the exchange rate. They were responses to a complex of price setting and exchange rate factors, combined with group bargaining affecting supply decisions. The behavior of cotton exports thus fits the hypothesis that exchange rate improvements do promote exports, but tilts the regression more strongly in this direction than might be expected from exchange rate variation alone.

Sugar exports also fit the basic hypothesis well, rising with improving exchange rates in 1961 and 1962, falling with deteriorating rates in 1963-64, then picking up again in 1965. There is no reason to doubt the reality of a genuine relationship, but this case also happens to work out in such a way as to overstate the case for the potency of exchange rates.

The decrease in sugar exports from \$7.4 million in 1962 to \$3.3 million in 1964 was a truly extraordinary performance, since world prices rose quite strongly between those two years. What happened in Colombia was that the domestic price was controlled and frozen, while the world price was rising. Sellers naturally

focused on export markets, and domestic purchasers began to complain about shortages. Instead of raising the domestic price, the government tried to force sellers to supply the internal market in preference to exporting. The dock workers' union backed this up by refusing to load sugar for export. The government accepted this pressure and placed an effective embargo on exports, exactly across the period in which a world shortage was forcing an increase in external prices. Much sugar seemed to disappear in the process, and perhaps more was actually exported than is indicated by official statistics. As far as official receipts from exports were concerned, the value of exports fell abruptly in 1964. They jumped up again in 1965, and this made the regression analysis for exchange rates look good, but the main determinant was a return toward market equilibrium and relaxation of the embargo on exports.

As in the case of cotton, the facts worked out to give more credit to the exchange rate hypothesis than it really deserved. On a more fundamental level, they worked out to add support to the central point of the present paper: domestic economic policy affecting the supply available for export can have significant effects on the course of foreign exchange earnings.

Pending an opportunity to go into the details of the wide variety of remaining exports, it would not seem that there is any particular reason to believe that their behavior has been such as to falsify the evidence about the connection between exchange rates and exports. Some of the individual products show such strong growth trends that a deterioration of exchange rates does little

more than slow the expansion of exports--as for chemicals and textiles between 1962 and 1963--but a sharply favorable change such as that between 1963 and 1965 seems to push an expansion process into motion for practically everything.

VI. Forecasting Exports

Most attempts to project Colombian exports of goods other than coffee and oil rely on extrapolation of past growth rates, as in the Vanek study cited above. The tests reported here suggest that this is a most doubtful procedure. Past results were what they were because of past policies. If the effective exchange rate is raised in the future, export growth will be faster than it has been in the past. If inflation outpaces the effective exchange rate, then export growth will slow down. Any forecasts for particular future years should specify what effective exchange rate is expected, because this will make a major difference to the result.

Perhaps the simplest forecast, in the absence of knowledge of policies to change the balance, would be to assume that the effective exchange rate remains at its average for some past period. For the 1958-66 period used in the above regressions, the mean effective rate was 6.44 pesos per dollar (i.e., this is the average ratio of the official rate to the cost of living index, when the latter is stated on a basis of 1.00 for 1958). Using this exchange rate, and a simple extrapolation of the rate of growth of the indicator for world demand, equation

1 above would predict exports other than coffee and oil equal to \$199 million by 1970.*

The relevance of the effective exchange rate can be brought out by substituting alternative values in the forecast for 1970, using the same regression equation and the same estimate of world demand. Moving the effective exchange rate up by 2 pesos per dollar (relative to the cost of living index), would lead to a prediction of exports equal to \$252 million. Letting it drop 2 pesos below the 1953-66 average would imply a forecast of \$145 million.

VII . Conclusions

Too many things go on at once in an economy as complex as Colombia's to hope for high precision from any simplified statistical hypothesis. As such things go, the main point tested, the possibility of stimulating exports other than coffee and oil by use of exchange rate policy, holds up well. The relationships between exchange rates and these exports proved to be statistically significant at the 1 percent level in five of the six equations reported in Table 4, and at the 10 percent level in the test using first differences. The elasticity of the reaction is such that the percentage change in exports is almost equal to the percentage change in effective exchange rates.

* For purposes of forecasting, it is preferable to work with equation 1 in logarithmic form. It then becomes:

$$\log X_1 = -7.91813 + .36102 \log X_2 + 1.86560 \log X_3$$

Vanak's suggestion that Colombia cannot do much to determine its own exports is wrong. Wilber's estimate of a supply elasticity response equal to 2 or 2.5 is probably too high. The tests here referred to exports at actual values, not corrected for price changes. If increases in these exports had any negative effects on their prices in terms of foreign currency, this consequence was included within the results observed.

Colombian economic policies sometimes seem to reflect a fear that efforts to stimulate export volume will reduce prices and foreign exchange earnings. These fears are valid for coffee, but not for the wide variety of other exports. Colombia's market share is negligible in almost all these cases, so the question of whether or not world demand is elastic can be practically ignored. The facts seem to show that incentives to increase export supply pay off systematically in higher foreign exchange earnings.