CONSUMPTION EFFECTS OF AGRICULTURAL POLICIES: PERU

"TRADE POLICY, AGRICULTURAL PRICES AND FOOD CONSUMPTION: AN ECONOMY WIDE PERSPECTIVE"

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SIGMA ONE CORPORATION

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EXECUTIVE SUMMARY

This report summarizes a study which explored the effects of agricultural pricing policies on food consumption in Peru and the interaction of those policies with Import Substitution/ Industrialization development strategy during the last three decades. Specifically, the study identifies the food consumption effects of agricultural policies for five population groups (three urban and two rural) within the context of economy wide relationships between agriculture and the rest of the economy.

The following conclusions emerge from the results of the study:

1) In the late 1960's and throughout the 1970's protection of the industrial sector was very high;

2) Protection of the industrial sector affected real exchange rates and caused an effective taxation of agriculture;

3) Real producer prices for agricultural products declined;

4) As a result, consumption of all foods increased by modest amounts;

5) The deterioration in the real exchange rate reduced agricultural exports and more food imports were required;

6) Subsidies which were paid through marketing parastatals contributed to increase consumption of imported foods, and, when world prices declined, the subsidies were captured in part by domestic rice producers.

7) Upper income urban dwellers benefitted at the expense of rural coastal dwellers, and increased their food consumption of food more in relative terms and absolute terms.

8) With the changes in the relative prices of locally produced versus imported foodstuffs, the diet has shifted from traditional local foods to imported foodsuffs. This change has been most marked in the highlands.

During the late 1960's and thoughout the 70's tariff and non-tariff protection of the industrial sector in Peru was raised to extremely high levels by an array of tariffs, quantitative restrictions, import licensing and outright prohibitions. In this study, mainstream and contemporary economic analyses have been used to measure the induced taxation of agriculture which arose through the effect of the industrial protection policy on the real exchange rate.

Time series data on prices were used to estimate the incidence of trade policies on the structure of relative prices under general equilibrium conditions. Time series data from the national product and income accounts were used to estimate the structure of production (supply elasticities) and the resource allocation consequences of the resulting structure of relative prices. The effects of changes in relative prices, in turn, were traced to their impact on the consumption patterns for the five population groups by means of econometric estimates of the determinants of consumption.

Summary of Results

Efforts to close the economy of Peru to the conditions in world markets during the decade of the seventies distorted the structure of incentives against agriculture as a whole, and average real producer prices for agricultural products declined drastically. At the retail level however, the decline in food prices was modest because retail prices include services and manufactured components whose prices rose as a result of the trade policy interventions. As a result urban consumers and some rural dwellers (particularly in the Sierra) 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 intake. The improvements in food intake by these higher income groups came at the expense of intake by rural coastal dwellers.

The deterioration of incentives to agriculture arose primarily through the decline of the real exchange rate as a result of the rise in the price of non-tradeables which was induced by the protective instruments which favored the industrial sector. As a result of reduced incentives, export performance declined for the agricultural sector and food imports were increasingly required. Subsidies which were under the control of parastatals, further increased the need for food imports. Midway through the decade, the subsidy on food was 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).

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

The principal effects on food consumption and income distribution have arisen from the restrictive trade policies which were pursued rather than from direct price policies for agriculture. Price controls may have shielded tradeable

agriculture from fluctuations in world markets but any benefits for either farmers or consumers were more than off set by the decline of real personal incomes that arose from the trade restrictions. Even urban dwellers observed declines in their real incomes during the decade of the seventies. The income effects of the trade policies tended to exacerbate the existing maldistribution of income. The use of subsidies for tradeable foods only partially offset the negative income effects of the trade policy. It is also clear that the urban dwellers with higher incomes tended to benefit relatively and absolutely more than other population groups from the effect of the subsidies.

The analyses on food subsidies did not include the effects of financing the subsidy. Since the Peruvian tax system is not very effective, it is most likely that the subsidy scheme would have added to the fiscal deficit. In some years, the fiscal requirement to finance the subsidies exceeded the deficit i.e. there would have been no deficit in absence of the subsidies. To the extent that the deficit was financed through money creation the subsidy scheme may have aggravated inflationary pressures. If the incidence of inflation falls more on the urban poor, then these effects would tend to offset the calculated improvements in food consumption attributable to the subsidy scheme.

Regarding the trade liberalization efforts of the late 70's and early 80's, it is difficult to attribute to them any deterioration of food intake by the poor in Lima or elsewhere in the country. In fact it would appear that free trade would have neutralized any possible deleterious food consumption impacts which could have arisen in the move to liberalization, because world prices for food were falling during the recent period of trade liberalization. Had international prices been allowed to transmit themselves to domestic prices, Peruvian agriculture would have shifted to exportable products and non-tradeables with a net positive effect on the balance of agricultural trade. Nevertheless, more food imports would have been needed. 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 incidence of the policies on the diets and incomes of specific population groups is clearest for the early seventies. The food consumption and income distribution effects of the price changes which resulted from the trade policy in the period 1969 to 1973, relative to conditions in the previous five years indicate that in terms of food consumption, 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 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.

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 Sierra urban and rural populations benefitted more from the lower food prices (in terms of income effects) than did the rest of the population. The gains in consumption of food resulting from the subsidies were concentrated among the upper income groups of Lima. The most important effect is that the overall policy framework benefitted urban consumers at a high cost to coastal rural dwellers. Finally the results suggest that the subsidies were instrumental in shifting Sierra consumption from traditional patterns to the consumption of imported goods, such as cereal products (noodles, bread, etc.).

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 analysis of the effects of trade liberalization were based on the changes that would have occurred after 1968 if the policies pursued after 1978 had been pursued throughout the seventies.

In the absence of subsidies and 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. Under the "free" market solution there would have been a very small (around 1%) improvement in the consumption of food, on aggregate. In this case, price controls would have isolated Peruvian consumers from the benefits of world price declines and in the absence of subsidies would have caused a small decline in food consumption. On the producers' side, however, the price controls 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".

Under this trade and policy regime, the diets of the Sierra rural dwellers would have deteriorated by about one percent and the diets of the non-poor urban dwellers by about 2.5 percent. Urban poor and coastal rural dwellers would have had marginally improved diets. In contrast to the "free" trade solution (no subsidies), the use of subsidies (with or without price controls) would have improved food intake significantly for all consumer groups, with the urban poor and the rural coastal dwellers benefitting relatively more than other groups. The improvement in intake of tradeable foods would have generally been partially offset by the decline in the intake of non-tradeable foods.

1.0 Introduction

Over the last four decades, the majority of Peruvians have experienced conditions of poverty of which one manifestation is the widespread prevalence of chronic malnutrition, which in part is the result of inadequate diets. The inadequacy of the diets of the urban and rural poor and the persistence of malnutrition has been amply documented (The Lancet, 1949; Collazos et al., 1959; Amat y Leon and Curonisy, 1981; Franklin et al., 1983). Many explanations have been offered as probable causes for the persistence of chronic undernutrition, e.g. the fragility of the ecology, the susceptibility of the country's agriculture to drought, high costs in the transport system, economic inefficiencies in the food distribution system, unfavorable conditions in international markets for Peru's tradeable products, and disincentives arising from policies for agriculture and the import substitution/industrialization strategies which have been pursued. Undoubtedly, each of these explanations accounts for some part of the nutrition problem for Peru.

This report summarizes a study which has explored the role of agricultural pricing policies, and the interaction of these with the policy instruments of the Import Substitution/Industrialization development strategies which have been pursued throughout the last decades. The principal focus is to measure the effects of commercial (trade) policy on the real exchange rate as measured by the relative prices of tradeables versus non tradeables. The analytical apparatus is designed to

trace the effect of changes on the real exchange rate on the structure of relative prices and hence on consumption and incomes. The objective is to estimate the impact of past policies on the consumption of food by different population groups, and from these estimates, contribute information which may assist policy makers in identifying policies which may enhance nutrition in the future.

Specifically, this study seeks to identify the food consumption effects of agricultural policies in the context of economy-wide relationships between agriculture and the rest of the economy. Principal among the policy instruments of interest are those related to international trade, and the structure of economic incentives for productive sectors and the structure of relative prices faced by the consumers. The study measures the food consumption effects of policies by tracing the effect of changes in prices on the food consumption patterns of five population groups in urban and rural areas.

It is important to emphasize that this study focuses only on one determinant of the real exchange rate, i.e. trade policy and the industrial protection strategy. Other important determinants of the real exchange rate, such as international terms of trade, the fiscal deficit and its financing, and the management for the capital accounts of the economy may have in recent times had a substantial and perhaps dominant effect on the structure of economic incentives within Peru.

1.1 The Food Consumption Situation Since 1950

Autunes de Mayolo (1981) has reported that the adequacy of

the Peruvian diet has deteriorated since pre-Colombian times when the inhabitants of Peru achieved food sufficiency through the domestication and husbandry of a large number of animal and vegetable species and successfully exploited the diversity of the ecology to achieve food security. In the last four decades, food availability appears to have been inadequate and the diversity of the diet has deteriorated. The composition of the diet has shifted away from proteins obtained from animal sources towards carbohydrates, with cereals (and products manufactured from cereals) becoming the most important sources of calories throughout the country. The level of food energy available has averaged less than 90 percent of the recommended level (FAO, United Nations). The available evidence suggests that both rural and urban populations have suffered from chronic undernutrition; a report by The Lancet as early as 1949 stated that:

> "Lima is expanding rapidly. The birth rate is high and immigrants are coming in from the countryside to work in new industries. But the population seems to have already outgrown its food supply, its housing, and its sanitary system."

Reports of dietary patterns from the early 1950's (Collazos et al., 1959) indicate that regional diets varied greatly as a function of locally available foodstuffs. For example, in 1958, 15 percent of the rural coastal population were consuming only half of the daily recommended calories, and 16 percent and 3 percent of the Sierra and Selva communities, respectively, consumed half or less of the daily recommended calories. For the 1960's and early 1970's, Reutlinger and Alderman(1979) reported

that average aggregate calorie availability was approximately 97 percent of recommended levels, and that the income distribution was so skewed that in 1973 more than half of the population was eating food in quantities which were insufficient to meet calorie recommendations.

Coutu and King(1966) reported that by the 1960's it was clear that the national food supply was not keeping pace with the growth of the population and that the cause of this situation was centered more on agricultural policies than on natural factors. ECIEL (Estudios Conjuntos sobre Integracion Economica Latinoamericana) data for Lima indicate that in 1968 the distribution of expenditures on all types of food, with the exception of roots and tubers, was concentrated in the upper income stratum of Lima, and the lowest quartile of the population was consuming disproportionately fewer quantities of dairy products, meats, fish, seafood and fruit. This maldistribution of nutrients was closely linked to the fact that Lima had one of the most skewed distributions of income among the cities in the Americas (Musgrove, 1978).

The inadequacy of the diets of most Peruvians was further emphasized when in 1971/1972, a national food consumption survey (ENCA: Encuesta Nacional de Consumo de Alimentos) was undertaken to analyze Peru's consumption and nutritional problems. Those data revealed that 44 percent of preschool-aged children were classified as malnourished (Amat y Leon and Curonisy, 1981). Children in rural areas showed sufficient growth retardation to be classified as stunted as a result of chronic undernutrition,

while urban children generally appeared to be able to recover from acute episodes of malnutrition so that weights appeared normal for height. The higher incidences of malnutrition were found in rural areas; 50 percent of severely malnourished children were concentrated in the Sierra, although only 32 percent of the country's children lived in this region. The ENCA data revealed a greater maldistribution of incomes in the rural areas than in the cities.

Contrary to widely held popular beliefs that rural households were primarily self-sufficient subsistence households, the ENCA studies revealed that even in the Sierra, rural households were highly dependent on markets for their products, labor, and consumption. Although rural households consumed much of what they produced, and this represented a major portion of their total food consumption (63.4 percent for all rural areas), a large share of rural household incomes was derived from off-farm labor earnings. Analysis of the ENCA data for southern and central Sierra populations by Ferroni (1980) showed that "rural smallholders typically need to generate a significant part of their livelihood through market transactions." Rural dwellers were highly dependent on the market place for about a third of their food and most of their incomes, and the majority of rural households were unable to produce enough food or earn enough income through market activities to meet their nutritional needs. More recent anthropological reports highlight the growing importance of processed wheat products in the rural diets

(Franklin et al., 1983).

A 1981 World Bank report (Thumm et al.) analyzed the changes in the level and distribution of income from 1970 to 1979. They found that real per capita incomes of the lowest half of the distribution fell by 18 percent and real disposable incomes of the urban poor deteriorated significantly during the latter half of the 1970's. A continuing influx of rural workers to the cities aggravated this decline in incomes. Concurrently, for the rural areas total real personal income in the agricultural sector declined at a rate of approximately 1.4 percent per year from 1970 to 1982, even though the agricultural labor force continued to grow (INE, 1983).

Recently, there has been concern that efforts to liberalize international commerce have interacted with unfavorable conditions in world markets and catastrophic climatic disruptions to further aggravate the food consumption situation for the urban and rural poor. In 1983, field work by a team from Sigma One Corporation revealed that throughout the country, diets had become dependent on a few commodities--particularly rice, bread and noodles--all of which are purchased in the market, even in traditionally subsistence regions. Calculations with data from that field work also indicate that if all income from rural wage work were allocated to food, only 91 percent of calorie recommendations could be met. It was concluded that a large proportion of the population was consuming diets that were grossly inadequate in energy, and therefore in nutrients. While this situation was, in part, the result of the climatic disasters

of 1983, it is hypothesized that the climatic crisis only aggravated a long-standing problem whose origins are also to be found in national economic policies and development strategies.

1.2 Economic, Agricultural and Food Policies

Various economic events have had direct and indirect effects on the availability and cost of food for different population groups in Peru. Apparently, Peru has followed a cheap food policy for urban consumers for many years (Orden et al., 1982), which may be the basis for an increased dependence on imported foodstuffs to satisfy urban food requirements. In 1983, Peru imported one billion dollars worth of food. Ostensibly, this cheap food policy was one instrument among several directed at promoting the development of an industrial manufacturing sector to compete with imported goods. This process to develop the industrial sector through policy interventions such as selective protective tariffs and an array of non tariff barriers gained impetus at the end of the 1950's and has continued throughout the subsequent decades, and even recent efforts to return to more neutral structures of economic incentives preserve strong elements of intervention in the markets , particularly those for foodstuffs. One purpose of the industrialization strategy has been to generate employment and improve labor incomes.

Additionally, an agrarian reform process was initiated in the 1960's and was intensified after the military takeover in 1968. During the 1970's, the military government attempted to

restructure the agricultural sector through several interventions, including land redistribution and increased parastatal intervention in the marketing of food commodities. It was expected that these approaches to economic development 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 adequate and low cost food supplies, particularly for urban households. While factor market interventions were designed to aid the producers of agricultural products, increasing subsidies were necessary to maintain domestic prices at low levels when international prices for agricultural commodities rose sharply in the mid-1970's; market incentives for food production deteriorated so much that the sowing of food crops in irrigated lands in the coast had to be mandated.

The production impacts of the land reforms were not substantial (Caballero, 1976; Caballero and Alvarez, 1980). Apparently, the assistance given through factor markets was nullified by depressed product prices. With their increased intervention into the marketing of food commodities, 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, milk and dairy

*The notable exception being rice, which is almost totally controlled by a parastatal marketing agency--ECASA (Enpresa de Comercializacion del Arroz, S.A.).

products. Beginning in 1973, wheat was subsized to maintain low domestic prices to the milling industry and to maintain fixed prices for consumers. By 1980, direct subsidies on imported foodstuffs totaled approximately 180 million U.S. dollars, lowering consumer prices on these foods by an average of 15 percent (Franklin, 1980). Since 1969, Peru's annual food subsidy budget has averaged approximately $100 U.S. million in real 1973 dollars; the 1983 budget allocated approximately $200 U.S. million to subsidize food consumption. Non-controlled commodities rose in price during this time. Even with price controls and the high level of subsidization, the index of food prices rose more rapidly than the consumer price index in the latter part of the 70's. The ratio of the food price index to the rest of the consumer price index rose by nearly 30 percent from 1970 to 1980.

The civilian government which was in office from 1980 to 1985 attempted to promote economic recovery by implementing policies designed to liberalize trade and shift subsidies from imported foods to domestically produced foods, particularly rice. In the agricultural sector, investments were directed at extension and research services, and there was a shift to reliance on market forces and the private sector for the allocation of domestic resources. At the same time there was a general decline in the world prices of primary commodities which seriously affected Peru's import earnings. The previous government and the private sector had borrowed heavily from international sources, and in the 80's Peru has faced severe

problems with the repayment of its international debt. The climatic crisis of 1983 aggravated conditions of internal and external disequilibrium in the economy, which were in part due to the "international debt crisis" and very low prices for mineral exports. A program of "stabilization-cum-economic recovery" which was begun in 1978 was short lived at best. During the late 70's and throughout the 80's, the economy has been stagnant and dominated by accelerating inflation and very high unemployment as measured by official statistics.

It is also widely believed that the move towards trade liberalization has aggravated the problems of poverty and the maldistribution of income. At this writing, there exist calls from many political points of view for policy initiatives to improve the food consumption situation and to promote rural and urban employment. Among the instruments proposed are "selective" protection to industries that can generate employment, incentives for agriculture (producer subsidies and subsidized credit), various approaches to "exchange rate management" and a return to retail price controls for basic goods. It is hoped that this study can contribute information which might be useful in the ongoing debates on the issues regarding the food consumption effects of such policies.

1.3 Overview of the Study

This study on the food consumption effects of agricultural policies is based on the hypothesis that agricultural output for most of the post-World War II period has been depressed because of disincentives in agricultural pricing policies and their

interaction with selective trade policies. During the late 1960's and thoughout the 70's protection to the industrial sector was raised to incredibly high levels by an array of tariffs, quantitative restrictions, import licensing and outright prohibitions. Recently, policies have tended to reverse the distortions against agriculture, but within the agricultural sector, even recent policies appear to have been biased in favor of commercial rather than household-based agriculture. It is hypothesized that these conditions, through their independent effect on the real exchange rate, i.e. the price of non-traded commodities relative to the price of those that are internationally tradeable have resulted in a greater dependence on imported food commodities for the urban areas and poorer rural diets than would have occurred under a more neutral structure of economic incentives. This hypothesis isolates one determinant of the real exchange rate from others to focus on the interaction of trade policy with domestic policies for the prices of food and agricultural products.

The study is an empirical application of mainstream economic analysis. The policy instruments of interest are those that affect the structure of relative prices within the Peruvian economy. Relative prices are seen as the signals that influence the allocation of resources by individuals to production and consumption activities. The choices of individuals lead to the aggregate structure of production and consumption for the economy as a whole and to the structure of income and consumption for

particular population groups. In the analyses that follow, the productive side of the economy is divided into sectors that correspond to the internationally traded and non-traded components of agriculture and the rest of the economy. The consumption side of the economy is divided into the real expenditures on food and other consumption for five population groups--the upper half and lower half of the expenditure/income distribution in the city of Lima, the rural Sierra, and other urban and rural populations.

Time series data on prices have been used to estimate the incidence of trade policies on the structure of relative prices under general equilibrium conditions. Time series data from the national product and income accounts have been used to estimate the structure of production (supply elasticities) and the resource allocation consequences of the resulting structure of relative prices. The effects of changes in relative prices, in turn, are traced to their impact on the consumption patterns for the five population groups by means of econometric estimates of the determinants of consumption expenditures for the five population groups. The three components of the analytical apparatus--incidence of policies on relative prices, supply analysis, and income and expenditure analysis--were integrated by means of a computer simulation model to compute the effect of alternative policies on food prices, food supply, and food consumption. The apparatus is a model of resource allocation in the real parts of the economy and excludes explicit consideration of monetary aspects. The effects of monetary policy and the rate

of growth of the economy are not part of this study; the conclusions of the study must therefore be interpreted as if these omitted effects were neutral with respect to food consumption, sectoral employment and the distribution of income.

2.0 Policy Instruments and the Structure of Economic Incentives

Various policies have been used to modify the structure of economic incentives in the Peruvian economy. In this study, two kinds of policy interventions are considered, those directed at the economy as a whole and those that were explicitly centered on agriculture and food. The political economy underlying the policy interventions of the post-World War II era has been discussed by several authors--Thorp and Bertram, 1978; Fitzgerald, 1979; Samaniego, 1979; Schydlowsky and Wicht, 1979; Figueroa, 1981; and Alvarez, 1983. Essentially, these works indicate that from the late 1950's through the late 1970's Peru has pursued policies which tended to protect import-competing non-agricultural activities and which tended to depress the structure of incentives facing agriculture. At the same time, price controls and subsidies in the markets for food have attempted to foster the industrialization process by attempting to lower the urban cost of living.

2.1 International Prices and Exchange Rate Effects on Agriculture

Peru, like other Latin American economies is essentially open to international trade, having traditionally depended on exporting primary commodities (minerals, fish products, and agricultural commodities) for an important part of its national income and employment and for almost all of its foreign exchange earnings. More recently Peru has increased its participation in international markets as an importer of cereal grains, vegetable oils and animal products.

The analysis in this report is based on Peru's traditional openness to international trade as an exporter and importer of agricultural commodities. In the context of relative openness to international trade, a country exports commodities in which the domestic market clearing price (gross of transport, marketing and processing costs) would secularly lie below prices prevailing in international markets, and imports those for which the domestic market clearing price would lie above world prices in a secular manner. Those commodities for which transport costs or other natural rather than contrived barriers cause international trade to be prohibitive would be essentially not tradeable. Changes in world market conditions, domestic demand and domestic costs of production as well as technical innovations could cause switching of these conditions from time to time, e.g. the case of rice for Peru.

The non traded commodities and services are related to the tradeable commodities (exportable and importable) through the possibilities for substitution that exist in consumption and in production within the economy. International prices can therefore affect the relative prices of all commodities, those not traded as well as the tradeables. Accordingly, the fundamental relationship of domestic prices to international prices for tradeable commodities forms the core of the analysis; it is presented symbolically as:

$$P_{Domestic} = R^{o}P_{world}(1+t), \text{ where}$$

R^{o} is the nominal exchange rate at which trade in the particular commodity would occur, and t is a proportional tax or subsidy

which may result from explicit import tariffs (export subsidies) or indirectly from efforts to maintain domestic prices at levels different than the prevailing international price, e.g. through price controls.

2.1.1 Nominal Protection and Net Protection

When the proportional tax factor, t, is positive at the official exchange rate, domestic prices lie above world market prices as stated in domestic currency. This condition is described as positive nominal protection; when the opposite is true, i.e. domestic prices lie below the international price converted to domestic currency at the official exchange rate, nominal protection is said to be negative. These conditions can be the result of price variability in domestic or international markets or they can be the consequence of explicit domestic policies.

Secular patterns of nominal protection can reveal insight into domestic pricing policy for agricultural commodities. Negative nominal protection can result from explicit taxation for revenue purposes, among others, or from implicit taxation as a consequence of export quotas or price controls. A secular pattern of positive protection could reveal efforts to provide self sufficiency or food security as well as attempts to transfer income to producers of the protected commodities. Either pattern of negative or positive protection can also result as the intended or unintended consequence of efforts to stabilize prices particularly when parastatal organizations are involved in the marketing of the commodity in question.

As the pricing equation shows, domestic prices are computed by converting international prices to domestic currency at some exchange rate. Peru, like other Latin American countries has, intentionally and otherwise, used exchange rate controls to affect the structure of relative prices faced by their consumers and producers of agricultural products. In Peru, real exchange rates have fluctuated either as a consequence of domestic economic policies, trade policies, deterioration in terms of trade or other monetary and real phenomena. The fluctuations in the real exchange rate affect the incentives for production and consumption in opposite directions; an overvaluation of the nominal exchange rate resulting from deterioration of the real exchange rate can stimulate increased consumption of nontraded goods and decreased production of tradeables. Exchange rate overvaluation causes the domestic price of agricultural tradeables to be lower than the international price. This becomes, in effect, a tax on the production of tradeables and a subsidy to the consumption of importables and exportables. To the extent that the products of the agricultural sector are tradeable, overvaluation becomes a tax on the agricultural sector.

The effects of exchange rate distortions are also frequently aggravated by the instruments chosen to attempt to manage the resulting deterioration in the balance of trade such as selective import prohibitions, quantitative restrictions on imports, subsidies to non-traditional exports and increasing levels of tariff protection to non-agricultural import competing

activities. Such efforts can lead to further deterioration of the real exchange rate.

When the degree of overvaluation of the exchange rate is subtracted from the estimates of nominal protection, the resulting measure of the divergence of domestic prices from international prices is known as net protection. Net protection thus consists of two components: explicit pricing policies which can result in some level of nominal protection and economy wide policy which can result in divergence between nominal and real exchange rates. These two components may be mutually reinforcing or partially off-setting.

2.1.2 Factor Market Interventions and Effective Protection

Exchange rate management and factor market interventions through parastatal involvement or through controls in the markets for production factors also affect the structure of agricultural incentives and have important distributional consequences. Overvalued exchange rates, in the absence of other interventions, cause imported factors of production such as machinery and chemical products to be lower priced in domestic currency than they would otherwise be. It is also not uncommon that under the aegis of development programs factors of production will be subsidized directly by government entities or indirectly through supervised credit schemes with negative real interest rates (See Scobie and Franklin, 1977, for examples). These interventions seek to promote agricultural production and often the adoption of yield increasing technologies; they become, in many cases, de facto attempts to compensate through factor markets for what has

been taxed away through the product market and through overvaluation of the exchange rate. Factors will not always be lower priced since they may also include the products of protected domestic industry and these will be higher priced in domestic markets than in international markets.

The effective rate of protection (ERP) measures the total effect of distortions in product, factor and foreign exchange markets that results from the overall structure of economic incentives. For any commodity, this structure comprises import tariffs, export taxes and subsidies, price controls, quantity restrictions, and the divergence of the exchange rate from equilibrium resulting in over or under valuation applicable to the commodity or any inputs used to produce the commodity. The ERP measures the percentage deviation of domestic value added in an activity from the value added that would result under free trade at international prices for all inputs and outputs.

The concept of the effective rate of protection in the presence of tariffs has been extensively developed by Corden (1966) and Johnson (1969). The formula for its calculation was extended by Valdes (1973) to account for the effects of price controls, quantity restrictions and nominal exchange rates. In this formulation, the effect of the protective structure is reflected solely in the differentials between domestic prices of inputs and outputs and international (free trade) prices. While explicit data on actual tariffs, taxes, subsidies, etc. are therefore not required in the presence of price controls or quantity restrictions, the accuracy of the estimates depends

solely on the quality of price data for the relevant inputs and outputs.

2.2 Effective Protection for Agricultural Products in Peru

Table 1 presents nominal rates of protection, exchange rate overvaluation, net rates of protection and effective rates of protection for rice and cotton for the selected years for a number of locations in coastal Peru. Rice production was positively protected in nominal terms in 1965 and 1982, while effective protection was negative in 1965 and positive in 1982. The principal source of negative effective protection in 1965 was the substantial overvaluation of the exchange rate (estimated through purchasing power parity calculations) while nominal protection was very high in 1982, reflecting a producers' subsidy being paid by ECASA, the rice marketing parastatal. Small differences between net and effective rates for the same years suggest only limited factor market distortions. This suggests that the principal source of distortions may have been the overall economic policy working though its effect on the real exchange rate rather than specific agricultural pricing policies.

For cotton, nominal, net and effective protection rates were negative for each year studied. Net rates of protection remained between -0.35 and -0.54 throughout this period, with exchange rate overvaluation contributing more in 1969 and 1971 and higher rates of nominal negative protection contributing more in the two later years. This result suggests that exportable agriculture was being taxed directly, in addition to the depressing effects on prices arising from an apparent deterioration of the real

Table 1. Nominal, Net and Effective Rates of Protection for Rice and Cotton in Selected Years

Rice

Region	Year	Nominal Rate[a] of Protection	Overvaluation[b] of Exchange Rate	Net Rate[c] of Protection	Effective Rate of Protection
Lambayeque	1965	+0.028	+0.353	-0.325	-0.326
Lambayeque	1973	-0.359	+0.219	-0.578	-0.878
Lambayeque	1976/77	-0.064	+0.057	-0.124	-0.689
Piura	1982	+0.220	+0.041	+0.180	+0.124

Cotton

Region	Year	Nominal Rate[a] of Protection	Overvaluation[b] of Exchange Rate	Net Rate[c] of Protection	Effective Rate of Protection
Pisco	1969	-0.187	+0.285	-0.472	-0.576
Lima	1971	-0.080	+0.283	-0.363	-0.505
Canete	1976/77	-0.482	+0.057	-0.539	-0.841
Ica	1982	-0.313	+0.041	-0.354	-0.673

[a]Nominal rate of protection (NRP) = (Domestic Producer Price/[Int'l Producer Price x Official Exchange Rate]) - 1.

[b]Overvaluation = (Official Exchange Rate - Parity Exchange Estimate)/Official Exchange Rate.

[c]Net Rate = NRP - Overvaluation.

Source: Sigma One Corporation

exchange rate.

The above analyses suggest that the principal distortions to agricultural incentives arose from the divergence of the nominal from the real exchange rate, although cotton (an export crop) was also being taxed through product and factor pricing. Two important caveats are warranted, however. First it must be noted that the exchange rate distortions are measured by purchasing power parity calculations and may therefore differ substantially if other measures of the real exchange rate were used. Secondly, the calculations of the effective rate of protection are partial equilibrium results. The results are, therefore, best interpreted qualitatively as an indication of the overall direction and intensity of the distortions to agricultural incentives. The next section presents a description of a more general approach towards measuring the effect of trade policy on the real exchange rate and on the structure of relative prices on the economy as a whole.

2.3 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 such as the requirement for previous licensing for certain imports. These instruments sought to promote industrialization and import substitution by attempting to protect the import competing non-agricultural sectors from international competition. The resulting structure of protection can be represented by the equivalent uniform tariff, defined as the tariff which would have

resulted in the same volume of international trade as resulted from the combination of policy instruments. Table 2 presents the uniform equivalent tariff estimates for various periods in the post World War II era. The level of implied protection rose steadily (in nominal terms) through the period from the 1950's through the 1960's and 1980's and reached extraordinarily high levels in the mid- to late 1970's. Even the move towards trade liberalization by the Belaunde government maintained the uniform equivalent tariff at 91 percent in the period 1979-1982.

Attempts to selectively protect a particular productive sector of an economy through tariffs or other barriers to imports can generate important and perhaps unintended effects on the other (unprotected) sectors of the economy. Sjaastad (1980) and Garcia Garcia (1981) have shown how a tariff that was intended to protect domestic producers of goods which compete with importables may become a tax on exportables through the effect that the tariff may have on the real exchange rate. The tariff raises the price of the protected importable, and this in turn causes substitution by users of goods from the protected sector away from the protected goods to all other goods in the economy. Consumption is thus shifted to the non protected goods and services. The domestic costs of production of the non-protected goods may also increase, if the protected importables are factors of production in the non protected sectors. The extent by which the nominal price in each of the unprotected sectors adjusts in response to the induced changes in consumption and production is the measure of the incidence of the tariff and other protective

Table 2. Uniform Equivalent Tariff Estimate

Year	Uniform Equivalent Tariff Estimate (percent)
1949-1953	+5.3
1954-1958	+29.9
1959-1963	+71.2
1964-1968	+133.0
1969-1973	+256.0
1974-1978	+181.0
1979-1982	+91.3

Source: Valdes, 1985.

mechanisms on the unprotected sectors of the economy. Goods that are totally independent of all other goods (in consumption and (production) will be unaffected by the efforts to protect the goods produced by another sector. For those that are affected, the incidence is a function of the possibilities for substitution of the affected goods with all other goods. The higher the degree of substitution of the affected goods within the economy the higher would be the incidence of the structure of protection on the unprotected sectors and the policy of protection would be less effective in the degree that other sectors are affected.

The processes by which this may happen are as follows. If the protected sector produces manufactured goods for direct consumption by households, the consumption of the protected goods will decline, and the demand by households for "unprotected" consumer goods will increase as a consequence of induced substitution in consumption. If the protected sector also produces goods which are factors of production in other sectors, producers of goods in the unprotected sectors will reduce their use of the "protected" goods as factors of production. This will cause a reduction in the domestic production of "unprotected" goods and services at any given price. In the case of unprotected exportables, the domestic price (in local currency) is given by the world price converted at the prevailing exchange rate. With world prices given by international markets, the induced increase in domestic demand and reduction in supply can only be accomodated by an adjustment in the price of non tradeables and thus on the the real exchange rate.

In the market for non-tradeables, the induced increase in demand and decline in output induced by the structure of protection will create upward pressure on the market clearing price for non-tradeables. This increase in the price of non-tradeables is the mechanism by which the real exchange rate would deteriorate. Consider that within any economy all prices represent ratios of the value of goods relative to some standard; these are relative or "real" prices and the standard is frequently referred to as the numeraire. In an open economy, the real (or relative) price of foreign exchange is the rate at which international currency is converted to domestic currency relative to a numeraire. The numeraire must be an index of prices of goods and services, the value of which is determined within the economy, a price index of non-traded goods for example. If all prices in the economy including the exchange rate were expressed in real rather than nominal terms relative to an index of the price of non tradeables (home goods) then the higher home goods prices would imply lower relative prices in all sectors and also a deterioration of the real exchange rate relative to the nominal exchange rate. When such conditions prevail, the nominal exchange rate becomes over-valued unless it is allowed to fall. If the overvaluation is allowed to persist, for example by a policy of maintaining fixed exchange rates, exports would be taxed by the extent of the overvaluation.

The above process applies also to the unprotected import competing sector, not only to exportables, e.g. food imports in the case of Peru. A tariff on a particular sector which produces

goods that compete with imports causes substitution away from the protected goods, because users of the protected goods adjust their consumption or production to use less of the now higher priced protected goods. This leads to increases in demands for the goods by all the other sectors. In the case of tradeables (exportables and importables), there are two effects: one,an increase in imports (or reduction of exports) and two, a decrease in the relative prices of these goods through the decline in the real exchange rate. Thus other import competing sectors will also be taxed as a result of the tariff and other instruments of protection to 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 fact that at the lower real exchange rates the imported commodities are lower priced than before. This forces the domestic price of non-protected import competing food products downward in real(relative) terms. As a result of the 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 also imply lower incomes to producers of import competing food products.

In the case of non-tradeable food stuffs (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 tradeable foods, i.e. it

would further increase the demand for food imports. If these imports were forthcoming they would put some 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 and on the evolution of international prices for imported foods. The effect of the structure of protection on the prices for non-traded foods cannot, therefore, be predicted, a priori. What can be predicted by the theory for small open economies is that the economic forces induced by the attempts to protect a particular sector from international competition would be in the direction of increasing the contribution of imported foods and of decreasing the contribution of non tradeables in the food consumption patterns of the population. Such a phenomenon is widely believed to have taken place in Peru.

As such, selective protection to industrial goods could make the domestic food supply more subject to the price variations in international markets and perhaps more costly. Price controls used as attempts to insulate domestic food prices from international price variability in the presence of declining real exchange rates would increase the taxation to domestic producers of tradeable agricultural products and would cause further declines in the domestic supply of agricultural products (foods and non foods). The analyses of this study are directed at measuring these effects and tracing them to the food consumption patterns of five population groups. The analytical framework for the study is presented in the next section.

3.0 Analytical Framework for Assessing Consumption Effects in Agricultural Pricing and Trade Policies

The analytical framework for assessing the food consumption effects of agricultural pricing 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. In the analysis, the real (as opposed to monetary) sectors of the economy are assumed to be clasified into two major sectors--agriculture and the rest of the economy. Within each of these, there is a subsector whose output is not traded internationally and others that produce internationally tradeable commodities for export or that compete with imports. In any given setting the classification of economic activities into each of these sectors would be a matter of empirical convenience and 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 subsector in the economy that is, in principle, not traded internationally. In this abstraction, 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. The agricultural sector may or may not include a non-traded 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 tradeable in Peru's northern neighbor, Ecuador, because for Ecuador most of these are traded substantially with Colombia.

Peru 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 abstraction, the performance of this sector is assumed to be given by its sectoral policies and international prices, and thus this sector is assumed to not be affected by economic policies for the other sectors, particularly those for agriculture. Such assumption is not central to the analysis it is only made for the sake of "completeness" of the analytical framework.

Under the above broad assumptions, the nomenclature and symbols for the analytical framework can be defined as follows: the letter "a" denotes agriculture, the letter "n" denotes the rest of the economy (not agriculture), and the letters "x" and "m" denote the tradeables, exports (x) and import competing (m) in each sector, respectively. The non-traded subsectors are denoted by the letter "h" i.e. "home goods". The letter Z will denote production in value added terms and the letter C will denote consumption in final personal expenditure terms. Thus the basic identities in the economy are:

$$Z = C + (I=S) + (m-x),$$

that is, national income is equal to consumption plus investment

(equal to savings) and the balance of imports less exports. In this abstraction questions of internal and external balance and of capital stocks and flows are ignored; general equilibrium is assumed to be restored in the markets for home goods and services and in the balance of payments within the relevant time period.

For this analysis the production of interest is that of the agricultural sectors,

$$Z_a = Z_{ah} + Z_{ax} + Z_{am},$$

that is the sum of the value added by the agricultural non-traded (agricultural home goods), the agricultural export producing and the agricultural import competing sectors. In Peru these categories include traditional foods (potatoes, cassava, plantains, other tubers, grain legumes, the Andean grains other than wheat or barley, fruits and other horticultural crops) as the non-traded commodities; plantation crops (sugar, cotton, coffee, cacao, bananas, etc.) and wool as the exportables; and cereals, edible oils, dairy products and meat as the import competing agricultural commodities.

Consumption in the form of final household expenditures can be expressed as:

$$C = C_{ah} + C_{ax} + C_{am} + C_{nm} + C_{nh}$$

that is, the sum of aggregate household expenditures on agricultural products, and non-agricultural products. Final consumption expenditures on agricultural products (e.g. food expenditures) will include expenditures on manufactured goods (e.g. processing and packaging) and services (e.g. marketing).

Accordingly, the retail price of food would in general be determined by the wholesale price (farmgate) and the price of manufactured goods and the price of non-traded services, e.g.

$$EP_{(retail)} = w_a EP_a + w_{nm} EP_{nm} + w_{nh} EP_{nh}^*$$

where w_a, w_{nm}, w_{nh} represent the weights (based on value) of agricultural products, manufactured goods and, non-traded, non-agricultural services in the value of final consumption expenditures on food. The price of home goods and importables from the non-agricultural sectors affect the price of food in two ways--as inputs into the production process and, importantly, as components of the farm to retail price spread.

The above equation is central to the analyses in this study. It indicates that retail food prices can be affected in different ways by policies that affect agricultural prices, manufactured goods and non-tradeable goods and services.

3.1 Consumption Expenditures and the Structure of Relative Prices

The Demand System for the economy can be described by the utility function;

$$U\ (C_{ah},\ C_{ax},\ C_{am},\ C_{nm},\ C_{nh}),$$

which represents final consumption expenditures for each of the expenditure categories as the objects of choice. Income and the structure of relative prices are the determinants of the level and composition of real household consumption. With P_{nh}

*The letter E denotes logarithmic differentiation, i.e., E = dLn and EP can be interpreted as a proportional change or a price index; ratios of logarithmic differentials are, of course, known as elasticities.

as the numeraire for the structure of relative prices, the relevant price indices for the expenditures can be computed by subtracting the logarithmic differential of P_{nh} from both sides of the price index equations as follows (the superscript R denotes retail prices) :

$$E(P_{ah}/P_{nh})R = w_{ah}(EP_{ah}-EP_{nh}) + w_{nm,ah}(EP_{nm}-EP_{nh}) + w_{nh}(EP_{nh}-EP_{nh}),$$

and therefore, $E(P_{ah}/P_{nh})^R = w_{ah}(P_{ah}/P_{nh})$,

since $w_{nm,ah} = 0$ (by assumption i.e. agricultural home goods are assumed to not be used in any manufacturing process e.g. all fruits and vegetables are assumed to be consumed in fresh form). In similar manner:

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

gives the retail domestic price of exportable foods (sugar, etc.) and,

$$E(P_{am}/P_{nh})^R = w_{am}E(P_{am}/P_{nh}) + w_{nm,am}E(P_{nm}/P_{nh}).$$

gives the retail price of import competing foods e.g. cereals. For Peru, the weights were developed from expenditure survey data and from price index and national account data. The above two equations emphasize the point that 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 off-set the effects of cheap food policies (at least in part) because the protected goods and non-traded services form part of the marketing margin.

The fundamental prices in the analyses are the relative prices (at wholesale) for the three agricultural commodities and for the import competing non-agricultural commodity, P_{ah}/P_{nh},

P_{ax}/P_{nh}, P_{am}/P_{nh} and P_{nm}/P_{nh}, respectively. The domestic prices of the tradeable commodities are the result of international prices, the exchange rate and any taxes or subsidies, i.e.

$$P^D = R^o P^w (1+t),$$

where R^o is the nominal (or official) exchange rate, P^w is the c.i.f. world price of the particular tradeable commodity and t is a proportional tax or subsidy on that commodity. In log differential form, changes in domestic prices can be expressed as:

$$EP^D = ER^o + EP^w + Et,$$

an exchange rate effect, a world price effect and a direct policy effect. The pricing structure for the analysis consists of wholesale (farmgate) and retail prices.

(1.) Wholesale relative prices in log differential form are given by:

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

$$E(P_{ax}/P_{nh}) = E(P_{ax}/P_{nh})^w + Et_{ax} + E(R^o/P_{nh}),$$

$$E(P_{am}/P_{nh}) = E(P_{am}/P_{nh})^w + Et_{am} + E(R^o/P_{nh}), \text{ and}$$

$$E(P_{nm}/P_{nh}) = E(P_{nm}/P_{nh})^w + Et_{nm} + E(R^o/P_{nh}).$$

(2.) Retail prices are given by:

$$E(P_{ah}/P_{nh})^R = w_{ah}E(P_{ah}/P_{nh}),$$

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

$$E(P_{am}/P_{nh})^R = w_{am}E(P_{am}/P_{nh}) + w_{nm,am}E(P_{nm}/P_{nh}), \text{ and}$$

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

The above structure of 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 ($E(R^o/P_{nh})$). As an illustration consider, the relative price of an importable food product in the P_{am} price index such as bread; this domestic price has the following components which are obtained by substituting equations from (1) into (2):

$$E(P_{am}/P_{nh})^R = w_{am}E(P_{am}/P_{nh})^w,$$

the effect of changes in the world price of the basic commodity (say wheat grain);

$$E(P_{am}/P_{nh})^R = w_{am}Et_{am},$$

the effect of explicit taxes or subsidies on that commodity;

$$E(P_{am}/P_{nh})^R = w_{nm,am}E(P_{nm}/P_{nh})^w,$$

the effect of the world price of the manufacturing/processing component for the final consumption good (e.g. bread includes flour milling, baking, packaging etc.);

$E(P_{am}/P_{nh})^R = w_{nm,am}Et_{nm}$, the direct effect of tariffs on the manufactured components; and,finally, the effect of the induced exchange rate distortions,

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

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. In the prototypical "cheap food" policy in the context of an industrial protection strategy, for example, $E(t_{am})$ would be negative as a result of price controls or consumer subsidies and $E(t_{nm})$ would be positive as a result of the protective tariff. Furthermore, P_{nh} would tend to rise as previously described, and this would result in a deterioration of the real exchange rate (R^o/P_{nh}) and a further reduction in the

retail price of the importable food stuff. This latter effect, in particular, cannot be directly controlled by policy because it is a consequence of the substitutability between products within the economy. What can be stated clearly is that the price of food at retail can be affected by changes in the international prices of the tradeable components of final consumption expenditure and the implicit and explicit taxes (subsidies) arising out of the country's trade policy for agriculture and the rest of the economy. Changes in these relative prices will affect the composition and size of households' expenditure on foods and non-foods. It is in this manner that the effects of trade and agricultural policies are traced through to the food consumption effect for different population groups. As such, these effects require economy wide approaches rather than the traditional partial equilibrium approaches.

3.2 Measurement of the Incidence of Protection

The incidence of a country's international trade regime on the structure of relative prices can be measured econometrically by estimating the adjustments in the markets for domestic non-traded goods in response to policy-induced distortions in the markets for internationally traded commodities. The structure and logic of such analysis are based on open-economy general equilibrium models such as those discussed in Dornbush (1972). The method for analysis was developed by Sjaastad (1980) and refined by Garcia Garcia (1981) for Colombia. At any one point in time, small open economy faces given international prices for

its tradeable commodities; domestic policy initiatives can attempt to manipulate the nominal prices of tradeables through explicit import tariffs, export subsidies and through other instruments of trade policy such as licensing requirements and quantitative restrictions. As policy makers attempt to affect resource allocation within the economy by imposing protection on importables that compete with domestically produced goods, the relative price of non-tradeable (or home) goods may rise (the real exchange rate would thus fall) in response to higher prices for the protected goods, and as a consequence, the unprotected tradeables may be taxed (Garcia Garcia, 1981). The extent of these adjustments and the magnitude of the implicit taxation to the unprotected sectors depends on the structures of supply and demand in each sector of the economy and on exchange rate policy.

In the estimation of the incidence of trade policy for Peru, all prices are expressed relative to the price of non-tradeable goods in the non-agricultural sector, e.g. non-agricultural services. A tax on imports causes the relative price in domestic currency of the importables relative to home goods to rise as imports from abroad are made more expensive. The market for importables is not independent, however, of the other markets, as they are linked through factor markets and the demand structure of the economy. Therefore, a price rise in the market for importables causes excess demands in the markets for non-tradeables and therefore changes in the relative price structure in the rest of the economy. The principal measure of incidence of trade policy is the proportion by which the relative

price between exportables and home goods will adjust in response to a policy-induced distortion in the market for importables. The higher this effect, the higher the incidence on the unprotected tradeable sectors. Valdes (1985) and others working at IFPRI have estimated the incidence of trade policy on the structure of relative prices for various countries. For Peru, Valdes has estimated the tax or subsidy factors that result from a 100% nominal tariff on manufactured importables. His results indicated that the induced adjustments in the home goods sectors would result in only 28% true protection for the manufacturing sector and that the induced adjustment in the markets for non agricultural home (non-traded) goods and services, would lead to the following incidence of the protective tariff on agricultural exportables and importables.

Period	Incidence Parameter	
	Agricultural Exportables	Agricultural Importables
1966/1983	+.66	+.56
1949/1963	N.A.	+.39

Source: Valdes (1985).

The incidence parameters for the 1966/1983 period (which were estimated econometrically) yield the following price relationships:

$$E(P_{ax}/P_{nh}) = \frac{-(\quad .66)}{(1\ -.66)} E(P_{nm}/P_{nh})$$

$$= -1.94\ E(P_{nm}/P_{nh})$$

for exportable agriculture; and

$$E(P_{am}/P_{nh}) = -1.27\ E(P_{nm}/P_{nh}),$$

for import competing agriculture. That is, an effort to raise the nominal price of manufactured goods by 10 percent through the industrial protection strategy would have resulted in taxation of 19.4 percent and 12.7 percent for agricultural exportables and importables, respectively. These values suggest that a surprisingly high degree of substitution is possible in the Peruvian economy.

Trade policy in Peru during the last four decades proceeded from relative openness until the late 50's to extreme attempts at restricting manufactured imports during the 70's as part of an import substitution-industrialization strategy. The instruments of trade policy were many including import prohibitions on many items, licensing requirements, prior deposits, exchange controls, explicit tariffs etc. As Table 2 indicated from Valdes' estimates, the uniform equivalent tariffs (that would have produced the volume of trade which Peru experienced) rose from around 5% in 1949 to a high of 256% in the 1969 to 1973 period. Even the so called trade liberalization efforts, early in the Belaunde government, maintained a high level of protection (91.3%) to the manufacturing sector. To illustrate the incidence of these levels of protection on the unprotected sectors, Table 3 presents the "true" tariff protection and taxation to all exportables which resulted from the structure of protection and from the induced adjustments by the rest of the economy. Valdes'

Table 3. True Tariff Equivalents and Subsidies to Exports

	Tariff Equivalents	Subsidies to Exports
1949-1953	+1.4	-3.7
1954-1958	+6.6	-17.9
1959-1963	12.6	-34.2
1964-1968	18.2	-49.3
1969-1973	+24.1	-65.1
1974-1978	+21.1	-57.0
1979-1982	+14.8	-40.0

Source: Valdes, 1985.

estimates suggest that the strategy had little effectiveness in "protecting" the manufacturing sector, but rather that the level of protection achieved induced a high degree of taxation in other sectors.

3.3 The Structure of Supply and Demand and the Price of Agricultural Non-traded Goods

To complete the framework, the domestic wholesale and retail prices of the tradeable commodities are all specified by world prices and the tax factors that result from the policy interventions, and the determination of the relative price of agricultural home goods is given by the demand and supply relationships for agricultural home goods. The constant income demand relationship for aggregate household expenditures for this commodity is given by:

$$C_{ah} = N_{ah}E(P_{ah}/P_{nh}) + N_{ah,ax}E(P_{ax}/P_{nh}) + N_{ah,am}E(P_{am}/P_{nh}) + N_{ah,nm}E(P_{nm}/P_{nh}),$$

where the N's are respectively the own price and cross price elasticities of demand for the non traded agricultural commodity. The corresponding supply relationship is given by:

$$Z_{ah} = S_{ah}E(P_{ah}/P_{nh}) + S_{ah,ax}E(P_{ax}/P_{nh}) + S_{ah,am}E(P_{am}/P_{nh}) + S_{ah,nm}E(P_{nm}/P_{nh}),$$

where the S's are the supply and cross supply elasticities for the non-traded agricultural commodities. The equilibrium price is determined by setting supply equal to demand:

$$E(P_{ah}/P_{nh})^e = 1/(S_{ah}-N_{ah})[N_{ah,ax}-S_{ah,ax})E(P_{ax}/P_{nh}) + (N_{ah,am}-S_{ah,am})E(P_{am}/P_{nh}) + (N_{ah,nm}-S_{ah,nm})E(P_{nm}/P_{nh})].$$

The above expression computes the effect on the relative price of the non-traded agricultural commodity as a function of the changes in the relative prices of the tradeable goods, which may result from changes in the world prices of the tradeables or from policy induced changes in the structure of relative prices. With this result it is possible to assess the impact of world prices and trade policies on the structure of relative prices for agriculture and on the retail prices of food and non-food commodities. These structures of relative prices can in turn be used with supply and demand elasticities to trace through the agricultural supply and food demand effects of the trade policies. Table 4 presents estimates of the supply elasticities for agriculture and manufacturing in Peru which were econometrically estimated with annual data for the period 1950-1982. Table 5 presents the demand structure for consumption expenditures for the consumer groups in the Peruvian population. The resulting apparatus forms the basis for an analytical framework that can be used to trace the effects of exchange rate, tariffs, direct pricing and factor pricing policies on the structure of production and consumption in an open economy.

3.4 A Simulation Model of Resource Allocation and Consumption for the Peruvian Economy

A computer simulation model has been developed for this study which explores the separation of economic and food consumption outcomes into components which may be attributable to

Table 4. Maximum Likelihood Estimates of Long Run Supply and Cross-Supply Elasticities for the Peruvian Economy 1950-1982

Sectoral Value Added	Prices			
	Ag. Home Goods	Ag. Exportables	Ag. Importables	Manufacturing
Ag. Home Goods	0.390	-0.489	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.

Table 5. Matrices of Own- and Cross-Price Elasticities for Consumer Expenditures by Population Group in Peru, 1950-1982

	Income Elasticity	Ag. Home Goods	Ag. Exportable	Ag. Importables	Non-Ag. Import-Competing	Non-Ag. Non-Tradeables
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.-Competing	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	0.085	0.105	-0.627	0.281	0.162
Non-Ag. Imp.-Competing	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.-Competing	1.573	0.319	0.149	0.371	-1.285	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.-Competing	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						
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.-Competing	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.

changes in food prices and other policy variables. There are four components to this model: price determination, supply, consumption, and labor incomes. The consumption component relates the level and composition of household food expenditure for five socioeconomic and demographic groups to their incomes, and the real relative prices that result from adjustments of the domestic economy to variations in international prices and the trade policy interventions. For the personal income component, the model computes the changes on sectoral "wage bills" which result from the adjustments of output in the sectors considered, and adds this effect to the changes in a cost of living index computed from the expenditure shares and changes in consumer prices. The inputs to the model are the policy interventions represented as actual or simulated price changes for tradeable agricultural commodities and the actual or simulated change in the uniform tariff. The outputs are equilibrium prices of agricultural home goods, retail prices for traded and non-traded food commodities, income effects and changes in the patterns of food consumption. The model calculates the resulting demand for food imports and the balance of trade in agricultural products.

The effects of relative price changes induced by the trade and agricultural policies are traced through the structure of supply for the economy, and to the patterns of consumption of five population groups. The demand structure for consumers was estimated in terms of final consumption expenditures using data from the 1972 ENCA survey (Amat y Leon and Curonisy, 1981) and time series data on prices, agricultural production and the

national accounts. The expenditure patterns were reconstructed from national value added and a demand system was estimated using a translog function to estimate the national demand system for five commodities--three agricultural commodity groups, manufactured commodities and non-agricultural home goods (Table 5). It was assumed that the exportable non-agricultural (minerals) commodities produced within Peru are not consumed directly, but are processed through the manufacturing sector to provide final consumption goods.

All consumers are assumed to have an identical utility function. Households in different subsectors exhibit different consumption patterns in the initial equilibrium, and only the different budget shares imply differences in the demand parameters. Therefore, there exist differences in the cost of living for households in the different sectors. Prices as seen by final consumers are gross (net) of taxes (subsidies) and gross of marketing margins. Production is assumed to occur with not-identical Cobb-Douglas production functions in all sectors; in each sector, there are two factors of production, labor (human capital) and manufactured goods. With the Cobb-Douglas assumptions, labor incomes in aggregate are determined as a factor cost share of the value added in each subsector. Total personal income is computed from changes in the structure of production and changes in the "real" cost of living for each group of consumers. The factor cost shares were derived from a social accounting matrix presented by Reardon (1984). The

distribution of the change in the sectoral wage bill to the population group was also derived from Reardon's (1984) work.

The demand parameters, income elasticities and the matrices of own- and cross-price elasticities were estimated with the aggregate data constructed from the national accounts and allocated according to the social accounting matrix in Reardon (1984) to reproduce the expenditure patterns reported in Amat y Leon et al. (1981). The simulation model converts the structure of coefficients which were estimated by a translog model for the economy as a whole into group-specific demand parameters by applying the equations in Swamy and Binswanger (1983). Consumption patterns for the five population groups are different and change in various ways due to differences in the budget shares and the levels of income, not because there might exist differences in tastes among the different population groups.

The model establishes the equilibrium in the agricultural home goods market, and uses that equilibrium price and the exogenous price changes (world prices and the change in the uniform equivalent tariff) to determine the changes in production and consumption for the economy as a whole. The consumption patterns of each group are adjusted for the change in income arising from increased or decreased labor incomes which results from adjustments in domestic production in each sector and, the change in real purchasing power that results from changes in relative prices at the retail level. The change arising from changes in labor incomes is allocated to each population group by assigning a portion of the change in value added (Table 6)

Table 6. Distributional Coefficients for Assigning Labor Factor Shares of Sectoral Value Added to Personal Income

Population Group	Agricultural			Non-Agricultural	
	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.

implied by the change in output from each of the productive sectors to each of the population groups and multiplying that proportion by the labor share (Table 7) in that productive sector. The income change due to the change in relative prices is computed by computing a cost of living index that is specific to each group by multiplying the change in relative prices by their respective initial budget shares.

Table 7 presents data which describes the structure of the Peruvian economy and Table 8 presents the structure of household expenditures for 1973, a year which serves as the basis for most Peruvian data, and, coincidentally, was the peak of interventions of the military government. These values form the pivotal point for the computations in the resource allocation and consumption model.

A rough but not exact association can be made between productive sectors and population groups as represented by the tables: sierra dwellers produce home goods and import competing agricultural commodities and the other rural dwellers are associated primarily with the production of agricultural tradeables, whereas the urban dwellers are associated with import competing or non-tradeable activities (services).

The model is used to solve for equilibrium in the market for agricultural home goods by forcing it to be the sector by which total general equilibrium is achieved. The exportable sector in non-agriculture is totally passive; its performance is given as independent of other relative prices in the economy. Another major assumption is that total resource productivity of the

Table 7. 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 Riordan (1984).

Table 8. Expenditure Patterns for Peruvian Households in 1973. (Percentage of Annual Expenditures)

Population Group	Percent of National Consumption	Expenditure Categories				
		Agricultural			Non-agricultural	
		Non-Traded	Export-able	Import competing	Import competing	Services
Lima Upper Income	25.5	12.0	6.0	17.0	38.0	27.0
Lima Lower Income	8.5	15.6	9.9	28.2	20.2	26.1
Sierra Rural	24.0	30.3	6.3	25.0	18.3	20.1
Urban Non-Lima	30.0	18.6	8.0	27.7	25.4	20.3
Rural Non-Sierra	12.0	20.6	5.7	29.1	20.6	24.0

Computed from Amat y Leon and Curonisy (1981) and National Account Data.

economy is given and the re-allocation of resources that would come about as a result of removing or increasing the structure of industrial protection would neither increase nor decrease total resource productivity. Growth in the economy is therefore exogenous to the analysis. The model simply re-allocates the realized national income and the resulting national consumption. Implicitly, it is assumed that there is full employment; any observed unemployment occurs in the non-agricultural home goods sector, which is frequently referred to in the Peruvian literature as the informal sector. This sector is the residual user of surplus productive resources, and it is the supplier of labor resources to the rest of the economy; the structure of the economy therefore adjusts by moving productive resources in and out of the non-agricultural home goods sector and among the other sectors, but not by increasing total resource productivity. As such, the model underestimates changes in personal income, because it does not include labor market adjustments explicitly.

4.0 Analyses and Results

The central focus of this study is to measure the effects from trade and agricultural policies on the levels and composition of food consumption expenditures by different population groups in Peru. The analytical apparatus developed and presented in the earlier sections has been used to compute the income and food consumption effects of the trade policies and other instruments of the import substitution - industrialization strategy as well as those effects from explicit agricultural pricing policies such as price controls and the subsidization of food. The analysis captures the effect of these policies through their effect on the structure of relative prices and of these prices on the allocation of resources by producers and consumers within Peru. The policies can be simply synthesized by three variables: the estimated equivalent tariff from Table 3, the actual or simulated variation in international prices for Peru's agricultural exportables and importables and specific consumer subsidies for importable foods.

The analyses were used to evaluate the impact of the high levels of protection which were applied throughout the 1970's. These high levels of protection resulted in high levels of taxation to tradeable agriculture through their effect on the real exchange rate. They would therefore be expected to have significant impacts on the composition of food production and consumption. Other important determinants of the real exchange rate, such as terms of trade, interest rates, and the financing of the fiscal deficit are excluded. For the 70's these latter

effects were probably secondary to the extreme efforts to control imports of manufactured goods; for more recent times they may have become dominant, e.g. the international debt crisis and the high fiscal deficits financed through rapid expansion of domestic credit. The analyses nevertheless capture important aspects of the relationships between agriculture and the rest of the economy and are therefore more complete than traditional partial equilibrium analyses of the markets for food stuffs.

Three policy scenarios were developed for each of three periods of time. One scenario computes the effect of the trade policies in the presence of price controls, another computes the effects of changes in international prices for Peru's agricultural exportables and importables, and the third measures the effect of a 15% subsidy on importable food products. The periods selected, each begin in the 1964-1968 quinquennium and differ in the ending periods. The first covers the period of rapid increase in the level of protection and a high degree of market intervention of the early periods of the military governments (1969/73). The second of these five year periods is the 1974/78 quinquennium and the other is the 1978 to 1982 time period. Through these comparisons it is possible to evaluate the effects of the extreme attempts that were undertaken in the early 1970's 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.

4.1 The Effects of High Levels of Protection

The base period from 1964 to 1968 reflected, already, a substantial increase in the protection offered to the Peruvian industrial sector by the trade policies of the industrial development and import substitution strategy. The average equivalent tariff for the base period rose to 133% from the average of the earlier five years of 71.2% (See Table 3). The average for the next five years (1969 to 1973) nearly doubled to 256%. By comparing this latter period to the base period it is possible to measure the income and food consumption effects of high levels of industrial protection.

This period of import restrictions coincided with a very high degree of intervention in the production and marketing of agricultural products (particularly food commodities). Among the interventions were price controls and parastatal participation in food marketing. During this period the measured food price index remained nearly constant relative to the index of other consumer prices. Towards the end of the period international prices of imported cereals (wheat and rice) appreciated drastically, and government subsidies were used to attempt to maintain the price of imported cereals at the domestic controlled levels.

4.1.1 Aggregate Effects

The trade restrictions which were applied in the period 1969 to 1973 caused the average equivalent tariff to rise by 123% from the average over the previous five year period. Table 9 presents a comparison of the trade policy and agricultural and food pricing scenarios. The direct effect of the trade policy, is

Table 9. Proportional Effects* of Industrial Protection and Alternative Price Control and Food Subsidy Policies on the Production and Consumption of Agricultural Products in Peru for the 1969/73 Period Relative to a 1964/68 Baseline

Proportional Changes in the Output Variables	Policy Instruments: Industrial Protection			
	With Price Control		Without Price Control	
	Without Subsidies	With Subsidies	Without Subsidies	With Subsidies
Retail Price Indices				
Non-Tradeable Foods	-2.9	-2.0	-2.6	-1.8
Importable Foods	-2.5	-17.5	-1.6	-16.6
Manufactured Goods	18.2	18.2	-18.2	18.2
Aggregate Consumption				
Non-Tradeable Foods	3.5	3.7	3.2	3.4
Importable Foods	4.5	17.1	3.8	16.4
Agricultural Production				
Non-Tradeable Foods	3.2	3.6	2.9	3.3
Importable Foods	-6.5	-7.1	-3.8	-4.4
Exportable Products	-17.4	-17.6	-16.9	-17.1
Producer (Real)Price Indices				
Non-Tradeable Foods	-2.9	-2.0	-2.6	-1.8
Importable Foods	-28.0	-28.0	-23.2	-23.2
Export Products	-37.6	-37.6	-35.4	-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 baseline period. All price indices are relative to the price index for non-agricultural home goods and services.

given by relative retail price of manufactured goods. The induced effects on the other markets are presented in four scenarios; the scenarios are formed from the two by two combination of price control and price subsidy policies. The price control policy scenario implies that Peru would have been able to totally isolate itself from the movement of international prices for its tradeable agriculture and that nominal prices would have remained constant. The scenario without price controls implies that international agricultural prices for tradeable agriculture would have transmitted themselves fully to determine the prices received by producers at the prevailing (nominal) exchange rate. These are extremes for the policy scenarios; it is highly unlikely that the government could have made such controls effective (informal trade would have arisen) or that international prices are fully transmitted to the domestic economy. In the case of the subsidies, it is assumed that the level of real resources available to the treasury was sufficient to reduce the retail price of import competing food stuffs by 15%, on average, from the price that would have prevailed under free trade.

The process for subsidization of foods was not explicit, but rather an "ex-post" consequence of the price setting behavior and marketing activities of the parastatals involved. The parastatals would import food commodities or procure grains from domestic producers and sell all of these to millers, processors and directly through stores. The parastatals operated under set prices in domestic markets and were price takers in international

(importing) markets. The "subsidies" arose when the parastatals experienced operating losses. No consideration is given in the analyses for the means for financing the fiscal resources required by the process. It is therefore, assumed that the incidence of the financing of the policy would have been neutral relative to personal incomes. Under these assumptions, the policy scenarios are indicative of the direction in which the agricultural policies would have added or subtracted from the real price, income and consumption effects of the trade policies. It is important to note also, that with rising international prices, the "subsidy" would be captured by consumers, where as with declining international prices, the "subsidy" could be captured by producers. Alternatively, the subsidy could have all been captured as high costs in the parastatal operations.

The effects are presented in Table 9 as real price effects measured relative to an index of non-agricultural nontraded goods and services. The industrial protection instruments would have caused the real price of manufactured goods to rise by 18% and induced a modest reduction in the retail price of food. The subsidies if effective could have caused a further reduction of 15% in the retail price of imported or import competing foods. Regarding producer prices, the trade policy would have reduced the real price of exportables in agriculture by approximately 35% and of import competing products by approximately 25%; non-tradeable (traditional) agriculture would have experienced real prices approximately 2% lower.

Relative to the effects of the trade policy, working through the real exchange rate 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 tradeable agriculture, and had a small impact (less than 1%) for non-tradeable 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 taxation of tradeable agriculture via the real exchange r.. e effects of the trade policy apparently caused a major shift of resources out of agriculture and a minor shift within agriculture towards production of non-tradeables. While the domestic production of non-tradeable 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%.

The trade policy per se and the price control policy induced a small positive increase in aggregate food consumption, between three and four percent for the trade policy alone and an additional half percent for the price control policy. Only the price subsidy policy would have produced a significant increase in food consumption; about a 13 percent increase in the consumption of importable foods and less than one percent

increase in consumption of non-tradeable foods would have been observed with such a subsidy policy.

The actual policy experience for Peru in the period 1969 to 1973 was a transition from the policies represented in the first column of table 9 to those of the second column. Except for what would have been the direct effect of an effective scheme to subsidize the retail price of importable foods, the increase in aggregate food consumption would have been modest (perhaps a bit more than a three percent increase in total food consumtion). The major effects were those of the import restrictions which severely affected the producer prices for all of agriculture; the resulting declines in output were substantial for agricultural exports and about off setting between import competing foods and non-tradeable agriculture.

Regarding agricultural trade, the industrial protection policy severely affected the balance of agricultural trade. As a result of the indirect taxation of exportable agriculture, the production of export crops declined by approximately 17%. The production of import competing agricultural products also declined and their consumption increased. The price subsidy scheme would have increased imports substantially since consumption would have increased by an additional 12 to 13 percent.

The food subsidy scheme would have been an effective instrument for reducing the aggregate caloric deficit of approximately 10%, but would have cost approximately four percent

of the national income to finance. The final outcome towards reducing malnutrition among the poor would depend, of course, on the incidence of the subsidies on the food consumption patterns of specific population groups and, importantly, on the incidence of the tax used to finance the subsidies. If the tax were a progressive tax on personal incomes and it were effectively administered then the subsidy scheme could have been an effective tool for reducing malnutrition through the increased consumption of imported foods.

These aggregate estimates of the consumption effects of the subsidies do not necesarily imply a major improvement in the consumption of food by the poor, since those effects depend on the incidence of the financing of the subsidy and on the impact of the subsidies on the consumption patterns of the poor viz-a-viz the consumption patterns of the not so poor. The next subsection presents an analysis of the incidence of the various policies on the incomes and diets of five population groups.

4.1.2 Incidence of Policies on the Diets and Incomes of Specific Population Groups.

The food consumption and income distribution effects of the price changes which resulted from the trade policy for the five year period 1969 to 1973, relative to conditions in the previous five years, are presented in Table 10. The five population groups for whom the effects were computed are the upper half of the income distribution in Lima, the lower half of the income distribution in Lima, the rural Sierra dwellers, the rest of the urban population (which includes Coastal, Sierra and Jungle urban

Table 10. Distributional and Consumption Effects* of Economic and Agricultural Policies for Peru in the Period 1969/1973 Relative to a Baseline in the Period 1964/68

Population Group	Agricultural Price Policies					
	With Price Controls			Without Price Controls		
Without Subsidies	Income Effects	Food Consumption Nontraded	Importable	Income Effects	Food Consumption Nontraded	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
With Subsidies						
Upper Income Lima	-0.3	+8.7	+20.3	+0.1	+8.9	+21.0
Lower Income Lima	-3.3	-0.3	+12.4	-3.0	-0.1	+13.0
Sierra Rural	+2.8	+4.1	+17.3	+2.7	+4.0	+17.7
Urban Non-Lima	+1.1	+4.2	+16.9	+1.3	+4.5	+17.6
Rural Non-Sierra	-6.7	-4.2	+9.5	-7.2	-4.6	+9.6

Source: Franklin and Valdes (1985)

*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.

areas) and the non Sierra rural population. Since the population groups and their income expenditure patterns were derived from ENCA data (1971/73), the rural non Sierra population is mostly from the rural Coast. The labor income effects are simulated by the use of Reardon's (1984) data under a constant labor share assumption. The simulated effects on labor incomes are computed as if no adjustments had yet taken place in the labor force. 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 10 is that in terms of food consumption, 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.

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 Sierra urban and rural populations benefitted more from the lower food prices (in terms of income effects) than did the rest of the population. The gains in consumption of food resulting from the subsidies were concentrated among the upper income groups of Lima. If the taxation to finance the subsidies had been progressive (i.e. tax the upper income groups more) then the subsidy policies could have been an effective tool for reducing malnutrition. The most important effect is that the overall policy framework benefitted urban consumers at a high cost to coastal rural dwellers. Finally the results suggest that the subsidies were instrumental in shifting Sierra consumption from traditional patterns to the consumption of imported foods, such as cereal products (noodles, bread, etc.).

The result that the upper half of the income distribution in Lima captured more of the consumption effects of the policies and the subsidies is a major and perhaps surprising result of this analysis. 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 (See Tables 7 and 8). 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 8). The relative gains result from the relatively high income and price elasticities in the upper income households' demand for importable foods (See Table 5).

4.2 The Effects of Less Restrictive Trade Policies

The period 1974 to 1978 reflected a period of relaxation of the severe curtailments of trade which were applied in the previous five years. While trade restrictions remained substantial, the equivalent uniform tariff declined by approximately 75 percentage points on average from the previous period (see Table 2). Relative to conditions during the 1964/68 period the 1974/78 period showed a substantial (48%) but not as severe increase in the equivalent tariff as had been observed at the start of the seventies.

This period coincided with a series of adverse factors in the world economy: the first oil crises quadrupled the nominal price of petroleum products. There were widespread droughts with international grain prices reaching all time highs. At the same time, Peru suffered from the effects of drought and from a decline in its fishing industry. By this time the agrarian reform was well underway and many lands had changed hands to new enterprise forms. The analyses presented in Tables 11 and 12 abstract from all but the changes in world prices for agricultural commodities to evaluate the "pure" effects of the trade policies, price control policies and the subsidies on foods.

4.2.1 Aggregate Effects (1974/78)

As in the previous section, the analyses are based on comparative static effects; the policies of the 1974/78 period are evaluated relative to conditions which would have prevailed if the trade policies of 1964 to 1968 had been pursued. Table 11 is in the same format as Table 9 and shows the aggregate effects of the policies and the agricultural price control and subsidy scenarios.

The direct effect of increasing the protection to the industrial sector by an increase in the equivalent tariff of almost 50% would have caused a relative price increase of almost ten percent (9.9%) for the goods from the protected sector. In the presence of price controls, agricultural producer prices would have fallen by 19.4%, 12.7% and 1.4%, for exportables, importables and non-traded agricultural goods. In the absence of price controls, prices would have fallen by approximately ten percent for exportables and one percent for importables in agriculture. The price of agricultural non-tradeables, at the farm level, would have risen modestly, by a little more than one percent. The trade policy and price control policy would have interacted to tax agriculture and cause resources to move out of the sector; and within agriculture, resources would have been reallocated to the non-traded sub-sector.

Agricultural production would have declined as a result of the indirect effect of the trade policy and the direct effects of the price controls. Export performance would have declined regardless of the agricultural policy, since the trade policy

Table 11. Proportional Effects of Industrial Protection and Alternative Price Control and Food Subsidy Policies on the Production and Consumption of Agricultural Products in Peru for the 1974/78 Period Relative to a 1964/68 Baseline

Proportional Changes in the Output Variables	Policy Instruments: Industrial Protection			
	With Price Control		Without Price Control	
	Without Subsidies	With Subsidies	Without Subsidies	With Subsidies
Retail Price Indices				
Non-Tradeable Foods	-1.4	-0.6	1.0	1.9
Importable Foods	-0.9	-15.9	1.1	13.9
Manufactured Goods	9.9	9.9	9.9	9.9
Aggregate Consumption				
Non-Tradeable Foods	1.7	1.9	-0.7	-0.5
Importable Foods	2.1	14.7	0.4	12.9
Agricultural Production				
Non-Tradeable Foods	1.7	1.9	-0.8	-0.5
Importable Foods	-2.1	-2.6	2.7	2.2
Exportable Products	-9.2	-9.4	-3.9	-4.1
Producer (Real) Price Indices				
Non-Tradeable Foods	-1.4	-0.6	1.0	1.9
Importable Foods	-12.7	-12.7	-1.7	-0.2
Export Products	-19.4	-19.4	-9.3	-9.3

* 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.

effects would have dominated. The price control policy would have served to re-allocate food production from tradeable to non-tradeable foods. Elimination of price controls would have reversed the effects, and, overall, the domestic production of foods would have stagnated regardless of the explicit food policies. Agricultural performance over all, would have declined as a result of the trade policies even if higher international prices had been allowed to be transmitted in nominal terms to the domestic economy.

Regarding consumption, the effects of the trade policy were modest; perhaps a two percent increase in total food consumption could be attributed to the trade and price control policies. The consumer subsidies, if effectively administered, would have increased the consumption of importable foods by an additional 12%. Food imports would have increased as a result of the policies. Only if higher international prices had been transmitted to producers and there had been no subsidies to consumers would the importation of foods been likely to decline. It is important to point out that under this simulation as well as the previous one, the modest increases in food consumption in the presence of substantial producer price declines arise, in part, because marketing margins tend to increase (as an induced effect of the trade policies). Furthermore, much of the subsidy is absorbed by the marketing margin. This suggests that a substantial part of the subsidy resources were used to finance the marketing parastatals.

4.2.2 Consumption and Distributional Effects (1974/78).

Table 12 presents the food consumption and income distribution effects of the economic and agricultural policies of 1974 to 1978 relative to conditions that prevailed during 1964/68. As can be seen, the major effect was to improve the consumption of the Lima upper income groups at the expense of the coastal rural dweller; the Lima rich benefitted relatively and absolutely more from the subsidies. The trade policies alone had adverse effects on the income of the urban poor and these were only partially off set by the price control and subsidy schemes for food. Perhaps, a surprising result of the analyses is that the highland rural population seems to benefit from price controls and food price subsidies as much or more than the urban populations when taken as a whole. This results from the higher food expenditure shares for this population. With food budget shares exceeding 60% for the Sierra population any reduction in market prices for food stuff's will be reflected as a significant income increase for this population. The results serve also to explain the widely observed phenomenon of Sierra dwellers' diets becoming more intensive on importable foods and less on traditional (non-traded) foods. In the context of the model, these effects arose in response to relative price changes caused by the agricultural and trade policy which have been pursued.

4.3 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" (Toledo, 1984). The economic conditions

Table 12. Consumption and Distributional Effects* of Economic and Agricultural Policies for Peru (comparing 1974/1978 with 1964/1968)

Population Group	Agricultural Price Policies With Price Controls			Without Price Controls		
Without Subsidies	Income Effect	Consumption Nontraded	Importable	Income Effect	Consumption Nontraded	Importable
Lima Upper Income	-2.0	+3.4	+4.2	-2.4	+1.2	+2.7
Lima Lower Income	-3.1	+0.2	+0.5	-4.0	-2.1	-1.1
Sierra Rural	-0.6	+2.0	+2.3	-2.3	-0.8	+0.4
Urban Non-Lima	-1.6	+2.1	+2.3	-2.1	+0.2	+1.0
Rural Non-Sierra	-5.9	-2.4	-1.7	-4.0	-2.0	-1.0
With Subsidies						
Lima Upper Income	+1.6	+5.9	+16.9	+1.3	+3.7	+15.4
Lima Lower Income	-0.7	-0.5	+11.9	-1.6	-2.7	+10.4
Sierra Rural	+3.3	+2.5	+15.4	+1.7	-0.3	+13.5
Urban Non-Lima	+2.4	+2.5	+15.0	+1.8	+0.6	+13.8
Rural Non-Sierra	-1.8	-2.2	+10.9	-0.06	-1.8	+11.7

*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.

in Peru during this period have been 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 call for 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 apparatus can provide, however, is an assessment of the degree to which trade liberalization, as manifested on one determinant of the real exchange rate, has helped or hindered regarding 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 after 1968 if the policies pursued after 1978 had been pursued throughout the post 1968 time period. Specifically, the policy change involves a reduction of the equivalent tariff from 133% to 91.3% and the price scenarios are based on the agricultural prices that prevailed in the 1979/82 time period.

4.3.1 Aggregate Effects of Trade Liberalization

Table 13 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

Table 13. Proportional Effects* of Industrial Protection and Alternative Price Control and Food Subsidy Policies on the Production and Consumption of Agricultural Products in Peru for the 1979/82 Period relative to a 1964/68 Baseline

Proportional Changes in the Output Variables	Policy Instruments: Industrial Protection			
	With Price Control		Without Price Control	
	Without Subsidies	With Subsidies	Without Subsidies	With Subsidies
Retail Price Indices				
Non-Tradeable Foods	2.5	3.4	-1.1	3.0
Importable Foods	1.5	-13.4	-4.5	-24.6
Manufactured Goods	-17.4	-17.4	-17.4	-17.4
Aggregate Consumption				
Non-Tradeable Foods	-3.1	-2.9	0.9	-1.5
Importable Foods	-3.7	8.9	1.4	18.2
Agricultural Production				
Non-Tradeable Foods	-3.1	-2.5	0.9	-1.5
Importable Foods	3.6	3.1	-14.2	-33.8
Exportable Products	16.2	15.9	8.5	16.2
Producer (Real) Price Indices				
Non-Tradeable Foods	2.5	3.4	-1.1	3.0
Importable Foods	22.1	22.1	-11.8	-40.1
Export Products	33.8	33.8	13.3	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.

towards such goods and away from food stuffs.

In this time period, relative to 1964/68, the price of industrial (manufactured or imported) goods would have been reduced approximately 17.4% in real terms. In the absence of subsidies and 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. Under the "free" market solution there would have been a very small (around 1%) improvement in the consumption of food, on aggregate. In this case, price controls would have isolated Peruvian consumers from the benefits of world price declines and in the absence of subsidies would have caused a small decline in food consumption. On the producers' side, however, the price controls 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-tradeable foods would have risen; and both output and consumption declined. The subsidy on tradeable foods would have helped to offset this effect and aggregate food consumption would have increased by approximately five percent. In the absence of the direct agricultural policies, the increase in food intake would have been more modest. The increase in food intake arising from the subsidies would have clearly been based on increased intake of imported food stuffs.

The production effects, under the most likely scenario, suggest that all of tradeable agriculture would have responded

positively, perhaps, extracting resources from non-tradeable agriculture. The subsidies and price controls would have helped produce a positive response in the domestic food sector (rice) which would have been negative under a free trade situation.

4.3.2 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 14. The policies that were pursued in the period 1979/82 most closely resemble the lower left hand quadrant of Table 14; reduction in the uniform equivalent tariff, positive nominal protection to producers of tradeable agriculture and consumer food subsidies for importable foods. The upper right hand quadrant represents the simulated outcome of a free trade regime for agriculture during the move towards trade liberalization. Under this latter regime, the diets of the Sierra rural dwellers would have deteriorated by about one percent and the diets of the non-poor urban dwellers by about 2.5 percent. Urban poor and coastal rural dwellers would have had marginally improved diets. In contrast to the "free" trade solution (no subsidies), the use of subsidies (with or without price controls) would have improved food intake significantly for all consumer groups, with the urban poor and the rural coastal dwellers benefitting relatively more than other groups. The improvement in intake of tradeable foods would have generally been partially offset by the decline in the intake of non-tradeable foods.

Table 14. 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		
Without Subsidies	Income Effect	Consumption Nontraded	Importables	Income Effect	Consumption Nontraded	Importables
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
With Subsidies						
Upper Income Lima	+7.2	-3.3	+5.4	+8.7	-1.9	+13.7
Lower Income Lima	+7.8	-1.1	+10.6	+10.2	-0.6	+19.2
Sierra Rural	+5.1	-3.0	+9.0	+0.1	-9.8	+12.0
Other Urban	+6.8	-3.1	+8.8	10.1	-1.9	+18.1
Rural Non-Sierra	+14.3	+4.3	+15.7	9.1	-2.5	18.2

*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.

4.4 Summary of Results

Efforts to close the economy of Peru to the conditions in world makets during the decade of the seventies 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 intake. The improvements in food intake by these groups would have come at the expense of intake by rural coastal dwellers since aggregate disappearance data shows a slight decline in the seventies in comparison to the sixties.

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-tradeables which was 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. Subsidies which were under the control of parastatals, increased the need for food imports. Midway through the decade, the subsidy on food was 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).

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

The principal effects on food consumption and income distribution have arisen from the restrictive trade policies which were pursued rather than from direct price policies for agriculture. Price controls may have shielded tradeable agriculture from fluctuations in world markets but any benefits for either farmers or consumers were more than off set by the deterioration of real personal incomes that arose from the trade restrictions. Even urban dwellers observed declines in their real incomes during the decade of the seventies. The income effects tended to exacerbate the maldistribution of income. The use of subsidies for tradeable foods only partially offset the negative income effects of the trade policy. In general, the rich urban dwellers tended to benefit relatively and absolutely more than other population groups from the effect of the subsidies.

The subsidy scenarios in the analyses did not include the effects of financing the subsidy. The financing requirements for

the level of subsidization used in the analysis amounted to as much as five percent of national income in some years. Since the Peruvian tax system is not very effective, it is most likely that the subsidy scheme would have added to the fiscal deficit. In some years, the fiscal requirement to finance the subsidies exceeded the deficit i.e. there would have been no deficit in absence of the subsidies. To the extent that the deficit were financed through money creation (or international borrowing) the subsidy scheme may have aggravated inflationary pressures and in later years the so called debt crisis. If the incidence of inflation falls more on the urban poor, then these effects would tend to offset the calculated food consumption improvements attributable to the subsidy scheme.

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. In fact it would appear that free trade would have neutralized any possible deleterious food consumption impacts which 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-tradeables 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. In fact, agricultural performance has improved. The crisis may owe its origins more to the previous attempts to isolate Peruvian product markets from international prices and the deterioration on the balance of agricultural trade that these actions implied.

The foregoing is not to say that trade liberalization would have been a solution to the nutritional problems of Peru, only that closing of the economy during the seventies may have exacerbated a long standing problem, the effects of which will require a long time to reverse or correct. Furthermore, this study has focused on only one element of a trade strategy - the effect of trade policy as *one* determinant of the real exchange rate.

The policies which were pursued and are being pursued in the 1980's may not constitute a consistent set of policies in that fiscal and monetary policies may have been (or be) offsetting the effects of trade liberallization. In the late 70's and the first half of the 1980's, purchasing power parity calculations were used to attempt to maintain a constant real exchange rate. Many attribute the resulting devaluations which were necessary as *the* cause of accelerating inflation. At the same time a growing fiscal deficit was financed through money creation, and this undoubtedly aggravated the inflation. Other determinants of the real exchange rate have not been studied; it is, therefore,

unknown whether the exchange rate regime and internal fiscal credit and other policies were mutually consistent or not. Much needs to be learned about the conduct of economic policy in Peru in recent times. The apparatus and the parameters of this study should help understand the food consumption effects of economic and agricultural policies.

APPENDIX - DATA DEVELOPMENT

The model is based on the following national income equation in value added terms:

$$Z = Z_{ah} + Z_{ax} + Z_{am} + Z_{nh} + Z_{nx} + Z_{nm},$$

where Z = Gross Domestic Product in real terms from national accounts statistics: $Z_{ag} = Z_{ah} + Z_{ax} + Z_{am}$ is vaule added by the agricultural sector which is represented by the Gross Domestic Product of the agricultural sector in real terms from the national accounts statistics. Z_{ax} is the value added by the exporting subsector of agriculture and was estimated as the sum of the values of cotton, sugar and coffee production in real terms with a minor adjustment in each year to account for the estimated value of wool and other agricultural exports. Z_{am} is the value added by the agricultural subsector producing import competing products which was estimated as the sum of the values of rice, wheat, beef and milk production in real terms with adjustments in each year to account for the estimated value of corn production and other import competing products. Z_{ah} is the value added by the non-traded subsector in agriculture and was calculated as the residual from agricultural value added, $Z^{ah} = Z^{ah} - Z^{ax} - Z^{am}$. The non-agricultural subsectors are Z^{nx}, which is the exporting subsector and is represented by the gross domestic product in real terms of the mining and fishing sectors, Z^{nm}, which produces import-competing goods and is represented by gross domestic product in real terms of the manufacuring sector and Z^{nh}, which represent non-tradeables in the rest of the

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APPENDIX - DATA DEVELOPMENT

The model is based on the following national income equation in value added terms:

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where Z = Gross Domestic Product in real terms from national accounts statistics: $Z_{ag} = Z_{ah} + Z_{ax} + Z_{am}$ is vaule added by the agricultural sector which is represented by the Gross Domestic Product of the agricultural sector in real terms from the national accounts statistics. Z_{ax} is the value added by the exporting subsector of agriculture and was estimated as the sum of the values of cotton, sugar and coffee production in real terms with a minor adjustment in each year to account for the estimated value of wool and other agricultural exports. Z_{am} is the value added by the agricultural subsector producing import competing products which was estimated as the sum of the values of rice, wheat, beef and milk production in real terms with adjustments in each year to account for the estimated value of corn production and other import competing products. Z_{ah} is the value added by the non-traded subsector in agriculture and was calculated as the residual from agricultural value added, $Z^{ah} = Z^{ah} - Z^{ax} - Z^{am}$. The non-agricultural subsectors are Z^{nx}, which is the exporting subsector and is represented by the gross domestic product in real terms of the mining and fishing sectors, Z^{nm}, which produces import-competing goods and is represented by gross domestic product in real terms of the manufacuring sector and Z^{nh}, which represent non-tradeables in the rest of the

economy and is calculated by residual, $Z^{nh} = Z - Z^{ag} - Z^{nx} - Z^{nm}$.

On the other side,

$Z^{c} = Z^{cah} + Z^{cam} + Z^{cax} + Z^{cnm} + Z^{cnx}$, where Z^{c} is total absorption, which is represented by Gross Domestic Product plus the value of imports minus the value of exports, all of which were extracted from the national accounts statistics. All values on the consumption side are also expressed in real terms. Z^{cah} represents consumption in the non-traded agricultural subsector and is equal to Z^{ah} because non-traded agriculture clears internally. Z^{cam} is consumption in the import-competing subsector of agriculture and was estimated as the sum of the values of rice, wheat, beef and milk consumption, including the value of imports, and is adjusted in each year to account for the estimated value of consumption of oils, corn and other importable foods. Z^{cax} is consumption in the exportable subsector of agriculture and is estimated as the sum of the values of sugar, cotton and coffee consumption, excluding export values. In the non-agricultural subsectors Z^{cnm} is consumption in the import-competing subsector and is estimated by adding the value of non-agricultural importables to Z^{nm} and subtracting the value of net capital formation. The value of non-agricultural importables was estimated as the value of total imports, from national accounts statistics, minus the value of agricultural importables Z^{cnh}, is consumption in the non-traded subsector of non-agriculture and is equal to Z^{nh}, because the non-traded subsector clears internally.

Z^{cnx}, the non-agricultural exportable subsector is calculated by residual $Z^{cnx} = Z^{c} - Z^{cah} - Z^{cam} - Z^{cax} - Z^{cnm} - Z^{cnx}$.

Price indices were formed for each of the six subsectors. The price index for agricultural non-tradeables was formed by combining the prices of potatoes (90% weight) and beans (10% weight). An index for agricultural importables combined price indices for rice, wheat, wheat flour, corn, beef, milk and oils and the index for agricultural exportables combined price indices for sugar, cotton, coffee and wool. The price index for the non-agricultural non-tradeable subsector consists of all components of the consumer price index except for food. The wholesale price index for exportables, adjusted by eliminating agricultural exportables, is used as the price index for the non-agricultural exporting subsector. Similarly, the wholesale price index for importables, adjusted for agricultural importables, is the price index for the non-agricultural importable subsector.

Initially, consumption expenditure shares were calculated using the budget and cunsumption shares for specific expenditure groups, including specific food groups, as presented in the ENCA analysis by Amat y Leon (1981) and the Ministerio de Economia y Finanzas (1977). The shares from ENCA were aggregated into five consumption sectors, agricultural importables, agricultural exportables, non-traded agriculture, non-traded non-agriculture and non-agricultural importables for several different population groups, Peru as a whole, Lima upper income, Lima lower income, other urban, rural Sierra and other rural.

The budget share for agricultural importables was formed by combining the shares for cereals, milk, beef, oils, alcoholic drinks, soft drinks, salt and eggs, and the share for agricultural exportables consisted of sugar and fish. Agricultural non-tradeables included roots and tubers, horticultural crops, fruits, legumes, and fresh water fish. The share for non-agricultural importables includes clothing, transportation, furnishings and a portion of housing and health. The non-tradeables non-agriculture share includes education, recreation, others, and a portion of housing and health. Final consumption of the exportable non-agricultural commodities is accounted for in the other subsectors because it was assumed that they were not consumed directly.

Population group specific expenditure shares were estimated from the shares presented by Amat y Leon (1981). Shares for Peru as a whole could be extracted directly from the ENCA results. The shares for Lima upper and lower income groups were estimated from initial income elasticity estimates for Lima as a whole and the relative income differences of each stratum from the median. A population weighted share was estimated for the other urban group and consisted of the large cities and small towns (grandes ciudades, centros poblados) presented in the ENCA analysis. The Sierra rural group was assumed to be the rural category from the ENCA analysis because 75 percent of the rural population resided in the Sierra. A combination of the shares from the coast and jungle regions resulted in the share for the other rural group.

The estimated value added of each subsector on the consumption side was allocated according to the social accounting matrix (SAM) from Reardon (1984) to reproduce the consumption expenditure shares for Peru as a whole from the ENCA analysis. Based on small differences between the shares from ENCA and the shares derived from this allocation for Peru as a whole, minor adjustments in the population group spevific shares from ENCA were made to yield the final shares. The allocation required distributing a portion of the value added from the importable non-agricultural and non-tradeable non-agricultural subsectors to the agricultural importable and exportable subsectors. A portion of the non-tradeable non-agricultural subsector was also allocated to non-tradeable agriculture.

A flexible consumer demand system utilizing a trans-long specification from Swamy and Binswanger (1983) was used to estimate own and cross-price elasticities and income elasticities for each of the five consumption subsectors. The final budget shares for each of the subsectors are regressed on total income, squared income term and the log of each of the price indices for each subsector where Z^c represents income.

Table A1. National Income Data in Value Added Terms by Sector of the Economy

Year	Z_{ah}	Z_{ax}	Z_{am}	Z_{nm}	Z_{nx}	Z_{nh}	Z
1950	13760.0	9121.1	6779.9	22930	7463	66249	126303
1951	10591.7	12222.9	7735.4	25218	8031	72269	136069
1952	10823.0	12325.1	8287.8	26572	8309	77200	143521
1953	12879.4	10570.4	8726.2	30013	7799	81179	151167
1954	11267.2	12717.3	8844.5	32849	10410	84080	160168
1955	11801.5	12031.2	8737.3	35319	10551	88497	166937
1956	10850.3	11876.0	8283.8	36400	11748	94079	173227
1957	10733.3	12291.0	8100.7	40124	12886	100342	184477
1958	12146.9	12725.2	8400.8	39049	12092	100702	185116
1959	14923.6	12067.1	7922.3	42700	12579	103252	193844
1960	12966.7	14830.8	9353.5	49523	13170	109919	215763
1961	14130.7	14634.7	9485.6	53376	21651	117519	230837
1962	15274.3	14196.7	9690.0	57763	21744	131025	249693
1963	16322.7	14501.7	8916.6	61021	23042	136243	260047
1964	18370.8	13351.6	9477.5	65305	25238	146897	279140
1965	23959.2	10379.5	8207.2	69602	24548	156848	293544
1966	24547.7	10257.2	10021.2	74983	27336	165225	312377
1967	27022.1	9085.6	10462.3	77944	28374	169978	322866
1968	23740.6	10342.7	10903.7	79425	29855	167779	322046
1969	26737.1	9023.3	12195.5	80322	29047	177161	334486
1970	28765.9	9761.1	13173.1	87238	32603	181054	352596
1971	29038.7	9993.5	13666.8	93214	31468	192835	370336
1972	29450.6	9727.8	12311.7	93862	30242	200907	376501
1973	29471.5	10495.7	11719.8	99524	29495	211853	392559
1974	27137.7	14214.7	12229.6	110401	31518	226432	421933
1975	26170.5	13107.2	14286.3	114959	28429	244121	441073
1976	31739.5	8756.4	13876.0	119565	30516	245533	449987
1977	27347.9	12174.7	14779.4	114469	36197	244780	449738
1978	26858.7	13063.1	13556.2	110026	40174	243732	447470
1979	25936.7	14687.8	14950.6	114697	43964	251703	465939
1980	26980.1	12768.7	12590.2	121275	44015	266219	483848
1981	34239.6	9479.7	14923.8	121031	42554	280435	502663
1982	34456.3	10795.4	15078.3	118010	44710	281401	504451

Z_{ah} = agricultural non-traded
Z_{ax} = agricultural exportables
Z_{am} = agricultural importables
Z_{nm} = non-agricultural importables
Z_{nx} = non-agricultural exportables
Z_{nh} = non-agricultural sector
Z = gross domestic product

Table A2. National Consumption Data by Sector of the Economy

Year	Z^c_{ah}	Z^c_{ax}	Z^c_{am}	Z^c_{mm}	Z^c_{mx}	Z^c_{nh}
1950	13760.0	887.84	10104.2	22845	1865.8	66249
1951	10591.7	3264.71	11326.9	30040	2007.8	72269
1952	10823.0	2231.22	11718.0	30986	2077.3	77200
1953	12879.4	2279.97	12037.0	31189	1949.8	81179
1954	11267.2	3521.89	12020.3	33063	2602.5	84080
1955	11801.5	2723.92	11994.9	37781	2637.8	88497
1956	10850.3	2805.97	11080.8	39927	2937.0	94079
1957	10733.3	3128.26	11472.2	45220	3221.5	100342
1958	12146.9	2653.90	11959.6	40125	3023.0	100702
1959	14923.6	2159.09	11806.5	35416	3244.8	103252
1960	12966.7	4024.27	13725.8	39821	4792.5	109919
1961	14130.7	3213.47	14011.0	41107	5422.8	117519
1962	15274.3	2985.25	14568.1	45756	5436.0	121022
1963	16322.7	3275.32	13316.3	55713	5760.5	136243
1964	18270.8	4093.82	14860.4	56809	6309.5	146897
1965	23959.2	3455.59	13318.1	63254	6137.0	156848
1966	24547.7	3636.03	14677.9	76617	6834.0	165226
1967	27022.1	3290.62	16149.4	81480	7093.5	169278
1968	23740.6	3718.01	14977.2	74210	7463.8	167779
1969	26737.1	3118.79	16595.5	75057	7261.8	177161
1970	28766.9	3860.33	16996.1	86149	8150.8	181054
1971	29038.7	4349.45	17965.1	95707	7867.0	192895
1972	29450.6	4152.58	16285.4	89550	7560.5	200907
1973	29471.5	4754.62	15651.7	125497	7373.8	211853
1974	27137.7	4725.80	16507.9	155625	7879.5	226432
1975	26170.5	3942.50	18040.2	152355	7107.3	244121
1976	31739.5	4246.28	18679.1	146393	7629.0	245533
1977	27347.9	6298.45	18211.7	142065	9046.8	244780
1978	26858.7	7594.04	17934.6	112382	10043.5	243792
1979	25936.7	9765.34	21868.8	111816	10991.0	251703
1980	26980.1	8608.37	19548.3	148797	11003.8	266219
1981	34239.6	8709.08	20279.2	154565	10638.5	280435
1982	34456.3	7855.53	19364.8	143862	11177.5	281401

Z^c_{ah} = non-traded agriculture

Z^c_{ax} = agricultural importables

Z^c_{am} = agricultural exportables

Z^c_{mm} = non-agricultural importables

Z^c_{nx} = non-agricultural exportables

Z^c_{nh} = non-agricultural non-traded

Table A3. Relative Prices of Agricultural Non-Traded Goods and Agricultural Exportables

YEAR	PAH73	PAHR	LPAHR	PAX73	PAXR	LPAXR	CPI	EXRATE	EXRATER
1950	1.51674	1.02263	0.02238	1.05791	0.71327	-0.33789	0.1526	15.43	10.403
1951	1.48552	1.03592	0.03529	1.28093	0.89325	-0.11289	0.1681	15.18	10.536
1952	1.40657	0.99208	-0.00795	1.27851	0.90175	-0.10342	0.1797	15.55	10.968
1953	1.46947	1.08039	0.07732	1.22615	0.90150	-0.10370	0.1961	16.94	12.455
1954	1.38947	1.05429	0.05285	1.27537	0.96771	-0.03282	0.2067	19.69	14.940
1955	1.45364	1.11651	0.11021	1.20025	0.92790	-0.07483	0.2161	19.18	14.730
1956	1.38718	1.04289	0.04200	1.15934	0.87160	-0.13743	0.2283	19.23	14.457
1957	1.35004	1.00959	0.00955	1.15140	0.86105	-0.14961	0.2451	19.07	14.261
1958	1.25932	0.94032	-0.06153	1.13263	0.84572	-0.16757	0.2646	23.40	17.473
1959	1.13661	0.90823	-0.09626	1.12239	0.89647	-0.10885	0.2902	27.64	22.086
1960	1.08835	0.92008	-0.08329	1.11439	0.94210	-0.05964	0.3239	27.30	23.079
1961	1.08705	0.94422	-0.05740	0.99823	0.86706	-0.14264	0.3450	26.81	23.287
1962	1.06305	0.94071	-0.06112	0.94720	0.83820	-0.17650	0.3661	26.81	23.725
1963	1.08644	0.97056	-0.02989	1.01097	0.90314	-0.10188	0.3874	26.82	23.959
1964	0.99634	0.90635	-0.09833	0.99717	0.90710	-0.09750	0.4224	26.82	24.398
1965	0.98918	0.98090	-0.01929	0.91876	0.91108	-0.09312	0.4930	26.82	26.595
1966	1.03389	1.04888	0.04772	0.91032	0.91819	-0.08535	0.5352	26.82	27.052
1967	0.91446	0.95464	-0.04642	0.89275	0.93198	-0.07045	0.5987	30.85	32.205
1968	0.98264	0.99798	-0.00202	0.89764	0.91165	-0.09250	0.7114	38.70	39.304
1969	0.92126	0.94360	-0.05805	0.85866	0.87949	-0.12841	0.7606	38.70	39.639
1970	0.84973	0.84021	-0.17410	0.93726	0.92676	-0.07606	0.7959	38.70	38.267
1971	0.78766	0.78199	-0.24591	0.90354	0.89703	-0.10866	0.8520	38.70	38.422
1972	0.89523	0.89271	-0.11350	0.88057	0.87799	-0.13012	0.9155	38.70	38.587
1973	1.00000	1.00002	0.00002	0.99995	0.99997	-0.00003	1.0000	38.70	38.701
1974	1.09888	1.11765	0.11123	1.04345	1.06127	0.05946	1.1691	38.70	39.361
1975	1.16348	1.26537	0.23532	0.72326	0.78672	-0.23989	1.4438	43.79	47.632
1976	0.94613	1.01453	0.01443	0.77567	0.83175	-0.18423	1.9298	55.76	59.791
1977	1.15892	1.38872	0.32839	1.08002	1.29418	0.25788	2.6619	84.23	100.933
1978	1.23028	1.49999	0.40546	0.92521	1.12804	0.12048	4.1974	150.35	190.626
1979	1.32537	1.55926	0.44421	0.92761	1.09130	0.08737	7.0423	224.72	264.377
1980	1.52736	1.87953	0.63103	0.78081	0.96086	-0.03993	11.2115	288.85	355.454
1981	1.09337	1.35974	0.30730	0.71611	0.89057	-0.11589	19.6623	422.32	525.206
1982	0.83514	0.94513	-0.05643	0.58323	0.66005	-0.41544	31.5224	787.04	890.696

PAH73 = price of agricultural non-traded goods in relative terms (relative to 1973)
PAHR = price of agricultural non-traded goods relative to non-traded non-agricultural goods (NH)
LPAHR = log (PAHR)
PAX73 = price of agricultural exportables relative to 1973
PAXR = price of agricultural exportables relative to non-traded non-agricultural goods (NH)
LPAXR = log (PAXR)
CPI = consumer price index
EXRATE = nominal exchange rate

Table A4. Relative Prices of Agricultural Importables and Non-Agricultural Importables and Exportables

YEAR	PAM73	PAMR	LPAMR	PNM73	PNMR	LPNMR	PNX73	PNXR	LPNXR	LPAGR
1950	1.52381	1.02740	0.02704	1.18654	0.80000	-0.22314	0.34303	0.23128	-1.4641	-0.04860
1951	1.42001	0.99023	-0.00981	1.29056	0.89998	-0.10538	0.66577	0.46427	-0.7673	-0.00472
1952	1.32657	0.93565	-0.06651	1.25254	0.86343	-0.12394	0.23624	0.16662	-1.7920	-0.04051
1953	1.24190	0.91308	-0.09093	1.10487	0.81233	-0.20785	0.19653	0.14449	-1.9345	0.00242
1954	1.25627	0.95322	-0.04791	1.18103	0.89613	-0.10967	0.40318	0.30592	-1.1844	0.01255
1955	1.24246	0.95418	-0.04691	1.20385	0.92452	-0.07848	0.53840	0.41347	-0.8832	0.03707
1956	1.17548	0.88373	-0.12360	1.22027	0.91740	-0.08621	0.74580	0.56070	-0.5786	-0.03197
1957	1.17026	0.87515	-0.13336	1.08536	0.81203	-0.20822	0.75884	0.56748	-0.5665	-0.05515
1958	1.17252	0.87580	-0.13261	1.11655	0.85612	-0.15534	0.57382	0.42846	-0.8476	-0.09909
1959	1.15699	0.92451	-0.07849	1.27868	1.02175	0.02152	0.65872	0.52636	-0.6418	-0.09469
1960	1.17415	0.99262	-0.00741	1.24430	1.05192	0.05062	0.80477	0.68035	-0.3851	-0.06111
1961	1.14879	0.99784	-0.00216	1.17780	1.02305	0.02278	0.81311	0.70627	-0.3478	-0.06174
1962	1.12574	0.99119	-0.00881	1.04734	0.92682	-0.07600	0.64625	0.57188	-0.5588	-0.07101
1963	1.17065	1.04397	0.04494	0.97957	0.87509	-0.13343	0.78699	0.70215	-0.3536	-0.02707
1964	1.15750	1.05295	0.05160	0.93961	0.85474	-0.15696	0.80882	0.73577	-0.3069	-0.06368
1965	1.06893	1.05998	0.05825	0.87321	0.86589	-0.14399	0.77721	0.77099	-0.2601	-0.01622
1966	1.06121	1.07036	0.06801	0.87262	0.88017	-0.12764	0.80370	0.81065	-0.2099	0.02577
1967	0.99614	1.03990	0.03913	0.90678	0.94661	-0.05486	0.78066	0.81517	-0.2044	-0.03155
1968	1.08466	1.10159	0.09675	0.94788	0.96268	-0.03803	0.94079	0.95548	-0.0455	0.00260
1969	1.11214	1.13912	0.13025	0.95283	0.97594	-0.02435	1.05077	1.07625	0.0735	-0.02881
1970	0.98034	0.96936	-0.03112	0.97128	0.96041	-0.04040	1.11459	1.10210	0.0972	-0.12161
1971	0.96557	0.95862	-0.04226	0.98190	0.97484	-0.02549	0.79349	0.78778	-0.2385	-0.17162
1972	1.01938	1.01639	0.01626	1.00566	1.00272	0.00271	0.75462	0.75241	-0.2845	-0.08698
1973	0.99993	0.99997	-0.00003	1.00003	1.00005	0.00005	0.99997	0.99998	-0.0000	-0.00000
1974	1.00700	1.02420	0.02391	1.06756	1.08589	0.08240	1.09926	1.11804	0.1116	0.08079
1975	1.20481	1.31052	0.27042	1.03979	1.13103	0.12313	0.69796	0.75921	-0.2755	0.14847
1976	1.03384	1.10858	0.10308	1.19041	1.27647	0.24410	0.75434	0.80887	-0.2121	-0.00491
1977	0.98672	1.18239	0.16754	1.47274	1.76479	0.56803	0.86150	1.03233	0.0318	0.27729
1978	1.10000	1.34115	0.29332	1.91134	2.33035	0.84602	1.04732	1.27692	0.2445	0.32272
1979	1.13941	1.34048	0.29303	1.85725	2.30265	0.83406	1.40460	1.65247	0.5023	0.33807
1980	1.17967	1.45169	0.37273	1.73632	2.13669	0.75926	1.35622	1.66894	0.5122	0.43743
1981	1.12591	1.40021	0.33662	1.43402	1.78338	0.57851	0.83464	1.03797	0.0373	0.22940
1982	1.05047	1.18882	0.17296	1.36877	1.54905	0.43764	0.69894	0.79099	-0.2345	-0.07547

PAM73 = price of agricultural importables relative to 1973
PAMR = price of agricultural importables relative to non-agricultural non-traded goods (NH)
LPAMR = log (PAMR)
PNM73 = price of non-agricultural importables relative to 1973
PNMR = price of non-agricultural importables relative to non-agricultural non-traded goods
LPNMR = log (PNMR)
PNX73 = price of non-agricultural exportables relative to 1973
PNXR = price of non-agricultural exportables relative to non-agricultural non-traded goods
LPNXR = log (PNXR)
LPAGR = log (price of all agricultural goods)

Table A5. Budget Shares of Domestic Consumption for the Agricultural and Non-Agricultural Sectors

YEAR	EXAH	EXAX	EXAM	EXNM	EXNH
1950	0.258041	0.0598387	0.284844	0.181431	0.215645
1951	0.217398	0.075:127	0.290201	0.215399	0.210389
1952	0.219072	0.0685746	0.283665	0.212954	0.215531
1953	0.230407	0.0688523	0.284723	0.199752	0.216265
1954	0.216292	0.0771932	0.283271	0.206950	0.216288
1955	0.211276	0.0704557	0.277513	0.223111	0.214644
1956	0.203507	0.0712037	0.272368	0.228551	0.219370
1957	0.201683	0.0715589	0.268733	0.240764	0.217262
1958	0.214627	0.0701956	0.276927	0.215727	0.222523
1959	0.234270	0.0691473	0.282978	0.185704	0.227901
1960	0.214102	0.0779555	0.286855	0.197312	0.223696
1961	0.217568	0.0732179	0.290542	0.192862	0.225809
1962	0.219086	0.0714173	0.285451	0.194343	0.229703
1963	0.214324	0.0701304	0.269355	0.223480	0.222709
1964	0.218275	0.0727402	0.272586	0.212305	0.223993
1965	0.232509	0.0684815	0.260030	0.217490	0.221490
1966	0.221917	0.0662467	0.253806	0.244370	0.213660
1967	0.224012	0.0637575	0.253351	0.248786	0.210094
1968	0.221012	0.0676710	0.259127	0.235490	0.216701
1969	0.228114	0.0651316	0.262104	0.226334	0.218316
1970	0.223902	0.0652881	0.254336	0.246437	0.210038
1971	0.218385	0.0656850	0.252820	0.254070	0.209040
1972	0.224977	0.0669992	0.255123	0.235190	0.217708
1973	0.205148	0.0632300	0.233516	0.295644	0.202403
1974	0.187450	0.0604095	0.223389	0.331992	0.196760
1975	0.189252	0.0603254	0.235140	0.311549	0.203733
1976	0.201233	0.0612659	0.237512	0.296198	0.203791
1977	0.193924	0.0662032	0.237915	0.295856	0.206102
1978	0.205698	0.0733549	0.251748	0.249621	0.219577
1979	0.201584	0.0779119	0.259883	0.241005	0.219616
1980	0.190523	0.0704225	0.239381	0.291084	0.208590
1981	0.201203	0.0689760	0.236101	0.285356	0.207764
1982	0.206451	0.0686318	0.239153	0.272725	0.212978

EXAH = budget share of agricultural non-traded goods
EXAX = budget share of agricultural exportables
EXAM = budget share of agricultural importables
EXNM = budget share of non-agricultural importables
EXNH = budget share of non-agricultural exportables

Table A6. Budget Shares of Domestic Consumption for the Agricultural and Non-Agricultural Sectors in Value Added Terms

YEAR	MUAX	MUAM	MUNX	MUNM	MUNH
1950	0.0076728	0.0873223	0.197431	0.0161241	0.572534	0.118916
1951	0.0252101	0.0874667	0.221969	0.0155033	0.558062	0.091782
1952	0.0165232	0.0867772	0.223468	0.0153829	0.571699	0.080149
1953	0.0161113	0.0850584	0.220395	0.0137778	0.573646	0.091011
1954	0.0240312	0.0820194	0.225602	0.0177578	0.573710	0.076880
1955	0.0175244	0.0771693	0.243064	0.0169700	0.559347	0.075925
1956	0.0173551	0.0585352	0.246951	0.0181655	0.581884	0.067109
1957	0.0179664	0.0658579	0.259709	0.0185019	0.576291	0.051644
1958	0.0155554	0.0700989	0.235183	0.0177189	0.590247	0.071197
1959	0.0126409	0.0691241	0.207352	0.0189371	0.604513	0.087374
1960	0.0217236	0.0740939	0.214958	0.0258706	0.593358	0.069996
1961	0.0163782	0.0754875	0.209512	0.0276383	0.598963	0.072020
1962	0.0138320	0.0677443	0.212778	0.0252784	0.609291	0.071028
1963	0.0142016	0.0577387	0.241568	0.0249771	0.590740	0.070774
1964	0.0165580	0.0601048	0.229774	0.0255136	0.594145	0.073899
1965	0.0129436	0.0498856	0.236932	0.0223874	0.587307	0.089744
1966	0.0124719	0.0503462	0.262803	0.0234411	0.566737	0.084200
1967	0.0107884	0.0529464	0.267137	0.0232563	0.557279	0.086563
1968	0.0127378	0.0513114	0.254242	0.0255705	0.574804	0.081334
1969	0.0101944	0.0542460	0.245339	0.0237366	0.579088	0.087396
1970	0.0118794	0.0522994	0.265092	0.0230810	0.557129	0.086520
1971	0.0125027	0.0516413	0.275113	0.0226140	0.554464	0.083645
1972	0.0119359	0.0468097	0.257397	0.0217314	0.577475	0.084651
1973	0.0120492	0.0396645	0.318035	0.0186865	0.536878	0.074687
1974	0.0107619	0.0378669	0.355059	0.0179771	0.516603	0.061915
1975	0.0087274	0.0399353	0.337265	0.0157332	0.540405	0.057933
1976	0.0093485	0.0411234	0.322296	0.0167938	0.540560	0.0598770
1977	0.0140669	0.0406737	0.317287	0.0202049	0.546669	0.0610786
1978	0.0181426	0.0428468	0.269415	0.0239943	0.582433	0.0641670
1979	0.0226007	0.0506127	0.258785	0.0254374	0.582537	0.0600273
1980	0.0178910	0.0406278	0.303249	0.0228694	0.553289	0.0550734
1981	0.0171147	0.0398518	0.303743	0.0209063	0.551098	0.0672060
1982	0.0157705	0.0388739	0.288811	0.0224395	0.564930	0.0691732

MUAH = agricultural non-traded goods
MUAX = agricultural exportables
MUAM = agricultural importables
MUNX = non-agricultural exportables
MUNM = non-agricultural importables
MUNH = non-agricultural non-traded goods

Table A7. Domestic Consumption of the Agricultural and Non-Agricultural Sectors

YEAR	SEXAH	SEXAX	SEXAM	SEXNM	SEXNH
1950	29858	6924.1	32960	20994	24976
1951	28153	9856.6	36286	27959	27245
1952	29583	9260.0	38332	28757	29104
1953	32505	9743.6	40292	28258	30604
1954	31639	11313.9	41515	30330	31698
1955	33306	10951.3	43135	34680	33363
1956	33711	11512.2	44036	36952	35468
1957	35116	12459.6	46791	41921	37829
1958	36618	11976.1	47247	36805	37965
1959	40014	11810.5	48333	31719	38926
1960	39677	14441.2	53140	36552	41439
1961	42688	14365.6	57006	37840	44305
1962	47113	15357.9	61385	41793	49396
1963	49430	16174.3	62122	51541	51364
1964	53967	17984.4	67419	52491	55360
1965	62073	18282.6	69421	58064	59132
1966	64698	19313.5	73994	71243	62290
1967	68327	19446.9	77275	75883	64082
1968	64511	19752.4	75636	68737	63253
1969	69787	19925.8	80186	69243	66790
1970	72763	21217.1	82653	80086	68257
1971	75972	22850.6	87951	88386	72721
1972	78271	23309.4	88760	81824	75742
1973	80952	24974.3	92146	116662	79869
1974	82161	26478.0	98790	145515	85365
1975	85492	27251.6	106221	140738	92034
1976	91404	27828.2	107883	134539	92566
1977	86829	29642.5	106527	132469	90382
1978	86100	30704.5	105376	104485	91910
1979	87101	33664.3	112290	104134	94892
1980	91671	33884.3	115180	140057	100365
1981	102385	35099.5	120144	145513	105724
1982	102837	34216.6	119126	135849	106068

SEXAH = agricultural non-traded goods
SEXAX = agricultural exportables
SEXAM = agricultural importables
SEXNM = non-agricultural importables
SEXNH = non-agricultural non-traded goods

Table A8. Wages for the Agricultural and Manufacturing Sectors and Demographic Data

YEAR	AGW73	LWAGR	MANW73	LMWAGE	POP	LPOP	GEXPAG73	LGEXP	CAPITAL	LCAP
1950	56.6729	3.64311	132.215	4.88443	7.24	1.97962	859.87	6.75678	25058	10.1290
1951	55.7304	3.66005	131.862	4.88175	7.45	2.00821	755.36	6.62720	32480	10.3884
1952	56.4695	3.68459	135.471	4.90876	7.66	2.03601	1023.68	6.93116	35070	10.4651
1953	69.6046	3.93525	136.558	4.91675	7.88	2.06433	800.58	6.68534	38107	10.5482
1954	66.7655	3.92513	135.708	4.9105:	8.11	2.09310	575.73	6.35564	35864	10.4875
1955	63.8587	3.89267	138.022	4.92741	8.35	2.12226	1192.15	7.00352	35812	10.4861
1956	73.8949	4.01737	140.344	4.98596	8.59	2.15060	1537.47	7.33789	40286	10.6038
1957	80.2372	4.09440	122.987	4.81208	8.84	2.17929	942.29	6.84831	44081	10.6938
1958	94.4853	4.25634	126.535	4.84052	9.10	2.20827	1511.76	7.32103	39901	10.5942
1959	88.5356	4.25910	131.563	4.87946	9.36	2.23645	476.21	6.16587	35314	10.4721
1960	85.1063	4.27595	136.504	4.91635	9.63	2.26488	583.43	6.36892	44289	10.6985
1961	89.8540	4.35732	139.071	4.93498	9.91	2.29354	1266.65	7.14413	44659	10.7068
1962	96.2135	4.44431	143.304	4.97863	10.20	2.32239	1016.22	6.92385	47081	10.7596
1963	93.1495	4.42142	147.558	4.99422	10.49	2.35042	1251.80	7.13234	45455	10.7245
1964	87.5419	4.37745	150.511	5.01404	10.80	2.37955	1829.90	7.51202	49151	10.8027
1965	76.8464	4.33343	153.210	5.03181	11.11	2.40785	2340.54	7.75814	55034	10.9157
1966	72.5575	4.28299	152.150	5.03142	11.43	2.43524	2745.82	7.91820	65327	11.0863
1967	66.4489	4.23943	151.222	5.01875	11.76	2.46470	2807.96	7.94021	64429	11.0733
1968	57.2954	4.06373	141.371	4.95139	12.11	2.49403	2995.55	8.00488	45149	10.7177
1969	54.9151	4.02975	147.930	4.99674	12.46	2.52252	2908.12	7.97526	46629	10.7500
1970	53.7729	3.97351	151.393	5.01988	12.82	2.55101	4080.71	8.31403	44704	10.7078
1971	54.1734	3.98681	151.001	5.01728	13.19	2.57946	3333.40	8.11175	51993	10.8512
1972	55.0642	4.00556	174.106	5.15966	13.54	2.60565	3783.82	8.23849	50917	10.8380
1973	61.9284	4.12600	195.495	5.27553	13.89	2.63117	5409.86	8.59598	65595	11.0913
1974	57.1537	4.04268	207.043	5.33293	14.24	2.65605	6683.62	8.80741	92319	11.4330
1975	65.2221	4.26190	176.897	5.17557	14.61	2.68171	8280.73	9.02169	87303	11.3840
1976	65.2207	4.24758	168.348	5.12603	14.98	2.70672	7718.59	8.95139	76690	11.2475
1977	62.4897	4.31590	148.166	4.99833	15.37	2.73242	7207.32	8.88285	57205	10.9544
1978	52.9662	4.16787	128.413	4.85525	15.76	2.75748	6179.32	8.72596	49130	10.8022
1979	70.6531	4.42030	111.611	4.71502	16.17	2.78316	5877.49	8.67889	50027	10.8203
1980	78.6112	4.57200	131.740	4.88083	16.58	2.80820	5590.41	8.62881	69926	11.1552
1981	72.2651	4.49837	125.621	4.83327	17.01	2.83380	4484.16	8.40831	81798	11.3120
1982	62.1923	4.25336	130.542	4.87170	17.44	2.85877	5057.61	8.52865	69458	11.1485

AGW73 = agricultural wage
LWAGR = log (agricultural wage)
MANW73 = manufacturing wage
LMWAGE = log (manufacturing wage)
POP = country-wide population
LPOP = log (population)
GEXPAG73 = expenditures on agricultural
LGEXP = log (agricultural expenditures)
CAPITAL = capital
LCAP = log (capital)