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# THE EFFECT OF TRADE POLICIES ON RELATIVE PRICES AND HOUSEHOLDS' REAL INCOMES AND FOOD CONSUMPTION PATTERNS: (PERU, 1964-1982)

David L. Franklin
Sigma One Corporation

and

Alberto Valdés E.
International Food Policy Research Institute

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## Introduction and Background

The economy of Peru during the postwar era was directed according to an import substitution industrialization strategy; and since the mid 1960s, it has experienced a myriad of policy interventions that have attempted to further isolate it from international economic forces. This study measures the effects of trade policy on the structure of relative prices and on households' food and non-food expenditures and real incomes.

Time series data on prices were used to estimate the incidence of trade policies on the structure of relative prices. These prices and other time series data from the national product and income accounts have been used to estimate supply elasticities for value added in three agricultural subsectors and for the manufacturing sector. The effects of changes in relative prices were traced to their impact on the expenditure patterns for five population groups by means of econometric estimates of the demand systems for consumption expenditures for the five population groups. The three components (incidence of trade policies on relative prices, supply analysis, and income and expenditure analysis) were integrated by means of a simulation program to compute the effect of alternative trade policies on relative prices, sectoral outputs, households' real income, and households' expenditure patterns. The computations measure short to medium- term adjustments, because important aspects related to factor mobility are not considered in the analysis.

Various economic events have had direct and indirect effects on the incomes and expenditures of different population groups in Peru. A process to develop the industrial sector through selective protective tariffs and an array of non-tariff barriers gained impetus at the end of the 1950's and has continued to date. Additionally, a land reform process was initiated in the 1960s and was intensified after 1968. During the 1970s the government attempted to restructure the agricultural sector in several ways, including land redistribution and increased parastatal intervention in the marketing of food commodities. It was expected that this would improve incomes for the rural population and increase the productivity of the agricultural sector. Price controls and direct involvement by parastatals in food markets, including significant subsidization of imported grains, were an attempt to maintain low food prices, particularly for urban households. While factor market interventions were designed to aid the producers of agricultural products, increasing consumer subsidies were necessary to maintain domestic prices at low levels when international prices for agricultural commodities rose sharply in the mid-1970s; during this period market incentives for food production deteriorated so much that the sowing of food crops in irrigated lands had to be mandated.

With the increased intervention into the marketing of food commodities, unofficial markets evolved and the parastatals were

only able to deliver small quantities of food to urban areas. This process apparently led to increased requirements for food imports, primarily of wheat, maize, beef, milk and dairy products.

While attempts to restructure the agricultural sector were intensified after 1968, the import substitution industrialization strategy virtually isolated the manufacturing sector from international competition. The central hypothesis of this study is that the effects of the import substitution policy on the structure of relative prices dominated the effects of the direct agricultural price policy as influences in determining the patterns and levels of agricultural output and of food expenditures.

**Trade Policy and the Structure of Relative Prices**

Trade or commercial policy for Peru in the last four decades has been implemented through a complex structure of tariffs, quota restrictions, and other protective mechanisms (non-tariff barriers). Such attempts to protect a particular sector of an economy can generate important and perhaps unintended effects on the other (unprotected) sectors of the economy. Protection raises the price of the protected importable, and this in turn causes substitution away from the protected goods to all other goods in the economy. Domestic costs of production of the non-protected goods may increase, if the protected importables are

factors of production in the non-protected sectors. The extent by which the relative price in each of the unprotected sectors adjusts in response to the induced changes in consumption and production are measures of the incidence of the industrial protection policies on the rest of the economy.

In the case of unprotected exportables, in the absence of subsidies or taxes, the domestic price (in local currency) is given by the world price converted at the prevailing nominal exchange rate. Any induced increase in domestic demand and/or reduction in supply can only be accommodated by a decline in the real exchange rate (defined in terms of the price of tradables relative to the price of non-tradables).

In the market for non-tradables, any increase in demand and decline in output induced by the structure of protection will create upward pressure on the market-clearing price for non-tradables. This increase in the price of non-tradables is the mechanism by which the real exchange rate declines.

In the case of non-protected tradables (importables and exportables), there are two possible effects: one, an increase in imports (or reduction of exports) and two, a decrease in the relative prices of these goods through the appreciation in the price of non-tradeables (and induced decline in the real exchange rate). Thus the non-protected import-competing sectors will be taxed as a result of the industrial protection strategy directed

at a particular import-competing sector. In the example of food imports, the domestic producers of foods that compete with imported foods are affected by their higher costs of production and by the lower real exchange rates. As a result of these two effects, more of these foods would be imported and less would be produced domestically. The lower real prices and the reduced output would imply lower revenues to the sector, and higher unit costs would imply lower incomes to producers.

In the case of non-tradable foods (e.g. roots and tubers in Peru), the induced substitutions would generate upward pressure on prices as demand increases and supply declines. This rise in the price of non-traded food stuffs would in turn induce further increases in the demand for tradable foods, i.e. it would further increase the demand for food imports. If these imports were forthcoming, they would put downward pressure on the price of non-traded foods. The final result on the price of non-traded foods would depend on the substitution possibilities in consumption and production between traded foods, on the evolution of international prices for imported foods, and on the trade regime for tradable foods.

**Analytical Framework**

The analytical framework for assessing the food consumption effects of agricultural pricing and trade policies is based on assumptions for a small open economy, i.e. one that faces given international prices for the goods in which it trades. The real

sectors of the economy are classified into two major sectors--agriculture and the rest of the economy. Within each of these, there is one subsector whose output is not traded internationally and the other subsectors produce internationally tradable commodities (exports or those that compete with imports). In any given setting the classification of economic activities into each of these categories would be a matter of policy relevance, dictated in part by the relative size of each subsector. For the analysis to be presented, the most relevant issue is the existence of at least one sector in the economy that is, in principle, not traded internationally. For Peru, the participation of a large portion of the population (urban and rural) in the services sectors constitutes the non-traded sector outside of agriculture; these economic activities include construction, transportation, clerical work, domestic services, and importantly among many others, the provision of marketing services for agricultural and food commodities.

In general, the agricultural sector may or may not include a non-trade sector. The existence of such a sector would be predicated by natural barriers to international trade for some commodities and their relative contribution to the national economy. Roots, tubers, legumes, and horticultural crops are considered as not-traded in Peru. In contrast, these same commodities are tradable in Peru's northern neighbor, Ecuador, because for Ecuador most of these are traded substantially with Colombia and to a lesser extent with Peru.

Peru also produces mineral products for export, and in some cases the performance of the entire economy may be determined to a large extent by the performance of the mineral-exporting sector. In this study, the performance of this sector is assumed to be given by its sectoral policies and international prices, and thus is assumed not to be affected by economic policies for the other sectors, particularly those for agriculture. Furthermore, the effect of the mineral sector on the rest of the economy did not change substantially during the period under study. For other countries that have experienced major booms in mineral exports, these effects could be substantial through the phenomenon known as "Dutch Disease".

Under the above broad assumptions, the nomenclature and symbols for the analytical framework are defined as follows. The letter "a" denotes agriculture; the letter "n" denotes the rest of the economy (not agriculture). The traded subsectors in each sector are denoted by "x" for exports and "m" for import-competing. The non-traded subsectors are denoted by the letter "h" for "home goods". The letter "Z" denotes production in value- added terms, and the letter "C" denotes consumption in final household expenditure terms.

The "value added" produced by the agricultural sector is given as:

(1) $$Z_{ag} = Z_{ah} + Z_{ax} + Z_{am},$$

the sum of value added by the agricultural non-traded, the agricultural export-producing, and the agricultural import competing sectors.

Consumption in the form of final household expenditures is:

(2) $$C = C_{ah} + C_{ax} + C_{am} + C_{nm} + C_{nh},$$

the sum of aggregate household expenditures on agricultural products, and non-agricultural products. Final consumption expenditures on agricultural products (e.g. food expenditures) are valued at retail prices, and these include the value of manufacturing (e.g. processing and packaging) and services (e.g. marketing). The retail price of food includes the wholesale price (farmgate) of agricultural commodities, the price of manufactured goods (as inputs into the production and processing of food), and the price of non-traded services, (e.g. marketing).

Symbolically a price index for food can be expressed as:

(3) $$EP_{(retail)} = \alpha_a EP_a + \alpha_{nm} EP_{nm} + \alpha_{nh} EP_{nh}$$ [1],

where $\alpha_a$, $\alpha_{nm}$, $\alpha_{nh}$ represent weights (based on value) of agricultural products, manufactured goods, and non-traded non-agricultural services in the value of final consumption expenditures on food.

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[1]The letter E denotes logarithmic differentiation, i.e., E = dLn, and EP can be interpreted as a proportional change.

The prices of non-agricultural home goods (services) and protected importables (manufacturing) affect the prices of foods in two ways--as inputs into the production process and, importantly, as components of the farm to retail price spread. Retail food prices can be affected in different ways by policies that affect the prices of agricultural goods, manufactured goods, and non-tradable goods and services. A policy that favors manufactured goods versus agricultural goods may produce smaller than anticipated reductions in the retail price of food since the effects of "protecting" industry would offset the effects of cheap food policies (at least in part) because the protected goods and non-traded services form part of the marketing margin for food products, and these latter prices will tend to increase.

The other prices in the analyses are the relative wholesale prices for the agricultural commodities and for the import-competing (protected) non-agricultural commodity. The domestic prices of the tradable commodities are the product of international prices, the nominal exchange rate, and any taxes or subsidies, i.e.

(4) $$P^D = R^O P^* (1+t),$$

where $R^O$ is the nominal (or official) exchange rate, $P^*$ is the c.i.f. (fob for exportables) world price of the particular tradable commodity, and t is a proportional tax or subsidy on that commodity.

The pricing structure for the analysis consists of wholesale (farmgate) and retail prices, given in relative terms with the price of non-agricultural non-tradeables as the economy's numeraire. Wholesale relative prices in log differential form are given by:

Non-Traded Agriculture:

(5) $$E(P_{ah}/P_{nh}) = E(P_{ah}/P_{nh}),$$

Exportable Agriculture:

(6) $$E(P_{ax}/P_{nh}) = E(P_{ax}^{*}/P_{nh}) + Et_{ax} + E(R^{O}/P_{nh}),$$

Import Competing Agriculture:

(7) $$E(P_{am}/P_{nh}) = E(P_{am}^{*}/P_{nh}) + Et_{am} + E(R^{O}/P_{nh}), \text{ and}$$

Manufactured Import Competing:

(8) $$E(P_{nm}/P_{nh}) = E(P_{nm}^{*}/P_{nh}) + Et_{nm} + E(R^{O}/P_{nh}).$$

The Log differentials of the <u>retail</u> prices are given by:

Non-Traded Agriculture:

(9) $$E(P_{ah}/P_{nh})^{R} = \alpha_{ah}E(P_{ah}/P_{nh}),$$ [2]

Exportable Agriculture:

(10) $$E(P_{ax}/P_{nh})^{R} = \alpha_{ax}E(P_{ax}/P_{nh}) + \alpha_{nm,ax}E(P_{nm}/P_{nh}),$$

Import Competing Agriculture:

(11) $$E(P_{am}/P_{nh})^{R} = \alpha_{am}E(P_{am}/P_{nh}) + \alpha_{nm,am}E(P_{nm}/P_{nh}),$$

and Manufactured Import Competing:

(12) $$E(P_{nm}/P_{nh})^{R} = E(P_{nm}/P_{nh}).$$

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[2] Non-traded agricultural goods are sold in forms not involving <u>industrial</u> processing.

The structure of relative prices shows how the retail prices for food can be affected directly by the tax/tariff structure resulting from trade policy and indirectly by the effect on the real exchange rate ($E(R^{o}/P_{nh})$). The net result of all these price and tax (subsidy) effects cannot be readily predicted since some of the effects would move in opposite directions. Changes in these relative prices will affect the composition and size of households' expenditure on foods and non-foods directly, as well as through the effect of the price change on the households' real income, and the effects of the price changes on labor incomes as production adjustments respond to the new structure of relative prices.

**The Price of Agricultural Non-traded Goods**

The relative prices of non-traded goods are determined by the domestic equilibrium. The demand function for aggregate household expenditures for agricultural non-traded goods is given by:

$$(13) \qquad EC_{ah} = \eta_{ah,y}EY + \eta_{ah}E(P_{ah}/P_{nh}) + \eta_{ah,ax}E(P_{ax}{}^{R}/P_{nh}) + \eta_{ah,am}E(P_{am}{}^{R}/P_{nh}) + \eta_{ah,nm}E(P_{nm}{}^{R}/P_{nh}),$$

where the $\eta$'s are respectively the income, own price and cross price elasticities of demand for the non-traded agricultural commodity. The corresponding supply relationship is given by:

$$(14) \qquad EZ_{ah} = S_{ah}E(P_{ah}/P_{nh}) + S_{ah,ax}E(P_{ax}/P_{nh}) + S_{ah,am}E(P_{am}/P_{nh}) + S_{ah,nm}E(P_{nm}/P_{nh}),$$

where the S's are the supply and cross supply elasticities for the non-traded agricultural commodity. The equilibrium price is determined by setting $EC_{ah} = EZ_{ah}$ and solving for $E(P_{ah}/P_{nh})^{e}$.

For the supply analysis, data from national accounts and from agricultural production statistics were used to disaggregate the national income in value-added terms into the following components:

(15) $$Z = Z_{ah} + Z_{ax} + Z_{am} + Z_{nx} + Z_{nm} + Z_{nh}$$

where Z = GDP, and $Z_{ag} = Z_{ah} + Z_{ax} + Z_{am}$ is value added by the agricultural sector[3]. $Z_{nx}$ is the exporting subsector of non-agriculture (primarily minerals); $Z_{nm}$ is the protected manufacturing sector; and $Z_{nh}$ are the non-tradables in the non-agriculture subsector (urban-based services, commerce, government, etc.).

Table 1 presents the direct and cross supply elasticities for the three agricultural commodity groupings and for manufactured goods. The elasticities were estimated as a system

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[3] Sectoral output for agriculture ($Z_{ag}$), Manufacturing ($Z_{nm}$) and Exportables (Minerals; $Z_{nx}$) were taken directly from the official national income statistics publications (INE, 1983). The non-traded sectoral output was computed by residual ($Z_{nh}$ = GDP - $Z_{ag}$ - $Z_{nm}$ - $Z_{nx}$). Agricultural value added ($Z_{ag}$) was further disaggregated into exportables ($Z_{ax}$), importables ($Z_{am}$) and non-traded ($Z_{ah}$). $Z_{ax}$ was estimated by summing the domestic value of output for cotton, sugar, coffee, wool, and minor agricultural exports and then subtracting a proportional amount for the value of non-domestic factors used in their production. In a similar fashion, $Z_{am}$ was estimated from the domestic value of the production of rice, wheat, beef, milk, and maize. The value added in non-traded agriculture was calculated as a residual by subtracting the computed values of $Z_{ax}$ and $Z_{am}$ from agricultural GDP, $Z_{ag}$.

with maximum likelihood techniques and a Nerlove (1958) specification for each supply equation. The relative prices of all tradables were treated as exogenous (i.e. given by world prices and the trade and exchange rate policies), and the relative price of non-traded agricultural goods was treated as endogenous. All prices were relative to the numeraire $P_{nh}$.

Table 1. Maximum Likelihood Estimates of Supply and Cross-Supply Elasticities for the Peruvian Economy 1950-1982

| | Prices | | | |
|---|---|---|---|---|
| Sectoral Value Added | Ag. Home Goods | Ag. Exportables | Ag. Importables | Manufacturing |
| Ag. Home Goods | 0.390 | -0.469 | 0.143 | -0.554 |
| Ag. Exportables | -0.197 | 0.909 | -0.304 | 0.408 |
| Ag. Importables | -0.650 | -0.011 | 0.597 | 0.437 |
| Manufacturing | -0.268 | -0.093 | 0.219 | 0.438 |

Source: Sigma One Corporation, Estimates from Annual Time Series Data.

The system of elasticities which were estimated does not reflect factor market adjustments, particularly in the labor market; it is based on "exogenous" product prices on the assumption that these reflect world prices and institutionally determined distortions. The system of supply equations should be considered the result of estimating a set of reduced form equations, because important endogenous relationships are

excluded from the structure; accordingly, no symmetry conditions are imposed on the parameter estimates. The estimated elasticities represent medium to short-run adjustments of output in response to changes in relative prices; as such, they are not adjusted for the effects of induced factor market adjustments or technical innovation. These elasticities, nevertheless, are useful for assessing the directions of changes in output in response to changes in the structure of relative prices, and for assessing approximate magnitudes of the short to mid-term responses to the trade and price policy instruments under study.

**Analysis of Consumer Expenditures**

The aggregate consumption expenditure series for the five commodity groupings were computed by adding imports or subtracting exports as appropriate and by allocating part of the manufacturing and non-traded non-agricultural GDP to each subsector so as to equate the output shares from the national accounts data for 1973 to the expenditure shares reported in the ENCA survey (Amat y Leon and Couronisy, 1981). The specific computations were as follows:

Consumption Expenditures:

(16) $C_{ah} = Z_{ah} + \beta_{ah,nh} Z_{nh}$

(17) $C_{am} = Z_{am} + Z^{M}_{am} + \beta_{am,nm} Z_{nm} + \beta_{am,nh} Z_{nh}$

where $Z^{M}_{am}$ represents food imports given by the official trade statistics, $\beta_{am,nm}$ represents the food processing subsector of

the manufacturing sector, and $\beta_{am,nh}$ represents the services sectors contribution to food processing, marketing, etc. The $\beta$'s are given in Table 2 and were computed by matching the ENCA expenditure patterns to national accounts by use of the input-output data for 1973, reported in Reardon (1984).

Table 2. Proportions of Sectoral Value Added for the Manufacturing and Services Sectors which are Incorporated in Final Consumption Expenditures for Foods in 1973.

| Food Items | Non Agricultural Sectors | |
|---|---|---|
| | Manufacturing | Non-traded (services) |
| Import Competing | .043 | .151 |
| Exportables | .005 | .045 |
| Non-Traded | 0.0 | .130 |

Source: Computations from Amat y Leon and Curonisy (1981), INE (1983), and Reardon (1984).

Similarly,

$$C_{ax} = Z_{ax} - Z^{X}_{ax} + \beta_{ax,nm}Z_{nm} + \beta_{ax,nh}Z_{nh} \tag{18}$$

computes the value of domestic expenditures on agricultural exportables by subtracting exports and adding the manufacturing and services components of the final consumption expenditures. In the case of the latter two commodities, the manufacturing and service components are necessary to account for final expenditures. Consequently, the final consumption expenditures for manufacturing and services have to be adjusted downward to

reflect that a portion of the output of these sectors is consumed as part of the "spread" between farmgate and retail food prices.

The expenditure series thus created and the corresponding relative prices were used to estimate econometrically a system of demand equations using a procedure described in Swamy and Binswanger (1983) for transcendental logarithmic demand functions. The following statistical specification was used:

(19) $$\mu_i = a_i + b_{iC.} \text{ Log } (C.) + b_2 \text{ Log } (C.)^2 + \sum \gamma_{ij} \text{ Log } P_j$$

for i,j = ah, ax, am, nm, nh and

$C. = \sum C_i$, and $\mu_i = C_i/C.$

The neoclassical conditions of demand were imposed to yield:

a) $\sum \gamma_{ij} = 0$ for all i,

b) $\gamma_{ij} = \gamma_{ji}$,

c) the nh equation is redundant,

d) the prices are relative to $P_{nh}$.

These conditions are either required, <u>a fortiori</u>, e.g. condition c), or were imposed in the estimation. The demand elasticities are estimated from the statistical parameter estimates as follows:

The direct (own) price demand elasticities:

(20) $$EC_i/EP_i = \gamma_{ii}/\mu_i + \mu_i - 1$$

The Cross price demand elasticities:

(21) $$EC_i/EP_j = \gamma_{ij}/\mu_i + \mu_j$$

The income elasticities:

(22) $$\eta_{iy} = b_{iC.} + 2b_{iC.} \text{ Log } C./\mu_i + 1$$

The translog specification was chosen because it represents a flexible demand system (at least locally), and because the formulas for the demand parameters are functions of the estimated coefficients ($\gamma_{ij}$, $b_{iC}$) and of the budget shares (equations 20 through 22). This latter feature permits the estimation of demand parameters for different population groups. The budget shares ($\mu_i$) from Table 3 and the estimated statistical parameters were used to compute a system of demand elasticities for each of the five population groups as presented in Table 4.

Table 3. Distribution of Households, and Aggregate Consumption Among Five Population Groups and Their Corresponding Expenditure Patterns for 1972/1973.

| | Income Distribution | | Expenditure Patterns | | | | |
|---|---|---|---|---|---|---|---|
| | | | Agricultural | | | Non-Agricultural | |
| Population Group | Proportion of National Consumption (by group) | Proportion of Country's Households (population) | Non-Traded | Exportable | Import-Competing | Import-Competing | Non-Traded |
| Lima Upper Half | 25.5 | 10.05 | 12.0 | 6.0 | 17.0 | 38.0 | 27.0 |
| Lima Lower Half | 8.5 | 10.05 | 15.6 | 9.9 | 26.2 | 20.2 | 26.1 |
| Sierra Rural | 24.0 | 40.4 | 30.3 | 6.3 | 25.0 | 18.3 | 20.1 |
| Urban Non-Lima | 30.0 | 25.5 | 18.6 | 8.0 | 27.7 | 25.4 | 20.3 |
| Rural Non-Sierra | 12.0 | 14.0 | 20.6 | 5.7 | 29.1 | 20.6 | 24.0 |

Sources: Amat y Leon (1981), Amat y Leon and Curonisy (1981), and National Account Data.

Table 4. Matrices of Own- and Cross-Price Elasticities for Consumer Expenditures by Population Group in Peru, 1950-1982

| | Income Elasticity | Ag. Home Goods (ah) | Ag. Exportable (ax) | Ag. Importables (am) | Non-Ag. Import-Competing (nm) | Non-Ag. Non-Tradeables (nh) |
|---|---|---|---|---|---|---|
| **Lima Upper Income** | | | | | | |
| Ag. Home Goods | 0.868 | -0.764 | 0.019 | 0.004 | 0.407 | 0.479 |
| Ag. Exportables | 0.768 | 0.039 | -0.799 | 0.196 | 0.645 | 0.619 |
| Ag. Importables | 0.678 | 0.003 | 0.069 | -0.678 | 0.512 | 0.097 |
| Non-Ag. Imp.-Compet. | 1.274 | 0.128 | 0.101 | 0.228 | -0.841 | 0.387 |
| Non-Ag. Non-Traded | 0.918 | 0.213 | 0.138 | 0.061 | 0.547 | -0.989 |
| **Lima Lower Half** | | | | | | |
| Ag. Home Goods | 0.898 | -0.755 | 0.068 | 0.154 | 0.220 | 0.427 |
| Ag. Exportables | 0.859 | 0.107 | -0.815 | 0.298 | 0.362 | 0.478 |
| Ag. Importables | 0.806 | 0.065 | 0.105 | -0.627 | 0.281 | 0.162 |
| Non-Ag. Imp.-Compet. | 1.518 | 0.171 | 0.177 | 0.392 | -1.221 | 0.487 |
| Non-Ag. Non-Traded | 0.906 | 0.250 | 0.178 | 0.172 | 0.370 | -0.997 |
| **Sierra Rural** | | | | | | |
| Ag. Home Goods | 0.948 | -0.651 | 0.047 | 0.184 | 0.192 | 0.265 |
| Ag. Exportables | 0.779 | 0.225 | -0.802 | 0.275 | 0.434 | 0.515 |
| Ag. Importables | 0.780 | 0.223 | 0.069 | -0.648 | 0.271 | 0.065 |
| Non-Ag. Imp.-Compet. | 1.573 | 0.319 | 0.149 | 0.371 | -1.265 | 0.427 |
| Non-Ag. Non-Traded | 0.996 | 0.440 | 0.178 | 0.089 | 0.427 | -1.201 |
| **Other Urban** | | | | | | |
| Ag. Home Goods | 0.915 | -0.739 | 0.054 | 0.170 | 0.270 | 0.355 |
| Ag. Exportables | 0.826 | 0.125 | -0.814 | 0.297 | 0.451 | 0.481 |
| Ag. Importables | 0.802 | 0.114 | 0.086 | -0.631 | 0.334 | 0.114 |
| Non-Ag. Imp.-Compet. | 1.413 | 0.197 | 0.142 | 0.365 | -1.083 | 0.395 |
| Non-Ag. Non-Traded | 0.835 | 0.300 | 0.176 | 0.143 | 0.457 | -1.100 |
| **Other Rural** | | | | | | |
| Ag. Home Goods | 0.923 | -0.726 | 0.033 | 0.194 | 0.221 | 0.365 |
| Ag. Exportables | 0.757 | 0.121 | -0.795 | 0.318 | 0.482 | 0.609 |
| Ag. Importables | 0.811 | 0.138 | 0.063 | -0.621 | 0.283 | 0.142 |
| Non-Ag. Imp.-Compet. | 1.508 | 0.221 | 0.134 | 0.398 | -1.208 | 0.459 |
| Non-Ag. Non-Traded | 0.903 | 0.310 | 0.143 | 0.170 | 0.390 | -1.004 |

Source: Sigma One Corporation Estimates from Time Series Data

**Measuring the Incidence of Industrial Protection on Relative Prices**

The effect of the foreign trade regime on relative prices is measured relative to the prices that would have prevailed in agriculture and non-agriculture under a more "neutral" trade regime. The degree of openness (or lack thereof) of the economy is measured by the "uniform equivalent tariff".

As in many other countries, the system of protection prevailing in Peru during the 1960s and 1970s consisted of import duties, quantitative restrictions, and export subsidies, such as y Certificado de Reintegro Tributario (CERTEX) which was created in 1969. Furthermore, these duties, quantitive restrictions, non-tariff barriers, and export subsidies varied among products. Accordingly, the estimation of the incidence of the trade policies requires the estimation of a uniform tariff (T') equivalent to a hypothetical ad valorem tariff which would be necessary to produce the existing structure of domestic relative prices. Such a "uniform equivalent tariff" would result in the same volume (but not composition) of trade, in the absence of adjustments in the nominal exchange rate or in nominal price of home goods. In other words, during the period under consideration, the equivalent uniform tariff would have restricted the demand for imports and adjusted the supply of exports by the same amount, in volume of trade, as did the actual trade restrictions (See Sjaastad, 1981).

The procedure for the estimation of T' is as follows:

(23) From $P = P_m/P_x = P_m^* R^o(1+t)/P_x^* R^o(1+s) = P^* T$

where $R^o$ is the nominal exchange rate,

(24) $T = (1+t)/(1+s)$ and

(25) $P^* = P_m^*/Px^*$,

where $^*$ refers to world prices, the following ratio is obtained:

(26) $P_m/P_x = (1+t)P_m^*/(1+s)P_x^* = (1+T')P_m^*/P_x^*$,

where $(1+T') = T$ replaces the actual set of trade interventions represented by $(1+t)$ and $(1+s)$. The nominal exchange rate, $R^o$, is in both the numerator and denominator in (24) and (27), and thus is cancelled out. From (27) above, by logarithmic differentiation, we get:

(27) $E(P_m/P_x) = E(1 + T') + E(P_m^*/P_x^*)$, that is,

(28) $E(1 + T') = E(P_m/P_x) - E(P_m^*/P_x^*)$;

the change in the uniform equivalent tariff is the difference in the changes in the domestic terms of trade vis a vis the international terms of trade for a country's importables relative to its exportables.

Assuming that a value of $T_0'$ is known in a base period, $T_i'$ can be estimated from:

(29) $E(1 + T') = \ln(1 + T_i') - \ln(1 + T_0')$

where

(30) $T_i' = [e^{E(1 + T')} . (1 + T_0')] - 1.$

Starting with a known value $T_0'$, the entire series $T_1'$, $T_2'$, . . . , $T_n'$, can be calculated.

In equation (28), $E(1 + T')$ is the variable that explains the changes in the actual volume of trade not explained by changes in the international terms of trade ($P_m^*/P_x^*$) and by other shifters of the demand for imports and supply of exports. This concept can be used to estimate T' econometrically when $P_m/P_x$ is not available. A reduced form for the excess demand for importables (import demand) can be expressed as a function of the two relative prices ($P_m$ and $P_x$), the level of aggregate real production (national income expressed as Z), and aggregate real expenditure (C):

(31) $$\ln M = a_0 + a_1 \ln(P_m/P_x) + a_2 \ln(P_h/P_x) + a_3 \ln Z + a_4 \ln C,$$

where M is a quantum index of imports and $P_h$ equals the price of non-tradables (For a more detailed presentation see Sjaastad, 1980b).

Coefficients $a_3$ and $a_4$ should not be treated as output and expenditure elasticities for importables, because M reflects production as well as demand, as it refers to an excess demand (for imports) and not to the demand for importables. Similarly, the excess supply of exportables (export supply function), is specified as:

(32) $$\ln X = b_0 + b_1 \ln(P_m/P_x) + b_2 \ln(P_h/P_x) + b_3 \ln Z + b_4 \ln C.$$

Using the condition of equilibrium in the home goods market, and after some substitution, equations (31) and (32) can be expressed as

(33) $$\ln M = \nu_0 + \nu_1 \ln(P_m/P_x) + \nu_2 \ln Z + \nu_3 \ln BT + \nu 4 \ln(M-X)$$

and

(34) $\ln X = \varkappa_0 + \varkappa_1 \ln(P_m/P_x) + \varkappa_2 \ln Z + \varkappa_3 \ln BT + \varkappa_4 \ln(M-X)$,

where M (X) equals the value of imports (exports) in domestic currency at external prices, and BT equals the trade balance as a fraction of national income.

Equations (33) and (34) are not independent, as (M - X), the difference between the two dependent variables, appears as an independent variable in both equations. Thus only one equation can be estimated.

The difficulty with estimating equation (33) is that data on $P_m/P_x$ are not usually available. (If they were available, then equation (28) could be used directly to obtain E(1 + T'), and there would be no need to estimate equations (33) or (34). Replacing $P_m/P_x$ in equation (34) with $P_m^*/P_x^*$, and assuming that the residual can be attributed to the difference between $P^*_m/P^*_x$ and $P_m/P_x$ yields:

(35) $\ln M = \nu_0 + \nu_1 \ln(P_m^*/P_x^*) + \nu_2 \ln Z + \nu 3 \ln BT + \nu_4 \ln(M-X) + U_M$

assuming that

$\nu_1 \ln(P_m^*/P_x^*) + U_M = \nu_1 \ln(P_m/P_x)$

or

$U_M/\nu_1 = \ln(P_m/P_x) - \ln(P_m^*/P_x^*)$

or

(36) $dU_M/\nu_1 = E(P_m/P_x) - E(P_m^*/P_x^*)$.

From equation (36),

(37) $E(1 + T') = dU_M/\nu_1$.

Thus, equation (35) must be estimated to obtain the estimated parameter $\nu_1$ and the series of residuals $U_M$. Then, the series on annual changes in $U_M$, $dU_M$, is used to obtain the series on annual changes in $\ln(1+T')$, $E(1+T')$, from equation (37).

The import demand equations used in this analysis for Peru were estimated by regression analysis using annual data for the period 1940-83. The regression coefficients for relative prices, income, and import/export ratio are quite stable and significant, while terms of trade and balance of trade were not. The evolution of the uniform equivalent tariff (T) for Peru is presented in Table 5. It indicates a drastic "closure" of the economy to international trade during the late 1960s and the 1970s.

Table 5. Uniform Equivalent Tariff (T), Peru, 1949-82[a]

| Year | Percent |
|---|---|
| 1949-53 | 5.4 |
| 1954-58 | 29.9 |
| 1959-63 | 71.2 |
| 1964-68 | 133.0 |
| 1969-73 | 256.0 |
| 1974-78 | 181.7 |
| 1979-82 | 91.3 |

Note: [a]Annual averages. A base value of $T_0'$ for 1948 equal to 6 percent was obtained from Nogues (1985).

The analysis of the incidence of trade regime and exchange rate policy presented here for a "small" open economy is based on a framework initially suggested by Dornbusch (1972) and later popularized by Sjaastad (1981). The excess demand for importables ($M^e$), excess supply of exportables ($X^e$), and excess demand for home goods ($H^e$) are assumed to depend only on relative prices ($P_m/P_h$, $P_x/P_h$) and real income, where $P_m$, $P_x$, and $P_h$ represent the domestic nominal prices of importables, exportables, and home goods. The domestic relative prices can be expressed as a function of world prices ($P_m^*$ and $P_x^*$), the nominal exchange rate ($R^o$), tariffs (t), and export subsidies (s):

(38) $$P_m/P_h = (R^o/P_h)\ P_m^*\ (1+t)$$

(39) $$P_x/P_h = (R^o/P_h)\ P_x^*\ (1-s)$$

and therefore

(40) $$P_m/P_x = P_m^*/P_x^*\ (1+t)/(1+s)$$

where $R^o/P_h$ represents the real exchange rate. In the short run, of course, the existence of large domestic stocks could alter this relationship, such as in equation (38) after a devaluation.

Assuming that expenditure equals income and the Balance of Payments (BOP) is zero, equilibrium in the home goods sector implies that $H^d = H^s$, where $H^d$ is the demand and $H^s$ the supply of home goods. After displacement from equilibrium, and holding income, capital, labor and technology constant, a new equilibrium is reached where:

(41) $(\eta_m - \varepsilon_m)\ E(P_M/P_h) + (\eta_x - \varepsilon_x)\ E(P_x/P_h) = 0$

where $\eta_m$ and $\eta_x$ represent the demand elasticities for home goods with respect to price of importables and exportables, respectively, and $\varepsilon_m$ and $\varepsilon_x$ are the corresponding cross supply elasticities.

Given world prices, the incidence of a change in trade barriers on exportables is given by:

(42) $E(P_h) - E(P_x) = \omega(EP_m - EP_x)$

(43) $\omega = (\eta_m - \varepsilon_m)/((\eta_m - \varepsilon_m) + (\eta_x - \varepsilon_x))$, with $0 \leq \omega \leq 1$.

The the incidence parameter, $\omega$, consists essentially of substitution relationships.

Let d represent the change in the nominal price of home goods; then, as shown by Sjaastad,

(44) $d = \omega t + (1 - \omega)s$,

that is, $\omega$ distributes the effect of the protective tariff between home goods and exportables.

The nominal distortion introduced by trade policy consists of $(t - s)$, where $(t - s) = (t - d) + (d - s)$, where $(d - s)$ represents the proportion of the "distortion" shifted in the form of an implicit tax on producers of exportables. Government policy determines the size of $(t - d)$ but cannot determine how this is allocated between import-competing activities and exports.

Equation (42) leads directly to the statistical specification for estimating $\omega$.

(45) $\ln(P_h/P_x) = a + \omega \ln(P_m/P_x)$

which can be estimated using ordinary least squares. Following the examples of García (1981) for Colombia and Bautista (1984) for the Philipines to capture the effect on agricutural exports, and disaggregating importables into agricultural and non-agricultural (e.g. manufacturing), this study has estimated the following equations:

For agricultural exportables;

(46) $\ln(P_{nh}/P_{ax}) = a + \omega_{ax} \ln(P_{nm}/P_{ax}) + \omega_{nx} \ln (P_{nx}/P_{ax})$,

and for agricultural importables,

(47) $\ln(P_{nh}/P_{am}) = a + \omega_{am} \ln(P_{nm}/P_{am}) + \omega_x \ln(P_x/P_{am})$,

where $P_{nh}$ is the numeraire for the structure of relative prices, the price index for non-agricultural home goods (e.g. services). Table 6 presents the regression estimates for equations (46) and (47).

These results can be used to compute the effects on the relative prices of the agricultural tradables. Partial differentiation of equation (46) and (47), holding $P_{nx}$ and $P_x$ constant, respectively, yields:

(48) $E(P_{nh}/P_{ax}) = \omega_{ax} E(P_{nm}/P_{ax})$ and

(49) $E(P_{nh}/P_{am}) = \omega_{am} E(P_{nm}/P_{am}$

Table 6. Statistical Estimates of Disaggregate Trade Incidence Parameters for Peru (1966-83) (Using monthly data and Cochrane Orcutt Technique)

| | Agricultural Importable | Agricultural Exportables |
|---|---|---|
| Intercept | -0.139<br>(-1.14)* | -0.113<br>(-0.73) |
| $\omega_{am}$<br>(t) | 0.5619<br>(15.7) | |
| $\omega_{ax}$ | | 0.6680<br>(18.7) |
| $\omega_{x}$ | 0.1852<br>(5.5) | |
| $\omega_{nx}$ | | 0.0657<br>(2.7) |
| $R^2$ | 0.96 | 0.97 |
| Durbin-Watson | 1.95 | 1.96 |
| Rho | 0.99 | 0.99 |
| n | 215 | 215 |

* The numbers in parentheses are t-statistics.

The effect of a change in the uniform equivalent tariff on the relative price structure, with $P_{nh}$ as numeraire, is obtained algebraically:[4]

---

[4] Consider $EP_{nh} - EP_{ax} = \omega_{ax} [EP_{nm} - EP_{ax})$

$$(1 - \omega_{ax})EP_{ax} = - \omega_{ax} EP_{nm} + EP_{nh}$$

$$(1 - \omega_{ax})EP_{ax} - (1 - \omega_{ax}) EP_{nh} = - \omega_{ax} EP_{nm} + \omega_{ax} EP_{nh}$$

$$(1 - \omega_{ax}) E(P_{ax}/P_{nh}) = - \omega_{ax} E(P_{nm}/P_{nh})$$

$$E(P_{ax}/P_{nh}) = - \omega_{ax}/(1 - \omega_{a}x) E(P_{nm}/P_{nh})$$

(50) $$E(P_{ax}/P_{nh}) = -\omega_{ax}/(1 - \omega_{ax})\ E(P_{nm}/P_{nh})$$

and

(51) $$E(P_{am}/P_{nh}) = -\omega_{am}/(1 - \omega_{am})\ E(P_{nm}/P_{nh}).$$

Sjaastad (1981) introduced the concept of "true protection" as the increase in the price of the protected importable relative to the price of home goods arising from an increase in the uniform equivalent tariff, $\tau = E(P_{nm}/P_{nh}/E(T)) = (1 - \omega)T'/(1 + \omega T')$. To illustrate the use of the disaggregated omegas, $\omega_{ax}$ and $\omega_{am}$, consider an increase in the uniform equivalent tariff that results in an increase of 10% in true protection. The estimated values for $\omega_{ax}$ and $\omega_{am}$ from Table 6 imply a "true" tax of 19.4 per cent on agricultural exportables and a tax of 12.7 percent on agricultural importables relative to the price of non-agricultural home goods.

## The Simulation Exercise

A computer simulation program was developed (Appendix A) to perform comparative static analyses. The exogenous variables used in the simulation were: T, the change in "true protection"; $EP_{am}^*$, the proportional change in the index of world prices of importable foods; and $EP_{ax}^*$, the proportional change in the index of world prices of exportable crops. In the simulation analyses, trade policy scenarios are represented by setting a value for T' as a change of the policy from a baseline period. Agricultural pricing policy is represented by the values of $EP_{am}^*$ and $EP_{ax}^*$;

if these are set to zero, a perfect isolation (price control policy) of domestic agricultural markets from world markets is achieved; if these two indices are set at the observed changes in world prices during the time interval from the baseline to the period under analysis, then "free" trade in agricultural commodities is implied. Proportional deviations from these "free trade" levels represent different degrees of net protection.

In the simulation analysis, the industrial protection scenarios are represented by giving a value to a measure of the presumed "anti-trade bias" relative to a more neutral, foreign trade regime. The degree of openness of the economy to trade was measured by the Uniform Tariff Equivalent (T'), and the simulations measured the effects of a change of the policy from a baseline period.

Two policy scenarios were developed for each of two time periods:

a) the effect of industrial protection in the presence of price controls for agricultural tradables, and

b) the industrial protection policy with free trade for Peru's agricultural importables and exportables.

The two <u>periods</u> selected each begin in the 1964-68 quinquennium, and differ in the ending periods. These are:

a) 1969 to 1973, a period of rapid increase in the level of industrial protection and a high degree of market

intervention of the early periods of the military governments (1969-73);

b) 1978 to 1982, a period which included an attempt at trade liberalization of the industrial protection strategy.

Through these comparisons it is possible to evaluate the effects of the extreme attempts undertaken in the early 1970s to "close" the Peruvian economy to manufactured imports and to isolate domestic prices from world price movements, versus what might have occurred under the policies of the base period (1964-68). Even during the base period, as shown in Table 1, the Peruvian industrial sector received a substantial increase in protection. The average equivalent tariff for the base period rose to 133 percent from the average of the earlier five years of 71.2 percent. The average for the next five years (1969 to 1973) nearly doubled to 256 percent. This period coincided with a high degree of intervention in the marketing of agricultural products (particularly food products). The simulations on the trade regime consider an <u>increase in T</u> from a base value of 133 percent in 1964-68 equal to a) 123 percent (to 256 percent in 1969-73); b) a reduction in T' of 42 percent (to 91 percent in 1978-82).

## The Effects of Industrial Protection

The aggregate effects of the industrial protection policies for 1969-73 are presented in Table 7 as real price effects measured relative to an index of non-agricultural nontraded goods and services. During the period 1969 to 1973, the industrial

Table 7. Proportional Effects* of Industrial Protection and Alternative Price Control Policies on the Production and Consumption of Agricultural Products in Peru for the 1969/73Period Relative to a 1964/68 Baseline

| Proporational Changes in the Output Variables | Policy Instruments: Industrial Protection | |
|---|---|---|
| | With Price Control | Without Price Control |
| Retail Price Indices | | |
| Non-Tradable Foods | - 2.9 | - 2.6 |
| Importable Foods | - 2.5 | - 1.6 |
| Manufactured Goods | 18.2 | 18.2 |
| Aggregate Consumption Expenditures | | |
| Non-Tradable Foods | 3.5 | 3.2 |
| Importable Foods | 4.5 | 3.8 |
| Agricultural Production | | |
| Non-Tradable Foods | 3.2 | 2.9 |
| Importable Foods | - 6.5 | - 3.8 |
| Exportable Products | -17.4 | -16.9 |
| Producer Price Indices | | |
| Non-Tradable Foods | - 2.9 | - 2.6 |
| Importable Foods | -28.0 | -23.2 |
| Export Products | -37.6 | -35.4 |

*Effects are proportional changes relative to what would have happened under the same price control and subsidy policy, but with the uniform equivalent tariff of the base.ine period. All price indices are relative to the price index for non-agricultural home goods and services.

protection instruments would have caused the relative price of manufactured goods to rise by 18% ("true protection") and induced a modest reduction in the retail price of food. Regarding agricultural producer prices, the industrial protection policy would have reduced the real price of exportables in agriculture by approximately 35% and of import competing products by approximately 25% as a result of the decline in the real exchange rate. Non-tradable (traditional) agriculture would have experienced real prices approximately 2% lower.

Relative to the effects of the industrial protection policy, on the agricultural producer prices, the effects of the direct agricultural pricing policies were relatively minor. The price control policies further reduced producer prices approximately 5% for tradable agriculture, and had a small impact (less than 1%) for non-tradable agriculture. The effect of the producer price controls alone was barely perceptible at the retail price level, but the combined effect of all the policies was to make non-traded food considerably more expensive than imported food, in relative terms. The main effects are a consequence of the industrial protection policy rather than the agricultural price control policies. For this period, the hypothesis on the dominance of the industrial protection policy appears verified.

The taxation of tradable agriculture via the industrial protection policy apparently caused a major shift of resources out of agriculture and a minor shift within agriculture towards

production of non-tradables. While the domestic production of non-tradable agricultural products increased by about three percent the domestic production of import competing foodstuffs declined by about five percent; domestic self sufficiency was thus reduced. The major effect of the industrial protection policies was to reduce the output of exportable agriculture by more than 15%. Overall agricultural output stagnated as a combined result of the trade and agricultural policies.

The industrial protection policy *per se* and the price control policy induced a small positive increase in aggregate food consumption, between three and four percent for the indirect effects of the industrial protection policy alone and an additional half percent for effects of the price control policy on agricultural importables.

The industrial protection policy, all other things equal, would have severely affected the balance of agricultural trade. As a result of the indirect taxation of exportable agriculture, the production of export crops would have declined by approximately 17%. The production of import competing agricultural products also would have declined and their consumption would have increased.

## Distributional Effects of the Industrialization Policy

The food consumption and income distribution effects of the price changes which would have resulted from the industrial protection policy, alone, for the five year period 1969 to 1973, relative to conditions in the previous five years, are presented in Table 8. The simulated effects on labor incomes are computed as if no adjustments had yet taken place in the labor market.

Table 8. Distributional and Consumption Effects* of Industrial Protection and Agricultural Policies in the Period 1969/1973 Relative to a Baseline in the Period 1964/1968

| Population Group | Agricultural Price Policies | | | | | |
|---|---|---|---|---|---|---|
| | With Price Controls | | | Without Price Controls | | |
| | Income Effects | Food Consumption Non-traded | Food Consumption Importable | Income Effects | Food Consumption Non-traded | Food Consumption Importable |
| Upper Income Lima | - 3.7 | + 6.1 | + 7.7 | - 3.6 | + 6.5 | + 8.3 |
| Lower Income Lima | - 5.7 | + 0.4 | + 0.9 | - 5.5 | + 0.6 | + 1.6 |
| Sierra Rural | - 1.1 | + 3.7 | + 4.2 | - 1.3 | + 3.5 | + 4.6 |
| Urban Non-Lima | - 2.9 | + 3.8 | + 4.2 | - 2.7 | + 4.0 | + 4.8 |
| Rural Non-Sierra | -10.7 | - 4.4 | - 3.2 | -11.2 | - 4.8 | - 3.1 |

*All effects are measured as percentage changes from the economic "comparative static" values which would have prevailed in the absence of the policy changes; these effects abstract from dynamic adjustment effects, growth, weather and investment. The non-traded commodities are traditional foods, e.g. potatoes, vegetables, small animal species, Andean grains, etc.; the importable foods are primarily wheat based products, rice, processed milk, beef and the like.

All these effects are not, therefore, the long-run general equilibrium effects that would result from intersectoral factor mobility. As such, the results serve primarily to illustrate the direction and approximate magnitude of the adjustments in production and consumption necessary to absorb the induced effects from the changes in relative prices arising from increasing levels of industrial protection and from the interventions on agricultural product markets.

The major and dominating result presented in Table 8 is that in terms of food expenditure, the upper half of the income distribution of Lima benefitted the most from all of the policies. In terms of food consumption, the poor in Lima benefitted very little from the industrial protection policies. All consumers in the country were made worse off by the industrial protection policies because the price of non-food items rose significantly and retail food prices moved very little. This shifted consumption towards food for the population as a whole and the upper income households in Lima increased their consumption of food by relatively and absolutely more than any other group.

According to this analysis, the combined effects of the policies were to significantly reduce the incomes of the rural coastal and jungle dwellers, relative to the rest of the population. Apparently, the Lima upper income and rural Sierra

populations benefitted relatively more from the lower food prices than did the rest of the population, because they have relatively high budget shares for food and within food for the tradeable foods (e.g. wheat, rice, milk, beef, etc.) In terms of the distribution of income, the Lima upper income and rural Sierra populations would have increased their share of a smaller national income slightly and the other groups' shares would have declined even more. It is important to remember that the Sierra rural population had household incomes equal to about one-fourth of the Lima upper income population. After 1973, their relative income was slightly better, but their absolute income was even lower. The rural producers of agricultural tradables were punished the most by the trade and agricultural policies.

That the richer Lima dwellers were able to capture absolutely and relatively more of the available foods than were the poor in Lima results from several facts. Principal among these are that the income effects tended to favor the rich as owners of factors of production in the protected sector and as consumers of importable (rather than non-traded) foods. The absolute gains result from the fact that the per capita incomes of the rich were three times the average incomes of the poor (Table 3). The relative gains result from the relatively high income and price elasticities in the upper income households' demand for importable foods (Table 4). It is important to point out that under this simulation, the relatively modest increases in food consumption in the presence of substantial producer price

declines, result, in part, because marketing margins tended to increase (as an induced effect of the industrial protection policies).

**The Effects of Trade Liberalization (1979/82)**

After 1978, Peru began an approach towards freer trade than had prevailed in the preceeding ten years. The post 1978 period is known as "The Crisis". The economic conditions in Peru during this period were affected by a multiplicity of interacting effects from economic, political and ecological disruptions. It is therefore difficult to ascertain the causes of the economic problems which have plagued Peru in the post 1978 period. Some attribute the problems to the turn towards trade liberalization and have promoted a return to selective protection of productive sectors, exchange rate and other price controls, and other efforts which implicitly call for greater isolation of the Peruvian economy from conditions in world markets. The apparatus developed for this study cannot be used to resolve this debate; what the analysis provides, however, is an assessment of the degree to which trade liberalization, as manifested on <u>one</u> determinant of the real exchange rate, has helped or hindered the food consumption, income distribution and agricultural production situation.

The scenarios for the analysis of the effects of trade liberalization are based on the changes that would have occurred

if the policies pursued after 1978 had been pursued throughout the post 1968 time period. Specifically, the policy change involves a reduction of the uniform equivalent tariff from 133% to 91.3%. The price scenarios are based on the agricultural prices that prevailed in world markets in the 1978/82 time period. The focus of the analysis is on the effect of trade liberalization; the price scenarios are principally used for the test of the central hypothesis.

**Aggregate Effects of Trade Liberalization**

Table 9 presents the "aggregate" effects of the turn towards liberalization. With a reduction in protection, imported manufactured goods would have driven the price of all manufactured goods down, and consumers would have substituted towards such goods and away from food stuffs. The price of industrial (manufactured or imported) goods would have been reduced approximately 17.4% in real terms. In the absence of price controls, the trade liberalization effects and the fall in world prices for foodstuffs would have reduced the price of food at retail between one and five percent. For agriculture, under the "free trade" solution, there would have been a very small (around 1%) increase in aggregate food expenditures. Price controls, on the other hand, would have prevented producer prices for food from dropping and would have maintained exportable prices at least 20% higher in real terms than under "free trade"; the retail price of non-tradable foods would have risen. This

protection of tradable agriculture would have extracted resources from non-tradable agriculture, particularly for the production of tradable foods.

Table 9. Proportional Effects* of "Trade Liberalization" and Price Control and Policies on the Production and Consumption of Agricultural Products in Peru for the 1978/82 Period Relative to a 1964/68 Baseline

| | Policy Instruments | |
|---|---|---|
| | Liberalization of Industrial Protection | |
| | With Price Control | Without Price Control |
| Retail Price Indices | | |
| Non-Tradable Foods | 2.5 | - 1.1 |
| Importable Foods | 1.5 | - 4.5 |
| Manufactured Goods | -17.4 | -17.4 |
| Aggregate Consumption | | |
| Non-Tradable Foods | - 3.1 | 0.9 |
| Importable Foods | - 3.7 | 1.4 |
| Agricultural Production | | |
| Non-Tradable Foods | - 3.1 | 0.9 |
| Importable Foods | 3.6 | -14.2 |
| Exportable Products | 16.2 | 8.5 |
| Producer (Real) Price Indices | | |
| Non-Tradable Foods | 2.5 | - 1.1 |
| Importable Foods | 22.1 | -11.8 |
| Export Products | 33.8 | 13.3 |

*Effects are proportional changes relative to what would have happened under the same price control and subsidy policy, but with the uniform equivalent tariff of the baseline period. All price indices are relative to the price index for non-agricultural home goods and services.

In a separate analysis (Franklin, et al., 1983), it was shown that the subsidy equivalent of the price control policy was captured by the producers of tradable foods, primarily rice. By 1983, Peru was spending approximately $100 million in food subsidies. The reported calculations indicated that approximately $49 million were going to producers, $14 million to the richer half of the Lima population, $13 million to the poorer half of the Lima population, and the rest to the rest of the country. The subsidy was required because Peru was attempting to isolate its food-producing subsector from lower international prices; in 1982 the effective rate of protection for rice was a positive 12%. During the trade liberalization period, direct agricultural policies appeared to be more effective than during the industrial protection period when direct price policies were swamped by the deleterious effects of the industrial policy.

**Consumption and Distributional Effects of Trade Liberalization (1979 to 1982)**

The food consumption and distributional effects under this hypothetical set of scenarios are presented in Table 10. A reduction in the uniform equivalent tariff, positive nominal protection to producers of tradable agriculture were the policies pursued by Peru during this time period.

Table 10. Consumption and Distributional Effects* of Trade Liberalization in Peru: A Comparison of 1979/1982 Relative to 1964/1968

| Population Group | Agricultural Price Policies | | | | | |
|---|---|---|---|---|---|---|
| | With Price Controls | | | Without Price Controls | | |
| | Income Effects | Food Consumption Non-traded | Food Consumption Importable | Income Effects | Food Consumption Non-traded | Food Consumption Importable |
| Upper Income Lima | + 3.5 | - 5.9 | - 7.3 | + 4.5 | - 2.4 | - 2.8 |
| Lower Income Lima | + 5.4 | - 0.4 | - 0.9 | + 7.4 | + 3.0 | + 3.9 |
| Sierra Rural | + 1.1 | - 3.5 | - 4.1 | + 2.0 | - 1.5 | - 0.4 |
| Urban Non-Lima | + 2.8 | - 3.6 | - 4.0 | + 4.5 | - 0.5 | - 0.5 |
| Rural Non-Sierra | +10.2 | + 4.2 | + 3.0 | + 6.0 | + 1.6 | + 2.6 |

*All effects are measured as percentage changes from the economic "comparative static" values which would have prevailed in the absence of the policy changes; these effects abstract from dynamic adjustment effects, growth, weather and investment.

The income distribution effects of the trade liberalization would have been progressive within the urban populations, i.e. the urban poor would have gained more in relative terms than the urban rich of Lima. Within the rural population, the relatively better off coastal and jungle rural populations would have gained relative to the highland population. The positive protection of tradable agriculture would have accentuated this latter effect, because the production of tradables is concentrated in the coastal and jungle areas, while the highland populations produce and consume non-tradables but also consume tradable foods

substantially. As consumers of tradable foods and producers of non-tradables, the Sierra rural population would have been negatively affected by the higher relative prices for tradable foods arising from the price control policies that kept rice, wheat, milk, and other tradable foods above world market prices.

From a nutritional and distributional point of view, trade liberalization across all sectors would have been generally beneficial. The persistent poverty of the highlands would still require specific policies and instruments beyond those considered in this study. A recent study (Parillón et al., 1987) which was based on the 1984 national nutrition survey concluded that:

> The number of children under six years of age with chronic malnutrition exceeded one million, and approximately a quarter of a million Peruvian children were severely stunted and underweight for their ages and at high risk of severe illness or death.
>
> Approximately sixty percent of the households with malnourished children were engaged in agricultural production and agricultural wage work for their livelihood. Their economic output in terms of product and labor effort was insufficient to provide them adequate diets, housing, sanitation, water and access to preventive and curative health services. Their poor health and diets in turn prevented them from participating more fully in the economic processes of the society. For the long run, the solution is to reverse (and perhaps compensate for) the long standing and continuing bias against agriculture and labor, particularly in the highlands. Such reversal of policy and of developmental strategy does not seem to be forthcoming, and even if it were, it would not solve the problems of the households whose conditions of extreme povery would prevent their response to improved economic incentives. Direct nutritional interventions must be undertaken urgently to assist these households.

**Summary**

Efforts to close the economy of Peru to the conditions in world markets during the 1970s distorted the structure of incentives against agriculture as a whole. Average real producer prices for agricultural products declined by more than the induced increases in the domestic price of manufactured goods. At the retail level, the decline in food prices was modest, so that urban consumers and some rural dwellers (particularly in the Sierra) would have increased their consumption of all foods by modest amounts. Upper income urban dwellers benefitted more in relative and absolute terms than did the rest of the country with respect to food consumption. The improvements in food consumption by these groups would have come at the expense of consumption by rural coastal dwellers since aggregate disappearance data shows a slight decline in total food availability in the 1970s in comparison to the 1960s.

The deteriorating incentives to agriculture arose primarily through the decline of the real exchange rate as a result of the rise in the price of non-tradables induced by the protective instruments for the industrial sector. As a result of the deterioration of agricultural incentives, export performance declined for the agricultural sector and food imports were increasingly required. Midway through the decade, subsidies on tradable foods were used to isolate domestic markets from rapid increases in the international price of cereals. Later, when

international prices declined, the subsidies were increasingly captured by domestic producers of cereals (primarily rice). There has been a general misconception about the nature of food subsidies in Peru in that they were not directed at consumers but rather resulted from parastatal deficits. During the industrial protection period the subsidies tended to be absorbed by the parastatals as part of their operating costs.

The evolution of the uniform equivalent tariff suggests that, during the 1960s and 1970s, the Peruvian economy became more closed, with increases in restrictions on trade. The real exchange rate underwent a major and persistent decline after the 1960s, reducing the profitability of producing tradables vis-a-vis non-tradables. Recovery did not begin until the late 1970s after a series of major devaluation and the institution of a crawling peg regime; this policy was terminated in 1985 and conditions similar to those of the mid-seventies prevail at the time of this writing.

Declines in the long-run real exchange rate have been particularly harmful for the production of agricultural tradables in developing countries, slowing their production and speeding up increases in the domestic consumption of tradables (imported cereals and exportables), reducing the contribution of agriculture to growth and to the balance of payments, and making developing countries more dependent on imported food. It is important to recognize, however, that a falling real exchange

rate is not necessarily a sign for a devaluation. The external accounts of a country could be in equilibrium at a low real exchange rate, because of restrictions on imports or larger inflows of capital, including foreign assistance. A result would be that agriculture, together with exportables in general, would be taxed implicitly. This penalty on agriculture is inherent and lasts as long as industry is highly protected. It cannot be eliminated by better management of other areas of economic policy.

For the period studied in Peru, the changes in relative prices induced by the trade and agricultural policies caused non-traded agricultural products to become relatively more expensive than tradable (imported) foods. As a result, there has been a major shift in the diet away from traditional foods to food products made from tradable or imported food stuffs. This impact is most obvious among highland dwellers whose diets have changed most drastically.

The principal effects on food consumption and income distribution have arisen from the restrictive trade policies that were pursued rather than from direct price policies for agriculture. Price controls may have shielded tradable agriculture from fluctuations in world markets, but any benefits for either farmers or consumers were more than offset by the deterioration of real personal incomes that arose from the trade

restrictions. Even urban dwellers observed declines in their real incomes during the 1970s.

Regarding trade liberalization, it is difficult to blame the real effects of the liberalization on any deterioration of food intake by the poor in Lima or elsewhere in the country that has been reported during the 1980s. In fact, it would appear that freer trade would have neutralized any possible deleterious food consumption impacts that could have arisen in the move to liberalization, because world prices for food were dropping during the period of trade liberalization. Had international prices been allowed to transmit themselves, Peruvian agriculture would have shifted to exportable products and non-tradables, with a net positive effect on the balance of agricultural trade even though more food would have been imported. From a distributional point of view, trade liberalization throughout the economy, including agriculture, would have been rather neutral with respect to the existing distribution of income. The move towards liberalization per se cannot be blamed on any apparent deterioration of incomes and food consumption which has been observed recently.

The analysis of this study ended in 1982. Since then, Peru has experienced a severe shock from the climatic effects of "El Niño" in 1983, a deterioration in the world prices for its exportables, a return to restrictive trade and exchange rate policies, as well as increasing political and civil strife. All

these recent events exacerbate the impoverishment of the Peruvian population that was aggravated by the trade policies of the 1960s and 1970s.

**Appendix: Description of the Trade Policy Simulation Program.**

The parameters are given as follows:

1. Incidence Parameters $\omega_{am}$ and $\omega_{ax}$ which are used to measure the implied taxation through real exchange rate effects on the relative prices of agricultural importables (am) and exportables (ax), respectively.

2. Supply Elasticity Matrix $[S_{ij}]$, where i, j = am, ax, ah, nm. A fifth sector is nh, non-traded non-agriculture (e.g. services) whose resource use and production is solved by residual to equate simulated aggregate value added to realized (actual) value added (GDP), to thus preserve consistency with the assumptions under which the $\omega$'s were estimated.

3. Relative Retail Price Weights $\alpha_{ij}$ which give the proportions of a retail price for a commodity i in terms of the wholesale prices of other commodities e.g. for i = am then j = am,nm because $EP_{am}^{Retail} = \alpha_{am,am}EP_{am} + \alpha_{am,nm}EP_{nm}$. These weights were solved from matching 1973 national product and income accounts and the 1973 input/output matrix to the ENCA expenditure data as described earlier.

4. Demand System $D^k = [\eta_{ij}]_k$, k = population groups identifier e.g. upper half of the income distribution in Lima, lower half, sierra rural, etc. and $[\eta_i]_k$, are the five sets of Demand Matrices D and income elasticities $\eta^Y$ which were estimated econometrically with yearly time series data from 1950-1982, and the budget shares of each commodity for each group as published by Amat y Leon (1981).

5. Consumption Shares for each population group representing the share of aggregate expenditures (in 1972/73), ($\delta_k$) allocated to the five commodity groupings, derived from ENCA data. So that the aggregate demand matrix is given on an element by element basis as

$$D_{ij} = \Sigma\delta_k D_{ij}^k \text{ and } \eta_i = \Sigma\delta_k\eta_i^k, \text{ where } \delta_k \text{ represents}$$

the share of aggregate expenditures represented by each population group (Table 3).

6. Labor Market Coefficients $\lambda_i$ the sectoral labor shares i = am, ax, ah, nm, nh were computed from the 1973 input-output matrix as reported by Reardon (1984) (Appendix Table 1). Thus changes in labor incomes for each group are computed as:

$$EL^k = \lambda_i \ell^k_i \text{ (SP')} \text{ where } \ell_i^k$$

are the coefficients for distributing sectoral wage bills to the population groups. These were also developed from Reardon's work (Appendix Table 2), **S** is the matrix of supply elasticities and **P'**

is the vector of proportional changes in the relative prices. Appendix Table 1 also presents the structure of the Peruvian economy in 1973, the year that serves as the "pivotal" point for the comparative static calculations in the simulation program.

The simulation program solves the following equations by Gauss - Siedel iteration:

a) Relative Producer Prices for Agricultural Tradables:

$$E(P_{am}/P_{nh}) = EP_{am}^{*} - [\omega_{am}/(1 - \omega_{am})]\ \tau$$

$$EP_{ax}/P_{nh} = EP_{ax}^{*} - [\omega_{ax}/(1 - \omega_{ax})]\ \tau .$$

b) Relative Retail Prices for Agricultural Tradables:

$$E(P^{R}_{am}/P_{nh}) = \alpha_{am}E(P_{am}/P_{nh}) + \alpha_{am,\ nm}E(P_{nm}/P_{nh})$$

$$E(P^{R}_{ax}/P_{nh}) = \alpha_{ax}E(P_{ax}/P_{nh}) + \alpha_{ax,\ nm}E(P_{nm}/P_{nh})$$

c) Income Effects for each population group:

$EY^{k} = -\ \mu^{k}EP + EL^{k}$, for each group, where $\mu^{k}$ is the vector of budget shares corresponding to each population group. P is the vector of price changes computed in the previous steps, and $El^{k}$ are the wage bill effects.

d) Equilibrium Price for Non-Tradable Agriculture:

$$EP_{ah} = \frac{(\eta_{ah,y}EY + \Sigma_j \eta_{ahj}EP^{R}{}_{j} - \Sigma_j S_{ah,j}EP_j)}{(S_{ah,ah} - \eta_{ah,\ ah})}$$

e) Consumption Effects on a commodity by commodity basis for each population group

$$EC_i{}^{k} = \eta_i{}^{k}EY^{k} + \Sigma_j D_{ij}{}^{k}EP_j{}^{R}.$$

Appendix Table 1. Structure of the Peruvian Economy in 1973

(Percentage Shares Excluding Minerals)

| | Value Added | Labor Force | Share of National Wage Bill | Labor's Share in Output |
|---|---|---|---|---|
| Agricultural Sector | | | | |
| Non-traded (home) | 7.62% | 12.76% | 7.85% | 84.3% |
| Exportable | 1.22 | 4.52 | 2.78 | 61.0 |
| Import-Competing | 4.04 | 7.04 | 4.33 | 49.6 |
| Non-Agricultural Sector | | | | |
| Import-Competing | 32.40 | 25.08 | 21.82 | 37.7 |
| Non-traded | 54.72 | 50.60 | 63.22 | 65.8 |

Derived from National Product and Income Account data (INE) except for labor cost shares which were derived from Reardon (1984).

Appendix Table 2. Distributional Coefficients for Assigning Labor Factor Shares of Sectoral Value Added to Personal Income

| | Agricultural | | | Non-Agricultural | |
|---|---|---|---|---|---|
| Population Group | Non-Traded | Exportables | Importables | Import Competing | Non-Traded |
| Lima Upper Half | 0.00 | 0.15 | 0.00 | 0.52 | 0.54 |
| Lima Lower Half | 0.00 | 0.00 | 0.00 | 0.10 | 0.10 |
| Sierra Rural | 0.70 | 0.00 | 0.50 | 0.04 | 0.03 |
| Urban Other Than Lima | 0.00 | 0.08 | 0.00 | 0.34 | 0.33 |
| Rural Other Than Lima | 0.30 | 0.77 | 0.50 | 0.00 | 0.00 |

Source: Derived from Reardon (1984).

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