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UNCTAD COMMODITY STABILIZATION AND PHILIPPINE TRADE: A SIMULATION ANALYSIS OF SELECTED COMMODITIES

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1. Overview

The Integrated Programme for Commodities (IPC) of the United Nations Conference on Trade and Development (UNCTAD) is the most recent and notable attempt at commodity control. Embodied in UNCTAD Resolution No. 93 (IV) dated 28 May 1976, it seeks to stabilize world commodity prices and at the same time improve the earnings, particularly of developing country producers, from the exports of these commodities out of the said scheme.

Other objectives, mostly long-term, of the IPC are export diversification, improvement of market access, assistance in marketing and distribution, and increased domestic processing of exportables. However, the major focus of efforts and perhaps the politically feasible objectives at the moment are commodity price stabilization and increased export revenue for developing country producers. This is envisioned to be mainly brought about by the maintenance of buffer stocks, whether global or globally-coordinated national buffer stocks.

The compatibility of these twin objectives has been the subject of wider discussions. It appears that certain conditions must exist before price stabilization can bring about revenue stabilization and increased revenue. Even then, intervention in certain commodity markets exhibits an incompatibility between these objectives which is quite difficult to ignore.

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Since the Philippines pledged US $50 million, the largest contribution of any UNCTAD member state to the financing of the IPC, the Philippine government must have perceived the importance of the scheme to its trade performance. This paper, therefore, aims to analyze the potential trade gains and/or losses from the country's participation in the IPC.

Specifically, this paper will: (1) provide a quantitative framework for measuring the gains and/or losses in the stabilization measures of the IPC; and (2) ascertain whether there is consistency between the objectives of price stabilization and revenue stabilization, and price stabilization and increased revenue.

The next section will briefly discuss the major features of the IPC, to be followed by the theoretical framework, including previous empirical findings. The methodological approach will then be presented after which will come the choice of commodities for this paper, actual commodity models used, data sources and peculiarities, and simulation results for the stabilization schemes. Finally, the results will be summarized and interpreted, and directions for future research will be suggested.

2. Major Features of the Integrated Programme for Commodities

The IPC departs from previous commodity control exercises in three ways: (1) apart from short-term stabilization measures, the scheme has explicit long-term objectives aimed at product and market development and diversification; (2) it involves joint action on a basket of priority commodities called the UNCTAD ten "core" commodities[1] and (3) the scheme is provided an integrated approach to financing through the Common Fund, which is envisioned to substantially reduce the operational expenses.[2]

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[1] The UNCTAD ten "core" commodities cover the following: cocoa, coffee, copper, cotton, hard fibers (hemp, sisal, etc), jute, rubber, sugar, tea and tin. An expanded list additionally covers iron ore, manganese, meat, phosphates, tropical timber and vegetable oils (olive oil, oilseeds, etc).

[2] A study by Behrman and Tinakorn-Ramangkura showed that by combining funding across commodities, rather than providing independent funding for each commodity, the total financing would be reduced by almost one-third. See Adams and Behrman (eds.), *Econometric Modelling of World Commodity Policy* (1978), Chapter 7.

The Common Fund intends to finance the stocking arrangements under its "first window," and the other forms of stabilization and long-term product development schemes under its "second window." The financial resources of the Fund will come from direct government contributions, resources deriving from the association of the international commodity agreements with the Fund, borrowings, voluntary contributions and net earnings.

The IPC is set within the broader framework of the New International Economic Order (NIEO) which seeks to restructure the global economy in order to promote the economic progress particularly of developing countries and to lessen international inequalities. An important precondition for the success of the NIEO is the effectivity of industrial countries in achieving structural adjustments in their economies, which is expected to result in expanded world trade, orderly global trading arrangements and more capital flows to the developing countries.

3. Theoretical Framework

Direct market intervention is a typical demand-oriented approach to improve the state of things. In commodity control, the proposal is designed to correct the secular decline in net terms of trade of major commodity exporting countries, and the short-run instability of commodity export prices and earnings.

Keynes noted these problems and suggested the setting up of buffer stocks to correct such problems, reminding that such measure be regarded as a means of temporary relief lest the cheapest producers are not allowed to expand their output. He added that it should aim at long-term economic price — the price which would yield to producers a "reasonable standard of living (Keynes 1974, pp. 299-315).

Other works find commodity control important merely as a means of transferring real resources from developed to less developed countries, the major producers of primary commodities, and that alternative forms of intervention such as compensatory finance be considered for certain commodities.[3] It was noted that fluctuating prices do not create serious national problems, and price stabilization in certain instances may result in destabilized earnings.

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[3] See, for instance, McBean (1966) and Law (1975).

The effect of commodity price stabilization via buffer stocks can be decomposed into pure welfare and income (revenue/expenditure) effects.

Massell noted that under rigid assumptions (linear functions, instantaneous reaction to price changes, parallel demand and supply shifts, and costless buffer operations), net welfare gain is achieved for both consumers and producers under price stability if actual compensation is allowed for so that gainers can compensate the losers (Massell 1969, pp. 285-297). If the source of fluctuation is on the supply, producers gain but consumers lose; if the source of fluctuation is on the demand, the reverse is true. The conclusion still holds up to a certain point when the assumptions are relaxed.

3.1. Welfare and Revenue Effect of Price Stabilization

The analysis presented in this section and in section (3.2) is based on Brooks, et al. (1977).

In Figure 1, it is assumed that shift in supply is the main source of fluctuation, and prices are stabilized at $p^* = (p_1+p_2)/2$. Welfare is measured in terms of consumer and producer surplus, with overall welfare as the sum of both consumer and producer welfare.

In the initial period, price stabilization implies pulling down of p to p^*. In this case, consumers will experience a net welfare gain of $a+b_1+b_2$ while producers will lose by the amount of a. There is a net welfare gain of b_1+b_2 jointly for both consumers and producers.

The next period assumes a shift in supply to S_2, resulting in p_2. Price stabilization then implies bringing up p_2 to p^*. At this point, consumers will lose by $c+d_1+d_2+d_3+d_4$ while producers will gain by $c+d_1+d_2d+d_3+d_4+e$. Hence, an overall net welfare gain will be registered amounting to e.

On the whole, price stabilization under a supply-shift market will bring about a net welfare gain of b_1+b_2+e. However, consumers will be at the losing end with a welfare loss of $c+d_1+d_2+d_3+d_4-a-b_1-b_2$ (note that $c+d_1+d_2+d_3+d_4 > a+b_1+b_2$), if actual compensation is not allowed for, while producers will reap benefits reaching $c+d_1+d_2+d_3+d_4+e-a$.

In Figure 2, the welfare effect of price stabilization is evaluated assuming that the source of market fluctuation originates on the demand side. Prices are still assumed to be stabilized at $p^* = (p_1+p_2)/2$.

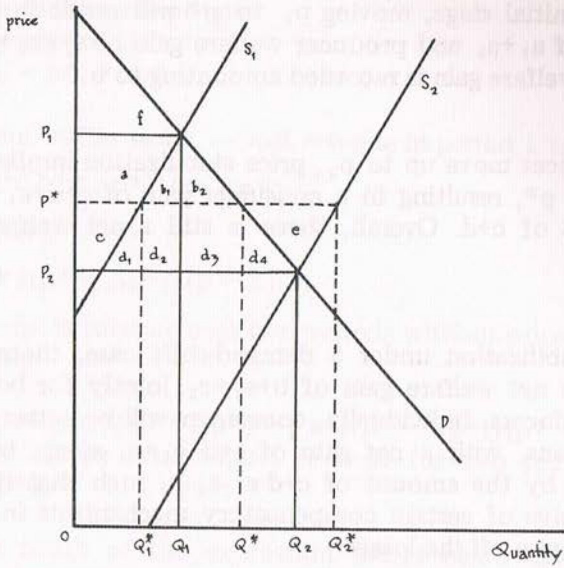


Figure 1 — Supply Shift Case

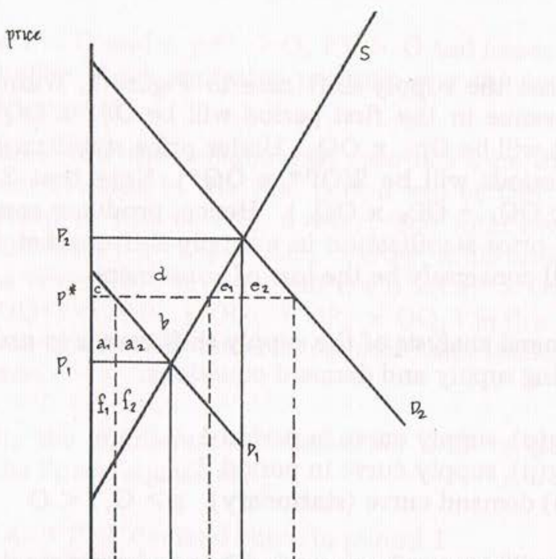


Figure 2 — Demand Shift Case

In the initial stage, moving p_1 to p^* will result in consumer welfare loss of $a_1 + a_2$ and producer welfare gain of $a_1 + a_2 + b$. On the whole, a net welfare gain is recorded amounting to b.

When prices move up to p_2, price stabilization implies bringing this down to p^*, resulting in a consumer gain of $c+d+e_1+e_2$ and a producer loss of c+d. Overall, there is still a net welfare gain of $e_1 + e_2$.

Price stabilization under a demand-shift case, therefore, will bring about a net welfare gain of $b+e_1+e_2$ jointly for both consumers and producers. Individually, consumers will be better off under these conditions, with a net gain of $c+d+e_1+e_2-a_1-a_2$, but producers will lose by the amount of $c+d-a_1-a_2-b$, such that it is necessary to conceive of certain compensatory mechanisms in order for the gainers to pay off the losers.

Hueth and Schmitz (1972, pp. 351-365) likewise found that with international compensation, price stabilization via buffer stocks increases global welfare whether the products are final or intermediate goods. Whether price stabilization will increase the export earnings of producing countries or not can also be shown from both figures.

Consider first the supply-shift case in Figure 1. Without price stabilization, revenue in the first period will be $OP_1 \times OQ_1$; in the second period it will be $Op_2 \times OQ_2$. Under price stabilization, revenue for both periods will be $2(OP^* \times OQ^*)$. Note that $2(OP^* \times OQ^*) > (OP_1 \times OQ_1 + OP_2 \times OQ_2)$. Hence, producer earnings are increased under price stabilization in a supply-shift market. The gain of producers will conversely be the loss of consumers.

A more general analysis of the supply shift case is in order. Consider the following supply and demand equations.

$S_1 = b_1 + g(p)$, supply curve in period 1
$S_2 = b_2 + g(p)$, supply curve in period 2
$D = a + f(p)$ demand curve (stationary) $g > O, f < O$

Let p_1 = equilibirum price in period 1 (w/o buffer stock)
p_2 = equilibrium price in period 2 (w/o buffer stock)
$p^* = (p_1 + p_2)/2$ = stabilized price (with buffer stock)

Under these assumptions,

$$p_1 = p^* + \Delta p^*$$
$$p_2 = p^* - \Delta p^*$$

Without buffer stock, export revenue in period 1 will be

$$[a+f(p^*+ \Delta p^*)]\,(p+ \Delta p^*)$$

and in period 2

$$[a+ f(p^* - \Delta p^*)]\,(p - \Delta p^*)$$

The total export revenue over two periods without price stabilization will then be:

$$[a+f(p^*+ \Delta p^*)]\,(p^*+ \Delta p^*) + [\, a+f(p^* - \Delta p^*)]\,(p^* - \Delta p^*)$$

With buffer stock, total export revenue for two periods will be:

$$2(a+fp^*)p^*$$

If the result of the expression found below is positive, the implication is revenue gain out of price stabilization.

$$\begin{aligned} PY &= 2(a+fp^*) - [a+f(p^*+\Delta p^*)]\,(p^*+\Delta p^*) \\ &\quad - [a + f(p^* - \Delta p^*)]\,(p^* - \Delta p^*) \\ &= 2ap^* + 2fp^* - ap^* - a\Delta p^* - f(p^{*2} + 2p^*\Delta p^* + \Delta p^{*2}) \\ &\quad - ap^* + a\,\Delta p^* - f(p^{*2} - 2p^*\Delta p^* + \Delta p^{*2}) \\ &= - 2f\Delta p^{*2} \end{aligned}$$

Since $f < O$ and $\Delta\, p^{*2} > O$, $PY > O$ and hence price stabilization via buffer stock increases revenue over the two periods in a supply shift market.

Consider now the demand-shift case in Figure 2. Without price stabilization, revenue in the first period will be $OP_1 \times OQ_1$; in the second period it will be $OP_2 \times OQ_2$. The total revenue for both periods will be $OP_1 \times OQ_1 + OP_2 \times OQ_2$, while under price stabilization, the two-period revenue will reach $2(OP^* \times OQ^*)$. Note that $2(OP^* \times OQ^*) < (OP_1 \times OQ_1 + OP_2 \times OQ_2)$ in this case, such that buffer stock generation under a demand-shift market tends to reduce revenue.

Again, the mathematical derivation will be presented here. Consider the linear equations:

$$D_1 = a_1 + f(p), \text{ demand curve in period 1}$$
$$D_2 = a_2 + f(p), \text{ demand curve in period 2}$$
$$= b+ g(p), \text{ supply curve (stationary)}$$
$$f < O,\ g > O$$

and let p_1 = equilibrium price in period 1 (w/o buffer stock)
p_2 = equilibrium price in period 2 (w/o buffer stock)
$p^* = (p_1 + p_2)/2$ = stabilized price (with buffer stock)

Under these assumptions,

$$p_1 = p^* - \Delta p$$
$$p_2 = p^* + \Delta p$$

For two periods, total revenue without buffer stocks will be $[b + g(p^* - \Delta p^*)](p^* - \Delta p^*) + [b + g(p^* + \Delta p^*)](p^* + \Delta p^*)$. With buffer stocks, total revenue will be $2(b + gp^*)p^*$.

Revenue gain or loss can be determined by the expression below:

$$PY = 2(b + gp^*)p^* - [b+g(p^* - \Delta p^*)](p^* - \Delta p^*) - [b+g(p^* + \Delta p^*)](p^* + \Delta p^*)$$
$$= 2bp^* + 2gp^{*2} - bp^* + b\Delta p^* - g(p^{*2} - 2p^*\Delta p^* + \Delta p^{*2})$$
$$- bp^* - b\Delta p^* - g(p^{*2} + 2p^*\Delta p^* + \Delta p^{*2})$$
$$= -2g\Delta p^{*2}$$

Since $g > O$ and $\Delta p^{*2} > O$, then $-2g\Delta p^{*2} < O$; hence, price stabilization via buffer stock in a demand-shift case will bring about net revenue loss over two periods.

The analysis can be extended for more than two periods, given expected value of prices, and the conclusion for both demand- and supply-shift cases will still hold. Likewise, buffer stockholding costs can be introduced but as long as the new levels of stabilized prices p_1' and p_2' cling to the condition $J = |P_1' - P_2'| < |P_1 - P_2|$, the welfare and revenue conclusions will remain the same.

The results suggest that the welfare effect of the buffer stock mechanism will always be positive. Hence, it is possible that in cases of producer revenue loss in certain commodities, a net gain can still be achieved if the global welfare gain exceeds the revenue loss. This, of course, assumes that compensation schemes are implementable.

3.2 Price Stabilization and Revenue Stabilization

Whether price stabilization entails revenue stabilization depends on the source of price change and price elasticities of demand and supply. In this instance, a new set of figures will be presented.

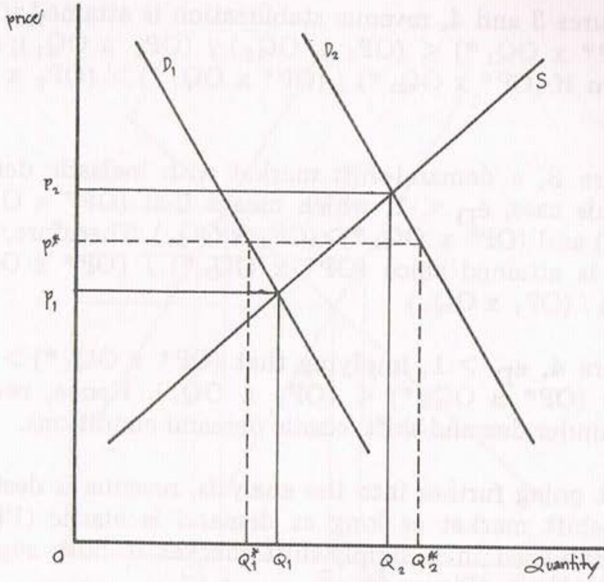


Figure 3 — Demand Shift Case: Price Inelastic Demand

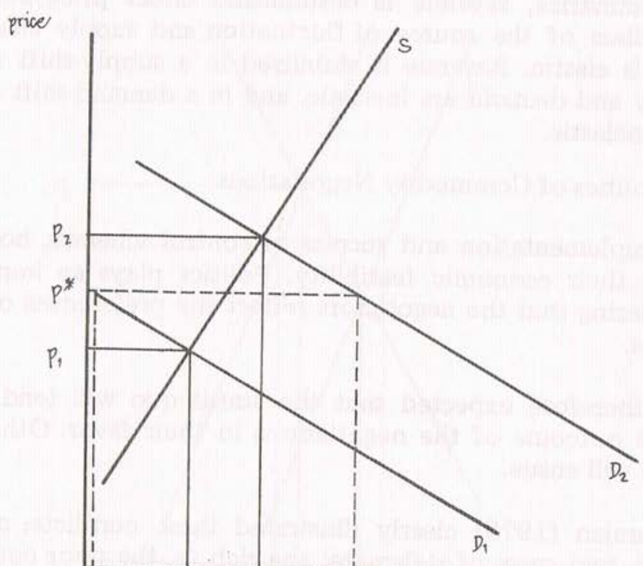


Figure 4 — Demand Shift Case: Price Elastic Demand

$p^* = (OP_1 + OP_2)/2$; for both cases

For Figures 3 and 4, revenue stabilization is attained if $(OP^* \times OQ_2^*) / (OP^* \times OQ_1^*) < (OP_2 \times OQ_2) / (OP_1 \times OQ_1)$; revenue destabilization if $(OP^* \times OQ_2^*) / (OP^* \times OQ_1^*) > (OP_2 \times OQ_2) / (OP_1 \times OQ_1)$.

In Figure 3, a demand-shift market with inelastic demand is shown. In this case, $e_D < 1$, which means that $(OP^* \times OQ_2^*) < (OP_2 \times OQ_2)$ and $(OP^* \times OQ_1^*) > (OP_1 \times OQ_1)$. Therefore, revenue stabilization is attained since $(OP^* \times OQ_2^*) / (OP^* \times OQ_1^*) < (OP_2 \times OQ_2) / (OP_1 \times OQ_1)$.

In Figure 4, $e_D > 1$, implying that $(OP^* \times OQ_2^*) > (OP_2 \times OQ_2)$, while $(OP^* \times OQ_1^*) < (OP_1 \times OQ_1)$. Hence, revenue is destabilized under demand-shift, elastic demand conditions.

Without going further into the analysis, revenue is destabilized in a supply-shift market as long as demand is elastic (Figure 5); revenue is stabilized in a supply-shift market if both supply and demand are inelastic (Figure 6).

To summarize, revenue is destabilized under price stabilization, regardless of the source of fluctuation and supply elasticity, if demand is elastic. Revenue is stabilized in a supply-shift case if both supply and demand are inelastic, and in a demand-shift case if demand is inelastic.

3.3 The Politics of Commodity Negotiations

The implementation and success of control schemes, however, go beyond their economic feasibility. Politics plays an important role considering that the negotiators reflect the preferences of their constituents.

It is therefore expected that the status quo will tend to influence the outcome of the negotiations in their favor. Otherwise, a stalemate will ensue.

Rangarajan (1978) clearly illustrated these conflicts, particularly in the two cases of stalemate: the rich vs. the poor countries, and among the poor countries, the large vs. the small commodity producers.

The lack of progress in commodity negotiations, he pointed out, was due to the conflict between the stability objective preferred by the developed countries and the increased revenue objective sought by the developing. Moreover, market intervention is being

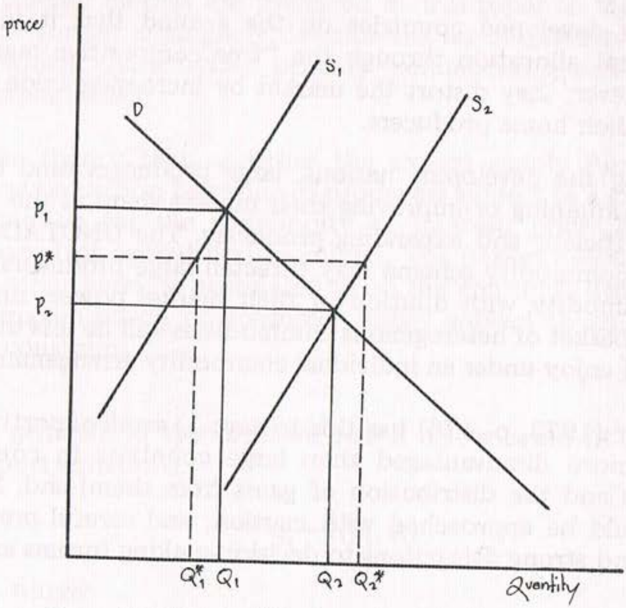
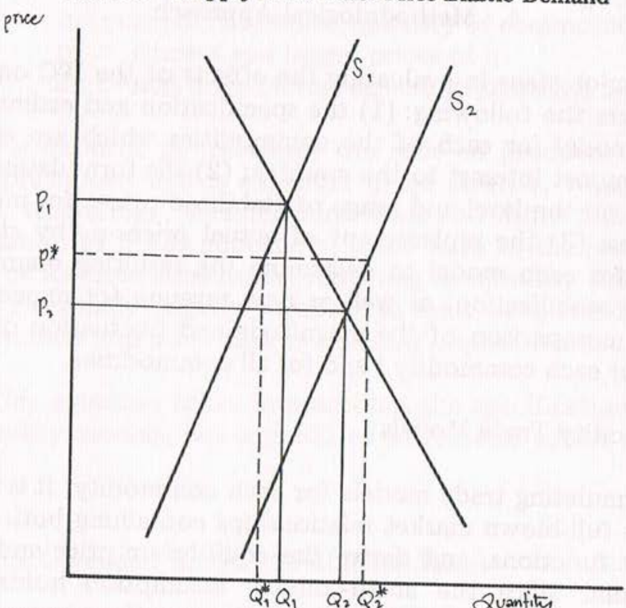


Figure 5 — Supply Shift Case: Price Elastic Demand



$p^* = (OP_2 + OP_1)/2$, in both cases

Figure 6 — Supply Shift Case: Price Inelastic Supply and Demand

rejected by developed countries on the ground that it interferes with efficient allocation through the "free"competitive market. In reality however, they distort the market by increasing trade barriers to protect their home producers.

Among the developing nations, large producers tend to favor policies maintaining or improving their market share at the expense of small, efficient and expanding producers. The UNCTAD-type of integrated commodity scheme may threaten large producers of individual commodity with dilution of their market power, since their share in a basket of heterogenous commodities will be less than what they would enjoy under an individual commodity arrangement.

Gwyer (1973, p. 476) has this to say: 1) small exporting countries are more disadvantaged than large countries in commodity agreements and the distribution of gains from them; and, 2) agreements should be approached with caution, and careful preparation of briefs and strong delegations to decision-making forums are necessary.

4. Methodological Approach

The major steps in evaluating the effects of the IPC on Philippine trade are the following: (1) the specification and estimation of the trade model for each of the commodities which are either of export or import interest to the country; (2) the formulation of the assumption on the level and range of stabilized prices for individual commodities; (3) the replacement of actual prices p_i*by stabilized prices p_i^* for each model to determine the resulting quantity q_i^* under price stabilization, as well as new revenue (or expenditure), $p_i^* q_i^*$; (4) comparison of the magnitude and fluctuation of $p_i^* q_i^*$ with $p_i q_i$ for each commodity i and for all commodities.

4.1. Commodity Trade Models

In formulating trade models for each commodity, it is needless to estimate full-blown market relationships containing both demand and supply functions, and derive the equilibrium price and quantity therefrom, since the small-country assumption holds in the Philippine case and as such, prices enter the equations exogenously.[4] Thus, no attempt was made to examine the demand side for the exports, and the supply side for the imports.

[4] Bautista and Encarnación, (1971), "A Foreign Trade Submodel of the Philippine Economy, 1950-1969." See also Sicat (1969), "Import Demand and Import Substitution in the Philippines."

Dynamic models are preferred in this paper to the static ones since the former adequately describe the lag in quantity response to price, which characterizes primary commodities, notably agricultural commodities.

The theory that underlies the export supply function is the profit-maximization behavior of producers subject to a given production function for the commodity of interest, prices and weather conditions (for agricultural products). The import demand function, on the other hand, is postulated upon the consumer demand theory — the maximization of consumer utility subject to an appropriate budget constraint.

A generalized specification found below could fit both export and import equations:

$$q_i = f(p_i, Z)$$

where:

q_i : export or import quantity of commodity i;
p_i : current and lagged prices of i;
Z : non-price factors affecting quantity of i.

For exports, p_i represents the ratio of producer price of i to input prices of i and is expected to be positive, while Z is mostly inputs, technology, weather conditions and other factors affecting exportation of i. For imports, p_i is the ratio of the price of i to the prices of its close substitutes, reflecting commodity substitutability, and is essentially negative, while Z in most cases stands for income of consumers and other factors affecting import demand for i.

This equation takes into account the specifications of existing commodity models, but is modified to respond to the needs of this study.[5]

4.2. The Level and Range of Stabilized Prices

Once the models have been derived, simulation analysis of control exercises proceeds. It would be necessary to assume that the

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[5] For an extensive discussion of commodity market models, see Labys (1973), and Adams and Behrman (1976).

models approximate market behavior even under control. This implies, among other things, the absence of surplus and shortage estimation resulting from the certainty that the price floor and ceiling will be defended, regardless of volume exported and speculative withholding of commodities. The price range could be defended if buffer stock authorities have sufficient financial reserves to support the price floor, and commodity reserves to support the price ceiling.

The stabilized range of prices p_i^* will be derived from band width of (1) the trendline ± 15 per cent and (2) the five-year moving average of prices ± 15 per cent. These assumptions are the widely discussed methodologies for setting the prices at UNCTAD.[6]

The trend line of prices is computed using the following equation:

$$\bar{p}_i = a_o + a_1 t, \qquad t = 1, 2, 3, \ldots, N$$

where N is the range of observation in the model estimation (in years).

From these values, $p_i^* = \bar{p}_i \pm 0.15\,\bar{p}_i$ where the price floor is $\bar{p}_i - 0.15\,p_i$ and the price ceiling $\bar{p} + 0.15\,\bar{p}_i$.

Using five-year moving averages to compute for $\bar{p}_i$ would incur losses in value in the last two years of observation. This is corrected by assuming that the stabilized prices obtained in the last two years are equal to the trend line of the five-year moving averages.

Note that if $p_i > \bar{p}_i + 0.15\,\bar{p}_i$, authorities sell stocks to bring prices down to $\bar{p}_i + 0.15\,\bar{p}_i$. If $p_i < \bar{p}_i - 0.15\,\bar{p}_i$, authorities will buy stocks to raise commodity prices to $\bar{p}_i - 0.15\,\bar{p}_i$. And if $\bar{p}_i - 0.15\,\bar{p}_i < \bar{p}_i < \bar{p}_i + 0.15\,\bar{p}_i$, no market intervention is necessary.

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[6] See, for instance, Behrman and Tinakorn-Ramangkura (1978) for the price assumptions.

4.3 Simulation Methods

This will test whether price stabilization will bring about (1) net revenue/expenditure stabilization and (2) increase/decrease in net revenue/expenditure.

For any commodity i, q_i^* can be determined by using the following equation:

$$q_i^* = f(p_i^*, Z);$$

then revenue is stabilized if

$$\text{s.d. } p_i^* q_i \div \text{s.d. } p_i q_i < 1$$

where:

$$\text{s.d. } p_i^* pq^* = \sqrt{\sum^{T} (p_i^* q_i^* - \overline{p_i q_i})^2 / T-1)}$$

$$\text{and s.d. } p_i\, q_i = \sqrt{\sum^{T} (p_i\, q_i - p_i q_i)^2 / (T-1)}$$

T = the number of control years.

$p_i q_i$ represents either the trend or the five-year moving average value of revenue, in conformity with the method of estimating stabilized prices.

There is a gain in net revenue if the inequality presented below for commodity i is satisfied:

$$(1+a)^{-t} \sum^{T} (p_{it}{}^* q_{it}{}^* - p_{it} q_{it}) > 0.$$

For collective gain involving all commodities, the individual gains (or losses) over the control period T are simply added. Note that for imports, negative result implies gain. The parameter a is the discount rate.

5. Empirical Results

The choice of commodities for simulation was based on major Philippine exports and imports covered under the UNCTAD 10 "core" commodities. These commodities of "substantial interest" were arrived at using the following rules of thumb — each commodity consistently appeared in the country's export or import list from 1970-78, and contributed an annual average of at least one half of one per cent to total value of exports or imports. Coffee was included due to its rapid growth in the latter 70s, and cocoa for registering a consistent share of 0.2 – 0.3 of one per cent throughout the 70s.

Six commodities were included for analysis: four as exports (abaca, coffee, copper and sugar) and two as imports (cocoa and cotton). While the two commodities of import interest are not significant, those of export interest are considerable. In spite of their declining trend in share to total exports in the immediate years, their combined share was still a formidable 14.8 per cent in 1978 (Table 1).

5.1 Commodity Trade Models

Price variables were obtained by dividing annual export or import value of each commodity by its corresponding volume, and subsequently transforming the result into an index with 1970 as base year. The index thus obtained was further corrected for exchange rate depreciation by multiplying it with the appropriate exchange rate index. In addition, export prices were deflated by the wholesale price index (1970 = 100) to reflect the cost of production inputs and/or the relative attractiveness of supplying the domestic market; import prices were deflated by the prices of their corresponding close substitutes. For cotton, the price of synthetic fibers was used as deflator; for cocoa, the price of tea.

Coffee prices significantly departed from the above formulation since World Bank prices were adopted rather than those implied in the Philippine foreign trade statistics. The latter was not used due to wild fluctuations in the data series partly attributable to inaccuracy of records notably in the initial stages of exportation. In addition, past prices which play an important role due to the lag from planting to harvest year (usually 4-5 years) were not available since the first year of sustained exportation started only in 1970.

5.2 Results of Model Estimations

Only the best fit solution with no serious serial correlation error for each six selected commodities is presented in Table 2. The range of observations is between 1961 and 1978, whenever applicable.

Table 1 — Major Philippine Trade Commodities Covered Under UNCTAD 10 "Core" Commodities, 1970-78 (Million U.S. dollars)

	Total Philippine Trade		Major Philippine Trade Commodities		Per Cent Share of Major Commodities to Total Philippine Trade	
	Exports	Imports	Exports (Abaca, Coffee, Copper and Sugar)	Imports (Cocoa and Cotton)	Exports	Imports
1970	1,142.2	1,159.3	387.9	21.5	33.9	1.9
1971	1,189.2	1,260.8	412.8	23.1	34.6	1.8
1972	1,168.0	1,333.6	412.7	22.5	35.3	1.6
1973	1,835.6	1,596.6	585.0	32.4	31.8	2.1
1974	2,722.4	3,143.3	1,168.5	41.1	42.9	1.3
1975	2,292.4	3,459.2	810.0	42.0	35.3	1.2
1976	2,550.0	3,633.5	735.8	43.6	28.8	1.2
1977	3,136.6	3,914.8	837.1	44.1	26.6	1.0
1978	3,403.0	4,732.2	513.8	58.0	14.8	1.2

Source of Basic Data: National Census and Statistics Office, *Foreign Trade Statistics of the Philippines*, 1970-78.

Table 2 — Trade Models for Selected Commodities

Commodity (Trade Status)	Coefficients of Explanatory Variables: Price Variables (t-values)	Coefficients of Explanatory Variables: Non-Price Variables (t-values)	Intercept	Equation Form	$\bar{R}^2$	D.W.	F-value
1. Abaca (Export)	$(p_{-1} + p_{-2})/2$: 0.28 (3.54)	t: −27.93 (−7.80)	795.43	Linear	0.95	1.75	80.41
2. Coffee (Export)	p: −1.14 (−12.01) p_{-6} : 4.52 (2.57)	t: 0.59 (5.49) d: 1.83 (3.83)	−15.50	Nat Log in q and p_{-6}	0.91	2.21	17.77
3. Copper (Export)	p: 1.10 (1.16)	q_{-1} : 0.95 (14.16)	0.52	Linear	0.93	1.79	104.25
4. Sugar (Export)	p_{-2} : 10.10 (6.80)		269.45	Linear	0.76	1.69	
5. Cocoa (Import)	p: −0002 (−.646)	q_{-1} : .63 (3.14)	1.876	Linear	0.48	1.59	6.96
6. Cotton (Import)	p: -.013 (−.92)	y: 0.02 (0.20) d: 14.04 (3.36)	32.95	Linear	0.56	2.24	6.40

Price variables for exports generally showed significant t-values, except for copper, and likewise exhibited the correct signs, except for the current price of abaca. One possible explanation for the price behavior of abaca is that exporters, hoping to maintain their level of earnings, tend to make more volume sales during periods of low prices.

Import prices, on the other hand, exhibited insignificant t-values but posted the right signs. The export equations likewise showed the substantial influence of past prices on the volume of exportation, notably for coffee with a response lag of six years. Table 3 indicates that coffee and copper are long-run price elastic, while the rest are price inelastic.

Non-price variables had the expected signs and were significant except for y (real Gross Domestic Product index, 1970 = 100) in cotton. The negative time trend t(1963=1, 1964=2, . . .) for abaca reflected the secular decline in abaca exports due to the competition from natural and synthetic substitutes in the world market (Srihadi 1968), while the t for coffee (1969=1, 1970=2, . . .) captured the emergence of the country as a new coffee exporter. Dummy variables d (1971, 1973=1 and 1974= −1, for coffee; 1968, 1973=1, for cotton) were inserted to reflect supply instability in the case of coffee, and the period of massive government financial support to the textile industry in the case of cotton.

Despite the sugar exports being primarily influenced by the U.S. sugar quota and not the free market forces prior to 1973 (Bautista and Encarnación 1971, pp. 15-16), the sugar model yielded highly significant price coefficient and $\bar{R}^2$.

The export models possessed high $\bar{R}^2$ values and hence, considerable explanatory power, but this could not be said of the import models. However, all the equations posed no serial correlation problems, and their F-values were significant.

Prediction errors were large, except for coffee at 6.4 per cent and abaca at 9.8 per cent (Table 3). Figures 7a and 7b show that fluctuations are not well-registered by the models, again with the exception of coffee.

5.3 Simulation Results

The level of stabilized prices p* for each commodity was estimated using the trend line of prices ± 15 per cent of those derived values and the "modified" five-year moving average ± 15 per cent band width. From these two sets of derivation, either the ceiling price or the floor price was adopted for any given year, depending on whether the actual price exceeded the former or fell below the latter.

Those p*s were transformed into index numbers, deflated by either the wholesale price index (in the case of exports) or the price index of the corresponding commodity's close substitute (in the case of imports), and multiplied by the exchange rate index. The results were then plugged to their corresponding models to obtain sequential values of q*.

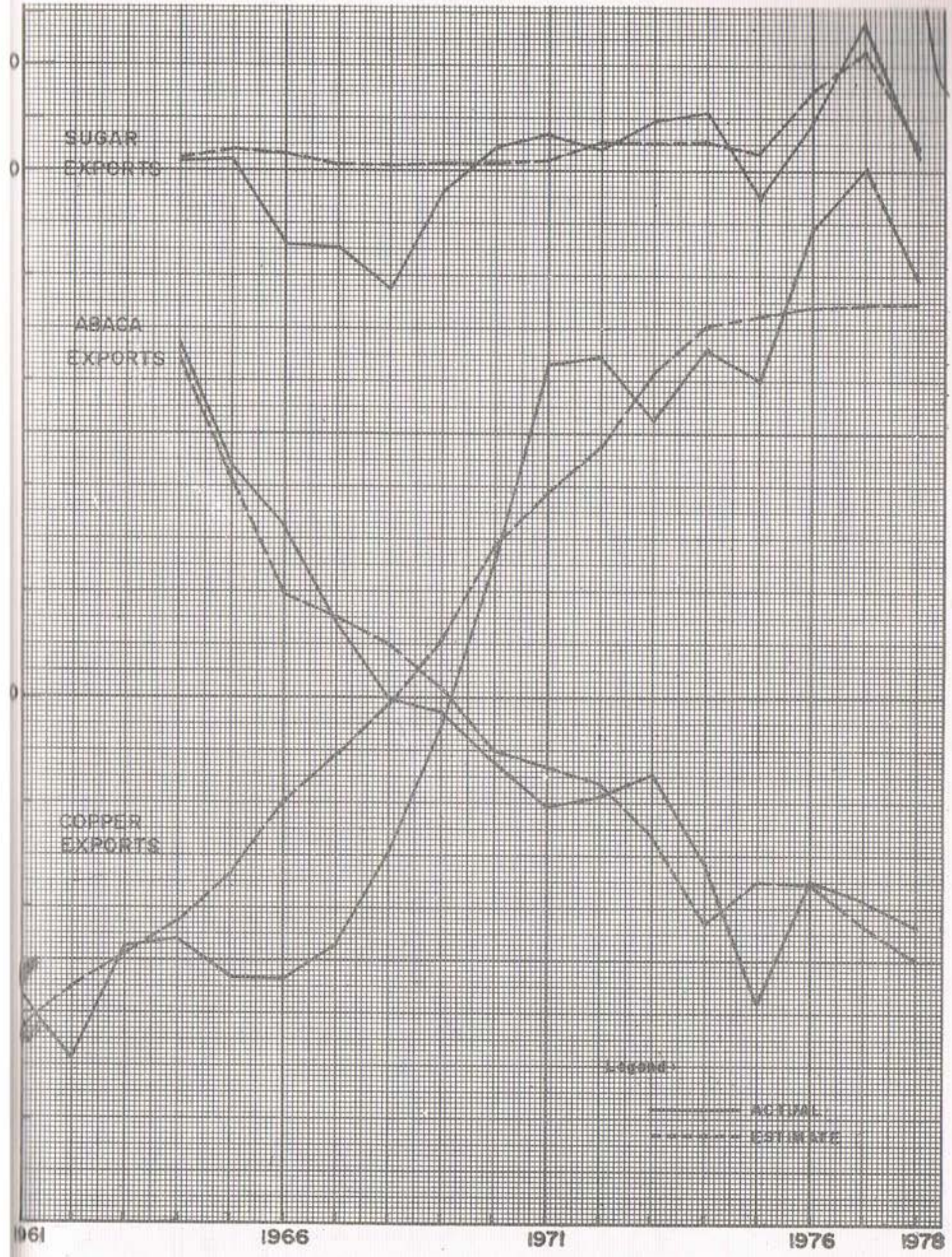
Table 3 — Long-term Price Elasticities and Mean Percentage Errors of Actual vs. Estimated Values

Commodity	Price Elasticity	Mean Percentage Error
Abaca	−0.30	9.8
Coffee	4.52	6.4 (Nat. Log.)
Copper	2.35	20.7
Sugar	0.78	13.4
Cotton	−0.08	11.1
Cocoa	−0.08	26.6

Due to the lagged nature of volume response to prices in most commodities covered, q* of succeeding years may change owing to the influence of past stabilized prices. Model estimates, not actual volumes, were used in presenting volumes under "without stabilization" case.

It was assumed that prices paid to Philippine exports and for Philippine imports move proportionately and in the same direction as world market prices. Hence, these prices would proxy for those subject to stabilization at the global level. World Bank prices for coffee, which were adopted rather than Philippine prices, may be adequate since the interest of this paper is on increments and not on absolute levels.

Finally, ten years — 1969 to 1978 — were chosen as control period, except for coffee, which starts in 1970. This range is perhaps long enough to cover cyclical fluctuations in commodity prices, but short enough to prevent serious structural changes to set in. Revenue effect of price stabilization was expressed in 1970 present value.



ure 7a — Estimated Vs. Actual Values of Abaca, Copper and Sugar Exports (volume in metric tons; in thousand bales for abaca)

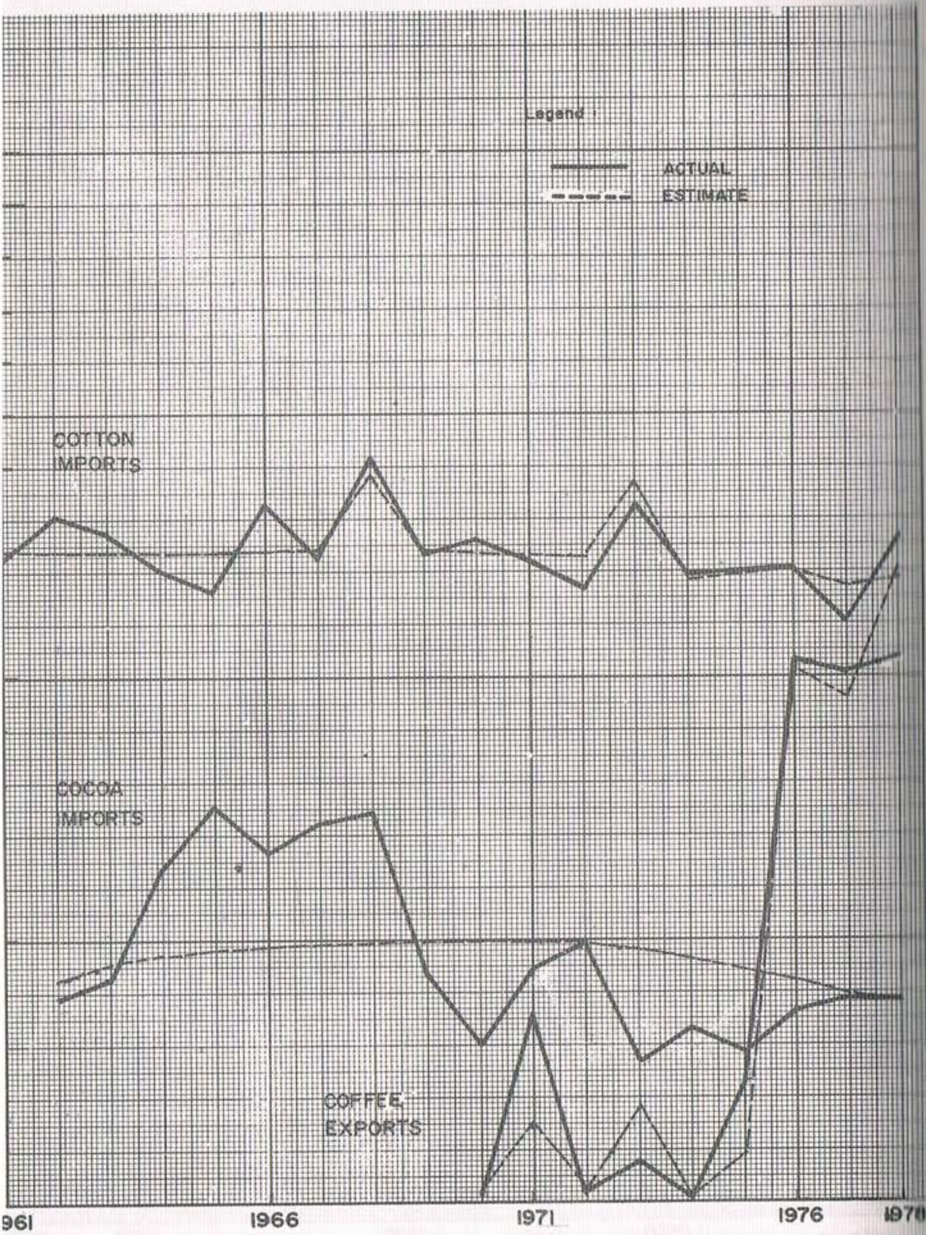


Figure 7b — Estimated vs. Actual Values of Coffee Exports, and Cotton and Cocoa Imports (volume in metric tons)

Table 4 — Stabilized Level of Commodity Prices (p*) Based on Trend Line of Prices and Corresponding Control Authority Action[a/]
(Prices in US dollars per metric ton)

	ABACA[c/]			COFFEE			COPPER			SUGAR			COCOA			COTTON		
	p[b/]	Action	p*	p[b/]	Action	p*	p[b/]	Action	p*	p[b/]	Action	p*	p[b/]	Action	p*	p[b/]	Action	p*
1969	29	P	35				282	S	261	152	P	167	3636	P	892	564	P	605
1970	34	P	37	1,140	N	1,140	293	S	277	153	P	182	704	P	1,032	543	P	656
1971	33	P	40	1,000	P	1,280	227	N	227	158	P	197	657	P	1,171	617	P	707
1972	32	P	43	1,100	P	1,516	232	N	232	172	P	212	670	P	1,312	724	P	758
1973	46	N	46	1,370	P	1,751	380	S	327	186	P	227	985	P	1,451	692	P	810
1974	110	S	65	1,460	P	1,987	473	S	343	478	S	328	1,960	N	1,960	1,186	S	1,165
1975	69	N	69	1,440	P	2,223	265	N	265	597	S	350	2,055	N	2,055	1,226	N	1,226
1976	57	N	57	3,160	N	3,160	282	N	282	293	N	293	1,910	N	1,910	1,195	N	1,195
1977	57	N	57	5,310	S	3,645	266	P	290	209	P	289	3,569	S	2,720	1,482	S	1,372
1978	69	N	69	3,660	N	3,660	280	P	302	175	P	304	3,696	S	2,909	1,225	N	1,225

a/ S = stock sales; P = stock purchases; N = no intervention.
b/ Actual prices.
c/ US dollars per thousand bales.

.4 Trend Line of Prices

Table 4 shows that control authority intervenes in 41 out of 9 cases, indicating a hyperactive role. Of the 41, there are 28 pur- hases, suggesting that almost half of the time, the actual prices are ɘss than the stabilized prices.

Revenue stabilization could be accomplished in abaca, sugar, ocoa and cotton under price stabilization, with cocoa registering a 2 per cent reduction in fluctuation as gleaned from Table 5. On the ther hand, coffee revenue was destabilized by 643 per cent, and opper by 169 per cent. The results for all commodities are, how- ver, theoretically consistent considering that coffee and copper vere found to be price elastic over the long-term while the rest were nelastic.

As shown in Table 6, the net revenue effect is a loss of JS$264.6 million at 1970 prices. Export commodities, except opper, registered revenue increases, but the US$405.6 million short- all in copper plus the US$20.5 million increased payment in cocoa nd cotton imports were not sufficiently covered by gains in abaca, offee and sugar. These results dramatize the fact that losers and ainers coexist under price stabilization. The exercise likewise sup- orted the findings of previous investigations that metal and mineral rices are vastly influenced by demand shifts (and hence would lose under price stabilization) while agricultural prices mostly change as result of supply fluctuations (Behrman and Tinakorn — Ramang- kura 1978, p. 165; Brook, et al. 1977, p. 30).

Table 5 — Revenue Stabilization Effect of Price Stabilization Based on Trend Line of Prices

	s.d. p*q*	s.d. pq	Stability Index s.d. p*q* ÷ s.d. pq
Abaca	5.53	5.59	0.94
Coffee	100.47	15.63	6.43
Copper	122.07	72.03	1.69
Sugar	74.26	176.34	0.42
Cocoa	0.82	2.58	0.32
Cotton	4.01	4.70	0.85

Table 6 — Net Revenue Effect on Price Stabilization Based on Trend Line of Prices[a/]
(Revenue in million US dollars)

	(1) Abaca	(2) Coffee	(3) Copper	(4) Sugar	(5) Cocoa	(6) Cotton	Net Revenue Effect (1)+(2)+(3)+(4)–(5)–(6)
1969	2.6		(53.5)	17.9	1.4	1.5	(35.9)
1970	1.0	b/	(49.6)	31.2	1.6	3.7	(22.7)
1971	2.0	0.4	(28.0)	53.6	2.3	2.6	23.1
1972	2.8	0.1	(25.3)	75.8	2.6	0.9	49.9
1973	0.3	0.6	(67.0)	80.6	1.7	3.9	8.9
1974	(5.4)	b/	(113.5)	(79.8)	b/	(0.3)	(198.4)
1975	(0.3)	0.5	(25.5)	(136.6)	b/	b/	(161.9)
1976	(0.3)	0.5	(23.7)	(78.1)	b/	b/	(101.6)
1977	0.2	30.3	(10.0)	(28.6)	1.5)	1.1	(7.7)
1978	—	118.9	(9.5)	71.3	(1.0)	b/	181.7
Total	2.9	151.3	(405.6)	7.3	7.1	13.4	(264.6)

a/ Expressed in 1970 present value using a discount rate of 10 per cent, the average annual growth rate of wholesale price index from 1961 to 1978.

b/ less than 0.1

Table 7 — Stabilized Level of Commodity Prices (p*) Based on Five-Year Moving Average of Prices and Corresponding Control Authority Action[a/]
(Prices in U.S. dollars per metric ton)

	ABACA			COFFEE			COPPER			SUGAR			COCOA			COTTON		
	p[b/]	Action	p*	p[b/]	Action	p*	p[b/]	Action	p*	p[b/]	Action	p*	p[b/]	Action	p*	p[b/]	Action	p*
1969	29	N	29				282	S	279	152	N	152	636	N	636	564	N	564
1970	34	N	34	1,140	N	1,140	293	S	289	153	N	153	704	N	704	543	N	543
1971	33	N	33	1,000	N	1,000	227	P	241	158	N	158	657	N	657	617	N	617
1972	32	P	43	1,100	N	1,100	232	P	274	172	P	195	670	P	846	724	N	724
1973	46	P	49	1,370	N	1,370	380	S	363	186	P	270	985	P	1,075	692	P	756
1974	110	S	72	1,460	N	1,460	473	S	376	478	S	397	1,960	S	1,743	1,186	S	1,156
1975	69	N	69	1,440	P	2,165	265	P	284	597	S	406	2,055	N	2,055	1,226	N	1,226
1976	57	P	61	3,160	N	3,160	282	N	282	293	P	298	1,910	P	2,242	1,195	N	1,195
1977	57	P	64	5,310	S	3,728	266	P	319	209	P	295	3,569	S	2,333	1,482	N	1,482
1978	69	N	69	3,660	N	3,660	280	P	333	175	P	310	3,696	S	2,499	1,225	N	1,225

a/ S = stock sales; P = stock purchases; N = no intervention
b/ Actual prices
c/ US dollars per thousand bales

5.5 Five-Year Moving Average

Table 7 shows a reduction in intervention from 41 to 31, but purchases still outnumber sales 19 against 12. Coffee and cotton experienced the most substantial reduction in intervention, while copper registered a substantial increase. Except for copper, commodity control was found to be unnecessary in the first three years under this assumption.

Table 8 — Revenue Stabilization Effect of Price Stabilization Based on Five-Year Moving Average of Prices

	s.d p*q*	s.d. pq	Stability Index s.d. p*q* ÷ s.d. pq
Abaca	2.46	4.62	0.53
Coffee	12.07	13.02	0.97
Copper	48.6	66.7	0.73
Sugar	94.2	74.5	1.26
Cocoa	1.23	1.63	0.75
Cotton	3.3	2.6	1.27

As indicated in Table 8, coffee and copper revenues were stabilized, but revenues from sugar and cotton were destabilized. On the other hand, a net revenue loss of US$170.6 million was recorded, much less than the loss under the trend-line assumption, with copper continuing to be the biggest loser at US$237.5 million. However, a negative revenue emerged for both coffee and cocoa (Table 9).

The results under the five-year moving average assumption indicated a marked divergence from theoretical assertions, especially on the revenue stabilization effect for coffee, copper, sugar and cotton (knowing very well that the first two commodities are supply-elastic over the long run, while the last two are supply- and demand-inelastic, respectively). Likewise, the net revenue results for coffee and cocoa contradicted expectations considering that supply shifts are known to substantially influence price fluctuations in agricultural products.

Perhaps the results imply that coffee could be stabilized at the cost of revenue loss; while for copper, cocoa and cotton, distortions may be caused by the insignificance of price coefficient in their respective models. There is no satisfactory explanation for the

Table 9 — Net Revenue Effect of Price Stabilization Based on Five-year Moving Average of Prices[a/]
(Revenue in million US dollars)

	(1) Abaca	(2) Coffee	(3) Copper	(4) Sugar	(5) Cocoa	(6) Cotton	Net Revenue Effect (1)+(2)+(3)+(4)—(5)—(6)
1969	—	—	(43.7)	—	—	—	(43.7)
1970	—	—	(40.8)	—	—	—	(40.8)
1971	—	—	(18.0)	—	—	—	(18.0)
1972	2.6	—	2.1	24.3	0.7	—	28.3
1973	0.7	—	(39.2)	79.6	0.3	2.2	38.6
1974	(4.2)	—	(87.5)	(35.4)	(0.6)	(0.3)	(126.2)
1975	(0.3)	0.4	(9.7)	(37.0)	0.1	—	(46.7)
1976	0.3	—	(16.9)	(38.0)	0.8	—	(55.4)
1977	1.0	(7.9)	7.9	3.3	(2.2)	—	6.5
1978	b/	—	8.3	76.8	(1.7)	—	86.8
Total	0.1	(7.5)	(237.5)	73.6	(2.6)	1.9	(170.6)

a/Expressed in 1970 present value using a discount rate of 10 per cent, the average annual growth rate of wholesale price index from 1961 to 1978.

b/less than /0.1/.

sugar revenue instability, but the best way to find out may be to investigate whether the price elasticity of demand for sugar is elastic. A closer look at the influence of assumptions on prices, other than elasticities and sources of fluctuations, may likewise be necessary.

6. Summary And Conclusion

This paper has presented a quantitative framework upon which the impact on Philippine trade performance of the UNCTAD integrated commodity scheme could be evaluated.

The methodology involved: (1) the setting up of econometric relationships between price and non-price factors, and the volume exported or imported of selected commodities (abaca, coffee, copper and sugar exports; cocoa and cotton imports); (2) the derivation of the level of stabilized prices p^* for a specific length of control period, on the basis of trend-line and five-year moving average prices of individual commodities; (3) the computation of q^* given p^*, and (4) the comparison between the standard deviations of p^*q^* of pq, as well as the computation of net revenue $p^*q^* - pq$, under both price assumptions.

The results of the exercise responded to key issues, namely compatibility of price stabilization with revenue stabilization and the direction of the change in revenue.

The models exhibited good fit for exports, correct signs for price variables except for the current price of abaca, but insignificant t-values for the price coefficients of copper, cocoa and cotton.

In both assumptions (trend-line of prices and five-year moving average), buffer stock authority purchases exceeded sales, dramatizing the fact that in a substantial number of cases, actual prices fall below the secular trend in prices.

Under the trend-line assumption, earnings from coffee and copper were destabilized, a result theoretically consistent with the highly elastic volume response to prices for these commodities in the long run. However, results under the five-year moving average assumption indicated that revenue from these two commodities were stabilized, while sugar earnings and cotton payments were destabilized.

In relation to the net revenue effect, the computations showed that the country would lose in certain commodities, but would gain in some under price stabilization. Individual gains, however, would not be able to offset the losses such that an overall shortfall in revenue may be expected. Copper would experience a tremendous loss under both assumptions, while coffee would lose under the five-year moving average assumption. Increased payments for imports are expected under the trend-line assumption, but lower payments by virtue of decline in cocoa payments are expected under the five-year moving average assumption.

Based on prior knowledge regarding elasticities and sources of fluctuations (demand for metals and minerals, supply for agricultural products), the revenue stability results for copper, coffee, sugar and cotton, and the net revenue results for coffee and cocoa are inconsistent under the five-year moving average assumption.

The results for coffee perhaps imply that earnings could be stabilized at the cost of revenue loss. Nevertheless, other factors which may have contributed to the distortion of the results have to be looked into, such as: (a) the wrong signs, and insignificance of the price coefficients, notably for copper, cocoa and cotton; and (b) the demand elasticities for exports, and supply elasticities of imports. More importantly, the resulting revenue stabilities and gains (or losses) could be possibly influenced not only by elasticities and sources of fluctuations, but also by the assumptions on the level of stabilized prices. This deserves a closer look.

But even if the results are fine-tuned, the overall revenue loss obtained from this study will possibly be maintained, considering the big loss from copper revenue, although this may be minimized under a favorable price assumption. Obviously, countries heavily dependent on commodities which are expected to experience revenue loss under price stabilization, e.g., mineral producers, will be reluctant to join such schemes. On the other hand, without stabilization, mineral consumers can use the futures market to hedge their positions.

This study, however, has not quantified the pure welfare effect of price stabilization, presenting only the income effect. If the former had been integrated into the analysis, an improved revenue picture would perhaps emerge. For the scheme to be feasible from the Philippine viewpoint, the revenue effect (including the pure welfare effect) must be positive even after the country's contribution to the Common fund had been deducted.

The pure welfare effect must of course be accompanied by a specific and concrete form of compensation for the losers. Otherwise, the commodity stabilization scheme will not work.

To date, the pace of the UNCTAD's work in commodity stabilization has been slow. The agreements on cocoa, tin, coffee and sugar had existed even before the IPC, while the agreement on natural rubber is still being finalized. The Common Fund, on the other hand, has yet to be signed by about one-third and ratified by around 85 per cent of the 90 member nations.

The role of politics in commodity negotiations, in particular the often disruptive process of reconciling various country interests, cannot be ignored. Conflicts arise on potential gains and losses from stabilization schemes, distribution of gains, and compensation for the losers.

Some of the future research thrusts could focus on the following:

a) review and, if necessary, respecification of certain models including refinement of the price equation involving the setting up of behavioral models which could serve as basis for determining p^*;

b) determination of the impact of various assumptions on p^* on revenue stabilization and net revenue effect;

c) determining feasible methods of compensation for the losers of stabilization schemes, including evaluation of the feasibility of other schemes or their combination such as compensatory financing, long-term contracts, and future markets;

d) formulation and extensive use of optimizing models to determine whether trade-offs among objectives could be handled, and diverse individual country interests could be reconciled under any commodity scheme.

There are existing notions that global structural adjustments aimed for in the provisions of the New International Economic Order (NIEO) would enhance the IPC. This would lessen undue fluctuations, particularly on the demand side, and improve commodity access to trade markets.

However, an improved state of condition on commodity markets could also be attained by changes in the supply side — for instance, increased efficiency in the production of commodities by individual commodity producers, and going into higher degree of processing of raw materials.

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