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NONTRADITIONAL EXPORT CROPS IN TRADITIONAL SMALLHOLDER AGRICULTURE: EFFECTS ON PRODUCTION, CONSUMPTION, AND NUTRITION IN GUATEMALA

by

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IN MEMORIAM FOR VICTOR VALVERDE

This research project was jointly designed and its first phase jointly directed with Victor Valverde of INCAP whose unexpected death in June 1986 came as a shock to his friends and colleagues. This project is one of many research activities which Victor stimulated aimed to improve the understanding of poor people's living conditions especially their nutritional situation.

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SUMMARY

Increased foreign exchange problems and deteriorating prices of traditional export commodities lead agricultural policymakers to seek diversification in export crop production. As nontraditional crops, export vegetables appear to be a promising option due to their high labor intensity and expanding demand in industrialized countries. This study deals with a case of export vegetable production and its effects on food production, employment, consumption, and nutrition in Guatemala.

Guatemala's agriculture has shifted away from food production to agroindustrial crops. Food crops covered 58 percent of the country's crop area in 1950 as compared to 37 percent in 1979. Small farms decreased their basic food crop area from 97 to 87 percent also in this period.

The focus of this study is the recent introduction of labor-intensive vegetable production for export into the traditional small-farm sector in the Western Highlands. The study area is well known for its problem of poverty and malnutrition. The population in the area is mostly of indigenous origin (*Maya*).

The research is based upon two detailed rural household surveys (400 families) in the Western Highlands of Guatemala which were undertaken in 1983 and 1985. The sample is divided into two groups of

households--those who produce the new export vegetables (snowpeas, broccoli, cauliflower, and parsley), under a cooperative scheme and those who do not. Also, differences in duration of participation in the export crop scheme--the cooperative *Cuatro Pinos*--characterize the subsample of the export crop growers (one to seven years).

Commercialization of traditional agriculture in a market economy is driven by changes in incentives or technology, but the process is to a large extent also influenced by actors and players. The smallholder cooperative *Cuatro Pinos* in the Western Highlands, which produces the export vegetables, is a case in point.

Export vegetable production did not end up in the small farms as a planned undertaking but moved there in several steps. Originally, the multinational grew the crops on large-scale units managed by the company itself. It moved then to medium-sized farms (20-30 hectares) in the form of contract growing, and from there to the smallest farmers (average 0.7 hectares) in the Highlands. The crops' characteristics which apparently have negative returns to scale in production and management led to this trial-and-error development path in which various actors and institutions interacted and responded to economic incentives.

The new export vegetables were rapidly adopted by the smallest farmers. Our model analysis shows that in the early phase of adoption, small farmers with somewhat bigger holdings (1-2 hectares) and households who had no reasonably secured off-farm income source showed a significantly higher probability to join the scheme.

The new export vegetables have certain risks for the small farmers. Such risks can possibly result from crop failures, from price collapses on the export market, and from a breakdown of the marketing institutions. Relative production variability of the new crops is not higher than in the traditional crops but because the new crops are much more input-intensive, the potential absolute income loss is higher than for the traditional crops.

The price variability of the new crops--especially of snowpeas--is extreme. Within-year prices in 1985 fluctuated between 0.10 and 2.00 Quetzal per pound, but farmers can partially cope with this by spreading the growing seasons and having a long harvest period (12 weeks).

Recently, in addition to the individual multinational company and the cooperative, other traders have handled the export channel. Also, local processing and freezing of fresh produce has been initiated. These developments reduce the risk of a sudden collapse of the marketing channel.

Nontraditional export crops are substantially more profitable to farmers than traditional crops. Net returns (gross margins) per unit of land of snowpeas--the most important new crop--are on average five times than those of maize--the most important traditional crop. Returns of the new crops per unit of family labor were about twice as high as maize and 60 percent higher than traditional vegetables produced for local markets in 1985. The input costs per hectare for snowpeas, however, are on average about four times higher than traditional vegetables and 13 times higher than maize. Short-term financing

of inputs poses a problem to small farmers and indicates the importance of rural credit.

Farm households which are not members of the export crop cooperative grow the traditional subsistence crops (maize and beans) on 78 percent of their land, whereas participants in the scheme grow them on 52 percent of their land. The smallest farms of coop members allocate the highest shares of land to the new export crops. For instance, farms below 0.25 hectares of coop members allocate 45 percent of their land to the new crops. A model to explain the area allocation confirms that the new export crops have not only replaced traditional vegetables but reduced the area allotted to the traditional subsistence crop (maize).

Despite smaller areas allocated to traditional subsistence crops by export crop producers, the great majority tend to have higher amounts of maize available (per capita) for consumption from own produce than other farmers of the same farm size because coop member's maize and beans yields are 30 percent higher on average than nonmembers' yields. A combination of factors is responsible for the increase in yields. Fertilizer inputs are increased and cropping practices are more labor-intensive (more weeding labor).

Our production function analysis shows that new export vegetables have favorable yield effects over and above the increased input use, and this is not an effect of a possible self-selection bias of more efficient farmers who became export crop producers. One reason is the positive effect of snowpeas on soil fertility (nitrogen fixation). A second more hypothetical reason is that export crop producers improved

their crop management of subsistence crops once new export crops were introduced.

Due to these output effects in food production, the introduction of new crops may have had only marginal price effects on staple foods. The study region was a net importer of staple food before. The degree of self-sufficiency in maize in the six communities is only 50.4 percent. Increasingly land is purchased and rented by farmers that grow new crops. Land prices and rental values have reportedly increased substantially in the communities. Landowners not participating in the export crop scheme benefit indirectly through increased land values. Adversely affected are households that rented land for subsistence crop production and did not join the scheme.

Analysis with the help of a consistent farm household model based on the survey data shows that with new export crops, the shadow cost of maize produced for own consumption increased drastically. The difference between the shadow cost and the actual market price (0.29 Quetzal in 1985) may be interpreted as an "insurance premium" which farmers are willing to pay for the degree of self-sufficiency they actually maintain. This "insurance premium" is relatively high. It can be brought down further by technological change in the subsistence food production. Farmers adopting the nontraditionals have a strong incentive to increase productivity in subsistence crops which brings down the "insurance premium."

Nontraditional export crops created local employment directly on farms and indirectly through forward and backward linkages and multiplier effects resulting from increased income spent locally. Combining

farm-level employment to the roughly estimated employment created through the input supply and output marketing yields an overall 21 percent increase in agricultural employment in the six communities. Labor input in agriculture increased in the export vegetable producing farms by 45 percent. About half of this increase is covered by family labor and half by hired labor.

There is a shift of labor from traditional to new crops and a partial substitution between family labor and hired labor. Total family labor input is cut back in maize by 13 percent, in beans by 43 percent, and in traditional vegetables by 29 percent, but hired labor input into maize even increased somewhat, as family labor in the traditional subsistence crop was partly displaced by hired labor.

A substantial share of the incremental increase in family labor is from women. It is 44 percent of the increase in the farms below 0.5 hectares and 32 percent in the farms above one hectare. Women's labor input into the subsistence crop (maize) is low (9 percent) as compared to traditional vegetables (25 percent) and the new export vegetables (31 percent). Yet most of the field labor provided by the family is from men (in maize, 83 percent; in snowpeas, 59 percent; in traditional vegetables, 61 percent). As a consequence of increased on-farm employment, off-farm work and interregional migration of household members from export vegetable producers' households are found to be reduced.

The export crop production scheme led to increased income in the participants' households. This increase between the two surveys (1983-1985) was most pronounced in the group of new adopters in which

expenditures--used as an income proxy--increased by 33 percent. The income gains were highest among the adopters in the smallest farms, thereby the new export crops had a favorable effect of moving the poorest upward on the income scale. As for the export crop producers among the poorest one-third of the households, only 38 percent stayed in this tercile from 1983 to 1985, compared to 55 percent for the lowest tercile of the other households.

Export crop producers spend on average 64 percent of their total expenditures on food compared to 66.8 percent among the other households (including own-produced food consumed by households). The difference can be mainly explained by Engel's Law.

At same income levels, export crop-producing farm households spend less of additional income on food. While nonmembers in the lowest quartile on the income scale spend 61 percent of additional income on food, coop members in the same income class spend 53 percent. Income from new export crops is mainly male-controlled. Holding income constant suggests a negative effect of an increased household income share from (male-controlled) new export crops for the budget share spent on food. Among the nonmember households, a similar relationship for food expenditures is observed in case of male-earned nonagricultural income.

Additional income increases calorie acquisition significantly but at decreasing rates at the margin. At the sample mean a 10 percent increase in income increases calories in the household by 3.1 percent. Joining the export crop scheme apparently reduces the positive income effect on calorie consumption, but does not eliminate it. Coop house-

holds in the lowest half of the income scale increase their calorie consumption by 2.8 percent with a 10 percent increase in income while noncoop households increase theirs by 4.4 percent which is consistent with above-mentioned results of the analysis on budget allocation.

Despite the relative closeness to Guatemala City and to infrastructure of some of the sample villages, the general nutritional status in the study area is as poor as in other more remote rural Guatemalan regions where there is comparable data.

The nutritional situation of the sample population in general, as measured by anthropometric standards of children, has hardly improved between 1983 and 1985. While slight improvements are recognized in the top income tercile, prevalence of underweightness and stunting actually increased in the bottom and middle income tercile. Guatemala was going through a severe economic crisis during these years that affected the rural areas in the form of reduced overall employment in the nonagricultural sector.

It is found that increased income leads to significant nutritional improvement, but decreasing so at the margin. The hypothesis that an increased share of income from the export crops would lead to adverse nutritional effects (holding total income constant) does not find support by this analysis. A higher share of women-controlled nonagricultural income, however, tends to add to nutritional improvement over and above the absolute income effect. Significant positive relationships between increased food availability at household level and nutritional improvement are established with respect to the short-term nutrition indicators (weight/height). Thus, as found in the

consumption analysis, nutritional improvements resulted from the effect of the new crops on real income and thereby on calorie availability.

In brief:

- The production and income-related analysis concluded with favorable effects of the nontraditional crops for food crop productivity, employment, income growth, and income distribution.
- The expenditure and food consumption analysis found that incremental income earned from the nontraditional crops tends--at same income level--to be relatively spent less on food than other income, and this is also reflected, although to a lesser extent, in calorie availability. Thus, food expenditures and consumption increased relatively less than expected.
- The nutrition-related analysis shows that the increased food consumption and income in the export crop-producing households improved nutritional status of children, and most significantly the short-run indicators (weight-for-height).

Especially in the late 1970s and early 1980s, steps to alleviate poverty and improve living conditions in Guatemala were constrained by the economic and political environment. The case study shows, however, that with appropriate access to resources and markets and effective assistance in institution building at the community level, the poor in the Western Highlands can substantially improve their income and welfare. That this also rapidly translates into nutritional improvement of children requires appropriate health and nutrition-oriented social infrastructure.

1. THE RESEARCH ISSUES AND APPROACH

COMMERCIALIZATION OF TRADITIONAL AGRICULTURE

An increasing number of low-income countries are facing crucial strategic decisions on how to cope with short- and long-run food security problems. At the core of these strategic decisions is the appropriate choice of policies to promote production of export crops and cash crops for the domestic market (food and nonfood) and subsistence food crops.

Many developing countries are encouraging the increased production of export crops as a way to generate foreign exchange earnings and fiscal revenues, to increase the income of small landholders, and to provide employment for the rural poor. However, critics of policies advocating cash crop production argue that the potential benefits have never materialized and, more important, in areas where cash crop production has increased, food consumption and the nutritional status of the poorest households have deteriorated. A comprehensive review of the existing literature and earlier research on the issue shows mixed results.[1] This is not surprising, given the great variety of cash crops and production conditions in general.

In developing countries, increased market integration of semi-subsistence agriculture appears unavoidable. Rapid urbanization, growth of the rural nonagricultural sector, and technological change in

agricultural production are the major driving forces of this commercialization process. Urbanization without increased rural-urban market integration would lead to volatile dualistic structures and import dependence.

On the basis of existing research, it is evident that critical relationships which determine food consumption and nutrition are affected by increased commercialization. These effects may be positive or negative. At the macroeconomic level, an issue of concern is if foreign exchange generated through export cropping is actually used for imports of goods and services that improve the food consumption and nutritional situation of the poor. Foreign exchange regulations and taxation of export crop along with import controls by governments may lead to distortions that may prevent the poor, including small farmers in the export sector and other rural households, from access to the direct and indirect benefits of the specialization.

This study is mainly concentrated toward the household-level effects in rural areas. At this micro level, the actual outcome depends on factors such as the actual increase in real income from cash cropping and its distribution, income composition, change in who controls income (men or women), and how these translate into food consumption in households as well as effects on the allocation of time of household individuals (especially mothers), and health and sanitary factors. At this point, no clear ranking of factors is possible on the basis of existing research. A number of studies show, however, that the positive effect of increased cash income on calorie consumption may

be quite small, even among the poor.[2] This may be a result of changes in income composition and income control within the household.

A crucial question for policy and program design is whether potential adverse effects of increased cash cropping on nutrition are actually observed and, if so, are they of a short- or a long-term nature? This is not to say that short-term effects for, say, one-to-two years should not be an issue of concern. But appropriate and efficient policy measures to balance potential adverse effects are dependent on the time frame of the problem. Whereas short-term problems may be dealt with mainly by adjusting the timing of project implementation and a combination of measures such as temporary income support, price subsidies, and nutrition education, long-term adverse effects require very different policy instruments. These must have the potential to improve and stabilize living conditions for the losers in the commercialization process. Employment generation in rural areas would be a major element of those policies.

The uneasiness about the above mentioned critical relationships between agricultural production and nutrition in the commercialization process suggested a series of detailed case studies which are being executed at IFPRI in collaboration with other institutions.

THEORETICAL APPROACH AND CONCEPT

This case study on the commercialization of smallholder agriculture in Guatemala looks into the case of introduction of nontraditional vegetables for export. It was clear at the outset that this change had substantial effects on agricultural production and employment in the

study area. The order of magnitude of these effects and the effects on income, consumption, and nutrition, however, were not clear at all. It was precisely the concern that expansion of a crop for export in an area with a well-known nutrition problem might have adverse effects on the availability and security of food and might further aggravate the nutrition problem. If the export crop scheme increased employment and income of the poor, a related issue which stimulated the research of this particular case was the provision of background understanding needed to assure rapid translation of income growth into improved physical welfare, especially nutrition, in the households.

The theoretical concept of the household-level analysis of commercialization effects takes a disaggregated approach to trace the consequences for different types of households and different groups inside the households. It is not *a priori* assumed here that incremental employment and income from the new crops leaves household utility functions unchanged. It is widely recognized now that (farm) households are not necessarily homogeneous units of decisionmaking.[3] Profound changes in the opportunities of income earning on the farm--be it through new technology or new market outlets--may have profound implications for division of labor, and relative control of income shares which may change budget allocations within the household over and above the pure income effect. This study attempts to trace such effects and quantify the extent of the impact on the consumption and nutrition effects of increased commercialization of traditional agriculture. Understanding these relationships is crucial to identify policy options that avoid adverse effects of commercialization for

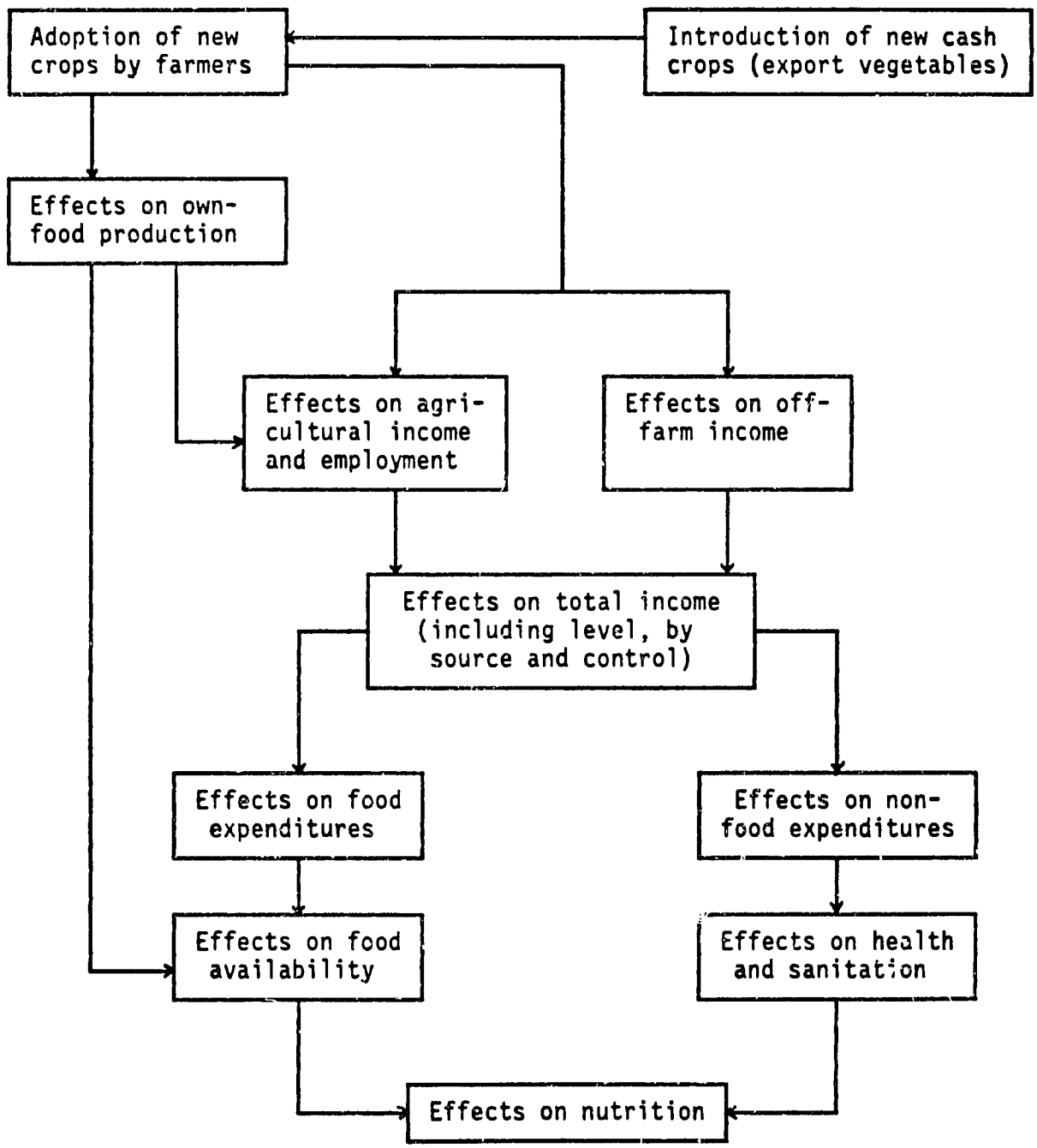
consumption and nutrition in poor households and enhance positive ones. The research focuses on the effects of the commercialization process on household level food security. Food security, in this context, is understood in the broad sense as the ability of households and their members to acquire sufficient quantities of food over time be it from own produce or from the market. Related to this, the effects of change in commercialization on the actual nutritional situation of children is assessed. The main relationships studied in this evaluation of increased commercialization are its effects on:

- o agricultural production (especially food),
- o employment and income (on-farm, off-farm), and the extent to which these translate into effects for,
- o expenditures for food and nonfoods,
- o food consumption, and
- o nutrition.

Clearly, these issues are related among each other. A simplified overview on the relationships as affected by the commercialization at the household level is provided in Figure 1. Figure 1 also provides an overview of the steps of analysis.

The commercialization process at the micro farm-household level should be understood in the context of the macroeconomic environment and its political economy. A review of commercialization of Guatemala's agriculture is provided at the outset. Introduction of new cash crops is evaluated in its institutional context. This requires a focus on the actual making and operations of the commercialization process. Success (or failure) of a program is largely determined in

Figure 1--Flow of analysis for evaluation of effects of the commercialization process at the household level (simplified)



this sphere which is much under-researched. We, therefore, first look into the actors and players of the commercialization before the household-level effects are evaluated.

At the farm-household level, the process and determinants of adoption of the new crops are evaluated. Main questions addressed are: who are the (early) adopters and what are their characteristics? In the context of this case study, this leads directly into the issue of competition and complementarity between nontraditional and traditional crops, on-farm and off-farm labor supply, and division of labor in the households. How is food availability from own production affected? Where does the increased labor input on farm stem from? Who in the household controls the incremental farm income?

From the income effects, the effects for households resource allocation to food and nonfood expenditures are being traced. Special focus is on food expenditures and food (calorie) availability. What share of incremental expenditure in export crop-producing households versus other households (at same income levels) is spent on food and what types of food? To what extent is food availability in terms of calories improved?

Finally, these effects are traced to nutritional status of children in the households. How is nutritional status--measured in anthropometric terms (weight, height-for-age)--affected by changes in food availability and the health and sanitation environment of the households?

The study concludes with lessons for policy from this particular case and an attempt to identify generalizable findings.

NOTES

[1] Joachim von Braun and Eileen Kennedy, Commercialization of Subsistence Agriculture: Income and Nutritional Effects in Developing Countries, Working Papers on Commercialization of Agriculture and Nutrition No. 1 (Washington, D.C.: International Food Policy Research Institute, April 1986).

[2] See the review in von Braun and Kennedy, ibid., pp. 55-59.

[3] Nancy Folbre, "Cleaning House--New Perspectives on Households and Economic Development," Journal of Development Economics 22 (No. 1, July 1986), pp. 5-41, and the literature quoted in this article.

2. COMMERCIALIZATION OF GUATEMALA'S AGRICULTURE

Guatemala is the third largest of the Central American republics after Nicaragua and Honduras, but its population of about 8.4 million (1984 figure) exceeds that of the latter two countries combined. About two-thirds of the population lives in rural areas, about 60 percent of which is indigenous Indian people who are descendants from the ethnic group of the *Maya*. This population is mainly concentrated in the Western Highlands of Guatemala where this study was conducted.

The agricultural sector provides about 50 percent of the country's employment and accounts for 25 percent of gross domestic product in the mid-1980s. Agricultural exports hold a share of about 65 percent in total merchandise exports which make agriculture the primary foreign exchange earner of the economy.

Guatemala's highly dualistic agricultural structure is well documented.[1] A modern export-oriented, large-scale farm sector and a traditional subsistence-oriented, small-scale sector coexisted since a long time. The coexistence of these two different sectors is not independent but closely linked through the rural labor market. Labor from the traditional sector in the Western Highlands which is operating on an agricultural-resource base per household which, in most cases, cannot support the bare survival requirements of the family, seeks employment through interregional migration to the areas of the large-

scale export crop sector, mainly in the lower altitude regions and in recent decades also increasingly in urban services.

This pattern of export crop production and its interaction with the subsistence farm sector has been in existence for decades. Its effects on the subsistence farm sector are substantial.[2] Yet, the focus of this research is not to study these indirect effects but the recent changes that are occurring in the subsistence sector itself--namely, the shift into export crop production by the small farmers themselves in the Western Highlands. The traditional dualistic pattern of subsistence and export crop sector, however, has to be kept in perspective in assessing the implications of the change in commercialization in the small farm sector. Clearly, this subsector--though mainly subsistence-oriented in crop production--was "commercialized" before by selling a high share of its labor rather than its crops.

AGRICULTURAL EXPORTS FROM A DUALISTIC AGRICULTURAL SECTOR

Agricultural exports from Guatemala may be grouped into traditional and nontraditional exports. The traditional ones in their order of share in total agricultural exports are coffee, cotton, sugar, banana, and beef. These account for 76 percent of agricultural exports in the mid-1980s (Table 1). Among the important nontraditional agricultural exports which account for the remaining 24 percent are cardamon, vegetables, plants, fruits, and sesame seeds (Table 1). Since the mid-1970s the share of agricultural exports in total merchandise exports remained stable but the composition of agricultural exports changed to greater diversity. The share of traditional

Table 1--Value of agricultural exports from Guatemala, 1975-1984

	1975	1980	1984
		(in million U.S. $)	
Traditional agricultural exports			
Coffee	164	464	361
Cotton	74	166	72
Banana	35	45	55
Beef	17	29	13
Sugar	116	69	71
Subtotal	405	773	572
Percent of total agricultural exports	92	79	76
Nontraditional agricultural exports			
Cardamon	10	56	100
Vegetables, plants, flowers, fruits	9	68	43
Others[a]	15	75	39
Subtotal	34	199	182
Percent of total agricultural exports	8	20	24
Total agricultural exports	440	972	754
Total exports	651	1,520	1,132
Agricultural exports in percent of total exports	67	64	67

Source: Bank of Guatemala, "Economic Data, 1985" (mimeographed).

[a] Includes essential oils, fish, gum, honey, cocoa, cotton seed, sesame seed, cotton lint.

agricultural exports dropped from 92 percent in 1975 to 76 percent in 1984, although traditional exports grew in absolute dollar terms. Increased diversification of the agricultural export sector is a stated policy objective to reduce instability in foreign exchange earnings due to price fluctuations--that is, of coffee--in international markets.[3]

Land ownership in Guatemala is extremely skewed. The Gini coefficient, which ranges from zero in a situation of perfect equality to 100 in a situation of maximum inequality, was 85.1 for land distribution in Guatemala in 1979 which is higher than all Latin American countries.[4] The Gini coefficient increased from 82.4 to 85.1 between 1964 and 1979 indicating further inequality.[5] Two percent of the farmers held 67 percent of the agricultural land which is generally also of better quality than the land cultivated by the small farmers.

For those at the bottom end of the distribution population growth further leads to rapid reduction of average farm size. From 1964 to 1979, the average farm size under 1.4 hectares (2 manzanas) decreased from 1.0 to 0.7 hectare. Sixty percent of Guatemalan farms fall in this group who cultivate 4 percent of the land (Table 2). Most of the subsistence farm households in the Western Highlands also fall in this group; thus, not surprisingly, more than 90 percent of our sample survey households are part of this farm-size class.

Total agricultural land used increased by 0.8 percent per annum between 1950 and 1979. Expansion into new lands did not provide any significant relief for the land constraint burdening the small farm sector and does not provide a potential solution for this either.[6] The

Table 2--Farm size distribution in Guatemala, 1950, 1964, 1979

Farm Size	Percent of Farms			Percent of Area		
	1950	1964	1979	1950	1964	1979
(hectares)						
Below 1.4	47[a]	44	60	3[a]	3	4
1.4- 3.5	29	31	21	6	7	6
3.5-44.5	22	23	17	19	23	23
Above 44.5	2	2	2	72	67	67
Total	100	100	100	100	100	100

Source: SEGEPLAN, Agricultura, Población, y Empleo en Guatemala: (Guatemala: SEGEPLAN, 1984).

[a] In the 1950 census, farms with less than 0.04 hectare were excluded.

obvious solution--agrarian reform with redistribution of land from large-scale farms to small farmers--was attempted by governments in the latest and early 1950s, but the attempts were finally blocked when the government was toppled in a coup in 1953.

Guatemala's agriculture has continuously and substantially shifted away from staple food production (which includes a large share of subsistence production) to cash crops and production for exports. Basic food crops covered 58 percent of the agricultural area in 1950 as compared to only 37.4 percent in 1979 (Table 3). Cash crops and export crops increased their share in land use from 20 to 29.8 percent during the same period. Although this change in cropping patterns mainly took place in the medium-sized farms (3.5-44.5 hectares), the smallest farms are, however, following the same pattern of change. They decreased their basic food crop area from 96.7 to 87.4 percent in this period and increased their area devoted to cash crops (Table 3).

Since 1979 the area allocated to the major staple foods, maize and beans, increased somewhat but yields show a downward trend which stagnated the total staple food production and reduced the per capita staple food production by a rate of -0.3 percent per annum during 1968 and 1982.[7]

How did overall food availability develop over time against this background of change in production patterns toward exports and the slow growth in domestic food production? Overall per capita staple food availability was stable in the sixties but declined in the seventies. Calorie consumption per capita increased by 6.1 percent over the 1970s

Table 3--Specialization in crop production, by farm size, 1950, 1964, 1979

Farm Size	Type of Crops[a]	Land Use in Percent of Farm-Size Class 1950	1964	1979
(hectares)			(percent)	
Below 1.4	Basic food crops	96.7	91.1	87.4
	Cash and export crops	3.3	8.5	12.2
	Pasture	-	0.4	0.4
1.4 - 3.5	Basic food crops	93.5	90.1	84.6
	Cash and export crops	6.2	8.4	14.0
	Pasture	0.3	1.5	1.4
3.5 - 44.5	Basic food crops	84.8	68.0	64.4
	Cash and export crops	10.8	12.6	19.1
	Pasture	4.4	19.4	16.5
Above 44.5	Basic food crops	18.8	14.4	13.7
	Cash and export crops	35.1	32.1	38.4
	Pasture	46.1	53.5	47.9
Total	Basic food crops	58.0	41.3	37.4
	Cash and export crops	20.0	23.1	29.8
	Pasture	22.0	35.6	32.8

Source: SEGEPLAN, Agricultura, Población, y Empleo en Guatemala (Guatemala: SEGEPLAN, 1984).

[a] Basic food crops include maize, beans, rice wheat, potatoes, and traditional vegetables. Cash and export crops include sorghum, cotton, coffee, sugarcane, cardamon, sesame, groundnut, tobacco, rubber, and fruits. Pasture includes permanent pasture and land for fodder crops.

(Table 4). Obviously, relatively more calories come now from nonstaple foods. It should be stressed that such country averages do not really address the food situation properly, especially in countries with such large spreads in the income distribution as in Guatemala.

Generally, developing countries tend to manage joint growth in the basic food crop and in the cash crop subsectors, or fail to achieve growth in either.[8] Guatemala, however, appears as an exception to this general tendency. Its cash crop sector was growing over the long term while its basic food crop sector stagnated.[9] This may be explained by the highly dualistic structure of Guatemala's agricultural sector. This structure does not accommodate positive spillover effects from traditional export crops promotion through credit, inputs, market infrastructure, etc., to the basic food crops as the two are mainly grown in two very distinct types of farms--large scale versus small scale--as well as in different locations.

The effects of increased commercialization through the introduction of new cash crops for food crop production in the small-farm sector may, however, turn out to be very different from the development path of the isolated expansion of agroindustrial crops in the large-scale farm sector. In principle, positive linkages between the new cash crops and promotion of traditional food crops could be established in this case.

RECENT VARIATIONS IN AGRICULTURAL POLICY

In the early 1980s Guatemala's substantial export-led economic growth with low levels of general inflation and an impressively strong

Table 4--Availability of staple food and consumption of calories in the 1960s, 1970s, and 1980s in Guatemala

Years	Staple Food Availability in Wheat Equivalent	Calorie Consumption
(3-year averages)	(kg/capita/annum)	(calories/capita/day
1961-63	134	1,937
1971-73	135	2,056
1981-83	128	2,080

Source: Food and Agriculture Organization of the United Nations, Food Balance Sheet data tapes (Rome: FAO), 19

currency experienced a crisis. Between 1982 and 1985 per capita GNP was down by 20.5 percent in real terms.[10] The Quetzal, which was valued at a fixed 1-to-1 rate against the U.S. dollar for more than 40 years, was devalued in 1984 and further devaluated in 1985 to about 3 Quetzales to 1 US$ in the parallel market. A product-specific system which allowed differential access to the parallel market exchange rate and imposes different shares of the export revenue to be converted at the old 1-to-1 exchange rate leads to numerous variable exchange rates and implicitly to a host of different export tax levels through the exchange rate regulation. Coffee dollars were, for instance, to be exchanged at 25 percent parallel rate and 75 percent official rate in early 1986. Export vegetable dollars got better treatment by an imposed share of 50 percent in official rate.

This exchange rate policy induced equivalent distortions on the import side. A policy to use the foreign exchange acquired through the implicit taxation of exports for importation of so-called essential agricultural imports (e.g., fertilizer, food) at the old exchange rate was largely ineffective. Fertilizer prices roughly doubled from 1985 to 1986. Thus the input-intensive export crops came under pressure from both sides--export taxation through partly maintained overvalued exchange rate, and the full effect of the devaluation of domestic currency on the input price side. Export values declined during 1980-1984 much more among the traditional export crops (-7.3 percent) than the nontraditional ones (-2.2 percent). On the basis of this experience, the government policy for agriculture, as laid out in the 1984-86 National Development Plan, emphasizes diversification of export-

oriented agricultural production and increasing the production of food commodities. These priorities should help to bring Guatemala's agricultural sector back to its growth record of the 1960s and 1970s.

The causes of the recent economic crisis must be seen in the context of both the country's violent internal conflicts and the external economic factors, especially the deterioration of terms of trade and the much increased interest rates for capital investments. In a country with a very small public sector and extremely limited public services for the poor, the economic crisis is assumed to have hit particularly hard the low-income stratum of the population, which in Guatemala is a large proportion of the population.

Poverty in Guatemala is predominantly a rural problem and particularly concentrated in the Western Highlands. A survey in 1980 classified 36.2 percent of the rural population as absolute poor, as their income was too low to purchase an adequate diet. These rural poor constituted 73.5 percent of all poor. Agricultural income per household was about 40 percent below the average of other rural areas in the country.[11]

HISTORICAL EVOLUTION OF COMMERCIAL AGRICULTURE IN THE LARGE AND SMALL FARM SECTOR

The dualistic structure of Guatemala's agriculture with large-scale farms versus *minifundas* mainly in the hands of Indian farmers is largely an inheritance of the structural change introduced by the Spanish during the colonization of the country.[12] With the introduction of coffee cultivation after the 1840s, much of the best land in

the highland departments was absorbed into expanding coffee haciendas. The indigenous population who had been farming these lands for generations were forced to move to higher, less fertile lands in order to continue to grow their subsistence crops--maize and beans.[13] This change took place mainly between 1870 and 1920.

Another major export-oriented change with long-term consequences not only for agriculture but also for political stability of the country emerged in the 1920s and 1930s when the United Fruit Company acquired large landholdings mainly for banana plantations in the fertile lowlands. Concessions to the company by the government were about 190,000 hectares.[14]

The basic effect of the traditional export orientation in Guatemala's agriculture was an increased concentration of land in large farms and of the indigenous population in the remaining high altitude areas with unfavorable land quality. At times forced labor obligations were imposed on this population to provide the labor demand in the export crop sector.[15] Through reduction of the land-resource base for the Indian population, the opportunity cost of labor on their own small holdings was reduced which assured a cheap labor supply to the large-scale farmers.

Technological change in the food crop sector was not exceedingly successful in Guatemala.[16] Growth in yields of maize was 1.6 percent per annum between 1971/73 and 1981/83. The traditional food crops in the small farm sector are only produced at a level of small marketed surplus and have thus not developed to cash income-earning crops. In the typical Western Highland situation, about 90 percent of maize grown

is retained for own consumption. It is only recently that maize production has increased in the large-scale farms.

Export vegetables, the focus of this study, were introduced to Guatemala in the mid-1970s with substantial foreign investment.[17] Originally the scheme operated with an integrated production-processing (screening, packing, cooling) exportation system in the hands of one company. Soon the economic advantage of contract growing in the smallholdings in the Western Highlands became apparent. Company crop production was phased out and farmers in selected villages were awarded contracts. Main commodities were cauliflower, broccoli, snowpeas, and brussel sprouts.

This system continues to operate and the farmers of the cooperative *Cuatro Pinos*, the focus of this research, were part of this contract system in the early 1980s. Kusterer et al. point out the rather different effects of the contract-growing scheme in different locations of its operation.[18] The access to inputs and to restricted delivery for the contracted amounts of outputs was at various locations a problem to farmers. In general farmers were very eager to join the scheme. In fact a major short-term problem was that farmers had moved unexpectedly fast into production of some of the vegetables and the marketing and export channel did not keep up with this rapid adoption which led to critical frictions in the scheme between the contract partners.[19]

Export vegetable production is done at the individual farm level in the context of contract growing or independently relying on market middlemen--so-called *coyotes*. Much of the export vegetable production

stems from farmers who formed cooperatives. The positive attitude of Guatemala Indian peasants toward cooperation in production with households from the same ethnic group is a good basis for agricultural cooperatives.[20] In 1984, 812 cooperatives with more than 143,000 members were registered, of which 382 cooperatives were agricultural ones.[21] More than half of all cooperatives are located in the Western Highlands, the area of this study. Agricultural cooperatives had on average 167 members in 1983, less than half the size of the cooperative *Cuatro Pinos*, the subject of this study.

NOTES

[1] See R. F. Nyrop, ed., Foreign Area Studies, Guatemala: A Country Study (Washington, D.C.: American University, 1984), and extensive bibliography in this source; also World Bank, Guatemala: Economic and Social Position and Prospects (Washington, D.C.: World Bank, 1978).

[2] Lester Schmid, "The Productivity of Agricultural Labor in the Export Crops of Guatemala: Its Relation to Wages and Living Conditions," Inter-American Economic Affairs 22 (No. 2, Autumn 1968): 33-45.

[11] Guatemala, Ministerio de Economía, Encuesta Nacional de Ingresos y Gastos (Guatemala City: Ministerio de Economía, 1982).

[12] R. F. Nyrop, ed., Foreign Area Studies: Guatemala.

[13] Hough et al., Land and Labor in Guatemala, pp. 21-24.

[14] S. Kinzer and S. Schlesinger, Bitter Fruit: The Untold Story of the American Coup in Guatemala (New York: Double Day, 1983).

[15] R. F. Nyrop, ed., Foreign Area Studies: Guatemala.

[16] Consultative Group on International Agricultural Research Centres, Guatemala and the CGIAR Centres, Study Paper No. 5 (Washington, D.C.: CGIAR, 1984).

[17] A very comprehensive description and evaluation of the early operation is given by Ken Kusterer, Maria R. Estrada de Bafres, Josephina X. Cuxil, The Social Impact of Agribusiness: A Case Study of ALCOSA in Guatemala, Evaluation Special Study No. 4 (Washington, D.C.: U.S. Agency for International Development, July 1981).

[18] Ibid., pp. 6-9.

[19] Ibid., pp. 17-24.

[20] Laurel Herbenar Bossen, The Redivision of Labor: Women and Economic Choice in Four Guatemalan Communities (Albany: New York Press, 1984).

[21] Of the 812 cooperatives, 731 were considered actually active at the end of 1983 (according to El Instituto Nacional de Cooperativas (INACOP) as stated in Fondo Internacional de Desarollo Agricola, Estrategia Para el Desarollo de la Produccion Campesina, p. 137.

3. ACTORS THAT INITIATED AND OPERATE EXPORT CROPPING IN SMALLHOLDER AGRICULTURE: THE CASE OF THE COOPERATIVE *CUATRO PINOS*

Food and agricultural policy plays a key role in shaping the commercialization of traditional agriculture. Commercialization of subsistence agriculture does not simply develop as a result of changes in economic incentives or new technology at the farm level, the processing level, or in marketing. In a specific case as the one studied here, it is apparent that the commercialization process is to a large extent also influenced and designed by actors at the local level and, especially in case of export crops, by actors who are quite removed from the local farm production scene. The cooperative *Cuatro Pinos* is an interesting case in point.

SOCIOECONOMIC ENVIRONMENT OF *CUATRO PINOS* AT THE OUTSET

The cooperative *Cuatro Pinos* is active in six villages in and around the municipio (county) Santiago Sacatepéquez located about 35 kilometers to the west of Guatemala City.[1] Santiago is the base of the cooperative with its storage and processing facilities for the export vegetables. The community is connected to the paved road of the Pan-American Highway which is five kilometers away. The altitude is around 1,900 to 2,000 meters.

According to a survey carried out in 1977, 10 percent of the cultivated area was devoted to the production of different vegetables.

The remaining 90 percent were for maize and beans.[2] Between 10 and 15 percent of family heads living in Santiago were working in Guatemala City. In general they were relatively young and had access to small parcels of land below subsistence levels.

In one of the main villages in which *Cuatro Pinos* is operating--Santa María Cauqué--a comprehensive longitudinal study on population, agriculture, nutrition, and health depicts the situation before implementation of the cooperative.[3] Between 1963 and 1971, the population increased at a rate of 3.1 percent per annum, while farm size decreased at a rate of 3.5 percent. Since then population growth increased at a rate of 3.5 percent per annum. This particular village, however, is a rather untypical case. The trend toward cash crops was established even prior to the establishment of the cooperative, but the cooperative reinforced the trend. This village was more commercialized at the outset than the other five villages of the cooperative, mainly because of its favorable access to transport and communication infrastructure by virtue of its proximity to the Pan-American Highway. In the 1960s the cropping pattern changed gradually showing a reduced share of subsistence crops. Since the early 1970s to 1985, the share dropped substantially from 70 to 50 percent corresponding to the increased share of new export crops and traditional vegetables (Table 5).

The incidence of severe protein calorie malnutrition (PCM) was found to be considerable in the village of Santa María Cauqué. In a cohort analysis between 1964-69, 13 percent of 1-year-old children, 27 percent of 2-year-old children, as well as 9 percent of 3-year-old

Table 5--Average farm size, population, and land use pattern in Santa María Cauqué, Western Highlands, 1963-1985

	1963	1967	1971	1985
Farm size (in hectares)	1.2	1.1	0.9	0.8
Land use (in percent)				
Maize and beans	78.7	73.2	70.5	49.5
Vegetables and others (including export crops)	21.3	26.8	29.5	50.5
Population	1,071	1,254	1,370	2,225[a]

Source: L. J. Mata, The Children of Santa María Cauqué: A Prospective Field Study of Health and Growth (Cambridge: Massachusetts Institute of Technology Press, 1978), p. 18, and INCAP/IFPRI survey, 1985.

[a] Estimated on the basis of a 1983 census done by INCAP.

children, were found to be affected by PCM.[4] Most cases of severe PCM occurred in the rainy season (June-September) when infectious diseases --particularly measles, diarrhea, and respiratory infections--are more frequent. In explaining this pattern of the prevalence of PCM, Mata concludes that "the relationship of food availability, marketing, and cash to malnutrition deserves serious investigation."[5]

At the outset, the general socioeconomic environment, health and nutrition situation in the area of the *Cuatro Pinos* communities appeared to be not particularly different from the general situation in the Western Highlands. Some special features of the economic environment are, however, noteworthy: the closeness to the capital city and the good infrastructure facilitated market integration with fresh vegetables. Average farm size is below the average in the Western Highlands. Also, there are no big farms in the location. This has two implications: there were no serious conflicts over land at least in the 1970s, and the influence of non-Indian farmers on the social organization and economic activities in the municipality was small. Thus, there was neither an important social force to oppose the local development of the cooperative nor landowners who considered the promotion of the profitable labor-intensive crops as a threat to their control over the labor market.[6]

THE EVOLUTION OF EXPORT CROPPING BY *CUATRO PINOS* FARMERS

The adoption of export vegetable production by small farmers in the Western Highlands is determined by long-term changes in economic

variables, especially increased demand for these crops in the U.S. and European markets and the growing labor-land ratio in the small farms. Both of these factors increase the comparative advantage of labor-intensive crops in rural environments of increased (seasonal) under-employment. International development assistance organizations played a catalytic role in the beginning for the rapid use of potential economic benefits from nontraditional export crop production in the Western Highlands. The interaction of four groups of actors finally led to the rapid expansion of export vegetable production:

- External development assistance organizations were instrumental at two different levels. First, they provided the seed money (loans) to a private company, Alimentos Cogelados S.A. (ALCOSA), to open up the export channel (Latin American Agribusiness Corporation S.A. [LAAD] and U.S. Agency for international Development [AID] played a role in this respect); second, they stimulated the formation of the cooperative, implemented its programs, and assisted in securing access to the export channel through private exporters (SWISS GROUP, a Swiss nongovernmental organization).
- An external private company (ALCOSA, a subsidiary of Hanover Brand Company based in the United States) provided the know-how, the export channel to the U.S. market, including the related infrastructure facilities such as cold storage.
- Guatemalan public institutions provided the know-how on agricultural technology (ICTA, INCAP) and farm level credit (BANDESA).
- Local farmers (cooperative *Cuatro Pinos*) formed the cooperative which organizes the export vegetable production, provides field

level extension, input supply, produce collection, selection, and storage. Lately the cooperative has organized its own exports independently from the ALCOSA outlet both to the U.S.A. and Europe.

The interaction of these players in the various phases of the process of increased commercialization was quite different in the different phases of the process. The following calendar of events which led to the expansion of vegetable production for exports at *Cuatro Pinos* sheds light on this:

	Export Vegetables in Guatemala	Cooperative *Cuatro Pinos*
1970	LAAD founded (LAAD's Central American subsidiary mainly funded through USAID loans)	
1971	(ALCOSA) began operations in Guatemala with a LAAD loan (freezing fruits and vegetables)	
1975	ALCOSA is purchased by Hanover Brands, Inc. and expanded with new loans from LAAD to export vegetables to U.S. (okra, broccoli, cauliflower, brussel sprouts)	
1976	Main production of vegetables for export by ALCOSA started on company lands leased by ALCOSA. Small experiments with small farmers began.	Earthquake in the Western Highlands. Death toll about 20,000. The Swiss group comes to rebuild Santiago Sacatepéquez.
1977	Setting up of buying stations for cauliflower from small farmers in the highlands.	Swiss group's development programs: food aid; literacy courses, along with reconstruction work in villages. Formation of groups which later formed the cooperative.

continued

	Export Vegetables in Guatemala	Cooperative *Cuatro Pinos*
1978	Rapid expansion of cauliflower program	Implementation of agricultural programs: maize improvement, traditional vegetables; contract with ALCOSA through Swiss group for broccoli and cauliflower production in Santiago Sacatepéquez.
1980	Production on ALCOSA's own farmland closed; all cold weather vegetables now from small highland farmers (about 2,000 farmers in purchasing program; delivering to 17 stations); crisis of ALCOSA: contracts were signed for much more broccoli, cauliflower than plant's processing capacity; breakdown of field organization; suspension of purchases; losses to farmers.	Construction of buildings for cold storage and packing at cooperative headquarters at Santiago Sacatepéquez; contractual arrangements with fresh snowpea exporters.
1981	Expansion of processing capacities of ALCOSA; change in contractual arrangements with farmers.	Rapid expansion of the cauliflower, broccoli and snow pea production and direct exports by the Cooperative to U.S.
1987	Five companies (Guatemalan) in addition to ALCOSA started freezing vegetable business.	Further expansion of cooperative. Construction of own freezing, processing facilities. 20 percent of exports to Europe.

Production technology, management, and on-field supervision requirements for export vegetables suggest that these crops are well placed in the smallest farms. The early experience of ALCOSA with crop production and procurement clearly indicates that the production of export vegetables (broccoli, cauliflower, snowpeas) has rapidly decreasing returns to scale. The production initially started on land leased by ALCOSA where up to 400 people were directly employed by the company. Then ALCOSA contracted middle-sized farms of 20 to 40 hectares operated by agricultural entrepreneurs, and finally, shifted to the very small farmers. While ALCOSA initially intended to depend on its own farming for raw material, it soon began to rely more on its outgrowers.[7] Likewise the experience showed that nontraditional commercial farming entrepreneurs in the middle-sized farms were not a satisfactory source of supply in this case.

The apparently higher comparative advantage of this type of vegetable production in the smallest farmsize class is not only due to the high labor intensity of the work tasks but also due to careful on-field management and supervision requirements to meet quality standards that are better fulfilled by the small farmers which have experience in traditional vegetable production. These production characteristics are important features for the sustainability of export vegetable production in the hands of small farmers. Along its development path, *Cuatro Pinos* has benefitted from institutional support and soft loans for its investment but not of subsidies for on-farm production. The institutional support and know-how transfer was probably the more important ingredient for the growth of the cooperative.

By 1987, the cooperative *Cuatro Pinos* had expanded to 1150 members, compared to 177 members in 1979 (Table 6). The coop farmers were growing nearly 300 hectares of export vegetables in 1985. More than half of it was devoted to snowpeas. The area under these crops quadrupled since 1980/81 (Table 7). At the cooperative headquarters, about 150 persons--more than half of them women--found employment in screening and packing work.

SUSTAINABILITY OF THE EXPORT CROP PRODUCTION BY SMALL FARMERS

Export vegetable production is frequently considered risky for small farmers. Various types of risks are distinguished in this respect:

- the risk of crop failures (pest, weather).
- the risk of price collapses.
- the risk of a breakdown of the marketing institutions (the domestic or external part of the channel or both).

While the production risk at the farm level shall be discussed later on the basis of farm survey data, the two "institutional" risks shall be immediately addressed.

Price Risk and Exchange Rate Policy

Prices of export vegetables, and those of snowpeas in particular, are extremely unstable compared to, say, staple food prices. Highest and lowest prices for snowpeas of similar quality paid to *Cuatro Pinos* farmers in 1985 ranged from 0.10 to 2.00 Quetzal with a median of about 0.80 Quetzal per pound (see Figure 2). These fluctuations

Table 6--Evolution of membership in the cooperative *Cuatro Pinos*, 1979-1986

Year	Number of Members
1979	177
1983	419
1987	1150

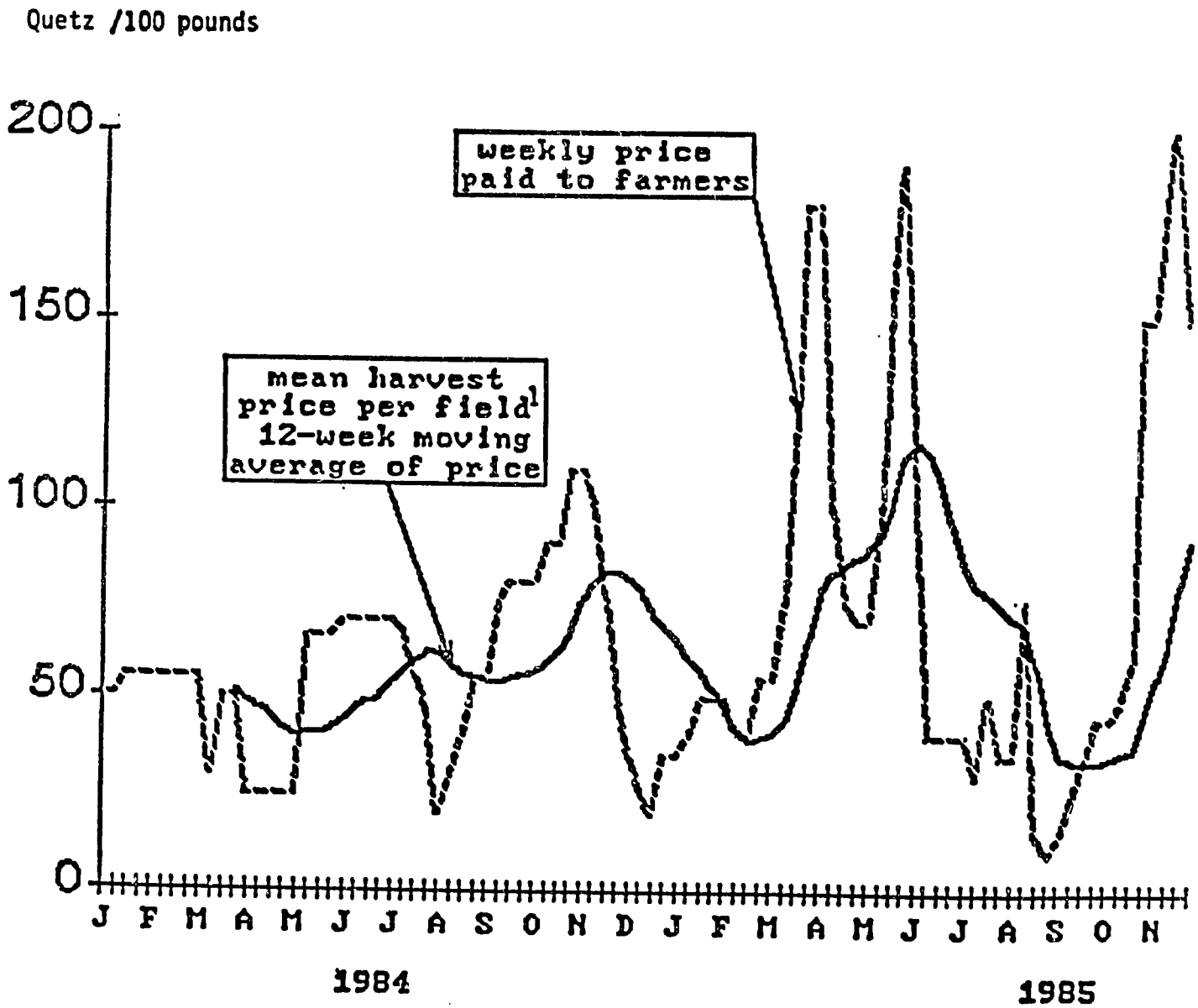
Table 7--Area under export vegetable crops marketed by cooperative *Cuatro Pinos*, 1980-1985

	1980/81[a]	1984/85	1985/86
		(hectares)	
Snowpeas	6	90	170
Cauliflower	61	67	67
Broccoli	0	10	45
Parsley	0	2	7
Total	67	169	289

Sources: Records of cooperative *Cuatro Pinos*.

[a] Rough estimate.

Figure 2--Snowpeas prices paid to farmers by Cooperative "Cuatro Pinos" (1984-1985)



Source: Management of Cooperative "Cuatro Pinos".

[1] The 12-week moving average represents the average harvest price of a field as a field is harvested over a period of 12 weeks.

reflect directly the actual price movements in the export markets (that is especially the spot markets in Miami, Los Angeles, and London). The fluctuations are the result of short-term supply and demand changes. Various regions enter the markets of these products at different points in time (Mexico, California, Dominican Republic). Other types of fresh vegetables probably induce substitution effects on the demand side in various seasons but little is known about these. However, it is important to note that the high degree of price instability of snowpeas from week to week does not translate into a similar instability of returns from the crop. Harvesting of the crop starts 9 weeks after planting and extends over 10 to 12 weeks with 3 pickings of crop per week. The grower is thus facing an average price over the whole harvesting period of a field. A farmer who, for example, has grown his crop in the beginning of June 1985 and was harvesting in August, September, and October delivered his crop at prices ranging from 0.10 to 1.50 Quetzal per pound with an average--depending on volume at the specific points in time--of about 0.55 Quetzal per pound. The price fluctuations listed in Figure 2 are thus smoothed out in 12-week moving averages with which they actually translate into gross revenues from the crop. Farmers also can--and actually do--phase grow the crops on different plots at various different points in a year which further reduces the price risk.

Such price variability is not necessarily a problem for farmers if it represents a seasonal pattern with predictable ups and downs in prices. For some time it was assumed that snowpea export prices were at a seasonal high during September to December and farmers were

accordingly advised to plant during that time. In recent years, however, no clear seasonal price pattern occurred, confronting farmers with a high degree of uncertainty. Developments on the supply and demand side of the international market for snowpeas, such as increased demand from Western Europe and increased supply in various seasons from other producing regions such as the Dominican Republic, other Central American countries, and California, appear as important factors. Also, little is known about substitution effects of changes in prices of competing types of vegetables for the formation of prices of such luxury vegetables as snowpeas. To predict future crop prices, which is crucial for the sustainability of the export operation, is hardly possible with any acceptable margin of error. Demand in the rich countries of the North appears to rise. However, as long as new technologies are not developed which would permit the cultivation of the crop with substantially lower labor input in comparable climatic zones, small farmers in the Guatemalan highlands have a sustained comparative advantage due to the local labor supply situation. So far deflated average prices for snowpeas paid to coop farmers do neither show a decreasing nor an increasing tendency since 1984. First quarter averages (January-April in 1984 prices) were 0.50 Quetzal per pound in 1984, 0.36 in 1985, 0.76 in 1986, and 0.61 in 1987. The variability of prices also does not show a particular tendency in these years.

Comparative advantage of export vegetables at the farm level is directly affected by the exchange rate policy which determines changes in the price ratio between traded and nontraded agricultural products and inputs. Only recently in Guatemala, exchange rate policy changes

introduce an additional uncertainty element into the price environment. Government policy changes on exchange rate are not predictable for farmers. Thus, the erratic exchange rate policy discussed above establishes one component of the price risk facing the farmer.

The overvalued exchange rate in the early 1980s and the multiple exchange rate system in place in 1985/86 translate into a changing taxation of the export vegetables. In mid-1985, the exchange rate system for vegetable exports required 50 percent of the sales value to be exchanged at the official exchanged rate (1 Quetzal=U.S. $1) and permitted the other 50 percent to be exchanged at the parallel rate (about 1 Quetzal = U.S. $0.27). Even taking into account a common practice of under-reporting the sales value, this exchange rate policy resulted in an export tax of about 25 percent for snowpeas (see Table 8). This tax favors production of domestically consumed traditional vegetables and to some extent the subsistence crops (maize, beans). It also suggests that returns to farm labor in the small enterprises in the Western Highlands are cut. The export tax for the labor-intensive new vegetables in the Western Highlands had adverse effects on employment and real income of the rural poor.

Risks in the Marketing Institutions

It is obvious that the sustainability of the export operation of a perishable commodity highly depends upon the proper functioning of the marketing channel of inputs and outputs (Figure 3). Input markets of fertilizer and pesticides appear well integrated in Guatemala.

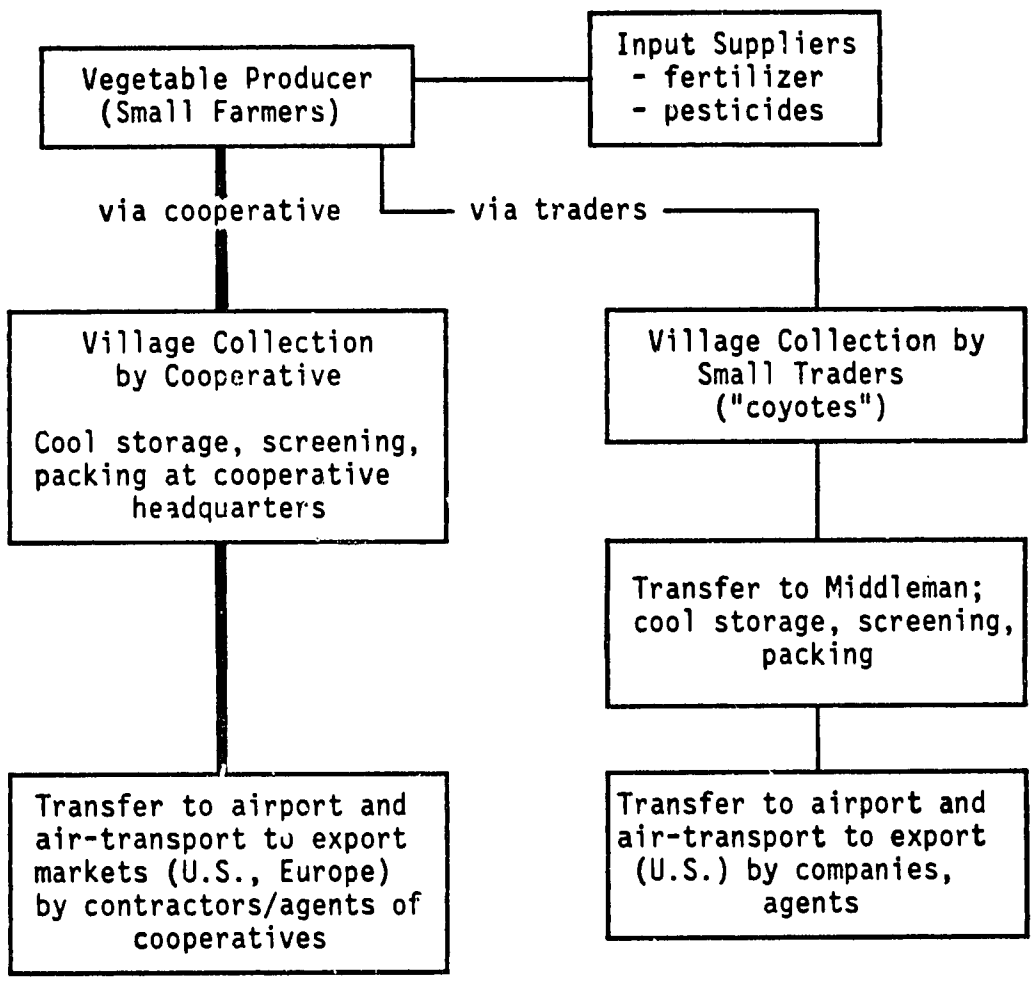
Table 8--Effect of exchange rate policy on export vegetable producer price: an example from a snowpea sale in July 1985 from Guatemala to United States

(1)	Actual "return-price"[a] of a shipment	0.35 US$/pound
(2)	Declared "return-price" of shipment (lowest price noted on market in reference period of shipping)	0.25 US$/pound
(3)	50 percent of declared "return-price" at official exchange rate (1 Q = U.S. $1)	0.125 Quetzal/pound
(4)	50 percent of declared "return-price" at parallel exchange rate (1 Q = U.S. $0.27)	0.463 Quetzal/pound
(5)	Difference between actual and declared "return-price" at parallel exchange rate (1 Q = U.S. $0.27)	0.407 Quetzal/pound
(6)	Actual "return-price" in domestic currency (position [3] + [4] + [5])	0.995 Quetzal/pound
(7)	Tax due to official exchange rate applied to 50 percent of declared "return-price" (in position [3])	0.338 Quetzal/pound
Tax in percent of actual "return-price" position [1] at parallel exchange rate		25.4 percent

Source: Information from traders in Guatemala.

[a] "Return-price" is the net price CIF US market (Miami) after transport and handling costs are deducted. It is "returned" to the exporting cooperative who passes it on to farmers after deducting local marketing margins.

Figure 3--Marketing channel for fresh export vegetables from Guatemala



Domestic prices of inputs are largely determined by international price changes and increasingly so by the exchange rate policy.

The output marketing in the study area is largely via the cooperative *Cuatro Pinos*. The sustainability of this institution is crucial for the profitability of export crop production. Cooperatives in the Western Highlands have a mixed record of success. It is not uncommon for cooperatives to collapse due to dishonest management practices or political reasons especially during the period of violent conflicts in the late 1970s and early 1980s. The survival and growth of the cooperative *Cuatro Pinos* appears as a successful exception to the rule.

The technology required for the operation of the first phase of the export channel within the country is simple and does not require major external inputs or expertise. An important component of the marketing system is the flow of information from the export market to the cooperative and the growers. Increasingly developing its outreach, the cooperative has recently started shipping to European markets. This international flexibility further reduces the risk of dependence that occurred in the early stage of the export vegetable production when ALCOSA was the single buyer (see discussion in previous chapter). In 1987 five companies, in addition to ALCOSA, processed frozen vegetables and 6 other companies are operating the fresh export channel which now provides for a highly competitive market structure. Recently the cooperative has started to process dried vegetables (parsley) in storable form and construction of an own freezing facility.

Also, farmers have now an alternative market outlet for export vegetables, in addition to the coop, via small traders which collect at

village level. The quantities acquired by these traders appear small in the study region. This competitive outlet reduces the risk to farmers that his access to export markets would break down in case of a collapse of the cooperative.

The marketing costs of fresh vegetables (for example, snowpea) are high. The consumer price in the U.S. was about five times the producer price paid in Guatemala in 1985 (Table 9). Apart from a 10 percent sales commission to the brokers who arrange the sale in the U.S. market, the marketing costs (CIF Miami) are not affected by the sales value. The marketing costs to Miami were about 18.7 percent of the consumer price or roughly equal to the producer price. Any fluctuations in the U.S. market price are fully and immediately transmitted to the (Guatemalan) producer. Cutting marketing cost appears a desirable approach to benefit producers and consumers, but in this particular case not much space appears available for cost-cutting measures.

Some interesting conclusions can be drawn from the assessment of "institutional risks" faced by the export crop producer. These risks can be reduced by opening up alternative marketing and processing lines at a level close to the farmers as well as by diversifying the export markets to avoid monopsonistic pressures. Options for diversification in production and processing, and export target markets within the group of export vegetables are substantial and have effectively been exploited as risk-reducing measures. The know-how for this--transferred via an institution such as a cooperative--may be at least as

Table 9--Marketing costs of a fresh export vegetable (snowpeas) from Guatemala to the United States, 1985

	Price	Prices and Marketing Costs in Percent of U.S. Consumer Price
(1) Price paid to farmer	0.90 Quetz/lb[a]	
	0.57 U.S.$[b]	19.0
(2) Cost of marketing		
(2.1) Local cost at cooperative:		
o loss due to final selection	0.05 Quetz/lb	
o packing box	0.15 "	
o labor	0.03 "	
o coding	0.02 "	
o overhead/or management	0.03 "	
Subtotal	0.28 "	
	(0.08) U.S.$[c]	2.7
(2.2) Cost of exporting to U.S.:		
o (air)freight to Miami	0.30 US$/lb	
o freight to sales place	0.03 "	
o cooling	0.02 "	
o customs	0.03 "	
o commission for broker (10% of gross sale) approx.	0.10 "	
Subtotal	0.48 "	16.0
Total marketing cost	0.56 "	18.7
(3) Total cost of produce CIF Miami	1.13 "	37.7
(4) Marketing margin and profit in U.S.	1.87 "	62.3
(4) Price to U.S. consumer	3.00 US$/lb[d]	100.0

[a] Approximate weighted average price for farmers in 1985; fluctuated actually between 0.15 to 2.00 per pound.
[b] The weighted split exchange rate 50 percent at parallel (=3.65) and 50 percent official (=1.00) is used here.
[c] The parallel exchange rate is applied here.
[d] In 1985, this price varied between 2.00 and 4.00 U.S.$ per pound.

advantageous to farmers' income stability as any attempts to efficiently organize on-field production stability.

It is in the best interest of farmers that cooperatives and merchants not only coexist and compete at the produce collection level but operate independent export lines. This has been finally achieved in the area where *Cuatro Pinos* operates. Such competitive structures can, however, not be expected to arise in the earliest phase of new export crop introduction. Monopsonistic patterns and i*s related problems appear more likely as was the situation in the early phase of export vegetable production (see Chapter 2 above). Export vegetable production of cooperative *Cuatro Pinos* started out as a contract activity with monopsonistic characteristics--a branch of a multinational being the sole buyer in the country. Over a period of 5 years, the cooperative changed substantially as it began to operate independently and competitively in the regional and international market and as other private companies were set up. This development is basic to the reduction of the "institutional risk" involved in export crop production.

NOTES

[1] Since 1987, the cooperative operates in 8 villages.

[2] Alberto Hintermeister, "Report on 'Cuatro Pinos,'" Guatemala City, June 1986, p. 10 (mimeographed).

[3] L. J. Mata, The Children of Santa María Cauqué: A Prospective Field Study of Health and Growth (Cambridge: MIT University Press, 1978).

[4] Ibid., p. 298.

[5] Ibid., p. 302.

[6] Hintermeister, "Report on *Cuatro Pinos*," pp. 11-12.

[7] Kusterer et al., The Social Impact of Agribusiness, p. 13.

4. SURVEY DESIGN, SAMPLING, AND SURVEY EXECUTION

The household level data of this research are based on representative surveys undertaken in the six villages where the cooperative *Cuatro Pinos* was active in 1985. The sample is based on a census in the villages done in 1983 by INCAP.[1] A roughly equal number of members of the cooperative (n=195)--that is, growers of the new export crops--and nonmembers (n=204) were drawn at random by village from the census information. To assure a reasonable coverage of the situation in the smaller villages, the sample was biased toward the four small communities among the six villages. This brings the sample closer to the prevailing village pattern in the Western Highlands. The proportional adjustments of the sample by village size led to a coverage of 38 to 75 percent of the coop members in each community (average, 47 percent) and 8 to 17 percent of noncoop member households (average, 11 percent) in these communities (see Table 10).

The identical households were surveyed in 1983 and 1985. The households were visited between November and January 1983/84 and 1985/86, respectively. The fact that the surveys were done during the same time of the year avoids the seasonality effects which might disturb comparisons between the two rounds.[2]

The composition of the 1985 sample is affected by changes in household characteristics since the 1983 survey. Some households split into two when the younger generation started its own households, some

Table 10--Village level information: sampling, 1983, 1985

	San Matéo	El Rejón	Sta. María Cauqué	Pacul	Pachalí	Santiago	Total
Size of village (number of households 1983)	195	180	445	95	141	1,250	2,306
Coop members 1983	21	15	65	32	38	248	419
Nonmembers 1983	174	165	380	63	103	1,002	1,887
Sample 1983							
Coop members	13	10	36	24	18	94	195
Sample population in percent of total[a]	(62)	(67)	(55)	(75)	(47)	(38)	(47)
Nonmembers	29	27	32	11	18	87	204
Sample population in percent of total[a]	(17)	(16)	(8)	(17)	(17)	(9)	(11)
Sample 1985							
Coop members	12	15	31	20	17	84	179
Nonmembers (incl. nonfarmers)	28	23	37	14	20	100	222
Nonmember farmers	24	23	34	12	16	70	179
Years of coop membership in 1985							
< 3	5	15	3	7	1	19	50
3-4	7	...	14	4	9	19	53
5-7	...	...	14	9	7	46	76

a The percentage figures represent the percent of total population covered in the communities by the sample survey.

coop members dropped out from the cooperative, and some nonmembers became members of the cooperative. Also, some households could no longer be interviewed because of long-term absence. Between 1983-85, 9 percent of the coop member sample left the cooperative and 6 percent of the nonmember sample became members. Taking the stratification of the sample into account, these numbers suggest a net increase of members by 19 percent since 1983. This roughly corresponds to the actual change in the membership statistics of the cooperative between 1983 and 1985.

The sample is spread over early and late adopters. Forty-two percent of the sampled households of the coop members are in the scheme as long as five to seven years. Newcomers are spread over all the six communities while the early adopters are all in the four founding villages of the cooperative (see Table 10, bottom).

The field data collection for the 1983 and 1985 survey was done by the experienced INCAP survey staff.

The household level information collected includes:

- demographics of the household (employment, schooling);
- health, anthropometrics of children under 10 years of age, and child feeding practices;
- housing conditions;
- access to services;
- nonfarm income (by individual, by source);
- agricultural production (inputs, outputs, labor at field level by crop, size of fields, produce sales, input purchases, animal production, land quality);

- food expenditures and consumption of own-produced food;
- nonfood expenditures.

The various types of information are covered over recall periods specific to the nature of the data. The agricultural production covers the crop years 1982/83 and 1984/85 (May-April) and the off-farm income which covers the 12 months preceding the surveys (November-October 1982-83 and 1984-85). Food and nonfood expenditures are monthly (October 1983, October 1985) with an annual recall for lumpy nonfood expenditures (especially durable goods) added to the 1985 survey which covers November 1984-October 1985.

In a subsample of the 1985 survey consisting of 40 households in two communities (El Rejón and Santiago de Sacatepéquez), a detailed assessment of intrahousehold decisionmaking and of sexual division of labor and time allocation of household members was undertaken parallel to the large survey.[3]

NOTES

[1] INCAP, Evaluación de Características Sociales y Nutricionales de Seis Comunidades Participantes en la Cooperative Cuatro Pinos, Departamento de Sacatepequez, Guatemala, 1983-1984 (Guatemala City: INCAP, División de Clasificación Alimentario y Nutricional, 1985).

[2] Seasonality in food consumption and nutritional status, however, appears not very pronounced in Guatemala. See Victor Valverde et al., "Seasonality in Health and Nutrition in a Guatemalan Coffee Plantation," Guatemala, INCAP, August 1985 (mimeographed).

[3] Isabel Nieves, "An Exploratory Study of Intrahousehold Resource Allocation in a Cash-Cropping Scheme in Highland Guatemala," International Centre for Research on Women, Washington, D.C., 1987 (mimeographed).

5. EFFECTS OF THE NEW EXPORT CROPS ON AGRICULTURAL PRODUCTION, INCOME, AND EMPLOYMENT

ADOPTION OF EXPORT CROPS BY THE SUBSISTENCE FARMERS

Agriculture in the survey area was formerly dominated by maize and beans production with 10 percent of the land devoted to vegetables for the local market. Those farm households who are not members of the export crop cooperative and live in the more remote sample villages still show this cropping pattern in 1985. In villages such as El Rejón, Pacul, and Pachalí, maize and beans cover 84 to 96 percent of the crop area of noncoop member farms (Table 11).

The importance of access to infrastructure for the degree of market integration is revealed by the case of Santa María Cauqué which is located at the highway to Guatemala City. There, even nonmember households plant only 51 percent of their land with the subsistence crops (Table 11).

Coop members farm on average 0.94 hectares while farming nonmembers have 0.66 hectares (Table 11). Comparisons of the two groups, therefore, must take the farm size difference into account. Accordingly, most agriculture-related information is presented by farm size classes in this chapter. It is interesting to note that with these holdings and the allocation of 52 percent of land to subsistence crops by coop members and 78 percent by nonmembers, on average, households in

Table 11--Village level information: farm size and cropping patterns of members and nonmembers of the cooperative *Cuatro Pinos*, 1985

	San Matéo	El Rejón	Sta. María Cauqué	Pacul	Pachalí	Santiago	Total Average
Farm size (hectares)							
Members	0.82	1.15	0.86	0.61	1.06	0.85	0.94
Nonmembers	0.64	0.95	0.83	0.80	0.58	0.54	0.66
Maize, beans (area percent)							
Members	48.8	62.6	41.3	45.3	42.4	57.7	51.8
Nonmembers	81.6	83.9	51.0	87.2	95.5	81.9	77.8
New cash crops (area percent)							
Members	45.9	35.4	38.8	41.8	53.3	35.9	39.3
Nonmembers	4.0	8.0	22.1	3.3	1.5	7.3	8.9
Traditional cash crops (area percent)							
Members	5.3	2.1	19.9	12.9	4.4	6.4	9.1
Nonmembers	14.5	8.1	26.9	9.5	3.0	10.9	12.8

Source: INCAP/IFPRI survey, 1985.

both groups allocate roughly the same land area to subsistence crops (members, 0.49, versus nonmembers, 0.51 hectares).

Export crop production is open to every farmer in the communities. Because another marketing channel for the new export crops has begun operation recently by merchants outside the cooperative *Cuatro Pinos*, the option to grow export vegetables is not entirely tied to the membership in the cooperative. However, with the exception of Santa María Cauqué, a centrally located village where many merchants base their operations, only a very small group of nonmember farmers grow the new crops. This means that becoming an export crop farmer was in most villages synonymous with becoming a coop member. This decision was a matter of free choice.[1]

The major decisions made in commercial and subsistence agriculture are decisions that are mostly made either exclusively by the male head or are made jointly by men and women but are dominated by men. Nieves finds that the presence of the cooperative seems not to have altered this relation, at least not in the short term. In her case study on 21 households which are a subsample of the INCAP/IFPRI survey in 1985, Nieves found that the decision to become a member was, in all 21 cases, prompted by the male head of the household.[2] In 16 of these cases, the male head asked the wife's opinion before taking any action. There are no legal or statutory barriers to female participation in the cooperative as member in their own right, yet very few women have membership status (5 women out of more than 1000 members in 1987). Nieves states that Indian women will only assume public, visible roles that are culturally sanctioned. Applying to the local committee for membership

in the coop would be an example of a public action traditionally not open to women. Coop membership is not a status that women feel they can attain, so they do not apply.

Membership in the cooperative is open to crop growers (but not necessarily a land owner) and small farmers by local standards (no coop member has more than 3 hectares). Coop members are obliged to participate in scheduled meetings of the organization and to pay a fee of 38 Quetzales once upon membership. This enrollment fee is not negligible as it roughly corresponds to a 12-day sum of wages for a farm worker.

To test the determinants of adoption of export cropping a PROBIT model is estimated in which the dependent variable equals 1 if the household is an export crop grower, and zero otherwise:

$$Y_i^* = \beta' X_i + u_i$$

with: $Y = 1$, if $Y_i > 0$

$Y = 0$ otherwise

and: $\text{Probability } (Y_i = 1) = \text{Probability } (u_i > \beta' X_i)$
$= 1 - F(-\beta' X_i)$

where F is the cumulative distribution function for u.[3] The β' are maximum likelihood estimates. As our sample of members and nonmembers is biased to have a higher (nonrepresentative) members' share in the sample, this has to be taken into account in estimating the probit model. The true proportion of members versus nonmembers are known from the census information 1983 and the cooperative records. They are used for weighing the observations with a weighing variable.[4] The probit estimates are listed in Table 12. From them the linear probabilities $\hat{\beta}_{LP}$ can be derived which can be approximated by[5]

$$\hat{\beta}_{LP} = 0.4\ \beta'$$

Table 12--Probit estimate of export crop adoption

Dependent variable: Export crop grower (=1, else=0)

Independent Variables	Coefficients	T-Ratio	Approximate Probabilities to Join the Export Crop Production[a]	Mean Value of Variable	Standard Deviation
FSZHA	0.65970	5.105	0.2630000	0.689	0.644
WLQ	-0.19191	-1.109	...	2.120	0.456
FOFFY	-0.00021	-2.540	0.0000848	406.600	932.900
LAB	-0.08476	-1.544	...	3.780	2.360
RWOMLAB	-1.00440	-2.016	0.4020000	0.466	0.179
HHAGE	-0.00822	-0.833	...	38.700	12.400
HHEDUC	0.32280	0.692	...	2.930	1.730
HHTRAD	-0.36682	-2.263	-0.1470000	0.545	0.489
VILLAGE 1	-0.54760	-1.953	-0.2190000	0.119	0.324
VILLAGE 2	0.17560	0.692	...	0.113	0.317
VILLAGE 3	0.78250	3.632	0.3130000	0.186	0.389
VILLAGE 4	-0.23840	-0.811	...	0.076	0.265
VILLAGE 5	-0.16220	-0.558	...	0.095	0.287
INTERCEPT	0.72380	1.258	...	...	...

Number of observations: 357.
Chi-Squared: 108.06.

[a] The values in this column are the $\hat{B}_{LP}$ for the parameters estimated with a reasonable degree of statistical significance (above 95 percent level).

The theoretical concept of the model application is the following: Income potentially earned off-farm determines the opportunity cost of working on the own farm. In the long run, earning off-farm income versus increased on-farm work growing the labor-intensive export vegetables is a choice facing farm households. This choice is determined by the off-farm versus on-farm opportunity costs of family labor. Endowment of human capital and established off-farm employment opportunities are determining these relationships for a specific household.

It is hypothesized that the choice to become an export crop grower was determined by the expected income increase which can be assumed to be determined by the resource endowments of the farm (farm size, land quality), on the one hand, and the access to alternative relatively secure off-farm employment. It should be noted that only a secure (formal) off-farm income source enters here as exogenous factor since, of course, high substitution of daily wage earnings and occasional trading income versus on-farm work in the new export crop prevails as is shown later.

We further hypothesize that the household labor force and its composition (women's share) may be a factor for adoption. A more sizeable household labor force may enhance adoption of the labor-intensive crop, and a higher share of women's labor may induce a different balance of preferences and bargaining positions in the household. Being mainly the male head of household's decision, his demographics (age), education level, and attitude toward traditional agriculture are other factors of hypothetical impact for the adoption decision.

Villages access to infrastructure makes a differences for adoption of the new crops. This and the step-wise expansion of the cooperative into some of the villages suggest to include village specific variables . into the model. Based on these hypotheses, the adoption model is specified as follows:

EXG = f (FSZHA, WLQ, FOFFY, LAB, RWOMLAB, HHAGE, HHEDUC, HHTRAD, VILLAGE1, ..., 5)

with:

EXG	=	export crop grower (=1 if more than 10 percent of area in nontraditional export crops, else = 0)
FSZHA	=	farm size (in hectares).
FOFFY	=	household income from formal off-farm employment (Quetzales per year).
WLQ	=	land quality index (1 = best, ..., 4 = worst).
LAB	=	total labor available in the household (that is, persons in working age) not disabled and not long-term absentees (in men equivalents).
RWOMLAB	=	share of women labor in total labor of households.
HHAGE	=	age of head of household (years).
HHEDUC	=	household heads education (years of schooling).
HHTRAD	=	household head's attitude toward maize production being "traditional" (= 1 if stated as most important reason for growing maize was for food <u>and</u> as second most important reason was that he grew maize to this extent because he always did so; else = 0).
VILLAGE 1-5	=	Dummy variables for villages 1...5 = 1 each (else = 0); villages as listed in Table 10 from left to right.

The estimation results indicate that the choice of households to adopt the new export crops is not independent of household and farm characteristics:

o Clearly, despite all farms in the sample being small by almost any standard, an increase in size of farm within this small-farm sector significantly increases the probability to become an export cropper. Applying the above mentioned conversion factor of 0.4 to

the parameter estimate (FSZHA in Table 12) suggests that one additional hectare of farm size increases the probability to grow export vegetables by 26 percent. The adoption-farm size relationship is complex. This finding of increased probability of adoption within the small farm sector with rising farm size is not contradictory to our earlier finding that the new export crops moved in a trial-and-error path from production on large-scale exporter enterprises to contract growing on medium-sized farms of 20-30 hectares to finally the small-farm sector. As the probability to adopt within the small farm sector is found here to increase with farm size up to a certain level, economies to scale are apparently not linear at the tail end. We find, however, that those smallest farms that did adopt actually grow a higher share of their land with the new crop. Adoption and extent of adoption are thus not synonymous (see Table 18).

- The model result suggests that the higher the income from formal off-farm employment--that is, relatively secure income from other sources than day labor--the higher the likelihood that households will not grow export crops. The estimation result suggests that if this type of relatively secure income increases by Quetzales 500 (which is approximately the difference between the mean and standard deviation of FOFFY), the probability to join the scheme decreases by 4 percent.
- An increased share of women's labor in total labor reduces the probability to grow export vegetables significantly (RWOMLAB). It should be noted that total labor force of the household is

controlled for (LAB). As noted earlier, adoption of the new crop is to a significant extent a male decision and the model results suggest that households with a women-dominated labor force stay away from the new crop.

- o Traditional motivation to grow maize to the current extent (as defined by HHTRAD) does significantly decrease the probability of becoming an export crop grower.
- o For households located in a remote village included in the scheme recently (village 1, San Matéo), the probability of becoming a member appears lower while it is significantly higher in village 3 (Santa Maria Cauqué) located at the highway.

The statistically nonsignificant results in the probit model are interesting to note as well:

- o Differences in land quality of the farm (WLQ) have not significantly affected the choice of becoming an export crop farmer.
- o Availability of household labor does not significantly affect the choice of becoming an export crop grower. The market for hired labor is highly integrated in the region which suggests this model outcome.
- o Age and level of education of the household head which we assumed to indicate human capital endowment of the household does not have a significant effect on the adoption probability.

In summary, we may conclude from these results that the less traditional farmers on the somewhat bigger (small) farms and those which do not have access to relatively secure (formal) off-farm employment were most likely to adopt the export crops.[6]

That comparatively bigger farms were joining the cooperative becomes clear from the distribution by farm size class among the member and nonmember groups. Table 13 reveals a tendency so often observed in patterns of adaption of new technologies and crops in peasant agriculture. Among early adopters are more with somewhat bigger farms (>1 hectare) than among the later cooperative members.

PROFITABILITY AND RISKS OF NEW EXPORT CROPS AND SUBSISTENCE CROPS

For those farmers willing to adopt new export crops, the returns of those crops to scarce factors is very important. In addition to the average profitability, the stability of returns from these crops is an important factor as risk may be an issue of concern. Gross margins are used as measure of profitability. The gross margins calculated are based upon the 1985 survey covering the 1984/85 cropping season as expressed in the cropping calendar (Figure 4). Gross margins include the value of output minus the direct costs. No rent for land is to be included if the field was rented. To assess the competitiveness of various crops at the farm level, gross margins are expressed per unit of land and per family labor day.

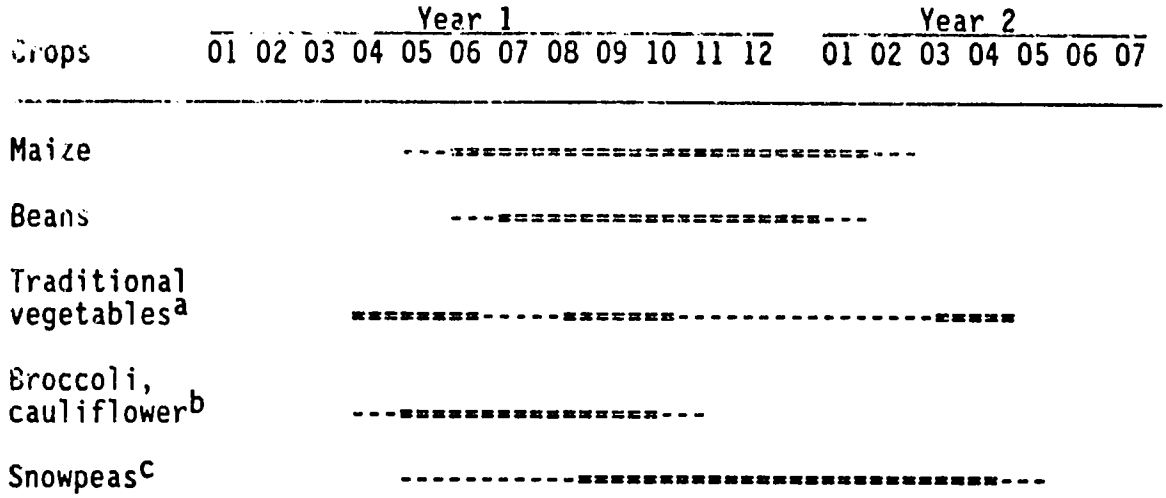
As snowpeas stand out as the main new crop in the following comparisons, its agronomic characteristics shall be mentioned here. The peas are sown in rows. Once about 20 centimeters high, the plants are tied to ropes that are stretched between sticks along the rows of the plants. The peas grow up to about 1 or 1.3 meters on the continuously added ropes. Main work tasks are weeding, spraying for pest

Table 13--Farm size distribution of coop members and nonmembers

Farm Size	Nonmembers	Coop Members Since... 2 Years or Less	3-4 Years	5 Years or More
(hectare)		(percent)		
< 0.25	25.8	5.0	6.1	2.8
0.25-0.50	36.0	20.0	24.5	20.8
0.50-1.00	21.3	47.5	40.8	41.7
> 1.00	16.9	27.5	28.6	34.7
Total	100.0	100.0	100.0	100.0

Source: INCAP/IFPRI survey, 1985.

Figure 4--Cropping calendar of subsistence crops, traditional vegetables and export vegetables in the Western Highlands of Guatemala



[a] Cabbage, carrots, radish, etc.

[b] Main planting season, May-August; main harvest season, June-September.

[c] Main growing period, August-April; main harvest period, October-June.

control, and picking the peas. Picking starts after an 8-week growing period and is extended over 10 to 12 weeks. The crop is thus on the field from 18 to 20 weeks. Snowpeas are sprayed 2 times per week over the growing period. The cost of recommended spraying in 1984/85 was 596 Quetzales per hectare. Because the devaluation of the Quetzal on the parallel market sharply increased this cost (see Chapter 3), the 1986 spraying bill was 310 percent of the 1984/85 bill.

The wage bill for snowpeas is considerably higher than any of the competing crops too. The related employment issues will be addressed later.

Being a legume (a variety of *p. sativum*), the snowpea enriches the nitrogen content of the soil which benefits crops that follow in the rotation.

Snowpeas yield a gross margin per unit of land 15 times higher than that of the principal subsistence crop, maize in coop member farms (Table 14). Per unit of family labor, the snowpeas gross margin is about twice the one reported for maize, as snowpeas absorb 7 times more family labor per hectare or 5 times more total labor input in terms of days than maize (Table 14). Traditional vegetables are roughly as profitable as broccoli and cauliflower per unit of family labor. Beans are between maize and the above vegetables. The per hectare input costs of snowpeas are about 13 times as high as maize. These high input costs of snowpeas stem from high use of pesticides and from the costs of special production inputs (sticks to bind the plants and ropes to tie the climbing snowpea plant to the sticks).

Table 14--Cost of production and gross margins of export vegetables and subsistence crops, 1984/85 (average sample values)[a]

Items, Costs	Noncoop Farmers Maize	Coop Member Farms: Traditional Crops: Maize	Traditional Crops: Beans[b]	Traditional Crops: Traditional Vegetables	New Export Crops: Broccoli/ Cauliflower	New Export Crops: Snowpeas
	(Quetzales per hectare, mean values of sample)					
Seeds, plants	0.20	0.21	26.55	106.30	85.76	54.87
Fertilizer	100.12	105.60	85.28	158.61	243.82	216.16
Other input	13.66	14.85	55.10	167.95	103.88	1,296.13
Total inputs	113.98	120.66	166.98	432.86	433.46	1,567.16
Wages paid	96.22	167.71	133.69	306.06	283.58	552.71
Value of output	353.75	457.80	681.00	1804.53	1,339.17	4,416.20
Gross margin/ha.[c]	**120.43**	**143.87**	**362.79**	**1,065.61**	**593.37**	**2,204.15**
	(Days per hectare, mean values of sample)					
Days of family labor per ha.[d]	63	54	121	299	168	400
Days of total labor per ha.[e]	101	119	172	416	277	613
	(Quetzales per day, mean values of sample)					
Gross margin per day of family labor	1.91	2.66	2.99	3.47	3.53	5.51

Source: Computed from INCAP/IFPRI survey (1985).

[a] The average values are based on 173 observations in noncoop member farms and 160 observations in member farms.

[b] Beans in sole stand.

[c] To compute the gross margin from value of output, wages, total inputs interest on the sum of purchased inputs and on the part of the wage bill for nonharvest labor is deducted. The interest rate used is 15 percent adjusted to the duration of the crop's growing period.

[d] Men's, women's, and child's labor days are weighted by 1.0, 1.0, 0.6, respectively.

[e] This includes hired labor.

Coop members finance the considerable input costs partly through agricultural credit. Forty-two percent of coop members had received credit during the previous year. On average the sum borrowed amounted to 480 Quetzal which covered the variable input cost for 0.3 hectares of snowpeas. Only three percent of the nonmembers reported to have had access to credit during 1984/85. It is interesting to note that those farmers who grow the new export vegetables under the cooperative scheme have higher returns and lower unit cost of production in the maize crop than other farmers (first two columns of Table 14). Their input cost and wage bill is higher, yet their output per unit of land is further increased which leads to this outcome. The relationship of this interesting pattern to the export vegetables is analyzed in detail below.

The ranking of crops by their profitability shows a similar pattern if the sample is disaggregated by farm size class (Table 15). There is a tendency that maize gross margins per hectare are decreasing with increasing farm size, both in export crop producers and other farms, but returns to family labor do not differ a great deal between farm size classes. Constant returns to family labor and decreased returns to land with increased farm size indicate that bigger farms operate at higher cost levels per unit of land and/or at lower yield levels. No general tendency is visible from the tabulations of gross margins of the new export vegetables per unit of land and labor. The apparently negative scale effects for these crops discussed above in the context of ALCOSA's experience (Chapter 3) may only become effective outside the range of small farm sizes observed in the sample.

Table 15--Gross margins of crops by farm size per hectare and per person day of family labor in farm households: export crop producers and traditional crop producers (coop members and nonmembers), 1984/85

Farm Size	Export Crop Producers					Traditional Crop Producers		
	Maize	Beans	Traditional Vegetables	Broccoli/ Cauliflower	Snowpeas	Maize	Beans	Traditional Vegetables
(hectares)				(Quetzales)				
< 0.25 per ha.	(188.00)[a]	...	(407.00)	...	(2198.00)	127.00	181.00	852.00
per day[b]	(2.61)	...	(1.00)	...	(3.74)	1.98	3.18	1.64
0.25 per ha.	175.00	(254.00)	(2654.00)	(365.00)	2791.00	149.00	191.00	609.00
< 0.50 per day[b]	3.13	(7.70)	(7.97)	(2.81)	6.10	2.10	3.19	2.14
0.50 per ha.	146.00	187.00	375.00	645.00	1785.00	85.00	(25.00)	397.00
< 1.00 per day[b]	2.43	2.25	1.24	3.41	4.52	1.42	(0.32)	1.15
> 1.00 per ha.	117.00	648.00	860.00	624.00	2398.00	84.00	83.00	935.00
per day[b]	2.72	5.36	3.54	4.22	6.97	1.83	3.19	4.16
Total per ha.	144.00	363.00	1066.00	593.00	2204.00	120.00	130.00	659.00
per day[b]	2.66	2.99	3.47	3.53	5.51	1.91	1.76	1.96

Source: INCAP/IFPRI survey (1985).

[a] Values computed from 10 observations or less are in parentheses.

[b] Child labor days are weighted with a factor 0.6; men's and women's working days are weighted 1.0 each.

Export crop producers being coop members have higher returns to both land and family labor on average for the three comparable crops (maize, beans, traditional vegetables; see last two lines in Table 15). In general this pattern is also revealed within the farm size classes.[7] Thus it appears that the more efficient farmers joined the export crop scheme as there is no indication of basic differences in land resource quality between the two groups. Yet, joining the cooperative farmers may have also improved their ability to access yield improving technologies--for example, inputs and information. These aspects shall be evaluated in more detail below. At this point it is worthwhile to note that export crop producers achieve higher returns to land and family labor from subsistence crops (maize, beans) than do other farmers although these farmers devote more resources into the new export vegetables.

The gross margin per day of family labor indicates the level of opportunity cost of family labor in agriculture. The gross margins per family labor day fall in the range of local wage rates which were 2.00 to 2.50 Quetzales in 1984 and 3.00 to 3.50 Quetzales in 1985 for a male's person day in the field. Women's wage rates are reported to range from 0.50 to 1.00 Quetzal below this. Returns to family labor in export crop farms exceed these male and female wage rates by a substantial margin. As a result, the labor supply into the local labor market from these farm households is expected to have substantially decreased.

Inseparable from the assessment of profitability of new export crops versus traditional crops is their comparative risk. There is a great deal of uncertainty about the new crops output and input price

fluctuations. A longitudinal study would be required to properly address the issue. Moreover, it should be reiterated that new export crops particularly impinge on off-farm labor supply of the small farm households in the Western Highlands. The comparison of risk to reallocate household labor away from the uncertain off-farm labor market into their own uncertain new crop enterprise is as important as the between-crop comparisons, which is the focus of most literature on farm production risk. While this study is not designed to assess this aspect it should be kept in mind that the crop versus crop comparisons are of limited relevance for an agriculture system that is as closely integrated into the nonagricultural labor market as is the case with the farmers in the Guatemalan Highlands.[8]

A first indication about differences in degrees of price risk of crops is given by the variance of prices within a cropping year across the survey area. Clearly average prices received by farmers for the new export crops vary much more than the maize price but not more than the price of beans and traditional vegetables grown for the local markets (Table 16). The coefficients of variation of snowpea, broccoli, and cauliflower prices in 1985 tended to be even lower than those for beans, and selected traditional vegetables. It should be noted, however, that the intra-year differences of the latter crops' prices may be of a seasonal nature which farmers may be able to predict with a certain probability. Thus, the level of uncertainty related to price variability of traditional crops may be less than, say, for snowpeas prices which do not follow a clear seasonal pattern (see discussion in Chapter 3).

Table 16--Price variance of average annual farmgate prices of traditional crops and new export vegetables, 1984/85

Crop	Coefficient of Variation
Maize	0.23
Beans	0.83
Traditional vegetables	
Beet	0.77
Radish	2.27
Lettuce	0.63
Spinach	1.00
New export crop	
Snowpea	0.58
Cauliflower	0.52
Broccoli	0.24

Source: Computed from INCAP/IFPRI survey (1985).

A second indication about the risk of new export crops versus traditional crops is given by a comparison of the variation of their respective gross margins (net returns) per hectare. We find that the new export vegetables' gross margins tend to be less variable across the sample than are the traditional crops.

Relative variability crop-by-crop does matter but levels of potential losses as a proportion to the asset base (land) are also important for the determination of household's risk. Given the high input levels for new export crops the potential loss from crop failure, output price depression or input price increases may constitute a much higher probability of substantial income loss. To assess this aspect, the frequencies and levels of losses from traditional crops and new export crops are evaluated. Losses are represented in this assessment by negative gross margins--that is, net returns to land and unpaid family labor were negative as variable costs exceeded the gross value of production. A combination of factors may lead to this outcome. In general, unfavorable input-output ratios, and high input and/or low producer prices are behind the result. From this comparison, it becomes evident that new export crops are produced at a loss by farmers as frequently as the traditional crops in 1985.[9] However, to take the two extreme cases--maize and snowpeas--the production of which does not cover the variable costs with a roughly similar frequency (24.5 and 25.1 percent, respectively), the absolute loss per unit of land is about ten times as much in the case of snowpeas as it is for maize (130 Quetzales versus 1,309 Quetzales per hectare). Clearly, this new export vegetable appears quite risky if viewed isolated in the farm.

Yet, most farmers tend to minimize loss by devoting only a fraction of their land to the new crop.

Losses and gains from crops within the farm enterprise may compensate each other. Comparison between coop members and nonmembers shows that the percentage of farms that reported an overall income loss was nearly similar in both groups in 1984/85 (17.8 percent of members and 16.8 percent of nonmembers). The income losses in percent of these households total expenditures averaged 7.7 percent in the member and 5.7 percent in the nonmember households which reported the losses. This suggests that overall income risk does not appear significantly greater among coop members than nonmembers.

EFFECTS OF NEW EXPORT CROPS ON LAND USE AND LAND MARKET

Despite the small absolute differences in farm size, cropping patterns change substantially by farm size among these small farms. It is particularly interesting to note maize. With increasing farm size, the share of maize in land use <u>in</u>creases in members farms but <u>de</u>creases in nonmembers' farms (Table 17). Snowpeas--the principal new export crop--have a relatively higher share in smaller farm size classes of coop members. While the probit model (Table 12) indicated that the choice to become an export cropper is biased toward the somewhat bigger farms within the small farm sector, the relative scale at which new export crops are adopted (once the decision to grow them has been made) appears larger in the smaller farms (or at least the same as in the bigger farms if snowpeas and broccoli-cauliflower are viewed together

Table 17--Cropping patterns of farms of members and nonmembers of coop, by farm size classes, 1985

Hectares	Maize	Beans	Snow-peas	Broccoli, Cauliflower	Traditional Vegetables	Other
			(percent of cropland)			
Member						
< 0.25	35.3	3.2	44.9	...	14.5	2.1
0.25-0.50	41.4	5.0	28.9	8.4	13.5	2.6
0.50-1.00	45.3	6.6	27.7	13.0	5.2	2.3
> 1.00	48.4	5.7	25.6	12.5	5.3	2.5
Total	46.7	5.2	28.0	11.1	6.7	2.4
Nonmembers						
< 0.25	67.7	13.1	5.8	...	12.4	0.5
0.25-0.50	60.0	19.0	4.8	1.8	11.0	3.4
0.50-1.00	60.7	14.2	7.0	4.1	12.7	1.3
> 1.00	54.0	12.8	15.8	7.0	9.1	1.3
Total	66.1	11.7	6.3	2.5	11.4	1.9

Source: INCAP/IFPRI survey (1985).

[Table 17]). It is noteworthy that some noncoop members also grow the new crops. These are mainly located in one village close to the Inter-American Highway where traders have started to pick up export vegetables.

An effort is made in the survey to assess differences in land quality between member and nonmember farmers. Farmers were asked to evaluate each of their fields according to a scale of 1 to 4 ("very good", "good", "not so good", "poor") in comparison to the land quality in their community. A variable derived from this subjective evaluation was included in the probit model in the previous chapter, where it turned out to be insignificant for adoption. The distribution pattern in Table 18 (column 1 and 2) of the surveyed fields by members and nonmembers underscores that there are no indications of substantial difference in land quality between member and nonmember farms. Yet, there is a clear indication that new export crops are grown on better fields of coop members. The coop members planted 69.2 percent of their land identified as "very good" with new export crops but only 31.6 percent of the land classified as "not so good" was grown with new export crops (Table 18, column 3).

The much higher returns of new export vegetables per unit of land compared to traditional local vegetables or subsistence food crops can be expected to impinge on the local land market. Demand for the quality land should increase, which will increase land prices in the prevailing situation of extreme land scarcity. Given the shortage of cash and limitations of collateral for borrowing substantial amounts of money, the increased demand for land is hypothesized to be largely

Table 18--Relative quality of land of coop members and nonmembers and of land used for the new export crop

Land Quality	Number of Parcels in Each Quality Group: Members	Number of Parcels in Each Quality Group: Nonmembers	Parcels Used by Members for New Export Crops
	(in percent)		(in percent of all parcels)
Very good	10.2	7.2	69.2
Good	74.3	74.4	55.9
Not so good	14.9	17.6	31.6
Poor	0.6	0.8	0.0
Total	100.0	100.0	..

Source: INCAP/IFPRI survey (1985).

realized on the land rental market rather than through land purchases. Yet, as the survey indicates, both the land rental market and the land purchase market appear to be stimulated by increased land demand from export crop growers. Coop members grow a significant share of new cash crops on rented land (20 percent, see Table 19). Also, members pay higher rents per hectare of land used for new cash crops than for land rented and used for subsistence crops (rents per hectare are 42 percent higher for export vegetable fields). This may be due to the better land quality demanded for these crops.

While coop members expanded their own total land area during the two years of 1984-1985, nonmembers had only a small increase. The reported net increase of members' land is 12.2 percent of the 1985 area compared to only 1.4 percent in the nonmembers group. The land purchases are more frequent among the members, as 23 percent of the coop members reported a land purchase during 1984-1985 compared to only 8 percent for nonmember households. Usually very small amounts of land are purchased. Coop members were paying much high prices for new land than nonmembers (6.272 versus 3.150 Quetzales per hectare). As is the case of land rented in this may be due to the members demand for more quality land for expansion of new export crop production versus the other farmers acquiring more land for maize and beans.

Two <u>conclusions</u> are to be highlighted from this assessment of the effects of new export vegetables on the land market. First, the effective demand for land is increased, as export crop producers operating bigger farms than average farmers outside the scheme expand their landholdings through renting as well as land purchases. This

Table 19--Land ownership of parcels and use for new cash crops

Status of Ownership	Members		Nonmembers
	Percent of All Parcels	Percent of Parcels for New Cash Crops	Percent of All Parcels
Owned	76	73	77
Rented	17	20	15
Other	7	7	8
Total	100	100	100

Source: INCAP/IFPRI survey (1985).

tends to further widen the existing gap of land size within the small farm sector between export crop producers and other farmers. In the long run, it should be expected that a concentration of quality land will evolve in the sector of new export crop farmers, although currently there is no evidence for such a distinction.

Second, land acquisition in the area is almost entirely from small farmer to small farmer. Increased land values may be realized by land sales, renting out land, or making use of the increased collateral value of owned land on the capital market. Land owners in the area thus benefit from the increased land values induced by the export crop production, regardless of whether they actually are export crop producers. Adversely affected through this effect are farm households that rent in land, especially if they have not (yet) joined the export crop scheme. Maintaining subsistence food levels from own production on rented land has become more expensive. The pressure to either give up rented land or join the export cropping scheme is increased due to the increased price for land to be paid by tenants

EFFECTS OF NEW EXPORT CROPS ON LABOR DEMAND AND EMPLOYMENT

The new export crops create employment directly on the field and through forward and backward linkages of the specific new crops and indirectly through multiplier effects of the related income and employment. Their backward linkages are substantial. They have much higher input demands not only for pesticides and fertilizer which are not very labor intensive but also--in the case of snowpeas--for the required sticks and ropes for tying plants, which are locally manufactured.

Also forward linkages are significant for employment as the operation of the first stage of marketing is quite labor-intensive (selection and screening, packing of produce). There are indirect employment effects from potentially higher income spent on services and goods with an employment content. The following discussion focusses on the direct employment effects.

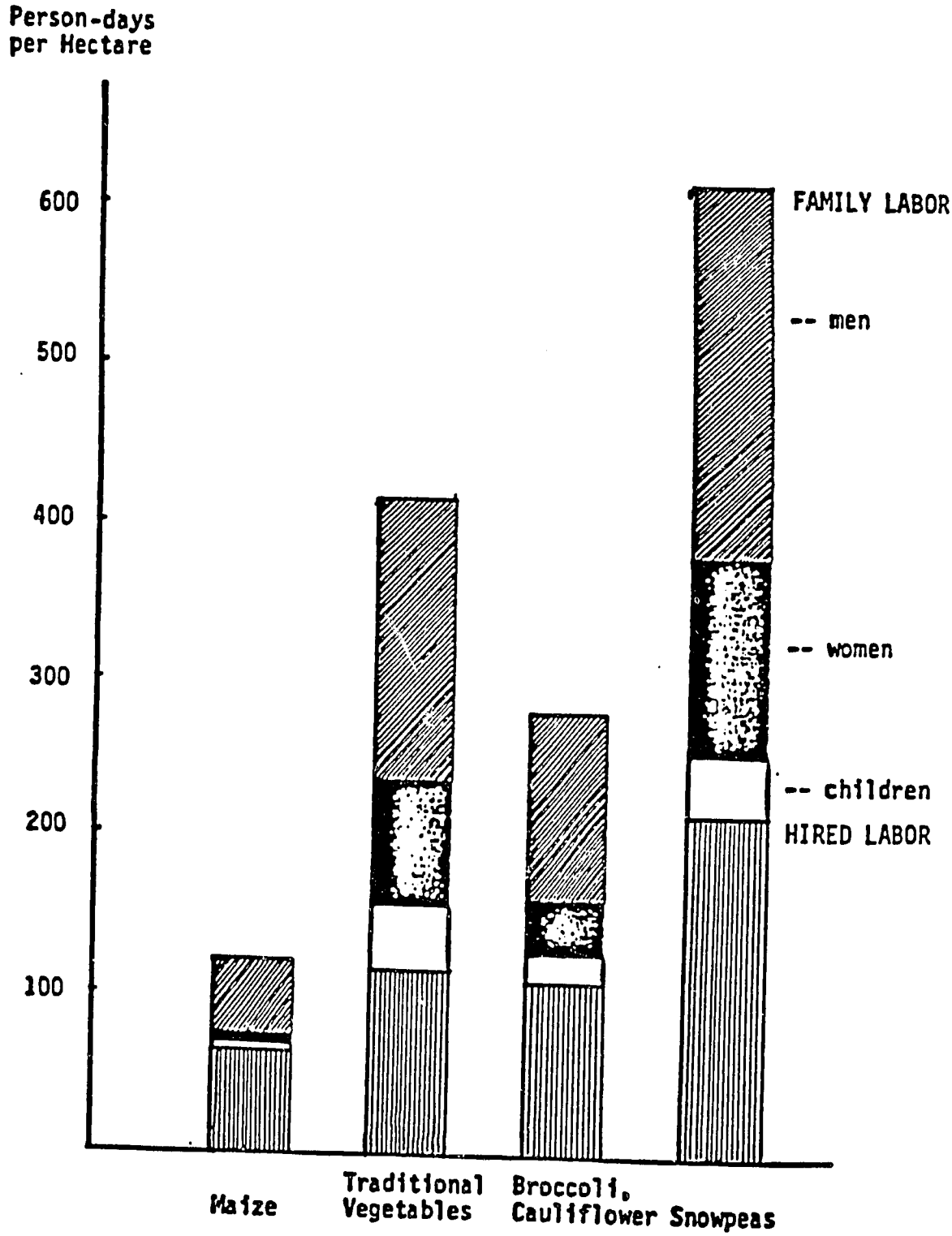
The new cash crops require much more labor input per unit of land than maize, the subsistence crop. Snowpeas also require more labor than traditional vegetables (Figure 5). Hired labor input is substantial not only in the cash crops but also in subsistence crop (maize), as more than half of the total labor input in maize is hired (Figure 5).

Most labor in all crops is provided by men, but this varies by crop type and by farm size class. Women are responsible for 9 percent of family labor in maize, 25 percent in traditional vegetables, and 31 percent in snowpeas (Table 20).

Family labor input decreases per hectare with increasing farm size for maize, traditional vegetables, as well as for new export crops (Table 21). This family labor input is, of course, combined with increased hired labor inputs, but even in the smallest farm size classes substantial wage bills per hectare occur from new cash crop production (Table 22).

Division of family labor between men, women, and children in the production of new export crops is not uniform across farm size. Men's share of total family labor remains quite stable across farm size classes while women's share declines and children's share increases

Figure 5--Labor Inputs in Traditional Crops and New Export Vegetables (Coop Members' Farms)



Source: INCAP/IFPRI survey (1985).

Table 20--Shares of men, women, and children in total family labor by crop (coop members)

	Maize	Snowpeas	Cauliflower, Broccoli	Traditional Vegetables
	(percentage of family labor)			
Men	85	59	70	61
Women	9	31	20	25
Children	6	10	10	14
Total	100	100	100	100

Source: Computed from Table 22.

Table 21--Family labor used per hectare for members and nonmembers, by crop and farm size (mean values)

Family Labor	Farm Size in Has.	Members				Nonmembers	
		Maize	Snow-peas	Cauli. Broccoli	Trad. Vegs.	Maize	Trad. Vegs.
		(person days/hectare)					
Men	<0.25	64	350	...	271	53	399
Women		8	228	...	141	7	68
Children[1]		...	10	...	0	4	53
Total		72	588	...	412	64	520
Men	0.25-0.50	49	272	105	176	60	180
Women		6	152	25	100	6	69
Children[a]		1	34	0	57	5	36
Total		56	4[illegible]	130	333	71	285
Men	0.50-1.00	50	231	133	181	52	249
Women		6	126	41	61	7	90
Children[1]		4	39	15	61	1	6
Total		60	395	189	303	60	345
Men	>1.00	37	200	104	167	42	169
Women		2	91	25	64	2	44
Children[1]		5	53	26	12	2	12
Total		43	344	155	243	46	225
Men	All	45	234	117	181	54	239
Women		5	125	33	76	6	69
Children[1]		3	41	18	42	3	28
Total		53	400	168	299	63	336

Source: INCAP/IFPRI survey (1985).

[a] Children's labor input is weighted with 0.6.

Table 22--Wages paid for hired farm labor (coop members and non-members), by crop and farm size

Farm Size in Has.	Coop Members				Nonmembers	
	Maize	Snow-peas	Cauli. Broccoli	Trad. Vegs.	Maize	Trad. Vegs.
	(Quetzales/hectare)					
<0.25	135	158	...	...	95	141
0.25-0.50	159	469	149	128	65	73
0.50-1.00	143	618	249	350	122	438
>1.00	209	570	368	340	136	358
Total	168	553	284	306	96	165

Source: INCAP/IFPRI survey (1985).

(Table 23). With increasing farm size women's labor is relatively replaced by hired labor and child labor. This is not true for men's labor. The high substitution between women's labor and hired labor is a phenomenon observed widely across countries of the third world.[10] It is probably related to the increasing opportunity cost of women's labor in the field when the household and farm enterprise expands. Returns to female household labor including activities such as meal preparation for hired labor, etc., increase and lead to higher degrees of specialization within the farm-household. This still means that absolute levels of family labor input by both men and women may increase with increasing farm size.

The pattern of hired labor use changes with the introduction of new export vegetables. Coop members demand more hired labor for the subsistence crop (maize) on a per hectare basis than nonmembers in the same farm size class (Table 22). This demand for hired labor is a result of the inability of family labor to meet the increased demand of producing cash crops. The production level of traditional crops is maintained to a certain extent by hiring outside labor for their cultivation.

The direct employment effects of new export crops on farms can be approximately accounted for by tracing the partial effects due to (1) switching land between traditional crops and new crops, (2) the change in labor input per unit of land, and (3) related substitutions between type(s) of labor input (family labor: men, women, children, and hired labor). These changes of the allocation of crops and labor differ by

Table 23--Relative divisions of family labor between men, women, and children

Farm Size	Percent of Family Labor			
	Men	Women	Children	Total
<0.25	59	39	2	100
0.25 - 0.50	59	33	7	100
0.50 - 1.00	58	32	10	100
>1.00	58	26	15	100

Source: INCAP/IFPRI survey (1985).

farm size. In a given farm size class (i) the net employment effect (E) is then:

$$E_i = \sum_j [\sum_s (a^*_{ijs} \cdot L^*_{ij} - a_{ijs} \cdot L_{ij}) + w^*_{ij} \cdot L^*_{ij} - w_{ij} \cdot L_{ij}]$$

with

a^*_{ijs}, a_{ijs} - per hectare labor input (days) of family labor types s(s=1,...,3) in crop j(j=1,...,6) and farm size class i(i=1,...,4) with (a^*) and without (a) the new export crops in the production program.

w^*_{ij}, w_{ij} - per hectare wage labor input (days) with (w*) and without (w) the new export crops.

L^*_{ij}, L_{ij} - land used (hectares) for each crop (j) in farm size class (i) with (L*) and without (L) the new export crops.

While the situation of new export crops is depicted by the situation of land and labor allocation in the coop member farms, the "without"-situation is represented by nonmember farms of the respective farm size class not growing the new crops. Participation in the scheme was found to be influenced by farm size and secure off-farm employment (see the probit model above). While the farm size effect is accounted for by the disaggregation into farm size classes the effect of off-farm employment is not. One might suspect that coop member farmers were growing more labor-intensive traditional vegetables before they switched to export vegetables. This hypothesis, which can be assessed by the small number of farmers which became coop members between the two surveys, is not supported. The cross-sectional evaluation of the employment effects appears therefore reasonable. Table 24 presents the results of the above computations. The main findings are:

- labor input in agriculture increases in the export crop producing farms by 45 percent (81 days per crop season);

Table 24--Direct employment effects of the new export vegetables, by farm size

Farm Size Class (hectares)	Person Days per Year Per Farm (Change in Labor Input due to Shifts in Crop Area and Reallocation of Labor) (days of work per farm)						
	Maize	Beans	Trad. Vegs.	Others Crops	Broccoli Cauliflower	Snow-peas	Total
<0.25							
family	-4	-2	-2	1	...	57	50
hired	0	0	-5	0	...	+6	+1
Total	-4	-2	-7	+1	...	+63	+51
0.25-0.50							
family	-11	-6	+4	0	+2	+61	+50
hired	+5	-2	+2	+2	+2	+26	+35
Total	-6	-8	+6	+2	+4	+87	+85
0.50-1.00							
family	-9	-6	-15	+1	+7	+58	+36
hired	-4	-1	-1	-4	+1	+42	+33
Total	-13	-7	-16	-3	+8	+100	+69
>1.00							
family	-9	+2	-11	+3	0	+62	+47
hired	+9	-5	-10	+7	+15	+42	+50
Total	0	-3	-21	+10	+15	+104	+97
Total[a]							
family	-9	-4	-9	+1	+3	+59	+41
hired	+2	-2	-3	+1	+5	+37	+40
Total	-7	-6	-12	+2	+8	+96	+81

Source: Computed from INCAP/IFPRI survey (1985).
[a] Weighted by the distribution of farm size classes.

- o this increase is equally shared by family labor and hired labor;
- o the increased labor demand results primarily from snowpea production. On average, labor is cut back in maize by 7 days (13 percent), beans by 6 days (43 percent), and traditional vegetables by 12 days (29 percent), but total hired labor input into maize increased somewhat (Table 24, bottom);
- o in the smallest farm size class virtually all the net increase in labor input comes from family labor. Total labor input in these farms below 0.25 hectare more than doubles.
- o with increased farm size more hired labor is covering the increased work load, but in all the four farm size classes family labor input increased by a roughly similar absolute amount.
- o a substantial share of the increased family labor is from women. It is 44 percent of the increase in the two smallest farm size classes and 32 percent in the biggest farm size class.

The farm level data can be used to extrapolate the employment effects to the 6 communities where the cooperative is operating. The increased labor demand in crop production corresponds to about 15 percent of agricultural employment (1985). When added to the employment in input supply (special input shops in the villages, special production inputs for snowpeas) and output marketing (coop staff), it yields an increase in agricultural employment of 21 percent.

Clearly the employment effects are significant and impinge on off-farm employment and interregional migration in the location. Among export crop producers an average of 0.72 persons per household work away compared to 0.92 family members among the other sample farmers.

Also, noncoop members spend more time away over the year (4.2 versus 2.3 months on average).

The increased demand for hired labor in the region spreads the employment effect. Much of the hired labor comes from neighboring communities wherein the export crop production has not been introduced.

EFFECTS OF NEW EXPORT CROPS ON STAPLE FOOD PRODUCTION

The evaluation above shows that new export vegetables yield higher returns per unit of land and labor than subsistence crops. Yet, farmers in the scheme still grow on average half of their land with maize and beans. Although this is significantly less than farmers not in the scheme, it is still a large proportion. No obvious technical reason exists why farmers should not further expand their export vegetable area as suitable land remains in reserve (Table 18). Hired labor is available in the region to fill increased labor demand. In the smallest farms underemployed family labor or family labor seeking off-farm employment could be drawn into the export crops as average returns per work day are much higher than the prevailing market wage rate (Table 15). This production behavior can be hypothesized as driven by concern of farmers about risk of the new crops--the potentially high absolute losses per unit of land were discussed above--and household's desire for food security.

A household is in a secure food situation when it always--throughout the seasons and over the years--has the ability to acquire the food requirements needed to maintain a healthy livelihood for all its members. In farm households, household level food security may be

achieved by own food production and related stockholding, or by relying on open market trading of food and nonfood production to generate income (and savings), or partially by seeking off-farm, income-earning possibilities. The level and mix of these alternatives depend upon a household's resource endowments (including human capital), the type of market integration for agricultural produce, food and labor, and the extent to which public institutions (intervention scheme), or community level institutions (villages, extended family) play a role in providing basic levels of food security in view of unforeseeable circumstances. It is obvious that with decreases of institutional food security, lower security of the off-farm employment opportunities, and more instability of the agricultural produce and food market, the food security burden shifts towards own production and stockholding. The historical record of food security in the Western Highlands suggests that these are the driving forces which lead farm households to maintain high levels of staple food production for direct household consumption. The survey region as a whole is, however, not self-sufficient. About 50 percent of maize consumed in the 6 survey villages are net imports into the region (Table 25). Self-sufficiency in maize is 67.7 percent among coop members and 53.4 percent among nonmembers.

Public institutions do not have the capacity to respond to household or local crisis situations. The food and agricultural produce markets are very unstable, as is the labor market. It can thus be hypothesized that farm households operating below or at the margin of food security provided from own food production put a risk premium on nonfood income earning alternatives. This risk premium--or food

Table 25--Consumption of own production (self-sufficiency) and net purchases of maize in coop and noncoop households, 1985

	Consumption of Own-Produced Maize[a]	Net Purchases of Maize
	(percent of maize consumption)	
Coop members	67.7	32.3
Nonmembers		
Farmers	53.4	46.6
Nonfarm households	...	100.0
Weighted average for the six villages	50.4	49.6

Source: INCAP/IFPRI survey (1985).

[a] Excluding use for animal feed.

insurance premium--which farm households are indirectly paying is represented by the difference between the actual market price of staple food and the shadow cost of production of staple food at the margin. Clearly, the shadow cost of staple food production increases when the opportunity cost of land and labor increases as a consequence of introduction of a new cash crop that yields higher returns to land and labor. To what extent this occurs in the case studied here will be evaluated with a farm model later in the chapter. Before this normative aspect is addressed, we will address the question: what actually happened to food production when the new export vegetables were introduced?

Practically all export crop producers (94 percent) maintain some maize production. Ninety-seven percent of the other sample farmers grow maize. Farm households were asked in the 1985 survey what the three most important reasons for them are to grow maize. By far the most important reason stated was "to always have food" (Table 26). Differences between export crop producers and other farmers are small in this respect. The second most important reason, tradition ("we always did it like that"), was followed by the perception that "other crops are risky" and because "maize is profitable". Much has been written about traditional and religious motivations of Western Highland Indians for growing maize.[11] While most farmers do not abandon their "milpa" and plant it with something else altogether, the attitude toward maize and its importance in the production program obviously undergoes change. The introduction of new export crops does play a role in this context and at the same time the adoption of new crops is

Table 26--Farmers attitudes toward growing maize

Stated Reasons for Growing Maize	Ranking of Reasons Given					
	Coop Members			Nonmembers		
	Most Important	Second	Third	Most Important	Second	Third
	(in percent of responses)					
To have always food	84	10	2	86	11	-
We always did it like that	3	57	15	1	57	19
Other crops are risky	1	7	16	-	8	12
Maize is profitable	-	2	9	-	5	6
Other	9	12	7	11	10	7
Not applicable	3	12	51	2	9	56
Total	100	100	100	100	100	100

Source: INCAP/IFPRI survey (1985).

affected by the attitudes. This was apparent already in the adoption model (Table 12) and is revealed when the reasons stated for growing maize are compared for early versus late adopters of new export crops (Table 26). Long-term members of the cooperative are more concerned about own produced maize supply than are new members: 92 percent of long term members of the cooperative ($\geq$ 5 years) give as first reason "to always have food", while it is 89 and 82 percent, respectively, for the medium and short-term members (3-5 years; 3 and less). Also, the early adopters have been or have become less traditional in their decisionmaking on production: the importance of tradition decreases with duration of membership in the coop (Table 27). Also, long-term members of the coop view other crops as less risky than new members.

This change in attitude patterns does <u>not</u> lead to a reduction in maize availability from own production for consumption. In fact, when corrected for farm size, the majority of export crop growers tend to have higher amounts of maize available for consumption from own produce than other farmers (Table 28). Despite reduction in area and labor inputs to maize, household level production is maintained because of higher yields of the staple food per unit of land. Coop members' yields are 30 percent higher on average than nonmembers' yields both for maize and beans (Table 29).

The two surveys of identical farms permit a comparison of farmers' maize yields once they moved from nonmember to coop member status and from recent to long-term members, respectively. Maize yields were substantially higher in 1985 than in 1983 in all groups. Climatic conditions played a role. The increase was highest in the group

Table 27--Reasons for growing maize stated by farmers by duration of growing export vegetables

Reasons[a]	Years of Membership in Coop		
	≥ 5 Years	3-5 Years	≤ 3 Years
		(percent)	
To always have food	92	89	82
We always did it like that	51	62	64
Other crops are risky	9	20	23

Source: INCAP/IFPRI survey (1985).

[a] Three reasons could be stated. Therefore, the percentage do not add up to 100 (see Table 26).

Table 28--Production of subsistence crop (maize) and use for consumption in farm households growing export crops and in other farm households, 1985

Farm Size	Coop Members		Nonmembers	
	Production	Used for Own Consumption[a]	Production	Used for Own Consumption
(hectares)	(kilogram per adult equivalent)[b]			
<0.25	48	41	59	49
0.25 - 0.50	103	88	95	82
0.50 - 1.00	131	113	127	97
>1.00	182	137	180	138
Total average	142	115	109	87

Source: Computed on the basis of the INCAP/IFPRI survey (1985).

[a] Calculated from a complete production and disappearance balance (production minus sales, losses, animal feed, gifts, seed).

[b] Adult equivalents are based on calorie requirements of persons in the household by age and sex.

Table 29--Yields of subsistence food crops per hectare in member and nonmember farms, 1985

Farm Size	Members		Nonmembers	
	Maize	Beans	Maize	Beans
	(tons per hectare)			
<0.25	(2.3)[a]	(1.1)	1.8	0.5
0.25 - 0.50	2.4	(0.7)	1.7	1.5
0.50 - 1.00	2.1	1.2	1.5	0.6
>1.00	2.2	1.8	1.7	0.8
Total	2.2	1.3	1.7	1.0

Source: INCAP/IFPRI survey (1985).

[a] Figures based on less than 10 observations are in parentheses.

consisting of coop members who joined 3 to 4 years ago and also above the average in the group who joined 5 to 6 years ago (Table 30). By far the lowest yield increase is in the group of coop members who joined the export crop production most recently. Their yield increase is even below that of the nonmembers. This pattern reveals some insights into the dynamics of maize yields in the context of increased export crop production: initially, yields per hectare stagnate or may even drop when the farmer pays much of his attention and resources to the new crops and maize is pushed on the more marginal land of his farm. A couple of seasons later, maize yields apparently do catch up. Appropriate program and policy packages that assist farmers to speed up in catching potential positive spillover effects from new cash crops to subsistence crops may have high returns.

A combination of factors is responsible for the maize yield increases among coop members. Fertilizer inputs increased by an average of 6 percent and cropping practices are more labor-intensive. Total labor input to staple foods decreases but labor input per unit of land is increased by 18 percent (mostly for more weeding). Much of the additional weeding labor is hired. Despite increased inputs (fertilizer) and labor, coop members produce maize at lower average cost per unit of output. Estimating the cost of family labor with the prevailing wage rate, coop members produce a ton of maize for 189 Quetzales while nonmembers produce it for 214 Quetzales. Thus, coop members appear to be more efficient, be it that they were so before joining the scheme or be it that they became more efficient through joining the scheme, an issue addressed in more detail in the following. Both of

Table 30--Change in maize yields of identical farmers between 1983 and 1985

Change in Group's Status	Change in Kilogram per Hectare
Nonmembers in 1983 and 1985	+272
Members since 1984 or 1985	+45
Members since 1982 or 1983	+456
Members since 1980 or 1981	+314

Sources: INCAP survey, 1983; and INCAP/IFPRI survey, 1985.

the above cost figures come close to the prevailing farm gate selling price of maize which was 210 Quetzales on average in the sample period 1985. Average costs are not much different from marginal cost in this production system.

A closer look at the subsistence crops-export vegetable interaction is provided in the following by production function and a programming model analysis. The objective of this analysis is it to assess competition and complementary between the new crops and the subsistence crop (maize) in particular. The approach shall be briefly described at the outset.

Crop production (q) is technically a result of area (a) times yield (y) of a crop (i):

$$q_i = a_i \cdot y_i \tag{1}$$

Choices on the use of inputs, technology, and the amount and quality of land for a certain crop are joint decisions. Acknowledging the problem of separating these decisions, competition between crops can be built into an area allocation function while input-output relations may be assessed on a per unit of land basis in a yield function.

$$a_i = b_{ij}X_j \tag{2}$$

$$y_i = b_o + b_{im}X_m \tag{3}$$

with b_{ij} and b_{im} being the parameters of the area allocation and yield function of the respective exogenous variables X_j and X_m. While the X_j in the are allocation model is mainly describing economic environment

and depicts the related response of farmers, the X^m in the yield model covers technical input-output relationships.

We hypothesize that consumption needs (calorie requirements) determine, among other things, that the traditional farm households plant a certain share of their total area with maize. With increased farm size, this "subsistence needs-oriented" determination of the maize area is reduced. If land quality of a farm is worse, a higher share of land for maize would be required for subsistence needs, every thing else being equal. Also, a more traditional attitude toward maize--we hypothesize--would lead to an increased share of maize land.

Maize is only to a minor extent a "cash crop", but its area share should be expected to be affected by the relative returns to maize versus new export vegetables after subsistence needs are fulfilled along above stated hypotheses. Also, we expect that membership in the cooperative leads to a decreased maize area share over and above the mentioned factors as the coop stimulates the growing of new crops. Finally, village specific dummy variables are included in the model as the land quality variable is based on village specific comparisons of farmers and not a generalizable measure.

The estimation results of the area model specified along these hypotheses are in Table 31. The model explains a high share of the variance in maize area allocation (85 percent). The following findings shall be highlighted:

- production is very much driven by staple food needs which becomes evident from the highly significant variable representing the calorie requirements of the household (ACU). One additional adult

Table 31--Area allocation to maize and the effects of export vegetable production: regression model

Dependent variable: maize area over total farmsize

Variable	Parameters	T - Value
DCID5	0.03370	0.647
DCID4	0.09424	1.855
DCID3	-0.03591	-0.892
DCID2	0.12100	2.391
DCID1	0.11986	2.454
RGM	-0.04209	-1.075
MZLANDQ	0.18134	16.542
FSZHA	-0.06416	-2.792
DMZREAS	0.06791	2.238
ACU	0.06005	10.189
MIEM	-0.04272	-1.509

R^2 = 0.85, DF = 337

with:

DCID1...5 = dummy variables for villages 1 through 5=1, else=0
RGM = ratio of gross margin of new export crops over gross margin of maize
MZLANDQ = quality of area under maize (1,...,4; 1=best)
FSZHA = farm size in hectare
DMZREAS = traditional attitude toward maize=1, else=0; 1="we grow maize for own consumption because we did it always like that"
ACU = calorie requirements of households (adult equivalents)
MIEM = membership in the cooperative=1, else=0.

equivalent unit in the household leads *ceteris paribus* to an expansion of the maize area share by 6 percent points. Clearly these semi-subsistence households not only (partly) consume what they grow but also base their maize production decisions on consumption requirements.

- o households with a more traditional attitude toward maize (DMZREAS) have a higher maize area share, but smaller farms grow relatively less area with maize (FSZHA). Both determinants are statistically highly significant.
- o the worse the land quality (MZLANDQ) the bigger the area share of maize. This is to be expected as alternative crops have less comparative advantage on such land and households also have absolute targets of maize supply from own production.
- o coop membership (MIEM) tends to decrease the area allocated to maize as expected; the net effect is about 4 percentage points, thus say, maize area decreases *ceteris paribus* from 60 to 56 percent. The respective parameter is not highly significant.
- o the ratio between the gross margins of maize and the new export vegetables do not turn out significant (RGM). It is probably only in the long run that their obvious role comes into play significantly.

Maize yield models are estimated for the total sample (model 1) and separately for the coop member farmers (model 2). Finally, yield model 2 is modified by including the degree of participation in export crop production to assess its effects on maize yields over and above the common production factors (model 3).

We take a heuristic approach to specification of the yield models. From increased fertilizer use, we expect higher yields though decreasing at the margin. Increased labor input should have positive yield effects. With better education farmers are expected to make more efficient use of resources and get higher yields. In smaller farms, we hypothesize, farmers pay more attention on yields over and above the factors mentioned. Yields are expected to be lower on plots of lower land quality.

The estimation results of the yield models formulated along these hypotheses are in Table 32. The main findings of this analysis are:

- o input levels of fertilizer (INPUT1) increase yields as expected, and at decreasing rates as the negative sign of the squared term indicates (SQINPUT1). Fertilizer cost per hectare is used as a proxy for nutrients. Differences between the coop members and the total sample are not significant in this respect. One additional Quetzal spent on fertilizer yields, calculated at sample means, 4.9 kilograms of maize at the margin which sold for 0.98 to 1.23 Quetzal on the market.[12] This suggests that fertilizer use is in the range of efficient levels.
- o increased labor inputs (LABDAYS1) have a higher than average positive yield effect in coop farms. Although marginal labor productivity in maize is higher among coop members than for the total sample, marginal returns to labor of 0.82 to 1.02 Quetzal (model 2 with maize price of 0.20 to 0.25) in the subsistence crop are at the lowest end of the prevailing wage rates which were 2.00

Table 32--Maize yields and effects of export vegetable production: regression models

Dependent variable: maize yields in kilogram per hectare, 1985

	Total Sample		Coop Members Only			
	Model 1		Model 2		Model 3	
Variable	Parameters	T-Values	Parameters	T-Values	Parameters	T-Values
DCID5	382.65000	1.729	621.41000	1.844	505.53500	1.512
DCID4	-65.68800	-0.298	23.72200	0.075	67.34400	0.217
DCID3	-6.77190	-0.039	-48.71030	-0.183	-56.24500	-0.215
DCID2	-824.29200	-3.886	23.72290	0.075	-877.94900	-2.527
DCID1	-40.26500	-0.195	513.74800	1.390	-58.24500	-0.215
MZLANDQ	-136.25200	-2.196	-34.01890	-0.265	68.67100	0.518
HHEDUC	33.77700	0.933	155.39500	2.645	162.74200	2.815
LABDAYS1	2.20680	2.081	4.07790	2.517	3.69015	2.307
RAREA34	...	...	...	...	811.23180	2.506
FSZHA	-17.92300	-0.186	-70.33560	-0.482	35.65770	0.238
INPUT1	9.81776	4.021	9.48170	2.144	8.14740	2.095
SQINPUT1	-0.02326	-2.973	-0.02451	-1.820	-0.02445	-1.848
(constant)	1,256.55000	4.449	834.56600	1.873	383.55100	0.810
	R^2 = 0.19		R^2 = 0.20		R^2 = 0.23	
	F = 7.02		F = 3.40		F = 3.75	
	DF = 326		DF = 148		DF = 147	

with:

DCID5 = dummy variables for villages 1 through 5=1, else = 0
MZLANDQ = quality of area under maize (1,...,4; 1=best)
FSZHA = farm size in hectare
HHEDUC = years of schooling of head of household
LABDAYS1 = total labor days in maize per hectare
RAREA34 = area under new export vegetables over total area (ratio)
INPUT1 = cost of fertilizer per hectare of maize
SQINPUT2 = cost of fertilizer per hectare of maize (squared)

to 2.50 Quetzales in 1984 for men and 1.00 to 2.00 Quetzales for women.

- A striking result is that better education does significantly shift the yield function in the group of coop members upward but does not so in general (model 2). Apparently literacy does become increasingly relevant for productivity of subsistence crops when the farms become more complex with the new export crops included into the production program than it does in general (model 1). This is fully in line with the interesting finding of the specific study on the effects of education on Guatemalan agriculture by Freire who finds that illiterate and literate farmers operate on the same aggregate production function, but literate farmers are technically more efficient than illiterate farmers in more diversified farms.[13]
- land quality (MZLANDQ) tends to affect yields as expected; here it becomes clear that separating the area allocation effect from the yield effect of production is useful as in case of land quality the effect works in opposite directions in the two functions of the model.
- a striking effect results from the new export vegetables in the crop production program (RAREA34): the higher the share of new crops in the land use, the higher the maize yields even after accounting for different levels of inputs and labor use and human capital (model 3). Two explanations for this result come to mind. First, the snowpea crop increases the soil nitrogen levels which benefits maize, if it follows in the rotation on that land.

Second (and more hypothetical), export crop producers improve crop management which leads to higher efficiency in input use in maize. This effect is then not captured in the input and labor variables. It is plausible that export vegetable producers in their desire to increase yields of maize for the purpose of maintaining household food security eliminate Leibensteinian "x-inefficiencies" tolerated before.[14] Export crop producers grow on average about 30 percent of their land with the new crops. The parameter estimated in the yield function implies that joining the scheme with average allocation of land to the new crops (RAREA34) results in a yield increase by 11 percent over and above what results from higher fertilizer input and labor use per hectare. The higher yields among coop members are to this extent a result of the complementary interaction with the new export crops and not just a result of inherently higher efficiency of coop members.

To sum up, the analysis on the basis of area and yield functions for the subsistence crop shows that new export vegetables play a complementary rather than a competitive role in the system. Although maize area is reduced and partly squeezed onto the land of less quality, increased input use (fertilizer and labor), favorable soil fertility effects of the main new crop (snowpeas) and more efficient crop production practices overcompensates the adverse effects and leaves export crop producers with higher yields <u>and</u> total supply levels of the subsistence crop. This finding is in line with findings by Reyes-Hernandez et al. who report positive yield increasing spillover effects for the traditional food crops (maize) in more diversified farm

production systems versus the traditional systems in the area of Chimaltenango (Western Highlands of Guatemala).[15] In their small sample of farms, maize yields in the diversified systems were about 40 percent higher than in the traditional system.

A PREMIUM FOR OWN-PRODUCED MAIZE: MODEL RESULTS

The context in which this interaction between new export vegetables and subsistence crops takes place is, of course, not only the field crop operation of the farm enterprise but the farm production-consumption unit. To evaluate the effects of introduction of the new crops for farm households incentive to provide food security from own production, a linear programming model is constructed.[16] Applying a programming model with a profit maximizing objective function under constraints does not imply that we assume the farm households in the Western Highlands are single-minded, short-term profit maximizers. We recognize that a multitude of objectives exists for farmers which may be only partly captured by the constraints introduced into the model. All evidence from the evaluation of response to crop profitability, however, suggests that small Highland farmers are managing their agricultural resources and their own time very efficiently and economically rational. Still, opposite conclusions have frequently been drawn for the Highland farmers even long after Schultz's successful crusade for the message that small farmers are poor but efficient.[17] Gollas, for instance, concludes from a Cobb-Douglas production function analysis with results that show a positive marginal productivity of farm labor in view of an assumed general surplus labor situation that

the Highland farmers are "poor and inefficient".[18] More careful production function analyses by Marsh et al. and by Stein as well as the assessment of households flexible response to returns to time inside and outside agriculture by Swetnam clearly refuted Gollas "poor and inefficient" conclusion for the traditional farmers of the highlands.[19]

While only a small proportion of farm households sell subsistence crops (13 percent of all maize producers in the sample sold maize during the year), almost all farm households grow maize for own consumption. The cost of this maize production to the farm household is determined by the opportunity cost of the resources used for its production. Obviously the opportunity cost of maize production increased since farmers had the option of growing snowpeas. It thus follows that consumption of own produced maize should therefore have become more costly. To what extent is this actually the case? How did farmers respond to this change in this key shadow price?

The model is based on average data of the 0.50-0.75 hectare farms in the sample. Three versions of a farm model are used for comparative static analysis:

Model 1: represents the situation before new export crops were introduced;

Model 2: represents the situation after export crops were introduced, but yield levels and technology in subsistence crops are not changed;

Model 3: represents the situation as in Model 2, but with actual improved productivity in subsistence crops.

The three model versions are described and listed in Appendix 1. The main features of the model are the usual constraints on land and family labor (by season). Inputs (fertilizer, pesticides), hired labor, and input financing are available at exogenously fixed prices. Rotational restrictions follow the ones widely accepted by farmers. In all three model versions, households' demand for staple food (maize and/or beans) is maintained at the same level as observed in the respective class of sample households. Family labor of men and women--but not children--may also earn income from off-farm employment at a constant wage rate.

In the initial situation (Model 1) the shadow cost of maize produced for own consumption is 0.49 Quetzal per kilogram (Table 33), more than twice the average sales price of maize in the respective survey year (0.21 Quetzal) and substantially higher than the average purchase price (0.26 Quetzal). Clearly, farm households are willing to pay the price in terms of income foregone to have maize from their own fields. The difference between the shadow cost of maize production for own consumption and the actual purchase price of maize can be interpreted as a "food security insurance premium." In 1985, the premium was 0.23 Quetzal per kilogram in farm households which did not grow the new export vegetables. This "insurance premium" increases drastically when the new export crops become an option for the farm household. It nearly quadruples, as demonstrated with Model 2 versus 1 (from 0.23 to 0.90 Quetzal per kilogram). Maintaining subsistence production becomes more than twice as costly as before: the shadow cost of maize produc-

Table 33--Effects of new export vegetables on shadow cost of subsistence food production and selected other variables: results of programming model scenarios (average 0.75 hectare-farm based on survey 1985)

	Model 1	Model 2	Model 3
	Before introduction of new export crop	After introduction of new export crop	
		W/o improved productivity in subsistence crops	With improved productivity in subsistence crops
Land Use:			
Subsistence crops (ha)	0.49	0.49	0.35
Traditional vegetables (ha)	0.26	...	...
Snowpeas (ha)	...	0.26	0.40
Family Labor:			
On-farm (days in Model	100.00	124.00	165.00
Off-farm 1 = 100)	100.00	84.00	55.00
Share of family labor on farm (percent)	49.30	59.60	75.00
Working Capital:			
Over year (Quetz. Modell = 100)	100.00	304.00	441.00
In percent of cash income	24.50	51.40	58.10
Shadow price of land (Quetz./ha)	456.00	1,455.00	1,455.00
Shadow cost of maize produced for own consumption (Quetz/kg)	0.49	1.16	0.84
Difference to average maize purchase price (Quetz/kg) ("insurance premium")	0.23	0.90	0.58

Model versions: see Appendix 1.

tion increase from 0.49 to 1.16 Quetzales per kilogram. While there was an incentive before, as indicated by the 1985 "insurance premium," to bring unit cost of production for subsistence down, this incentive was much increased by the introduction of the competitive export vegetables.

Households have two options to respond to the increased cost of food security provided from own production. They may simply cut back the staple food production, or increase its productivity (or a combination of the two). The yield function analysis above demonstrated that they most often chose the latter. This option's effect is traced in model 3 on the "insurance premium". Clearly, the cost of maintaining desired household food security through production of staple food for own consumption can be substantially decreased this way (from 0.90 to 0.58; Table 33). Still the "insurance premium" remains higher than in the situation at the outset. The incentive remains high to further increase productivity in staple food production.

The new crops lead to an increased labor and capital intensity of agricultural production. The new export crops require not only absolutely more working capital to grow them but also relatively so in percent of total household cash income. Without new export crops, working capital invested in crop production was about one quarter of the total cash income (Model 1). With the new crops it amounts to more than half of cash income (58.1 percent, Model 2).

With increased productivity of staple food, overall income increases and land is freed for the new export crop where these additional income can be generated. The income increase made possible

by increased productivity of subsistence crops (going from Model 2 to 3) is about as high as the income effect from the pure introduction of the export vegetables without improved productivity in the staple foods (going from Model 1 to 2) This key role of technological improvement in staple food production of farms with the option of growing new export crops must be understood in order to maximize both income and employment opportunities.

In summary, the following conclusions shall be stressed from this analysis of the agricultural production effects:

- Export crops and subsistence crops are complementary rather than competitive in this case studied.
- Household-level food security through a high level of subsistence food production was maintained or even expanded when new export crops were introduced. While this is understandable and explainable with market failures--that is, failures in the food market and in the labor market on which many of the small farmers with excess supply of labor depend--this approach to food security does not appear to be the "first best" economic solution, as indicated by the high "insurance premiums" paid by farm households for own-produced subsistence food. A policy environment that assures food markets functioning without major disruptions is a precondition for farm households to develop the confidence in the market and to consequently make use of the advantages of the exchange economy. It is thus a precondition for first best economic solutions to food insecurity. Other options than food security based on own-produced food exist for cost-effective provision of food security.

Be they, for instance, of a food-related income transfer nature or of employment-oriented measures targeted toward the absolute poor. Also, such measures would only impinge on the observed resource allocation in agricultural production biased toward staple food if they would be perceived reliable by the poor.

- The shadow cost of staple food production for own consumption increases drastically as returns to land and labor of new export crops increase. In view of the prevailing high preference for having maize from the own field for food security reasons, the increased shadow cost of subsistence production did lead to some reduced area allocation to the staple food production. However, variable inputs (labor, fertilizer) per unit of land increased. This and positive yield increasing effects of the new crops in the rotation permit reduction of staple food crop area cum an increase in food output combined with the favorable income and employment effects of the new crops.
- The Guatemalan Highland farmers were able to adopt this balanced strategy of crop diversification plus intensification of staple food production because of the availability of yield-increasing measures, related input supply channels (seed, fertilizer) and hired labor. In the absence of these conditions, farmers with strong preferences for subsistence crops will not adopt the export crop. The policy conclusion is obvious: if gains from diversification and export crop production are achieved through rapid adoption by small farmers without diminishing their food security

in an environment of market failures, farmers must have access to technology to enhance food crop productivity per unit of land.[20]

EFFECTS OF NEW EXPORT CROPS ON OFF-FARM INCOME EARNING

The previous chapters mainly dealt with agricultural production effects and related income effects. As stated earlier, agricultural income is very much complemented by income from other sources in these communities of the Highlands.

Patterns concerning sources of income differ by cooperative status. Not all households have, of course, incomes from all sources. Table 34 reports the frequencies of off-farm income source by farm size and coop membership. Nonmembers are more agricultural day laborers and nonagricultural workers. The coop member households are also active in related income-earning activities during the year. However, they work fewer days off-farm which explains their lower absolute income from these sources. In addition transfer income is not only higher on average in coop member households but also more widely distributed. Seventy-five percent of the households reported transfers.

The distribution pattern of income by source suggests that export crop producers withdraw from the labor market and spend more of their time in agricultural production on their own fields (see also employment effect above, Table 24). This reduces their off-farm earnings. Numerous intervening variables determine the extent to which this actually happens.

We hypothesize that household earnings are determined by available labor, demographic structure, the farm's resource base in relation to

Table 34--Percentage of households receiving income from off-farm activities, by farm size, members, and non-members

	Farm Size Class									
	(1)		(2)		(3)		(4)		All	
	Member	Non-member	Member	Non-member	Member	Non-member	Member	Non-member	Member	Non-member
	households in percent of total of respective group)									
Agricultural day labor	25.0	53.2	25.0	40.6	17.8	13.2	7.5	30.0	16.5	36.3
Nonagricultural wages	50.0	48.9	33.3	48.4	27.5	34.2	28.3	20.0	30.0	40.8
Nonagricultural merchant	12.5	10.6	13.9	17.2	19.2	28.9	11.3	6.7	15.3	16.2
Transfer income	62.5	55.3	75.0	57.8	76.7	57.9	75.5	36.7	75.3	53.6

Source: INCAP/IFPRI survey (1985).

household labor force which determines opportunity cost of off-farm work, and human capital which may impinge on the off-farm income earning possibilities. Local-level labor market conditions, including location of village, may further differentiate the effect of the various factors. An off-farm income earnings function (r) may thus be specified for i households as:

$$r_i = a_0 + b_j X_{ij} + b_k X_{ik} + \quad i$$

with:

b_j = the parameters of X_{ij} variables describing the off-farm income-earning potentials, and

b_k = the parameters of X_{ik} variables depicting the on-farm income-earning potential.

The results of the model specified along above-stated hypotheses in Table 35 underscore that off-farm income earning by farm households is reduced with an increased resource base for agricultural income earning on the own farm (RFMLAB) in Table 35. The opportunity to grow the new export vegetables with rising returns per unit of family labor can be interpreted as an expansion of the resource base per unit of family labor. Returns to family labor more than doubled those of traditional crop producers and export crop producers (for instance, maize, beans, traditional vegetables of traditional farmers versus snowpeas, broccoli/cauliflower of export crop producers in Table 15). A doubling of the resource base (land per family labor, RFMLAB) would reduce off-farm income earning by 11 percent at sample means.

The model only implicitly addresses the complex issue of the value of human time and its effect on substitution between off-farm versus

Table 35--Determinants of off-farm income earnings: regression model

Dependent variable: Total nonfarm income per capita per year (Quetzales)

Variable	Parameters	T-Value	Mean of Variable
RFMLAB	-362.947	-1.71	0.231
HHEDUC	184.600	5.68	3.003
RWOMLAB	-689.430	-2.04	0.463
DCID5	411.807	2.00	0.092
DCID4	100.564	0.48	0.089
DCID3	-327.380	-2.04	0.186
DCID2	-480.957	-2.43	0.102
DCID1	-288.961	-1.44	0.097
(Constant)	683.016	3.58	...

$\hat{R}^2$ = 0.12, F = 6.50, Degrees of Freedom = 3.62.

With:

DCID1...5 = village dummy variables.
HHEDUC = household education (years of school).
RWOMLAB = share of female labor in total household labor.
RFMLAB = farm size per person in working age availble for farm work (in hectares per person).

on-farm work. People may derive utility from spending less time searching and traveling for off-farm work. Also, the search cost for off-farm employment reduces the net income from such sources. An indication for this is that nonmembers of the cooperative spend relatively and absolutely more on transportation (Table 38). One Quetzal of gross income from off-farm work may therefore be worth less to the household than one Quetzal of discounted present value earned on the own farm.

Most important and significant is the influence of education levels on off-farm earnings (HHEDUC). Thirty percent of the explained variance is a result of this variable. In the simple model specification, the parameter estimate suggests that one additional year of schooling of the household head rises off-farm income, *ceteris paribus*, by 25 percent. It should be recalled that higher levels of human capital were also found to rise labor productivity in agriculture once the production system becomes more complex with new technologies and the new cash crops (see Table 32). Investment in human capital is thus shown here to shift both the agricultural and the nonagricultural income-earning capacities.

While more available labor per unit of land increases household's per capita off-farm earnings, an increased share of female labor (RWOMLAB) decreases it. Off-farm income earning opportunities are less favorable for women in the area and women's wages tend to be lower in agricultural work by 20 to 30 percent.

The village dummy variables all are defined in such a way as to test for the difference to Santiago, which is the biggest community and

provides the most opportunities. As expected most of the village dummy variables for the other communities are significantly negative.

The result of this analysis suggests that the net increase in farm income from the new export crops is not identical with the net increase in total income which is diminished by reduced off-farm income as households withdraw partly from off-farm income earning once they adopt growing more of the new export vegetables for which they allocate more of their time to on-farm work.

NOTES

[1] For the first time, the cooperative was closed to new members in Fall 1986 as the rapid expansion of members was considered unmanageable by the coop leadership.

[2] Nieves, "An Exploratory Study of Intrahousehold Resource Allocation," p. 11.

[3] For a description and discussion of the probit model, see, for example, G.S. Maddala, Limited-Dependent and Qualitative Variables in Econometrics (Cambridge: Cambridge University Press, 1983), pp. 22-27.

[4] The approach is described in C. Manski and D. McFadden, eds., Structural Analysis of Discrete Data with Econometric Applications (Cambridge: Massachusetts Institute of Technology Press, 1982).

[5] See Taveshi Amemiya, "Qualitative Response Models: A Survey," Journal of Economic Literature 19 (December 1981): 1,483-1,536.

[6] The PROBIT model of the same specification was also estimated for the dependent variable defined as membership/nonmembership in the cooperative (=1,0). While the results for the farm size and off-farm income variable were similar, the other variables were not statistically significant in that model.

[7] It should be noted that many different crops are aggregated into the group of traditional vegetables. The related gross margin figures do vary considerably between farms due to this aggregation.

[8] Increasing labor market participation in case of crop loss is a common risk-adjustment strategy of small farmers in Central America. In a survey in El Salvador, it turned out the most frequently used strategy. See Thomas S. Walker and N. S. Jodha, "How Small Farm Households Adopt to Risk," in Crop Insurance for Agricultural Development: Issues and Experience, ed. P. Hazell, Pomareda, and A. Valdes (Baltimore: Johns Hopkins University Press, 1985), pp. 17-34.

[9] It should be noted that the percentage levels of negative gross margins might be somewhat overstated due to the usual noisiness of such recall surveys that leads to extended tails of the distribution function of variables. For this analysis, the relative comparison across crops is relevant only which should not be affected too much by this problem.

[10] See, for instance, Ester Boserup, Woman's Role in Economic Development (London: George Allen Ltd., 1970), p. 30.

[11] A comprehensive piece is, for instance, Laurel H. Bossen, The Redivision of Labor: Women and Economic Choice in Four Guatemalan Communities (Albany: State University of New York Press, 1984); and insights are also provided by Christina H. Gladwin, "Contributions of Decisiontree Methodology to a Farming Systems Program," Human Organization 42 (No. 2, 1983): 146-157.

[12] Maize prices ranged between 0.20 and 0.25 Quetzal/kilogram in the 1984/85 crop year.

[13] Maria E. Freire, "Education and Agricultural Efficiency," in Malnourished Children of the Rural Poor, ed. J. B. Balderston et al. (Boston: Auborn House, 1981), pp. 107-145.

[14] Harvey Leibenstein, "Allocative Efficiency vs. X-Efficiency," American Economics Review 56 (June 1966): 362-415.

[15] Mamerto Reyes-Hernandez, Santos S. Garcia, and Arturo Campos, "Sistemas de Produccion Practicados en el Altiplano de Chimaltenango, Guatemala," thesis, Instituto de Ciencias y Tecnologias Agricolas, Guatemala, Deciembre 1985.

[16] Average data from the farm size class 0.50 and 1.00 are used for the model's coefficients.

[17] Theodore W. Schultz, Transforming Traditional Households Flexible Response to Agriculture (Chicago, Il: Chicago Press, 1964).

[18] Manuel Gollas, "Surplus Labor and Economic Efficiency in the Traditional Sector of a Dual Economy: The Guatemalan Case," Journal of Development Studies 13 (July 1977): 411-424.

[19] L. K. Marsh, K. P. Jameson, and J. M. Phillips, "Production Conditions in Guatemala's Key Agricultural Product: Corn," Land Economics 59 (No. 1, February 1983): 94-106; John P. Stein, Children and Women in Traditional and Cash Crop Agriculture (Santa Monica: Rand Corporation, 1982); John J. Swetnam, "Disguised Employment and Development Policy in Peasant Economics," Human Organization 39 (No. 1, 1980): 32-39.

[20] Similarly in labor scarce land rich environments, such as parts of Africa, productivity of labor in food production must increase to achieve this desired development effect.

6. EFFECTS OF THE NEW EXPORT CROPS ON EXPENDITURES, CONSUMPTION, AND NUTRITION

EFFECTS ON FOOD AND NONFOOD EXPENDITURES

Surveys on income--especially direct approaches to income assessment rather than indirect ones via disaggregated accounting of costs and returns, as we did for agricultural income--suffer both from inaccuracy and high intertemporal fluctuations which do not represent the long-term standard of living of households. This is particularly true in the Western Highlands where high shares of off-farm income may have significant fluctuations over time. Expenditures on food and nonfood (including the value of home-produced food) represent a more stable indicator of households' (permanent) income standard.

The following analysis of expenditures has two main purposes: first, to evaluate the effects of the new export crop production on levels of expenditures (using expenditures as an income proxy); and second, to assess the effects of changes in income levels and the nature of the income stream on the composition of expenditures. Here, we are especially interested in questions such as, "What happens to the composition of the diet once households earn more income from the export crop?" or "Do poor households increase their spending on 'luxury items' when they earn more cash income from cash crops rather than in-kind income from increased subsistence food production?"

This analysis is based on the complete expenditure surveys on all food and nonfood items for September 1983 and September 1985. Only the 1985 survey includes foods consumed from own production and an annual expenditure survey on durables and less frequent expenditures, such as for housing, education, health, feasts, and clothes. The following comparative evaluation between 1983 and 1985 is based on the strictly comparable monthly cash expenditure surveys. Analysis based only on the 1985 survey draws on the full expenditure survey, including own-produced food consumed in the household and items from the annual expenditure survey. This approach was taken to use a maximum of information from the longitudinal comparisons while presenting the complete picture from the more detailed 1985 survey.[1]

The export vegetable-producing households, after controlling for farmsize, spend absolutely more on both, food and nonfood items, than other households. Their home-produced food is of greater monetary value and they spend more on nonfoods as well. In the group of 0.5 to 1.00 hectare farms, for instance, coop members spend 15 percent more per capita on purchased food than nonmembers. Coop members' imputed value of the own-produced food for home consumption is 8 percent higher and their nonfood expenditures are 32 percent higher. Total expenditures--the income proxy--are 20 percent higher (see Table 36). Their budget share for food is somewhat lower but their absolute amount of expenditures on food is slightly higher. The mirror image of this is that coop members spend more absolutely and relatively--in terms of their own budget--on nonfoods than nonmembers (see Table 36).

Table 36--Expenditure on foods (purchased and own-produced) and nonfoods, by farm size and years of membership in the export vegetable cooperative, 1985

Groups	Food Purchased		Food Own-Produced		Nonfood		Total Expenditures	
	Quetzal	Percent	Quetzal	Percent	Quetzal	Percent	Quetzal	Percent
BY FARMSIZE								
Coop Members								
<0.25 ha.	(267.76)[a]	55.5	(36.30)	7.5	(178.92)[a]	(37.0)	(482.97)[a]	100.0
0.25-0.50 ha.	239.86	59.7	37.71	9.4	124.12	30.9	401.69	100.0
>0.50-1.00 ha.	240.30	49.8	57.08	11.9	184.85	38.3	482.24	100.0
>1.00 ha.	221.36	48.1	53.07	11.5	185.84	40.4	460.27	100.0
Total Average	233.15	51.5	50.39	11.1	169.56	37.4	453.09	100.0
Nonmembers								
<0.25 ha.	185.64	61.4	22.77	7.5	93.87	31.1	302.27	100.0
0.25-0.50 ha.	182.08	60.2	31.90	10.5	88.53	29.3	302.51	100.0
>0.50-1.00 ha.	208.83	52.0	52.92	13.2	139.64	34.8	401.39	100.0
>1.00 ha.	212.89	47.8	55.05	12.3	177.92	39.9	445.87	100.0
Total Average	204.82	54.4	35.05	9.3	136.46	36.3	376.33	100.0
BY YEARS OF MEMBERSHIP								
<2 years	237.97	51.4	44.07	9.5	181.36	39.1	463.41	100.0
2-4 years	222.17	53.4	54.30	13.0	140.02	33.6	416.49	100.0
5-6 years	244.99	50.4	52.11	10.7	188.94	38.9	486.05	100.0
Total Average	233.15	51.5	50.39	11.1	169.59	37.4	453.09	100.0

Source: INCAP-IFPRI Survey, 1985.

[a] There are only 6 observations in this group. In all other groups, at least 25 observations are the basis of the mean values listed.

No clear pattern is evident from a breakdown of the expenditures of coop members by years of membership (Table 36, bottom). The earlier export crop producers appear to have higher expenditures, but from earlier evaluations, we know their farms are larger too (see Chapter 5).

The cross-sectional comparison suggests that export crop production increases relative income the most in the smallest farmsize classes and, thus, contributes to a more equal income distribution among the poor (Table 37). Farm households with more than one hectare and who depend more on hired labor for additional labor input actually capture comparatively smaller benefit from new export vegetable production.

A more detailed breakdown of household expenditure patterns reveals that relative differences between export crop producers and other farm households are not substantial. For food items other than meat, eggs and fish, coop members spend relatively less than nonmembers. This implies that income elasticities for meat, eggs, and fish are above unity and below for other food items. For some of the main staple foods--e.g., maize, beans--the coop members also spend absolutely less (see Table 38). It should be noted that this may partly reflect price differences and not necessarily quantity differences. This issue is further addressed later in the food consumption analysis. Also, in 1983, the simple comparison of expenditure patterns of the two groups does not reveal striking differences (Table 39). The direction and magnitude of the differences between item-specific budget shares between members and nonmembers are as expected.

Table 37--Difference in total per capita expenditures (including own-produced food) between members and nonmembers of the export vegetable cooperative, by farm size, 1985

Farm Size	Difference in Per Capita Expenditure of Members Versus Nonmembers
(hectares)	(percent)
<0.25	+ 59.8
0.25-0.50	+ 33.1
0.50-1.00	+ 20.2
>1.00	+ 3.4

Source: Computed from Table 36.

Table 38--Food (including own-produced food) and nonfood expenditures per capita per year (based on one month recall, september 1985)

Commodities, Items	Coop Members						Nonmembers					
	Value of Purchases		Value of Consumed Own Produce		Total		Value of Purchases		Value of Consumed Own Produce		Total	
	(Quetzal)	(percent)	(Quetzal)	(percent)	(Quetzal)	(percent)	(Quetzal)	(percent)	(Quetzal)	(percent)	(Quetzal)	(percent)
Maize	15.59	4.0	26.93	53.8	42.52	9.6	22.90	7.1	21.16	60.4	44.08	12.3
Other cereals, bread	39.76	10.1	...	...	39.76	9.0	31.63	9.7	0.01	0.0	31.65	8.8
Pulses	15.72	4.0	6.80	13.6	22.52	5.1	18.13	5.6	3.72	10.6	21.85	6.1
Sugar	14.67	3.7	...	...	14.67	3.3	12.16	3.7	...	...	12.16	3.4
Roots, tubers, banana	10.73	2.7	1.11	2.2	11.85	2.7	9.25	2.9	0.60	1.7	9.85	2.8
Vegetables, fruits	27.45	7.0	9.86	19.7	37.31	8.4	23.43	7.2	7.06	20.2	30.49	8.5
Milk products	9.01	2.3	2.33	4.7	11.33	2.6	8.00	2.5	0.48	1.4	8.48	2.4
Meat, egg, fish	73.23	18.6	2.91	5.8	76.13	17.2	56.68	17.5	1.95	5.6	58.63	16.3
Fat, oil	6.26	1.6	0.12	0.2	6.38	1.4	5.25	1.6	0.05	0.1	5.30	1.5
Other foods	3.34	0.8	...	...	3.34	0.8	1.92	0.6	...	...	1.92	0.5
Nonnutritious foods, beverages	18.01	4.6	...	...	18.01	4.1	15.47	4.8	...	...	15.47	4.3
Total Food	233.77	59.4	50.06	100.0	283.83	64.0	204.82	63.2	35.05	100.0	239.87	66.8
Fuel, energy	26.30	6.7	...	...	26.30	5.9	22.36	6.9	...	...	22.36	6.2
Clothing	22.76	5.8	...	...	22.76	5.1	15.29	4.7	...	...	15.29	4.3
Home articles	11.62	2.9	...	...	11.62	2.6	5.01	1.5	...	...	5.01	1.4
Hygiene, cosmetics	24.18	6.2	...	...	24.18	5.5	22.76	7.0	...	...	22.76	6.3
Education	0.55	0.1	...	...	0.55	0.1	0.56	0.2	...	...	0.56	0.2
Health	13.19	3.4	...	...	13.19	3.0	10.45	3.2	...	...	10.45	2.9
Transport	20.27	5.2	...	...	20.27	4.6	22.76	7.0	...	...	22.76	6.3
Entertainment	3.15	0.8	...	...	3.15	0.7	3.77	1.2	...	...	3.77	1.0
Loans, transfers, donations	11.16	2.8	...	...	11.16	2.5	0.98	0.3	...	...	0.98	0.3
Other services	26.42	6.7	...	...	26.42	6.0	15.52	4.8	...	...	15.52	4.3
Total Nonfood	159.59	40.6	...	...	159.59	36.0	119.45	36.8	...	...	119.45	33.2
Total Expenditures	393.36	100.0	50.06	100.0	443.42	100.0	324.27	100.0	35.05	100.0	359.32	100.0

Source: INCAP-IFPRI Survey, 1985.

Table 39--Food and nonfood expenditures per capita per year (based on 1-month recall, September 1983)

Commodities, Items	Coop Members Value of Purchases[a]		Nonmembers Value of Purchases[a]	
	In Quetzal	In Percentage	In Quetzal	In Percentage
Maize	13.71	4.9	14.76	6.4
Other Cereal, Bread	40.68	14.5	38.32	16.6
Pulses	10.11	3.9	7.95	3.4
Sugar	12.61	4.5	11.19	4.8
Roots, Tuber, Bananas	8.36	3.0	7.16	3.1
Vegetables, Fruits	14.56	5.2	10.92	4.7
Milk Products	6.05	2.2	5.76	2.5
Meat, Egg, Fish	43.55	15.5	37.85	16.4
Fat, Oil	4.35	1.6	3.71	1.6
Other Foods	3.15	1.1	2.90	1.3
Non-Nutr. Food, Beverage	14.33	5.1	11.31	4.9
Total Food	171.46	61.2	151.85	65.7
Fuel, Energy	15.32	5.5	12.65	5.5
Clothing	33.09	11.8	13.37	5.8
Home Articles	6.74	2.4	3.94	1.7
Hygiene, Cosmetics	12.69	4.5	11.76	5.1
Education	0.42	0.1	0.0	0.0
Health	7.44	2.7	6.91	3.0
Transportation	7.79	2.8	14.24	6.1
Entertainment	1.08	0.4	1.24	0.5
Loans, Transfers, Donat.	4.23	1.5	0.0	0.0
Other Services	19.81	7.1	15.13	6.5
Total Nonfood	108.61	38.8	79.24	34.3
TOTAL EXPENDITURES	280.07	100.0	231.09	100.0

Source: INCAP Survey, 1983.

[a] Excluding own-produced food consumed in the household.

Between 1983 and 1985, total expenditures at 1985 constant prices for all purchased items (excluding own-produced food) increased by nearly the same rate in member and nonmember households (5.1 and 5.0 percent, respectively). The relative difference in total expenditures per capita between the two, thus, remained constant in this period (Tables 40 and 41). It should be noted, however, that coop members spend substantially more on such items as housing and land purchases, which cannot be included in this comparison as the 1983 baseline does not exist. The annual recall for 1985 showed 84 percent higher spending for land purchases by coop member households which may also be indicative of a higher savings rate in coop households. This expenditure-savings pattern may also be a reason for the higher increase in expenditures among the recent export crop producers versus households which have been in the scheme longer. The introduction of new export vegetables leads to increased consumption of food and nonfood expenditures especially in the first two years of membership. Total expenditures of the new members who entered the scheme between the two surveys increased by 33.1 percent and food expenditures went up by 13.8 percent. Later, consumption expenditures increase less substantially, or in case of the medium-term members (3-4 years) did even drop in real terms. This pattern is a function of the one-shot reallocation of resources to export vegetables and higher returns to land and labor. Once this is achieved, further growth on top of this specialization effect is constrained by resource endowments and lack of new technology.

Table 40--Expenditures of coop members and noncoop members on food and nonfood per capita in 1983 and 1985 (in 1985 prices)[a]

Groups	1983						1985					
	Food		Nonfood		Total		Food		Nonfood		Total	
	Quetzal	Percent	Quetzal	Percent	Quetzal	Percent	Quetzal	Percent	Quetzal	Percent	Quetzal	Percent
Landless	257.30	54.8	212.00	45.2	469.30	100.0	270.83	58.5	192.15	41.5	462.93	100.0
Coop members by years of membership[b]												
Coop members since 2 yrs. or less	209.87	66.3	106.84	33.7	316.71	100.0	238.76	56.6	182.86	43.4	421.63	100.0
Coop members since 3-4 years	225.08	60.7	145.94	39.3	371.02	100.0	222.17	66.1	113.77	33.9	335.94	100.0
Coop members since 5-6 years	248.16	58.7	174.33	41.3	422.49	100.0	246.29	57.1	184.96	42.9	431.25	100.0
Total average for coop members	229.07	61.2	145.10	38.8	374.17	100.0	233.77	59.4	159.59	40.6	393.36	100.0
Total average for noncoop members	202.87	65.7	105.86	34.3	308.73	100.0	204.82	63.2	119.45	36.8	324.27	100.0

Source: INCAP Survey, 1983, and INCAP-IFPRI Survey, 1985.

[a] Excluding own-produced food consumed in the household as the 1983 survey does not include related information.

[b] Years of membership in the cooperative in 1985.

[c] There are only 7 observations in this group. In all other groups, at least 25 observations are the basis of the mean values listed.

Table 41--Change in per capita expenditures[a] by coop membership and by years of membership, 1983-85

	Coop Members		Nonmembers	
	Total Expend.	Food Expend.	Total Expend.	Food Expend.
	(percent change, 1983-1985)			
Total averages	5.1	2.1	5.0	1.0
Landless	...	...	-1.3	5.3
Coop members by years of membership:				
since 2 years or less[b]	33.1	13.8	...	...
since 3-4 years	-9.5	-1.3	...	...
since 5-6 years	2.1	-0.8	...	...

Sources: INCAP Survey, 1983, and INCAP-IFPRI Survey, 1985.

[a] Value of own-produced food is not included here as the 1983 survey did not include these items. In 1985 the value of own-produced food was 13 percent in coop members and 11 percent in nonmember households' total expenditure (Table 38).

[b] This group became members in the cooperative since 2 years or less before 1985; thus, they entered the cooperative since the 1983 survey.

It is noteworthy that landless households' total expenditures dropped in real terms by 1.3 percent. Contraction in overall employment in Guatemala and reduced real wage rates in the context of the economic crisis in the mid-1980s affected this group the most in rural areas. The favorable employment effects from the export vegetables at the location have apparently not counterbalanced these effects for the landless in the sample, but certainly reduced the adverse effects of the economic crisis.

A number of factors determine how scarce resources are allocated by poor households to food consumption versus other consumer goods. In order to test the extent to which the source of income along with other factors impinges on the budget share allocated to food, we specify a model for estimation of Engel curves in which relevant sources of income (their relative shares) are included as explanatory variables together with the level of income. Also, household size is controlled for to account for potential scale effects. As sources of income, we distinguish income earned from the new export crops, male income earned off-farm, and female income earned off-farm. The hypotheses to be tested are that income earned under men's control (off-farm and from the new export vegetables) is relatively less spent on food than farm income in general and women-controlled income earned off-farm is relatively spent more on food than general household income.

Three different models are specified to evaluate the hypotheses. A first model includes members and nonmembers and coop membership is controlled for to assess if there may be an effect over and above the relative income share effect from the new crops. This could be so, as

the institutional arrangements under which the export crops are grown and managed--such as cash payment schemes, savings opportunity--differ from cash cropping outside the coop scheme and because there are various ongoing activities for household extensions work by the coop. Secondly, the same model is estimated separately for members and nonmembers to test additionally for differences in spending behavior between the two groups.

Total expenditure is used as a proxy for expected permanent income in this analysis with its not entirely satisfactory implications, that is, for simplistic assumptions on savings. The results of the analysis are in Table 42.

Food expenditures as a proportion of total expenditures decrease significantly but not rapidly with increased income. At total sample mean, a 10 percent increase in total expenditure decreases the budget share to food by only 0.21 percent (computed from Table 42). The dummy variable for separating the coop members which is included in the model for the total sample (MIEM) is not statistically significant (Table 42). Once income levels and sources are controlled for, membership in the coop does not seem to have a distinct effect on shifting the budget share for food in one way or the other. At the margin at higher income levels, however, the budget share to food decreases more rapidly with rising income in coop member households than in nonmember households (see LTEXPCSQ in the three models, Table 42).

There are indications that male-controlled income is spent more according to men's preferences and more food may not rank high among them.[2] The income source-related variables indicate in this analysis

Table 42--Determinants of budget shares to food in coop member and nonmember households, 1985: regression model

Dependent variable: Budget share to food

Variables	Total Sample Parameters	Total Sample T-Values	Nonmembers Parameters	Nonmembers T-Values	Members Parameters	Members T-Values
HHSZ	0.003765	1.424	0.005195	1.462	0.002795	0.704
RCASH	-0.023010	-1.691	-0.018140	-1.047	-0.038070	-1.655
RFNAGINC	0.009191	0.261	0.018070	-0.411	-0.007464	-0.104
RMNAGINC	-0.023100	-1.706	-0.033500	-2.263	0.020290	0.578
MIEM	0.010550	0.797	...	...	...	...
LTEXPC	0.279710	1.861	0.156420	0.913	0.579280	1.821
LTEXPCSQ	-0.035270	-2.809	-0.024610	-1.694	-0.060220	-2.314
(Constant)	0.248630	0.557	0.596770	1.193	-0.630700	-0.650
	R^2 = 0.34		R^2 = 0.37		R^2 = 0.33	
	DF = 342		DF = 178		DF = 158	
	F = 25.6		F = 17.7		F = 12.8	

Variables:

HHSZ = household size (number of persons)

LTEXPC = log of per capita total expenditures serving as a proxy for expected (permanent) income

LTEXPCSQ = LTEXPCSQ squared

RCASH = ratio of income from new export vegetables over total income (total expenditure is used as proxy for expected total income)

RFNAGINC, RMNAGINC = ratio of female (male) nonagricultural off-farm income over total income (total expenditure is used as proxy for expected total income)

MIEM = membership in cooperatives (1=members, else=0)

that an increased share of income from new export vegetables (RCASH) decreases the budget share to food over and above the total income effect in coop member households. The effect is, however, not highly statistically significant. If, for instance, the income share from new cash crops increases from 0 to 50 percent, food budget share is reduced by 1.2 percentage points holding income constant.

This analysis also shows that the net effect for the food budget share of an increased income share of new export crops is very similar in the order of magnitudes to the net effect of an increased share of male nonagricultural income (see the parameters for RCASH in coop member model and for RMNAGINC in the nonmember model in Table 42). On the contrary, women's share in total off-farm income (RFNAGINC) does not appear to have an effect on the budget share to food over and above total income.

Of 100 Quetzales of incremental income, coop members in the lowest income quartile spend 52.7 Quetzales on food but nonmembers spend 61.0 Quetzales on food (Table 43). The estimates of the marginal food expenditures within expenditure quartiles by members and nonmembers show generally lower values for the coop members within the same expenditure groups (Table 43). These estimates also point at an interesting relationship between income (total expenditure) and marginal food expenditures. In the poorest quartiles, both members and nonmembers spend less of incremental income on food than the second quartile (in case of the coop members, even less than the third quartile, Table 43). Apparently, the poorest households have a high propensity to spend on goods and services other than food at the

Table 43--Spending of incremental expenditure on food by member and nonmember households and within expenditure quartiles[a]

	Percent of Incremental Expenditure Spent on Food	
	Members	Nonmembers
Lowest quartile	52.7	61.0
Second quartile	70.4	76.6
Third quartile	58.1	57.0
Highest quartile	31.9	44.5

Source: INCAP/IFPRI Survey, 1985.

[a] The estimates of the presented marginal shares of food expenditures are based upon the following regression model estimated separately for each of the groups and quartiles:

food expenditure per capita = f (HHSX, LTEXPC, RCASH, RMNAGINC, RFNAGINC)

(See Table 42 for list of variables).

margin. This expenditure pattern may originate from fixed expenditure obligations for nonfood necessities. As shown in the following chapter, this expenditure behavior may still be consistent with a high expenditure elasticity of calorie consumption among the poor.

DYNAMIC CHANGES IN EXPENDITURE LEVELS

During the two-year period between the surveys, the distribution pattern of expenditures changed only slightly. This does not mean, however, that the situation of households in poverty in the area is a static one. To what extent did households stay, move upward or downward, in terms of real per capita income and what is the role of new export vegetables in this respect? The per capita expenditures from 1983 are, for the purpose of this comparison, expressed in 1985 prices.[3]

Transition matrices of households by expenditure classes inside and outside the export crop scheme provide interesting results. For coop members among the poorest 33 percent in terms of per capita expenditures, only 38.0 percent stagnated in this position from 1983 to 1985, while it was 55.0 percent in case of the nonmembers (Table 44). A much higher percentage of coop members moved upward in the expenditure classes and much less moved downward. This also holds true for the middle and "high" income terciles. For instance, among coop members, 30.4 percent dropped from the middle group to the lower class and 37.5 percent moved to the higher class; among the nonmembers in this class in 1983, 36.7 percent dropped to the lower and 25.0 percent

Table 44--Transition of households across expenditure terciles between 1983-1985 (at constant 1985 prices) by member and nonmember households

	Old Situation in 1983			New Situation in 1983 (Total)
	Lowest 33%	Middle	Highest 33%	
		(coop members)		
Transition between 1983 to 1985				
Lowest 33 percent	38.0	30.4	11.7	25.9
Middle	38.0	32.1	21.7	30.1
Highest 33 percent	24.0	37.5	66.7	44.0
Total in this class in 1983	100.0	100.0	100.0	
Old situation in 1983 (percent)	30.1	33.7	36.1	100.0
No. of observations	(50)	(56)	(60)	(166)
		(noncoop members)		
Transition between 1983 to 1985				
Lowest 33 percent	55.0	36.7	18.8	39.9
Middle	33.8	38.3	37.5	36.2
Highest 33 percent	11.3	25.0	43.8	23.9
Total in this class in 1983	100.0	100.0	100.0	
Old situation in 1983 (percent)	42.6	31.9	25.5	100.0
No. of observations	(80)	(60)	(48)	(188)

Sources: INCAP Survey, 1983, and INCAP-IFPRI Survey, 1985.

moved to the higher class. The whole spectrum of households moved more relatively upwards among coop members than among nonmembers.

EFFECTS ON CALORIE CONSUMPTION

The problem of protein-energy deficiency of the rural poor in Guatemala is well researched.[4] It is, therefore, not the objective of this research to comprehensively evaluate the nature and prevalence of food deficiencies and malnutrition but to assess the direction and magnitude of changes in consumption and nutrition due to increased export crop production in smallholder households.

Differences in food availability in the Western Highland households are closely related to income. This is to be expected, at such low levels of income. If the sample is grouped into four equal total expenditure per capita groups (including the value of home-produced food consumed), the lowest quartile had less than two-thirds of calories per adult equivalent unit than in the highest quartile (Table 45). Within the Western Highlands, the degree of poverty as reflected in levels of food availability in households indicates a considerable degree of inequality among the poor. It should be noted that calorie availability for this assessment was made on the basis of monthly purchases of food and food from own production used for home consumption. This rough approach to food consumption is likely to result in higher calorie per capita figures than through an accounting of actual food intake since losses in storage and processing and losses due to waste are not accounted for. Ideally, one would like to account for actual food intake of individual family members in view of findings from

Table 45--Food availability and composition of food consumption by expenditure quarters (mean values) in the sample

	Total Per Capita Expenditures[a]			
	Lowest 25%	25-50%	50-75%	75-100%
Average of 1985 per capita expenditures (Quetzales)	186	283	410	771
Calorie availability per adult equivalent per day				
Coop members	2,214	2,563	3,088	3,446
Nonmembers	2,122	2,680	3,101	3,401
Total average	2,153	2,628	3,094	3,429
Percent of total calories from:[b]				
Maize	57.2	57.0	54.6	49.4
Other cereals	6.1	7.4	5.7	6.8
Pulses	9.0	8.3	8.2	7.3
Sugar	13.7	11.7	10.7	11.8
Meat, egg, fish	4.8	5.6	6.5	7.4
All other foods and beverages	9.2	10.0	14.3	17.3
Total (percent)	100.0	100.0	100.0	100.0

Source: INCAP-IFPRI survey, 1985.

[a] This includes the value of own-produced food consumed by the household.

[b] For average of total sample.

earlier research in Guatemala which suggest that the income-food-intake relationship (calories) is more pronounced among children (preschoolers) than for the household as a whole.[5] To the extent Flores' finding based on survey data from the 1960s is still valid, the household income-calorie consumption relationship for preschoolers is assumed to be even higher than what is presented here for the total household averages.

More than half of the available calories in households stem from maize, but this share decreases with increasing income (Table 45). Also, the calorie share of pulses (mainly beans) decreased while the share of meat, eggs, fish, and other food calories increased with higher income. Accordingly, the price per calorie increases with rising income as the diet gets more diversified. Coop members spend an average 0.265 Quetzales per 1,000 calories while nonmembers spend 0.240 per 1,000 calories, or 10 percent less.

Comparison of food availability between export vegetable-producing households (coop members) and other households shows that the latter acquire, on the average, about 7 percent less calories per capita. Coop members acquire a lower share of maize calories but the absolute amount of calories per capita from maize is still 4.4 percent higher than in nonmember households (Table 46).

The diet composition of coop members and nonmembers is not significantly different. Coop members slightly increase the share of calories from sugar, starchy roots, vegetables, meat products, fats, and other processed foods (Table 46). These differences between averages of coop members and nonmembers' consumption appear largely

Table 46--Food availability and composition of food consumption in households with versus without export vegetable production

	Coop Members	Nonmembers
Calorie availability per adult equivalent per day	2,931	2,733
Percentage of total calories from:		
Maize	53.8	55.3
Other cereals	6.2	6.8
Pulses	8.1	8.3
Sugar	12.1	11.8
Starchy roots, bananas	2.7	2.5
Vegetables, fruits	5.6	5.4
Milk	0.5	0.4
Meat, egg, fish	6.4	5.8
Fats and oils	1.3	1.0
Other foods and beverages, meals outside home	3.3	2.7
Total (percent)	100.0	100.0

Source: INCAP-IFPRI survey, 1985.

determined by the differences in income levels and distribution between the two groups. As shown in Table 45 per capita calorie consumption of coop members within the same expenditure quartiles is sometimes slightly higher (for example, in the lowest and highest quartile) and sometimes slightly lower (for example, in the two middle quartiles) than nonmembers. More refined approaches are used below to test for the significance of these differences.

Our point of departure for the concept of this analysis of the effects of increased export crop production on food consumption is that the principal relationships between change in prices and levels of income and food consumption are well established. As real income increased in households which adopted new export crops, we hypothesize that food consumption levels increase too. Less clear are hypotheses related to the effects of income source changes, control over household income, and the form and frequency of income.[6] Export vegetable production impinges on all of these jointly with its favorable effect on the overall real income. The net effect of export vegetable production on household food consumption may thus be smaller or larger than the "pure" income effect suggests. These factors shall be evaluated in the following model which attempts to explain aggregate household-level food availability in the form of calories (c_i):

$$c_i = f(I_i, I_i^2, S_{ji}, D_{ni}, P_{mi}, M_{qi})$$

where:

I_i = per capita income of household i (total expenditure is used as income proxy)

S_j = a set of j variables describing sources of income (from new cash crops, off-farm women's income)

D_n = a set of n variables describing household size and composition

P_m = a set of m variables depicting food prices that respective households face

M_q = a set of q variables describing the membership and its duration in the cooperative for export vegetable production.

The model is estimated both for the total sample and separately for the lowest 50 percent of income groups among members and non-members. The actual specification of the model along above formulated hypothesis and the estimation results are presented in Table 47.

The estimated response of calorie availability to changes in levels of income is highly significant. Additional income increases calorie consumption (LTEXPC) but at decreasing rates at the margin (LTEXPCSQ). The elasticity of calorie consumption with respect to income is 0.306 at the total sample mean. As the new export crops increased household's per capita income substantially, a positive effect for calorie consumption in coop households is to be expected according to these parameter estimates.

As the results from the food expenditure analysis in the previous section suggested that export crop income is spent less for food at the margin, we want to test to what extent this translates into calorie consumption. The relevant forces here may be the membership in the cooperative reduced women's income earned off-farm and increased shares of cash income from new crops under men's control.[7]

Table 47--Availability of calories in households and export vegetable production: regression model

Dependent variable: calories available for consumption per day in the household (from purchases and consumed from own production, 1985)

	Total Sample		Lowest Two Quartiles			
			Coop Members		Nonmembers	
Variables	Parameters	T-Values	Parameters	T-Values	Parameters	T-Values
LTEXPC	20446.410	2.663	3928.210	1.218	6289.810	3.794
LTEXPCSQ	-1328.330	-2.072	...	...	...	...
RFNAGINC	-1685.120	-0.971	-1096.170	-0.437	-1675.740	-0.606
RCASH	57.254	0.082	553.030	0.438	173.124	0.194
HHSZ	1747.343	13.021	1244.150	5.075	1510.410	6.629
RCHILD	-6627.550	-3.106	-4957.520	-1.088	-4923.010	-1.230
MPRICE	-82424.880	-5.774	-46732.990	-1.821	-54545.190	-1.648
BFPRICE	505.477	1.020	949.183	0.826	1139.320	1.168
MIEM	-829.710	-1.218	...	...	...	...
(Constant)	-47623.400	-2.060	-6841.310	-0.394	-18424.900	-1.417
	R^2 = 0.41		R^2 = 0.33		R^2 = 0.64	
	F = 26.6		F = 4.20		F = 9.60	
	DF = 340		DF = 60		DF = 98	

LTEXPC = log of total expenditures per capita per year in Quetzales (as a proxy for permanent income)

LTEXPCSQ LTEXPC squared

RFNAGINC = ratio of female off-farm income over total income (total expenditure is used as proxy for permanent income in the ratio)

RCASH = ratio of income from new cash crops over total income (total expenditure is used as proxy for permanent income in the ratio)

PROD = production of maize and beans per year

HHSZ = number of persons in the household

RCHILD = ratio of number of children under 5 over number of persons in the household

MPRICE, BFPRICE = price of maize, beef

MIEM = membership in the cooperative (1, else = 0)

Most of purchased food items in Guatemalan households are actually acquired by women. Only in the case of maize is there a significant share of the transactions purchased by men (Table 48). In this environment, one might expect support for the hypothesis that women's income levels have a particularly positive effect on levels of food acquisition over and above total income of the household. This hypothesis is tested by the variable "share of (off-farm) income earned by women in total income (RFNAGINC)" in Table 47. It does not find statistical support. Income earned by women off-farm does not significantly change calorie acquisition after controlling for total income although we found earlier in the expenditure analysis that an increased share of women controlled off-farm income increased the budget share to food over and above the income effect. This difference may be explained as follows: the usual off-farm work in trading and services takes women away from home from morning till dawn even if temporary migration is not involved. More expensive time-saving foods may enter the budget of such households in this case. Obviously, generalizations of the relationships between women's income and food acquisition are risky if the interactions with mode of income earning are not taken into account. The issue of the actual value of human time discussed above and the possibly different utility derived by households from on-farm versus off-farm work at equal returns per unit of time are relevant here too.

An increased share of income from new export crops in total income (RCASH) does not have a significant effect on calorie acquisition over and above the income-level effect. The respective parameters of this

Table 48--Transactions in food purchases: "who bought the item?"
(based on monthly food purchase survey)

Food Item	Husband	Wife	Other Persons
		(percent)	
Milk	8	87	5
Eggs	1	92	7
Pork	2	95	3
Sausage	2	90	8
Maize	24	76	-
Beans	2	93	5

Source: INCAP-IFPRI survey, 1985.

variable are not statistically significant in any of the three models (Table 47). That is, income from the new export vegetables translates into calorie availability for consumption just as income in general in these households.

In the model for the total sample, we test if the membership in the cooperative (MIEM) has an effect on calorie acquisition over and above the income effect, and the effect for the structure of the agricultural income stream which now includes more cash income from export crops. The respective parameter estimate suggests a statistically hardly significant negative effect of coop membership holding everything else constant; that is, controlling for income level, income composition, household size and demographics, etc., coop members acquire 6 percent less calories than nonmembers. This tendency is further supported by the separate estimates of the calorie consumption functions for members and nonmembers in the lowest income half of the joint income distribution (Table 47). Nonmembers show a highly significant positive response in calorie acquisition with rising income but coop members do not. Calculated at the identical income level at the mean of the joint sample--not at the differing means of the two separate samples which would distort the picture--coop members increase their calorie acquisition by 2.8 percent with 10 percent more income, but nonmembers increase theirs by 4.4 percent.[8]

The households in the area are clearly price-responsive in their calorie acquisition. Understandably, the maize price (MPRICE) is most prominent in this respect as about 50 percent of calories come from maize.[9] The estimated (maize) price elasticity of calorie consumption

is high which is estimated to amount to -1.15 among the lowest income half of nonmembers and 0.95 among the coop members in that income group--which means that a 10 percent increase in the maize price reduces calorie availability by 9.5 percent at the household level. If increased growing of export vegetables were to shift farm households from net sellers or self-sufficiency to net purchasers, or whole village communities in the Western Highlands to net importers, the related price effect could have a significant effect on calorie consumption.

The net effects of the income level and income source and the switch to export crop production in the coop scheme on changes of calorie acquisition are captured in Table 49. In the final assessment, the effects of increased export crop production on food acquisition are positive in terms of calorie availability to the households, supporting further the conclusion drawn from the agricultural production and income assessments that household-level food security seems to have improved. Yet, the change in the structures of income earning reduces the positive gross-income effect for calorie acquisition from an expected increase by 7.2 percent to an overall net effect of 1.9 percent in a typical farm household that joined the coop. The following section traces these effects to the development of nutritional status of children in the households.

EFFECTS ON NUTRITION

The nutrition problem in the Guatemala Highlands is a syndrome which stems from poverty. The health and sanitation environment along

Table 49--Net effects of increased export crop production for calorie acquisition at the household level

Effect Due to ...	Percentage Change in Calorie Consumption[a]
Increase in real income	+7.20
Increase in share of total household income from cash crops	+0.09[b]
Reduced share of female nonagricultural income	+0.23[b]
Membership in the cooperative	-5.60[b]
Net effect of the above	+1.92

[a] Calculated on model for total sample (Table 47). The changes are computed from the mean variable levels in the range of the farm size groups, 0.25 to 1.0 hectare, and the respective changes between members and nonmembers. In this group, income increased by 26 percent, the ratio of income from cash crops changed from 0.04 to 0.29, and female nonagricultural income share is down from 0.05 to 0.03.

[b] These values are computed from parameter values below 10 percent of significance.

with the ability to acquire food--be it from own production or market --and the employment situation, especially of mothers, are important interrelated factors that determine nutritional performance of children.[10] The new export vegetable production scheme directly or indirectly impinges on all of these variables.

Patterns of Malnutrition in the Region and Sample Population

In a number of social indicators, coop member households appear to have a better standard of living than nonmembers. Many of these indicators may be directly or indirectly linked to increased income of coop members, but other indicators may reflect on their desire and ability to change their living standards as compared to others in the communities. In general coop members have higher education levels. Their housing and water supply conditions are also better, and they make more use of higher quality health services (clinics) when needed (see indicators, Table 50). Basic health services, such as vaccination, are used similarly by the two groups. Although generally less poor, the percent of coop members obtaining food aid tends to be higher than among nonmembers (Table 50).

As found in the above analyses, real income of households increased due to export vegetables and food from own production increased too; women's on farm employment likewise increased leading to less off-farm work. Also, overall employment in the six communities increased which should be beneficial to the local landless and smallest farmers which depend more on off-farm work. Thus it may be hypothesized that the nutritional situation in the six communities improved, in general

Table 50--Selected social indicators for coop members and nonmembers

	Coop Members means	Nonmembers means
Household size (persons)	6.7	6.4
Literate heads of household (percent)	61.7	55.4
Electricity in the house (percent)	60.3	47.7
Housing conditions		
Percent of houses with mud floor	41.7	56.5
Percent of houses with corrugated iron	69.7	49.8
Own water tap or own well (percent)	79.6	61.9
Use of health services (percent)		
At clinics	45.6	33.4
At pharmacy or other services	50.1	60.6
Vaccination of children under 5 years (percent)		
Measles	68.6	65.1
BCG	70.8	67.1
DPT (3 or 4 doses)	50.0	46.6
Polio (3 or 4 doses)	48.8	45.3
Food aid received in		
1983 (percent of households)	53.2	45.8
1985 (percent of households)	45.0	42.8

and in particular in households participating in the export crop cooperative. This hypothesis shall be tested using nutritional status indicators of children--weight-for-age, height-for-age, and weight-for-height. In this analysis, the respective indicators are normalized for age differences by expressing them in terms of their deviation from the age-specific standards over the standard deviation (Z-scores).[11]

The general nutritional situation in the study area, as represented by children in households not participating in the cooperative, is not very different from other parts of the Highlands despite the accessibility of the survey villages to Guatemala City and to infrastructure (Table 51). Also, prevalence rates of malnutrition are at similar levels or even higher, especially height-for-age, in these communities as found in more remote parts of the Western Highlands (Table 52).

Comparing the Guatemalan data with comparable data from Africa, we find significant differences. For instance, average Z-scores for growth retardation of about -1.4 were found in a comparable survey in The Gambia.[12] However, a straight comparison of average Z-scores of anthropometric indicators across populations may not be fully justified because of ethnic and other differences between populations.

A comparison of the 1983 and 1985 prevalence rates does not indicate a general improvement in nutritional status (Table 52). We should refrain from generalizing this tendency to local developments. During these years, Guatemala was going through a severe economic crisis, which may be the reason for this general pattern of development. Desired information on change over time in anthropometric

Table 51--Nutritional status in the study area and in other locations in Guatemala (children under 60 months)

	Weight-for-Age	Height-for-Age	Weight-for-Height
		(average Z-scores)	
Study area 1985[a] (nonmembers of cooperative)	-1.89	-3.27	0.11
A study area in four villages in Patulúl area 1984	-1.98	-3.26	0.00
A study area in coffee plantations 1984	-1.65	-2.61	-0.05

Sources: INCAP-IFPRI Survey, 1985; and Victor Valverde, Hernán Delgado, Rafael Flores, Ricardo Sibrián, "Minimum Wage Law and Nutritional Status in Guatemala" (Guatemala: INCAP, 1985).

[a] Children of 6-60 months of the non-members of the cooperative.

Table 52--Prevalence of malnutrition in the Western Highlands of Guatemala (surveys in the 1980s)

	Children Below -2 Z-scores in Percent		
	Weight-for-Age	Height-for-Age	Weight-for-Height
Study area 1983[a]	43.2	82.1	1.7
Study area 1985[a] (nonmembers of cooperative)	42.4	89.2	1.3
Western Highlands (North)			
1983[b]	37.9	71.1	1.3
1987[c]	58.3	66.2	8.2

Sources: USPADA/INCAP/UNPRODA, Resultados del Analysis de los Encuestos de base agroeconomica, Dicta y Estado de Nutricion Infantil, Del Proyecto Maga - AID 520-T-034/0255, 1983, Guatemala, Enero 1986; INCAP/IFPRI survey 1985; INCAP/COGAAT Survey, 1987.

[a] 6 - 60 month(s), noncoop members.

[b] Six departments: Huehuetenango, Quezaltenango, San Marcos, Totonicapan, El Quiche, y Solola; children 0-60 months.

[c] 0-71 month(s) in two departments: Totonicapan, El Quiche.

indicators from other locations in Guatemala in the early 1980s is not available. Comparison of cooperative members versus nonmembers shows that children of coop members tend to be better off in terms of weight and height-for-age and about the same in terms of weight-for-height.

Table 53 presents an analysis of the prevalence of wasting and stunting among the children of families who are coop members versus nonmembers. Two cut-off points are used for both the weight/height and height/age standard. The commonly used cut-off point to classify wasting is children below 80 percent weight/height and for stunting, below 90 percent height/age standards. Only children 6-60 months of age are included. By above standards, 66.7 percent of children of coop members and 75.7 percent of children of nonmembers were stunted in 1985. This reflects an increase in both groups, although somewhat higher in the nonmember group. Severe stunting (below 80 percent) hardly prevails among children of coop members (0.6 percent), but affects a small percent of children of nonmembers (5.8 percent). Severe wasting, which represents an indicator of short-term nutrition problems, is practically nonexistent in both groups. In 1985, 0.6 percent of children of coop members and 1.0 percent of children of nonmembers were affected.

Children in both groups who have been moderately underweight have substantially improved, relatively more among children of coop members. Between 1983 and 1985, the percentage of children below 90 percent of weight/height standard decreased from 15.1 to 6.8 percent among children of coop members, and from 10.2 to 7.8 percent among children of nonmembers.

Table 53--Prevalence of malnutrition among children of coop members and nonmembers, aged 6-60 months, 1983 and 1985

Year	Coop Members[a]		Nonmembers[a]	
	Weight/Height	Height/Age	Weight/Height	Height/Age
	(percent of children below 90 percent of reference standard)[b]			
		(Stunted)		(Stunted)
1983	15.1	59.3	10.2	65.1
1985	6.8	66.7	7.8	75.7
	(percent of children below 80 percent of reference standard)[b]			
	(Wasted)		(Wasted)	
1983	2.3	0.6	0.9	4.2
1985	0.6	0.6	1.0	5.8

Source: INCAP survey, 1983; INCAP/IFPRI survey, 1985.

[a] Number of children: 1983 = 172 coop members, 215 nonmembers.
1985 = 177 coop members, 206 nonmembers.

[b] The standards used are the NCHS standards.

Income and Nutritional Improvement

The straightforward comparisons of mean values and prevalence rates of malnutrition provide limited insights, since we know from the earlier analysis that members of the cooperative have higher incomes than nonmembers and have become richer through the export vegetables. The sample is therefore broken into three income classes using expenditure per capita as an income proxy. The separate tabulations (Table 54) for children aged 6-60 and 6-120 months indicate a generally positive but weak relationship between income and improvement in nutritional status. A striking pattern is the slight improvement between 1983 and 1985 in weight-for-age among children from households in the highest tercile income group, while a worsening among children from households in the lowest and middle income group appears. Similarly, prevalence of stunting (height-for-age) increased among children from households in these two terciles, while remaining essentially unchanged among the highest income group. The higher prevalence of stunting may be related to the worsening of the general socioeconomic conditions during the first half of the 1980s, when real per capita GDP decreased by 20.5 percent (1981-1985) in Guatemala.

The earlier analysis on the income effects for food consumption (calories) suggested a clear relationship between income and food energy consumption. What follows here is a multivariate analysis of the income-nutrition relationship. This model allows us to test for effects of change in income control and income composition in the household for nutrition resulting from increased commercialization.

Table 54--Income levels[a] and prevalence of malnutrition of children

	(N)	Lowest Tercile	Middle Tercile	Highest Tercile
		(percent of children below -2 Z-scores for children, 6-120 months)		
Weight-for-age	1983 (755)	41.6	38.9	36.8
	1985 (824)	43.0	36.5	32.2
Height-for-age	1983 (755)	77.4	75.0	77.7
	1985 (824)	83.4	87.4	74.4
Weight-for-height	1983 (755)	1.9	0.8	2.1
	1985 (824)	1.9	0.7	0.8
		(percent of children below -2 Z-scores for children, 6-60 months)		
Weight-for-age	1983 (406)	46.2	38.0	39.7
	1985 (394)	48.3	38.2	34.1
Height-for-age	1983 (406)	78.7	78.5	83.6
	1985 (394)	84.8	95.8	81.1
Weight-for-height	1983 (406)	2.4	1.7	0.9
	1985 (394)	1.7	1.4	0.8

Source: INCAP survey, 1983; INCAP/IFPRI survey, 1985.

[a] Expenditures of respective year in per capita terms as income proxy (excluding value of own-produced food consumed which was not collected in 1983 survey).

We hypothesize that increased per capita income improves nutritional status but diminishing so at the margin. We hypothesize that an increased share of male nonagricultural income and/or an increased income share from export crops which is also male-controlled may have a negative effect on child-welfare related spending, holding household income constant; this would be so if a disproportional share is spent on luxuries, child nutritional status would be worse at a given income level. On the other hand, we hypothesize further that an increased share of income received and controlled by females will lead to increased child welfare related spending and nutritional improvement given mothers' primary objectives. Subsistence food income is included in the total household income variable in this model.

The model has the following formula:

$$(1) \quad S_{ij} = f(DEM_{ij}, INCOME_j, INCOMP_j,)$$

where:

S_{ij} = nutritional status of child (i) in household (j) in 1985

DEM_{ij} = demographic variables of child (sex, age in months--level and squared, birth order)

$INCOME_j$ = household(j) income per capita per year (and the respective squared term)

$INCOMP_j$ = composition and sources of income (shares from new export crops, male- or female-earned nonagricultural income).

From the <u>results</u> of this model (Table 55), as applied to the three nutritional status variables of 1985, the following points are highlighted:

Table 55--Effects of income and income source and composition on the level of nutritional status: multivariate analysis (children aged 6-120 months)

Explanatory Variables	Weight-for-Age Z-Scores		Height-for-Age Z-Scores		Weight-for-Height Z-Scores	
	Estimated Parameters	T-Values	Estimated Parameters	T-Values	Estimated Parameters	T-Values
Age in months	-3.489E-03	-0.85	-0.0156	-3.03	-9.485E-03	-2.28
Age squared	3.497E-05	1.14	1.397E-04	3.64	1.053E-04	3.39
Birth order[a]	1.706E-04	0.01	-0.0240	-1.37	0.0220	1.55
Sex (male=1, female=2)	7.083E-03	0.12	0.0379	0.52	-0.0562	-0.96
Duration of breastfeeding[b]	9.663E-05	2.03	1.894E-04	3.17	-3.063E-05	-0.63
Income per capita[c]	8.231E-04	3.20	7.807E-04	2.41	5.162E-04	1.98
Income squared[c]	-3.930E-07	-2.74	-3.489E-07	-1.93	-2.625E-07	-1.80
Share of male nonagricultural income	0.1613	2.00	0.3291	3.24	-0.0531	-0.67
Share of female nonagricultural income	0.4953	2.20	0.4895	1.73	0.3140	1.37
Share of income from export crops	0.1569	1.88	0.1958	1.81	0.0640	0.73
Constant	-2.1165	-12.89	-3.110	-15.08	0.0549	0.33
R^2	0.032		0.073		0.028	
F-value	3.590		7.280		3.290	
Degrees of freedom	785		785		785	

[a] Birth order: first-born child = 1, second = 2, etc.
[b] Duration of breastfeeding: variable only for children above 24 months of age (else = 0).
[c] Expenditure per capita per year is used as proxy for income.

- The level of income (approximated by the 1985 per capita expenditure) is statistically highly significant for the weight/age, height/age, and for the weight/height indicator. At higher levels of income, the marginal effect is reduced as hypothesized and this is indicated by the negative sign for the squared income term. This means that marginal income increases improve nutrition more in poor households than indicated at sample means. The estimation results suggest that at sample mean, a 10 percent increase in income (total expenditure) increases the Z-score of weight-for-age by 1.5 percent, the Z-score of height-for-age by 0.9 percent, and the Z-score of weight/height by 9.7 percent. The high income elasticity of short-term nutritional improvement (for weight-for-height) suggests that even marginal income growth among the poor leads to significant short-term weight gains of children. It thus can be inferred that increased real income due to the export crops has a particularly significant effect in this respect. To reduce stunting substantially, however, would require a major increase in income.
- Higher shares of off-farm nonagricultural income improves the nutritional status of children regardless if female or male earned. This is opposite to our hypothesize in case of male-controlled income. The respective parameter values, however, indicate different levels of impact. Children's weight-for-age improved more for any additional percentage of women's income over total income versus men's income. In the height-for-age model which depicts the long-term effects, the differential effect

between male and female controlled income is less pronounced; and for short-term nutritional status (weight-for-height), income control within the household does not appear to be an issue (the parameters are not statistically significant).

- A higher share of income from the new export crops has a low positive effect on nutrition over and above the general income effects in the weight-for-age and height-for-age model, but is not significant in the weight-for-height model. Our hypothesis that income from new cash crops, which is largely men-controlled, would be disproportionately used for nonfood and luxury items that would adversely affect nutrition of children in the household does not find support in this analysis.

Social Programs

The commercialization process studied in this case is inseparable from the cooperative scheme *Cuatro Pinos*. The cooperative has developed and implemented a social program, including health and sanitation activities and education. These program activities are briefly described in the following. They may have an effect on nutritional improvement possibly over and above the income-consumption effect of the new export crops in the long term.

The programs that the cooperative offers can be divided into three categories: educational programs, medical services, and productive projects. In the latter category falls the rabbit project which was started in March 1986 for women. The project consists of providing credit for acquisition of a rabbit pen and three rabbits, credit which

must be repaid in one year. Furthermore, participants are trained in rabbit growing, maintenance, and slaughtering techniques. As of April 1987, 105 women had participated in the project. It is estimated that 50 percent of the rabbit meat production is for self-consumption, and the remainder is sold to supermarkets in Guatemala City.

By statute, 10 percent of the cooperative profits are earmarked for the cooperative's educational fund. This amount in 1986 to 77,000 Quetzales, and is estimated to total to 95,000 Quetzales in 1987. Among the educational programs, the first one which was initiated in 1978 (in Santiago) was an adult education program for members and nonmembers, with primary education and literacy classes. In 1983 the program was expanded to three communities with the three teachers being directly employed by the cooperative. In 1986, 132 adults finished the primary education subprogram (of which 36 were nonmembers), and 66 finished the literacy subprogram (12 nonmembers).

Since 1984 the cooperative has organized a food and nutrition program for spouses of members, in which as of mid-1987, 2[illegible]5 women have participated. The contents of the program centers on different forms of preparing vegetables (particularly broccoli, snowpeas, and cauliflower) and their nutritive values, in order to stimulate more self-consumption of these foods. The program is conducted by two home extension workers who are employees of the cooperative and who were partially trained by INCAP.

In 1980 with funds from the "Swiss group," a nongovernmental development organization, several children started to receive study scholarships. The scholarship program was formally organized in 1985,

and scholarships are provided for secondary education and vocational training and cover normally tuition and books. The education committee of the cooperative reviews and approves scholarship applications. In 1987, 47 scholarship applications were approved.

An institution providing secondary education has been established in Santiago and the cooperative is providing financial assistance, and so is benefitting indirectly some of its members. Additional educational programs were started in 1985 for school children in production techniques related to vegetables and aspects of cooperativism, and in 1986 cooperative education courses were organized for members, their spouses, school children, and cooperative officials. Technical training in administration, accounting, etc. was initiated in 1987 for personnel of the cooperative.

The medical services program consists of several subprograms: a) maternal-infant, b) pre- and post-natal care, c) outpatient consultations, and d) deworming. The program is currently carried out in all communities in which the coop is drawing members. The staff consists of a full-time doctor (as of August 1986), who is an employee of the cooperative and who spends four afternoons in the week in the health clinic in Santiago and divides the remainder of the time among the other communities; this is in addition to a full-time health promoter who, among other things, prescribes medicines. Starting in 1982 and until August 1986, a medical doctor provided services two mornings in the week in Santiago and Pacul. In January 1987 the cooperative established a pharmacy in Santiago which also supplies medicines to the other communities.

FOOD CONSUMPTION AND HEALTH BASED MODELS OF NUTRITIONAL IMPROVEMENT

In order to assess the effects of increased commercialization on nutritional status of children, we hypothesize that the related income effects can be traced to nutrition through increased food consumption and improved health and sanitary conditions. Specifically, in the following model, we include household calorie availability as a proxy variable for household food consumption. Household food availability may be not a satisfactory indicator of child food consumption. Yet, the hypothesis is that children capture a share of incremental household calories. We also introduce additional indicators related specifically to breastfeeding duration.

Poor latrine facility is used as a proxy for sanitation environment. We furthermore hypothesize that households with better education have the ability to make better use of available resource to improve health and nutrition of their children. Finally, we evaluate what effect the duration of membership in the coop has over and above the income-consumption effect, on children's health and nutritional status. Beneficial effects from coop membership may come from participation in the social programs, such as literacy classes, food and nutrition education of women, and improved information exchange among communities. Adverse effects might result from changes in income control not captured fully by the food consumption variables and women's time constraints for child-nurturing activities.

The model, other than the income-based model above specified, is a cohort-specific analysis of determinants of change in nutritional

status. The models for the cohorts of identical children aged 6-60 months in 1983 and 30-84 months in 1985 have the following form:

$$(2) \quad dS_{ij}^{(1983 - 1985)} = f(DEM_{ij}, CAL_j, BRE_{ij}, SAN_j, EDU_j, PER_j, S_{ij}^{(1983)})$$

with

$dS_{ij} = S_{ij}^{(1985)} - S_{ij}^{(1983)}$

S_{ij} = nutritional status of child$_{(i)}$ in household$_{(j)}$ in 1985 (weight or height-for-age, or weight-for-height Z-scores)

DEM_{ij} = demographic variables of child (sex, age in months-level and squared, birth order)

BRE_{ij} = breastfeeding duration (children over 24 months)

SAN_j = sanitary environment (latrine)

CAL_j = household-level calorie consumption per adult equivalent (level and squared)

PER_j = years of coop membership

EDU_j = education of head of household (years of schooling).

Inclusions of individual child's nutritional status indicator (1983) before the period during which change is measured (1983-85) takes account of individual characteristics and this increases overall explanatory power of the models as compared to the purely cross-sectional, income-based models. The lower the Z-score at the outset (1983), the greater the reduction in weight deficiencies during the two years of observation.

Children, for instance, which were underweight at -2 Z-scores in 1983 tended to catch up by one Z-score over the period (-0.5004 x -2, see Table 56). This points at the fact that a high proportion of malnutrition--reflected in weight deficiency--is of an episodic nature. These series of episodes of weight losses than create the long-term nutritional problem reflected in growth deficiency.[13] Although significantly increasing too, catch-up growth from a stunted position at the outset occurs much less than catching up weight. It should be noted that age of child is controlled for in this analysis and seasonality is eliminated as the sample surveys were done at the same time in two years.

Other interesting results of the regression models presented in Table 56 relate to the effects of food consumption: household-level calorie availability does have a strong positive effect--though decreasing at the margin--on the more short-term indicator of nutritional status (weight-for-height). It should be reiterated that household-level calorie availability is only a rough indicator for the more relevant child level caloric intake and that current calorie consumption would be an unsatisfactory indicator for the food availability history to which the children were exposed. For this reason in the long-term model of nutritional status (height-for-age), current calorie availability was not included as a variable. To the extent, the new export vegetables increased income and through that household food availability these results show that nutritional status of children is likely to be improved at least (statistically) significantly so in the short run.

Table 56--Determinants of change in nutritional status and the role of export crop production: multivariate analyses (cohort of children aged 6-60 months in 1983 and 30-84 months in 1985)

Explanatory Variables	Change in Weight-for-Age Z-Scores		Change in Height-for-Age Z-Scores		Change in Weight-for-Height Z-Scores	
	Estimated Parameters	T-Values	Estimated Parameters	T-Values	Estimated Parameters	T-Values
Age in months	0.0296	1.60	0.0140	0.74	0.0366	1.79
Age in months squared	-2.548E-04	-1.62	-4.248E-05	-0.27	-3.132E-04	-1.81
Birth order[a]	0.0482	2.72	0.0144	0.82	0.0689	3.54
Sex (male=1, female=2)	-0.0226	-0.32	-0.1009	-1.39	0.04133	0.52
Calories per day per adult equivalent, 1985	5.249E-05	0.73	...[c]	...	2.2029E-04	2.78
Calories squared	-5.586E-09	-0.69	...[c]	...	-2.491E-08	-2.76
Breastfeeding[b]	0.2662	1.64	0.1351	0.82	0.3169	1.77
Unsuitable latrine (=1, else=0)	-1.212	-0.68	-0.3459	-1.91	0.0556	0.28
Education of household head (yrs. in school)	0.0261	1.28	0.0188	0.92	0.0217	0.97
Z-score of weight/age, 1983	-0.5004	-13.48	...	...	...	...
Z-score of height/age, 1983	...	...	-0.2672	-7.90	...	...
Z-score of weight/height, 1983	...	...	...	...	-6.984	-17.34
Duration of membership in coop (years)	7.694E-03	3.37	0.01237	5.36	1.774E-03	0.70
Constant	-2.278	-3.88	-1.784	-3.10	-1.914	-2.95
R^2	0.360		0.229		0.469	
F-value	20.400		13.500		31.500	
Degree of freedom	369		371		369	

[a] Birth order: first-born child = 1, second = 2, etc.

[b] If child was breastfed = 1 (else = 0).

[c] The variable is not included in this model because it is not assumed to have an effect on the long-term measure of nutritional status.

[d] The variable is not included in this model because it is not assumed to have an effect on the short-term measure of nutritional status.

NOTES

[1] This explains the difference between the 1985 figures in the comparative tables with the 1983 data below versus the 1985 figures in the other tables.

[2] Isabel Nieves, "An Exploratory Study of Intrahousehold Resource Allocation," p. 32.

[3] The reported general inflation rate in Guatemala was 4 percent in 1984, 19 percent in 1985, and 23 percent in 1986. The inflation rate measured in the noncoop households, which is the majority of households at the location, was used to derive the location-specific inflation rate (33.6 percent over the two-year period).

[4] See, for instance, Judith B. Balderston, Alan Wilson, Maria E. Freire, Navi S. Simonen, Malnourished Children of the Rural Poor (Boston: Auburn House, 1981); and L. J. Mata, The Children of Santa Maria Cauqué: A Prospective Fie Study of Health and Growth (Cambridge, Mass: MIT Press, 19[illegible]).

[5] M. Flores, Diet Profiles in Guatemala (Guatemala City: INCAP, 1975), p. 10.

[6] For a review of evidence on this issue, see von Braun and Kennedy, Commercialization of Subsistence Agriculture, pp. 55-59.

[7] See, for instance, Irene Tinker, "New Technologies for Food Chain Activities: The Imperative of Equity for Women" (Washington, D.C., U.S. Agency for International Development, Office for Women in Development, 1979).

[8] This income elasticity of calorie acquisition among coop members is based on a parameter estimate which is statistically not significant (see Table 47).

[9] Price variability in the cross-sectional sample results from local price differences and the fact that households face in varying degrees a c.i.f. price if they are purchasing, or an f.o.b. price if they are selling. To households which are only consuming their own-produced maize, the local f.o.b. price was assigned to represent the shadow price of maize consumption.

[10] Balderston et al., Malnourished Children of the Rural Poor.

[11] The National Center for Health Statistics standards were used for Z-scores. Z-score are standard deviation scores. For any value X_i, the Z-score is $(X_i - \bar{X})/S$ where $\bar{X}$ is the median and S the standard deviation of the reference population. A negative (positive) Z-score means the specific value X_i is "Z" standard deviations below (above) the median of the reference population.

[12] Joachim von Braun, Detlev Puetz, and Patrick Webb, "Technological Change in Rice and Commercialization of Agriculture in a West African Setting: Effects on Production, Consumption, and Nutrition," report submitted to IFAD, Rome (Washington, D.C.: International Food Policy Research Institute, December 1987).

[13] See, for instance, Balderston et al., Malnourished Children of the Rural Poor.

7. POLICY CONCLUSIONS AND GENERALIZATIONS

This study of export crop production is based on experience with a specific scheme in which the success relies on particular conditions described earlier in the report. Clearly the "Cuatro Pinos" cooperative is an exceptional case of agricultural and rural development and not the average in Guatemala. However, the fact that the studied case stands out favorably in an environment of numerous failures of agricultural modernization with farmers' participation in Central America makes it possible to arrive at some policy conclusions.

Mellor and Desai stress that disparities in the distribution of assets and power, which are often based on the social as well as the economic structure, must be recognized.[1] "The need for radical institutional changes may have been overstated in recent years vis-a-vis technological change in agriculture but the necessity for such change must always be examined."[2] Also their emphasis that "state-sponsored dualism must be guarded against" and that "a full attack must be made on all discriminatory practices that restrain the poor is of greatest relevance for this case study.[3]

In studying the impact of increased commercialization of traditional smallholder agriculture in Guatemala, the broader context of the "agrarian crisis" in Latin America, which provides the political and economic environment of this case study, should be kept in mind. As de Janvry puts it, the agrarian crisis in Latin America is characterized

in terms of sharply uneven development among farms, crops, and regions and in terms of massive rural poverty and political tensions.[4] In contrast to the poverty issue in much of Africa, poverty is not a separate phenomenon but to be seen in terms of its functionality.[5] Low productivity in the traditional sector, unemployment and regressive income distribution patterns may be identified as direct causes of poverty but are, at the same time, a function of the political-economic systems. As a consequence, de Janvry points out, policy recommendations regarding poverty run the risk to assume a reality separate from the functioning of the economic system and are directed by idealistic and humanitarian concerns.[6]

Clearly, politics and structures are to be kept in focus when policy conclusions shall be derived from the case studied here. When the implications of the new export crop production is evaluated here in the context of the existing political economic system, this does not mean that we thereby imply that the effects of this type of export crop scheme are independent from the political system. In a drastic way, this became clear by violent repressions that peasant organizations, such as cooperatives, were suffering from in some parts of Central America in the early 1980s.[7]

Using Adelman's term, Guatemala may be a case for "redistribution before growth."[8] Taking a pragmatic evolutionary approach to the problem leads us to derive criteria for rural change that work in a desirable direction. Two issues are essential in this respect. First, to identify policies which make use of the chances of agricultural trade that sustains, not opposes, the relation between growth and

distribution. Secondly, the question which de Janvry classifies as probably the most important one in this context is "whether growth itself is articulating"--that is, does growth through the creation of employment and hence domestic demand for wage goods lead to gradual changes in the production structure that result in social articulation of the poor?[9]

With respect to the first issue, the production of export vegetables in this particular study has worked into the right direction. Some peculiarities of the new crops and the conditions at the location have produced this outcome. Due to their diseconomies of scale in production, nontraditional crops ended up in smallest farms in the poorest area of the country creating employment for the small farmers and local landless and substantially increased real income and had favorable effects for food security and consumption. The favorable effect of the nontraditionals for small farmers largely depends upon the crops' characteristics which are so different from the traditional export products, such as cotton, coffee, or beef, that have apparently positive returns to scale in production and which are produced more efficiently on the other end of the dual spectrum of Guatemala's agriculture--the large-scale farm enterprises.

With respect to the second issue--"social articulation"--we do find in this particular case study that institutional changes combined with the expansion of the export crop production in a cooperative scheme are forces leading toward "social articulation." Noteworthy are the strengthening of farmers' cooperation increased interaction between village communities, the development of local trading and entrepreneur-

ship due to the new crops, and the related build up of economic power in the rural areas by the small farmer-based economic growth. It has been described earlier (Chapter 3) that development assistance can and actually has played a catalytic role in this process. The economic costs of terminating this process are now higher especially in the situation of the country's severe foreign exchange problem the alleviation of which nontraditional export vegetable production contributes a very important role.

No general automation between growth and social articulation of the poor which could lead to development can be postulated based on this study. This case study demonstrates the existence of niches in the system that provide this potential and also highlights the specific conditions under which it may work. Central to these conditions are the diseconomies to scale in producing the export vegetable and the ecological conditions in the Western Highland along with the labor market situation.

The sustainability and expansion potentials of the program depends on the functioning of the marketing channels, domestically and internationally, both for inputs and outputs. The implicit taxation of small farmers through overvalued exchange rates for outputs is a matter of concern. The riskiness of the new crops due to potential disturbances in the marketing chain is to be a matter of constant attention.

For maximum gains from specialization policies that assure efficiently functioning markets, food, labor, and financial markets are the first-best solution. Market imperfections are the worse enemies of sustainable market integration of the subsistence farm sector. As long

as market failures cannot be excluded and small farmers' perception of their potential occurrence remains due to past experience (and this may change only slowly), second-best options for policy must be considered. Therefore, the deep-rooted desire for food security achieved by high levels of self-sufficiency at the household level in the Western Highlands can best be accommodated by rapid technological improvements in the traditional subsistence crops--maize and beans--along with the expansion of new export vegetables. This is also a condition for adoption of the new crops and, as we observed in this case study, small farmers actually manage to achieve complementarity between growth in the subsistence crops and the new crops.

Accelerated growth in food production alone would have little effect on the general poverty situation in the Western Highlands. Single-minded focus on nontraditional export crops would be risky for small farmers food security and anyway constrained by the adoption problem if food crops do not move jointly.

To cope with production risk and to finance the adoption of the input-intensive new crops, a functioning rural capital market is essential. Rural credit and banking schemes that open up an outlet for rural savings are essential for long-term growth. Otherwise savings find their way into the form of assets--i.e., land--with obvious efficiency losses of the initiated development and potential adverse distributional effects at the micro level.

Modest though statistically highly significant improvements in nutrition via the favorable income and consumption effects of the program were found in this analysis. This suggests that only rapid

employment and income growth will make a difference at the low levels of poverty to translate into nutritional improvement and that the income-growth effect is to be supported by appropriate health and nutrition-oriented social infrastructure. This requires sustained government commitment rather than short-term charity. Development assistance can play an important role if the objective is seen as building up the poor's human capital.

Given the important role of nonagricultural rural employment in the Western Highlands, the productivity of the growing landless population group depends upon improved human capital with education and training playing crucial roles. This applies also to agricultural productivity and it is hardly by chance that the early leadership of the export crop cooperative--which we mainly found as a success story in the difficult political and economic environment of Guatemala--emerged from intensive primary schooling courses provided by a local project.

NOTES

[1] John W. Mellor and Gunvant M. Desai, Agricultural Change and Rural Poverty: Variations in a Theme by Dharm Narain (Baltimore: Johns Hopkins University Press, 1985), p. 209.

[2] Ibid, p. 209.

[3] Ibid, p. 209.

[4] Alain de Janvry, The Agrarian Question and Reformism in Latin America (Baltimore: Johns Hopkins University Press, 1981), p. 3.

[5] Ibid, p. 149.

[6] Ibid, p. 150.

[7] Robert G. Williams, Export Agriculture and the Crisis in Central America (Chapel Hill: University of North Carolina Press, 1986).

[8] Irma Adelman, "Growth, Income Distribution and Equity-Oriented Development Strategies," World Development 3 (Nos. 2 and 3, February-March 1975).

[9] Alain de Janvry, The Agrarian Question, p. 246.

ANNEX--PROGRAMMING MODEL

The title of the problem is: pre zero situation

		Net Revenues		1 BPRD ha1 -5.000	2 BPRD ha1 -57.000	3 VPRD ha1 -128.000	4 BSAL kg1 0.210	5 BSAL kg1 0.170	6 VSAL kg1 0.120	7 FPUR kg1 -0.340	8 BPUR kg1 -4.500	9 FL13 dy1 0.000	10 FL46 dy1 0.000	11 FL712 dy1 0.000
1 LAND	HA	0.750	>	1.000	1.000	1.000	.	.	.	.	.	.	.	.
2 MYLD	KG	0.000	>=	-1500.000	.	.	1.000	.	.	.	.	.	.	.
3 BYLD	KG	0.000	>	.	-600.000	.	.	1.000	.	.	.	.	.	.
4 VYLD	KG	0.000	>	.	.	-12750.000	.	.	1.000	.	.	.	.	.
5 FERT	KG	0.000	>	271.000	102.000	494.000	.	.	.	-1.000	.	.	.	.
6 SPRY	KG	0.000	>	.	.	15.000	.	.	.	.	-1.000	.	.	.
7 LA13	DY	0.000	>	21.000	74.000	43.000	.	.	.	.	.	-1.000	.	.
8 LA46	DY	0.000	>	45.000	51.000	173.000	.	.	.	.	.	.	-1.000	.
9 LA712	DY	0.000	>	40.000	13.000	229.000	.	.	.	.	.	.	.	-1.000
10 FX13	DY	105.000	>	.	.	.	.	.	.	.	.	.	.	.
11 FX46	DY	105.000	>	.	.	.	.	.	.	.	.	1.000	.	.
12 FX712	DY	210.000	>	.	.	.	.	.	.	.	.	.	1.000	.
13 CREDIT	QZ	0.000	>	5.000	57.000	128.000	.	.	.	.	.	.	.	.
14 CRMAX	QZ	1583.000	>	.	.	.	.	.	.	0.340	4.500	.	.	.
15 STAPL	KG	736.000	<	1500.000	600.000	.	-1.000	-1.000	.	.	.	.	.	.
16 ROTAT	HA	0.000	<	1.000	1.000	-1.000	.	.	.	.	.	.	.	.

		12 HL13 dy1 -2.000	13 HL46 dy1 -2.000	14 HL712 dy1 -2.000	15 OF13 dy1 2.000	16 OF46 dy1 2.000	17 OF712 dy1 2.000	18 FIN qz1 -0.200
1 LAND	HA	.	.	.	.	.	.	.
2 MYLD	KG	.	.	.	.	.	.	.
3 BYLD	KG	.	.	.	.	.	.	.
4 VYLD	KG	.	.	.	.	.	.	.
5 FERT	KG	.	.	.	.	.	.	.
6 SPRY	KG	.	.	.	.	.	.	.
7 LA13	DY	-1.000	.	.	.	.	.	.
8 LA46	DY	.	-1.000	.	.	.	.	.
9 LA712	DY	.	.	-1.000	.	.	.	.
10 FX13	DY	.	.	.	1.000	.	.	.
11 FX46	DY	.	.	.	.	1.000	.	.
12 FX712	DY	.	.	.	.	.	1.000	.
13 CREDIT	QZ	2.000	2.000	2.000	.	.	.	.
14 CRMAX	QZ	.	.	.	.	.	.	-1.000
15 STAPL	KG	.	.	.	.	.	.	1.000
16 ROTAT	HA	.	.	.	.	.	.	.

The title of the problem is: post case a

		Net Revenues		1 BPRD ha1 -5.000	2 BPRD ha1 -57.000	3 VPRD ha1 -128.000	4 BSAL kg1 0.210	5 BSAL kg1 0.170	6 VSAL kg1 0.120	7 FPUR kg1 -0.340	8 BPUR kg1 -4.500	9 FL13 dy1 0.000	10 FL46 dy1 0.000	11 FL712 dy1 0.000
1 LAND	HA	0.750	>	1.000	1.000	1.000	.	.	.	.	.	.	.	.
2 MYLD	KG	0.000	>=	-1500.000	.	.	1.000	.	.	.	.	.	.	.
3 BYLD	KG	0.000	>	.	-600.000	.	.	1.000	.	.	.	.	.	.
4 SYLD	KG	0.000	>	.	.	.	.	.	.	.	.	.	.	.
5 VYLD	KG	0.000	>	.	.	-12750.000	.	.	1.000	.	.	.	.	.
6 FERT	KG	0.000	>	271.000	102.000	494.000	.	.	.	-1.000	.	.	.	.
7 SPRY	KG	0.000	>	.	.	15.000	.	.	.	.	-1.000	.	.	.
8 LA13	DY	0.000	>	21.000	74.000	43.000	.	.	.	.	.	-1.000	.	.
9 LA46	DY	0.000	>	45.000	51.000	173.000	.	.	.	.	.	.	-1.000	.
10 LA712	DY	0.000	>	40.000	13.000	229.000	.	.	.	.	.	.	.	-1.000
11 FX13	DY	105.000	>	.	.	.	.	.	.	.	.	1.000	.	.
12 FX46	DY	105.000	>	.	.	.	.	.	.	.	.	.	1.000	.
13 FX712	DY	210.000	>	.	.	.	.	.	.	.	.	.	.	1.000
14 CREDIT	QZ	0.000	>	5.000	57.000	128.000	.	.	.	0.340	4.500	.	.	.
15 CRMAX	QZ	1583.000	>	.	.	.	.	.	.	.	.	.	.	.
16 STAPL	KG	736.000	<	1500.000	600.000	.	-1.000	-1.000	.	.	.	.	.	.
17 ROTAT	HA	0.000	<	1.000	1.000	-1.000	.	.	.	.	.	.	.	.

		12 HL13 dy1 -2.000	13 HL46 dy1 -2.000	14 HL712 dy1 -2.000	15 OF13 dy1 2.000	16 OF46 dy1 2.000	17 OF712 dy1 2.000	18 FIN qz1 -0.200	19 bprd ha1 -481.000	20 bsal kg1 0.060
1 LAND	HA	.	.	.	.	.	.	.	1.000	.
2 MYLD	KG	.	.	.	.	.	.	.	.	.
3 BYLD	KG	.	.	.	.	.	.	.	.	.
4 SYLD	KG	.	.	.	.	.	.	.	-4250.000	1.000
5 VYLD	KG	.	.	.	.	.	.	.	.	.
6 FERT	KG	.	.	.	.	.	.	.	855.000	.
7 SPRY	KG	.	.	.	.	.	.	.	171.000	.
8 LA13	DY	-1.000	.	.	.	.	.	.	185.000	.
9 LA46	DY	.	-1.000	.	.	.	.	.	89.000	.
10 LA712	DY	.	.	-1.000	.	.	.	.	357.000	.
11 FX13	DY	.	.	.	1.000	.	.	.	.	.
12 FX46	DY	.	.	.	.	1.000	.	.	.	.
13 FX712	DY	.	.	.	.	.	1.000	.	.	.
14 CREDIT	QZ	2.000	2.000	2.000	.	.	.	-1.000	481.000	.
15 CRMAX	QZ	.	.	.	.	.	.	1.000	.	.
16 STAPL	KG	.	.	.	.	.	.	.	.	.
17 ROTAT	HA	.	.	.	.	.	.	.	-0.500	.

Annex--Programming Model (continued)

The setup of the problem for post sheep >

		Net Revenues		1 JPRD ha1 -3.000	2 SPRD ha1 -101.000	3 VPRD ha1 -128.000	4 RSAL kg1 0.210	5 GSAL kg1 0.170	6 VSAL kg1 0.120	7 FPUR kg1 -0.340	8 SPUR kg1 -4.580	9 FL13 dy1 0.000	10 FL46 dy1 0.000	11 FL712 dy1 0.000
1 LAN	HA	0.750	>	1.000	1.000	1.000	.	.	.	.	.	.	.	.
2 WYL	KG	0.000	>	-2100.000	.	.	1.000	.	.	.	.	.	.	.
3 BYL	KG	0.000	>	.	-1171.000	.	.	1.000	.	.	.	.	.	.
4 SYL	KG	0.000	>	.	.	.	.	.	.	.	.	.	.	.
5 VYL	KG	0.000	>	.	.	-12780.000	.	.	1.000	.	.	.	.	.
6 FER	KG	0.000	>	281.000	338.000	494.000	.	.	.	-1.000	.	.	.	.
7 SPR	KG	0.000	>	.	.	15.000	.	.	.	.	-1.000	.	.	.
8 LA	DY	0.000	>	31.000	83.000	43.000	.	.	.	.	.	-1.000	.	.
9 LA	DY	0.000	<	52.000	57.000	175.000	.	.	.	.	.	.	-1.000	.
10 LA	DY	0.000	<	40.000	15.000	329.000	.	.	.	.	.	.	.	-1.000
11 FX	DY	165.000	>	.	.	.	.	.	.	.	.	1.000	.	.
12 FX	DY	165.000	>	.	.	.	.	.	.	.	.	.	1.000	.
13 FX	DY	110.000	>	.	.	.	.	.	.	.	.	.	.	1.000
14 CR	QZ	0.000	>	5.000	57.000	120.000	.	.	.	0.240	4.500	.	.	.
15 CR	QZ	583.000	>	.	.	.	.	.	.	.	.	.	.	.
16 STA	KG	136.000	<	2100.000	1171.000	.	-1.000	-1.000	.	.	.	.	.	.
17 ROT	HA	0.000	<	1.000	1.000	-1.500	.	.	.	.	.	.	.	.

		12 HL13 dy1 -2.600	13 HL46 dy1 -2.600	14 HL712 dy1 -2.600	15 OF13 dy1 2.000	16 OF46 dy1 2.000	17 OF712 dy1 2.000	18 FIN qz1 -0.200	19 sprd ha1 -481.000	20 ssel kg1 0.960
1 LAN	HA	.	.	.	.	.	.	.	1.000	.
2 WYL	KG	.	.	.	.	.	.	.	.	.
3 BYL	KG	.	.	.	.	.	.	.	.	.
4 SYL	KG	.	.	.	.	.	.	.	-4250.000	1.000
5 VYL	KG	.	.	.	.	.	.	.	.	.
6 FER	KG	.	.	.	.	.	.	.	865.000	.
7 SPR	KG	.	.	.	.	.	.	.	171.000	.
8 LA	DY	-1.000	.	.	.	.	.	.	165.000	.
9 LA	DY	.	-1.000	.	.	.	.	.	99.000	.
10 LA	DY	.	.	-1.000	.	.	.	.	337.000	.
11 FX	DY	.	.	.	1.400	.	.	.	.	.
12 FX	DY	.	.	.	.	1.400	.	.	.	.
13 FX	DY	.	.	.	.	.	1.400	.	.	.
14 CR	QZ	2.600	2.600	2.600	.	.	.	-1.000	481.000	.
15 CR	QZ	.	.	.	.	.	.	1.000	.	.
16 STA	KG	.	.	.	.	.	.	.	.	.
17 ROT	HA	.	.	.	.	.	.	.	-0.500	.

Note: The Programming Model was solved using the following package: Wye College Micro-Linear Programming Package, Version 4.0, May 1985, developed by J. P. G. Webster, B. J. George, and P. A. Kentish.

Annex--Programming Model (continued)

VARIABLES IN THE PROGRAMMING MODEL

Activities

MPRD	=	production of maize
BPRD	=	production of beans
VPRD	=	production of vegetables (traditional)
SPRD	=	production of snowpeas
MSAL	=	sales of maize
BSAL	=	sales of beans
VSAL	=	sales of vegetables (traditional)
SSAL	=	sales of snowpeas
FPUR	=	purchase of fertilizer
SPUR	=	purchase of chemicals for spraying
FL13	=	use of family labor on farm in January-March
FL46	=	use of family labor on farm in April-June
FL712	=	use of family labor on farm in July-December
HL13	=	hiring in of labor in January-March
HL46	=	hiring in of labor in April-June
HL712	=	hiring in of labor in July-December
OF13	=	off-farm work of family labor in January-March
OF46	=	off-farm work of family labor in April-June
OF712	=	off-farm work of family labor in July-December
FIN	=	financing input acquisition and hired labor

Constraints

LAND	=	farm size
MYLD	=	yield of maize
BYLD	=	yield of beans
SYLD	=	yield of snowpeas
VYLD	=	yield of vegetables (traditional)
FERT	=	fertilizer use required
SPRY	=	spraying material use required
LA13	=	labor required in January-March
LA46	=	labor required in April-June
LA712	=	labor required in July-December
FX13	=	family labor available in January-March
FX46	=	family labor available in April-June
FX712	=	family labor available in July-December
CREDIT	=	financing requirement
CRMAX	=	collateral upper limit
STAPL	=	staple food for consumption from own production desired
ROTAT	=	rotational constraints

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