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CAPITAL FORMATION OF THE ECUADORIAN
FRONTIER: A STUDY OF HUMAN INVESTMENT
AND MODERNIZATION IN THE RIOBAMBENOS
COOPERATIVE

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<p>The agricultural production activities of spontaneous settlers is described in detail, with special focus upon the determinants of family income and investment and rate of capital formation. The cooperative Riobambenos del Rio Chilimpe was selected for extensive study. Production processes and family income structure was analyzed for 22 farmers for calendar year 1967. The most important sources of income for the majority of farmers were, in order: crop sales, livestock sales, and timber sales. 50% of family receipts for the average farmer were provided by crop sales. The most important crop was plantain. Limiting factors affecting family income and enterprise growth were found to be cash flows and managerial ability. By nature, spontaneous land settlement is inefficient, but it still provides the only practical means of selecting new settlers. The efficiency of the settlement process can greatly be increased by government programs to assist in providing title security, farm-to-market roads, and production credit. Important developmental benefits of land settlement in Santo Domingo de Los Colorados include: economic integration, redistribution of income, and creation of a modern agricultural sector.</p>			
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A STUDY OF

HUMAN INVESTMENT AND MODERNIZATION IN THE

RIOBAMBENOS COOPERATIVE

BY

PETER M. GLADHART

“Tell me, Don Benjamin, What worldly goods did you
bring with you when you came to settle in this place?”

“Three children, three chickens, and my wife.”

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INTRODUCTION

This monograph is an adaptation of the author's M.S. Thesis, The Role of Spontaneous Land Settlement in Economic Development: Santo Domingo De Los Colorados, Ecuador. It considers the formation of a modern sector of independent small-holders on the Ecuadorian frontier as an example of the mechanisms of institutional change which are operative in the process of socio-economic modernization and development.

The study describes in detail the agricultural production activities of a small group of spontaneous settlers, the Ríobambeños del Río Chilímpe, focusing upon the determinants of family income and investment. Special attention is given to an historical analysis of the transformation of virgin rain forest into productive plantations and pastures. The analysis presents some tentative conclusions on the long term rate of family labor investment and the growth of agricultural capital in a case where the developing frontier is strongly linked to the national economy.

Chapter I briefly reviews the land tenure institutions of Ecuador's traditional agricultural sector and the role of land settlement in national development policy. It then passes to a description of the settlement region selected for study, Santo Domingo de los Colorados.

Chapter II takes up land use, agricultural production and family income among the Ríobambeños del Río Chilímpe. Chapter III pursues in detail the question of savings and investment among the members of the cooperative. The topic is treated in two parts: the first analyses growth of land clearing from 1952 to 1958; the second considers the determinants of cash investment and the rate of growth of farm capital during calendar year 1967.

Chapter IV reviews the implications of spontaneous land settlement for Ecuador's socio-economic modernization and development. Chapter V summarizes the major findings and conclusions of the monograph.

CHAPTER I

LAND TENURE, AGRARIAN REFORM AND VIRGIN LAND SETTLEMENT:

THE ECUADORIAN CASE

The basic outlines of Latin American land tenure structures have been widely discussed in the past few years. Most notable have been the efforts of the Land Tenure Center of the University of Wisconsin and of the Interamerican Committee for Agricultural Development (CIDA), Land Tenure and Socio-Economic Development of the Agricultural Sector: Argentina, Brazil, Colombia, Chile, Ecuador, Guatemala, and Peru. The major findings of the seven CIDA studies have been summarized by Solon Barraclough and Arthur L. Domike, Agrarian Structure in Seven Latin American Countries (Barraclough, 1966). The picture presented includes the monopolization of land resources by a small minority of large land holders, with the vast majority of the agricultural population comprised of farmers of sub-family sized units and landless laborers. The educational level of the great mass of the agricultural population is low and its income is near subsistence level. For a sizable portion of the large land-owners, the benefits which accrue from landholding are primarily social and political rather than economic. Access to land and the relationships among various classes of producers are controlled by complex patterns of traditional institutions. Many of these are social and political in nature, severely conditioning or restricting the response of the agricultural sector to conventional "economic" forces and policies. All in all, it would require considerable imagination to devise an economic system less conducive to rapid, sustained growth and less amenable to the ordinarily conceived range of agricultural economic policies.

This description of agrarian structures in Latin America has long been used to justify demands for radical redistribution of agricultural lands to assure some minimal level of equity and human dignity for the agricultural population. Since the charter of Punta del Este was adopted, some measure of agrarian reform has been the declared policy of these Latin American governments. Indeed, denial of the need for land reform is no longer a viable political stance for even the most reactionary of landed elites. All shades of the political spectrum have programs for land reform. Size of holdings which land owners shall be allowed to keep, the degree to which expropriated land holders are to be compensated, whether reform should begin first in public or private agricultural lands, and the extent to which settlement of virgin public lands can be a substitute for the redistribution of lands already in use are the principal differences among the programs. Many have advocated settlement of virgin lands in the tropics as a sufficient solution to the agrarian problem, or at least as the solution to be first pursued, since the disruption of the status quo is thus minimized.

Ecuador provides a "classic" case of the maldistribution of agricultural resources in a country where advocacy of virgin land settlement has been particularly strong. Ecuador seems to be more richly endowed than most other Latin American countries with accessible virgin lands suitable for agriculture relative to the extent of current agricultural lands and the size of the agricultural population. Even in Ecuador the official position of the Agrarian Reform laws of 1964 (Decree Law 1480 and Decree

Law 2172) strongly states that settlement of virgin lands is a necessary adjunct of land tenure reform but that it cannot be a substitute for reform of the existing tenure structure and redistribution of agricultural lands.

While the importance of new land settlement as a policy measure will vary from country to country, it is felt that the nature of the settlement process is more generalized. In particular, the dynamics of farm growth and capital formation which are described in this case study of spontaneous settlers in western Ecuador should prove similar to the response of settlers and land reform beneficiaries in other places and in other countries.

Land Tenure in Ecuador, the Quantitative Dimension

Simple measures of farm area are inadequate for comparison in a country where climate, soils, access to markets, and levels of technological development differ so markedly from region to region and even within restricted areas. The authors of the CIDA report attempted to circumvent this problem by utilizing a classification based upon the amount of land required to provide full-time employment for a typical farm family using technological resources common to the region and consistent with local cultural values (CIDA, 1965: iv). For Ecuador, this resulted in four basic size classes:

- 1) Sub-Family, or "minifundio," lacking sufficient land to give full and productive employment to a family whose work force is equivalent to two man-years when common agricultural practices are employed.
- 2) The Family class which contain sufficient land to employ 2 to 4 men nearly full-time.
- 3) Medium-sized, Multifamily farms which have sufficient land to employ 4 to 12 men nearly full-time.
- 4) Large Multifamily farms, "latifundio," which have sufficient land to productively occupy the time of more than 12 men using prevailing agricultural practices (Ibid., 15).

A distribution of the number and size of agricultural holdings as classified in the CIDA study is reproduced in Table 1.

TABLE 1. NUMBER AND AREA OF THE AGRICULTURAL HOLDINGS,
SIZE GROUPS BY REGIONS, AGRICULTURAL CENSUS, ECUADOR, 1954

Regions and size groups	Number of holdings	Total area (1000 Hectares)
SIERRA		
Sub-family (Less than 10 has.)	234,596	496.4
Family (10 - 49.9 has.)	18,292	362.0
Medium Multifamily (50 - 499.9 has.)	5,962	689.8
Large Multifamily (More than 500 has.)	719	1,472.2
Total Region	259,569	3,020.4
COAST		
Sub-family (Less than 10 has.)	53,340	207.3
Family (10 - 99.9 has.)	27,256	852.3
Medium Multifamily (100 - 499.9 has.)	3,419	685.2
Large Multifamily (More than 500 has.)	650	1,234.5
Total Region	84,665	2,979.3
ECUADOR		
Sub-family	287,936	703.7
Family	45,548	1,214.3
Medium Multifamily	9,381	1,375.0
Large Multifamily	1,369	2,706.7
Total Sierra and Coast	344,234	5,999.7

Reproduced from: CIDA; Ecuador, 1965, Cuadro A-11, p. 522.

Principal land tenure and land use relationships derived from the 1954 agricultural census are summarized in Table 2. Censused farms with insufficient resources to fully and productively employ a family with a labor force equivalent to two man-years comprised 84 percent of the estimated 344,234 farms but controlled only 12 percent of the land in farms; however, they contained 27 percent of the cultivated land and 46 percent of the land in annual crops while producing an estimated 26 percent of the value of agricultural production. Family-sized farms comprised 13.2 percent of the total, contained 20.2 percent of the area and 30 percent of the cultivated area. Medium Multifamily farms comprised about 3 percent of the holdings and contained 23 percent of the land in farms. Less than 1/2 of one percent of the number of farms qualified as "latifundia" employing more than 12 man years of labor, but they controlled 45 percent of the land in farms, 21 percent of the cultivated land and 13 percent of the annual crop land; their production was estimated as 19 percent of the national total.^{1/}

^{1/} The term "farm," used here for convenience, implies "holding" when used in connection with data from the 1954 agricultural census. The census considered as a single holding, explotacion, all land or lands utilized wholly or partially in agricultural production by a single producer (who could be one or more natural persons or a company) without considering forms of tenancy. A producer is the person who makes the decisions and takes the risks of success or failure of the agricultural activity, be he proprietor, renter, sharecropper, squatter, etc. (Comision Coordinador 1954: III).

TABLE 2. PERCENTAGE DISTRIBUTION OF SELECTED AGRICULTURAL
TENURE AND PRODUCTION RELATIONSHIPS, SIZE GROUPS
BY REGIONS: AGRICULTURAL CENSUS, ECUADOR, 1954

	No. of farms	Area in farms	Culti- vated area	Area in annual crops	Graz- ing land ^{b/}	Cattle hold- ings	Value of agri- cultural pro- duction ^{a/}
Percent of Total							
SIERRA							
Sub-family	90.4	16.4	45.9	58.5	8.6	46.5	38.7
Family	7.0	12.0	18.9	17.8	10.7	17.4	21.4
Medium Multifamily	2.3	22.8	21.0	15.5	19.4	19.3	22.7
Large Multifamily	.3	48.8	14.1	8.2	61.3	16.8	17.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
COAST							
Sub-family	63.0	7.0	13.7	23.5	5.3	10.3	15.6
Family	32.2	28.6	38.4	39.2	31.1	38.9	42.8
Medium Multifamily	4.0	23.0	22.7	15.8	27.8	28.0	20.6
Large Multifamily	.8	41.4	25.2	21.5	35.8	22.8	21.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
ECUADOR							
Sub-family	83.7	11.8	26.8	46.1	7.2	33.7	26.3
Family	13.2	20.2	30.4	25.4	19.5	25.0	32.9
Medium Multifamily	2.7	22.9	22.0	15.6	23.1	22.4	21.6
Large Multifamily	.4	45.1	20.8	12.9	50.2	18.9	19.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

a/ Original Source: Universidad Central del Ecuador. *Boletín Trimestral de Información Económica*, No. 32-33, Quito, 1956. Reproduced in CIDA: *Ecuador*, Cuadro A-18, p. 529.

b/ Calculated as the sum of natural pasture, artificial pasture and land in fallow. Source: CIDA, 1965, Cuadros A-12, A-13, pp. 523, 524.

If grazing land is considered as the sum of natural pasture, artificial pasture and land in fallow, sub-family size producers in the sierra held only 8.6 percent of the grazing land, but 46.5 percent of the cattle with an apparent pasture availability of 0.28 hectares per head. This is not meant to suggest that the livestock of the sierra small-holder subsists on 0.3 of a hectare per head while the national average is 1.75 hectares. Rather it indicates the dependence of the small farmer upon the very large farmer for pasturage, either through the exercise of traditional rights in exchange for labor, through rental agreements or through simple encroachment upon the latifundista's unused resources. To the extent that agrarian reform or the modernization of the hacienda activities deprive the minifundista of access to these pasture lands, his plight will be considerably worsened and his ability to make a contribution to growth of agricultural output, even to the extent of producing as much as formerly, will be seriously affected.

In the two major regions of Ecuador, 46 percent of the land devoted to the production of foodstuffs in 1954 was controlled by families who necessarily dedicated much of their production to home consumption. In the sierra this was the state of affairs for producers controlling nearly 60 percent of the annual crop land. These producers had no access to bank credit, made practically no use of advanced technology, had little access to markets, and had low levels of education. The sub-family size group, and to a lesser extent the family-size group, were farming their land too intensively to prevent its steady deterioration. Many were so close to the subsistence level of production that willingness to risk any of their precious resources in experiments with improved technology (had it been available) would have been low indeed.

The Resource Base

Possibilities for Land Redistribution

A discussion of land use patterns among different tenancy classes runs the risk of assuming that all resources are equal in character, and that different use patterns reflect differences in tenancy classes rather than inherent differences in the natural resources controlled. The existence of minifundia intensive crop production on the steep slopes of the Andes while extensive latifundio lands are devoted to fallow or natural pasture is often advanced as proof that latifundio owners are not economically rational and that their lands do not adequately fulfill their "social function." Since this is likely to persist, runs the argument, the only way to insure that latifundio lands are cultivated at optimal levels of production is to distribute them to farmers whose land holdings are too small.

While it is true that distribution of these lands to the small holders and landless laborers of the Ecuadorian sierra would contribute toward a desirable redistribution of income, the magnitude of that redistribution would be considerably less than is suggested by a superficial comparison of land use patterns and rates of return per hectare.

Small holders in the sierra farm the steep mountain slopes and some garden plots near large towns while the haciendas control the level basin areas and the upland paramos or high grass lands. Insufficient income forces the sub-family and family sized farmer to maximize the returns from land, his scarce resource, through utilization of as much of his abundant labor resource as possible. The mountain slopes are well supplied with water and are protected from frost; many are nevertheless so steep that they should be maintained in permanent pasture or artificial forest in order to maintain the soil cover.

In contrast, many large basins held by the hacendados are subject to frost at high elevations and rainfall is less certain, requiring elaborate irrigation provisions. For much of this land, considering the risks attendant upon crop production under absentee control, pasture is the most rational use. More than 30 percent of the land of both the medium sized and large multifamily units in 1954 was classed as "sterile or other uses." Large multifamily units had 45 percent of their land in natural pasture and 17 percent in natural forests. Of all the land in these three categories, a reasonable

guess is that one-eighth to one-quarter of the land in natural pasture would be suitable for crop production. Any argument over the optimal use of latifundio lands should properly concern itself with the allocation of their cultivable lands (35 percent of all cultivated land in the sierra in 1954) to annual crops, artificial pasture and fallow. Somewhat at variance with this, the National Planning Board asserts that only 11.3 percent of the potentially productive lands in holdings of more than 1000 hectares are currently utilized (JNPCE, 1963_a Capitulo II: 18).

Thus, while the extent of underutilized land is not clear, it is evident that the needs of potential beneficiaries of even the most radical of land reforms would exceed the supply of good agricultural land. Many will have to migrate either to urban areas or new agricultural areas if they are to achieve decent incomes for their families.

Spontaneous Settlers

Spontaneous settlement of virgin and otherwise unoccupied lands has been underway in Ecuador for at least a century, generally following in the wake of the extension of railroads and highways into the coastal and amazon regions. In its General Development Plan the National Planning Board published a table of net urban and rural emigration and immigration between 1950 and 1962. Net emigration from rural areas totaled 414,986. Net immigration to rural areas totaled 25,014. This of course disguises the real magnitude of population shifts, since it measures net changes in rural and urban populations due to migration on a provincial basis. "Denuncias" or claims to unoccupied state lands totaled 20,660 between 1944 and 1962. Definitive grants between 1950 and 1962 were distributed in the following fashion:

	<u>Number</u>	<u>Hectares</u>
Sierra provinces	804	82,495
Coastal provinces	489	93,607
Oriente Province	1,013	64,820
Total	<u>2,306</u>	<u>240,932</u>

Until the Law of Vacant Lands was reformed in 1964, the acquisition of a definite title required more money, more weeks in the capital and more influence than an average colono farmer could hope to bring to bear.

Agrarian Reform and Agricultural Policy

The CIDA investigation of land tenure in Ecuador formed the basis of the sixth volume of Ecuador's General Development Plan, Reform of the Land Tenure Structure and Expansion of the Agricultural Frontier. The document analysed land tenure in the terms discussed here and made recommendations as well as reporting the effects of alternative courses of action. The Planning Board estimated the potential number of beneficiaries of a thorough land reform program as 254 thousand families (based on the 1954 agricultural census) (JNPCE, 1963_a Capitulo II: 106). Using estimates of the farm lands to be affected by agrarian reform, it was calculated that 170,600 families could be accommodated in these lands, principally in the sierra. Another 68,100 families would have to be induced to move to new lands in colonization areas. The

remaining 15,300 beneficiary families were estimated as the number of settlers or squatters whose holdings were to be legalized through the issuance of land titles. Since 1963 the major events in Ecuadorian land tenure have the Decree Law 1480 of Agrarian Reform and Colonization in July 1964 and the Decree Law 2172 of Vacant Lands and Colonization in September 1964, promulgated by the military junta which governed Ecuador from 1963 to 1966.

The agrarian reform law placed principal emphasis upon the abolition of the huasipungo and other forms of precarious tenancy together with the abolition of payments in kind or in resources in favor of payments in cash for all agricultural labor.^{2/} The law in essence "solved" the huasipungo problem by treating it as a labor question in which the value of the plot traditionally farmed by the huasipunguero was written off against the unpaid wages, vacations and other benefits owed him by the landowner. The major effect was not to create a new class of small independent farmers (which would have required large-scale expropriations of land) but rather to cut the traditional patronal ties of the worker to the hacienda and incorporate him into the mass of existing wage workers dependent upon the hacienda for employment.

Between October 1964 and May 31, 1968, the Instituto Ecuatoriana de Reforma Agraria y Colonización (IERAC) issued land titles to 31,515 families under various colonization and agrarian programs. Nearly three-fourths of the families who received land rights in this 44-month period were located in the sierra.

In view of the relatively large size of the holdings legalized under the Settlement Program as well as their modest numbers it seems likely that the program will have more direct impact upon total agricultural product than upon the distribution of income within the agricultural population. Available settlement lands are in the subtropical and tropical lowlands while the majority of potential settlers are highland indigenous groups with strong ties to their ancestral homelands and no preparation for life in a totally different ecological environment. Judging from experience in Ecuador and other countries such as Bolivia, the effective settlement rate in such circumstances is likely to be slow.

A Frontier Region: Santo Domingo De Los Colorados

Migration to new agricultural lands in Ecuador has traditionally flowed toward three principal foci: Santo Domingo de Los Colorados, Puyo-Tena in the upper reaches of the Pastaza, and Macas-Sucua in the Upano River Valley. The latter two are on the eastern slopes of the Andes and have developed less rapidly due to the physical difficulties of getting products to markets. Early settlement in the Santo Domingo zone can be attributed to its central location, lying astride the highway network connecting Quito, the capital, with the coastal cities of Esmeraldas, Manta, and Guayaquil, a network under construction or contemplation by the late 1940's. Also crucial to this development was the growth of the banana industry in Ecuador in the late 1940's. Cultivation expanded northward from Guayaquil and southward from

^{2/} For a discussion of the institution of huasipungaje, see: Gladhart, 1970: pp. 30, 39. See also Baraona for a typology of the haciendas in the Ecuadorian sierra.

Esmeraldas into the upper reaches of the Guayas and Esmeraldas river basins along the larger rivers many years before these areas were serviced by roads and highways. A large portion of banana exports were reached on rafts until the early 1960's. Much of the earlier settlement and agricultural production in what is considered the Santo Domingo zone would presumably thus have been in the extreme northern and southern portions.

In the areas closer to the town of Santo Domingo, early settlement was located along the new roads reaching down from the highlands and production was oriented toward the highland markets rather than toward export crops. This is reflected in the relative absence of banana plantations in this area and in the varieties of plantain planted by some of the older settlers. Different varieties are preferred by coastal and highland consumers.

Ecuador's population census of 1950 reported 6,951 people in the parroquia of Santo Domingo, 4,077 men and 2,874 women. In 1962 the population census reported 31,345 people in Santo Domingo parish. Of these, 24,395 were classed as "immigrants." A distribution of immigrants by sex and years of residence is presented below:

	Total	0-4	Years of Residence (1962 Census)			20+
			5-9	10-14	15-19	
Male	12,528	7,865	2,102	1,035	1,016	510
Female	11,867	7,428	1,129	1,527	1,006	777
Total	24,395	15,293	3,231	2,562	2,022	1,287

The total of all immigrants with 10 years or more of residence suggests that nearly 6,000 of the 1962 residents were in the area in 1952, compared with a total reported 1950 population of about 7,000. Assuming these figures to be reasonably correct, the parroquia (parish) had an annual net immigration which increased very moderately from 400 to 600 persons a year over a 15 year period from 1942 to 1957. In the five years after 1957 net immigration jumped to an average of more than 3,000 a year. Part of the rapid increase from 1947-51 to 1952-56 can be attributed to the construction work on the via Chone. This would also explain the immigration of nearly twice as many men as women during this period, compared to more nearly equal ratios in the other periods. The influx of 1957-61 can be attributed to a land rush stimulated by the Plan Piloto de Colonización, a government experiment in completely directed land settlement in an area about 40 kilometers north of the town of Santo Domingo de Los Colorados.

The provinces of origin of the 1962 migrant population in Santo Domingo is summarized in Table 3. It is clear from studying various documents and from conversation with people in the area that many people who came to Santo Domingo did not stay on as residents. People of all economic levels and a wide range of occupations came to speculate in what they expected to be a giant give away of government land. The obstacles to securing clear title to land in a reasonable amount of time meant that the poorer farming class was usually excluded from the better lands by other speculators;

many would work on a succession of claims for a time before selling their possession rights (or simply giving them up) and moving on.^{3/}

TABLE 3. PROVINCE OF ORIGIN OF IMMIGRANT POPULATION OF SANTO DOMINGO DE LOS COLORADOS, 1962

Province of Origin	Number
Azuay	588
Bolivar	1,398
Caffar	167
Carchi	411
Cotopaxi	3,721
Chimborazo	676
Imbabura	1,429
Loja	949
Total Sierra	9,339*
El Oro	780
Esmeraldas	1,480
Guayas	1,551
Los Ríos	1,603
Manabí	5,264
Total Coast	10,678

Source: Census of Population, 1962, Special tabulation. Located in files of Regional Planning Division, USAID, Quito.

* Data not presented for migration from sierra portions of Pichincha Province.

General Description of the Santo Domingo Area

Santo Domingo is located due west of Quito beyond the escarpment of the Andes on the edge of the coastal plain. The Santo Domingo Colonization Project is located between 0° and 0°30' south latitude and 79° and 79°37' west longitude (see Map 1). The topography is gently undulating but cut by many rivers and small streams. These form part of two major drainage basins: the Toachi, Blanco, Salazar, Eua, Guabal and Chila Rivers flow northwest to the Esmeraldas Basin; the Verde, Chiguilpe, Otongo, Baba, Congoma, Peripa, Pupusa, Cajones and La Esperanza Rivers flow southwest toward the Guayas River Basin.^{4/} The BID Polygon, official designation of the Santo Domingo Colonization Project, is an area of some 270,000 hectares in which the Ecuadorian Agrarian Reform and Colonization Institute (IERAC) is carrying out a project of assistance to spontaneous settlement with the aid of a loan of \$2.6 million from the Interamerican Development Bank. The maximum altitude in the project area is about 1000 meters in the vicinity of Alluriquin on the east; lower limits of elevation lie between 300 and 400 meters on the northern, western, and southern peripheries of the project. Most of the project area probably lies between 400 and 600 meters, 1300 and 1900 feet.

^{3/} See case histories, presented in CIDA, 1965, pp. 362-382.

^{4/} This section on climate and soils, and the succeeding one on ecology are adapted in large part from Garces (1967).

MAP I. ECUADOR, SHOWING LOCATION OF THE SANTO DOMINGO COLONIZATION PROJECT



The principal factors influencing and regulating the climate of the region are the ocean currents, the warm Nino and the cold Humboldt, and the Andes Mountains which form a physical barrier to the passage of wet air from the ocean (Garces, 1967). The climate is characteristically equatorial, with slight annual temperature variations, most of which can be observed in the course of a day. Annual rainfall is between 3,000 and 3,500 mm., 70% of which falls in the months of January through May.

Relative humidity is reported as about 90% during most of the year with only moderate fluctuations (Interamerican Development Bank, n.d.). The sky is cloudy most of the time, both during the dry and wet seasons. Both rainfall and cloudiness diminish as one moves generally west from the city of Santo Domingo. Temperature is also somewhat higher in the west.

Soils in the Santo Domingo area are lateritic regosols (dark sandy soils of the high tropical forest) and, in the western part of the area, dark latosols (dark reddish clay soils of the tropical forest). The first of these large groups are dark and somewhat sandy, originating in volcanic, alluvial, and eolic deposits. They are lightly acid with a pH of 5.0 to 6.3, a moderate level of organic material and quite fertile. The second large group are red tropical soils, generally acid, clayey and containing a high level of organic matter derived from parent materials of tertiary marine sandstone and volcanic ash. A typical physical analysis of Santo Domingo soils is given below:

Sand	52%
Clay	24%
Silt	23%

Garces presents an ecological map of the Santo Domingo project area based on the national ecological map prepared by the Ecuadorian Forestry Development Office. Using the vegetation classification system of Holdrige, the principal formations in the project area are wet tropical forest to the west and very wet sub-tropical forest east of the city of Santo Domingo. The former, comprising the major part of the area was divided by Garces into sub-areas of greater and lesser precipitation, the dryer zone beginning about kilometer 29 of the via Chone near El Carmen and extending westward.

The climate and resource base of the Riobambenos del Rio Chilimpe cooperative are not greatly different from those described for the area in general. The virgin forest is of the wet tropical forest type with a diversity of large evergreen species. The soil appears to be sandy clay, well drained, and of good and essentially uniform fertility throughout the cooperative area.

Government Settlement Projects

Plan Piloto

The Plan Piloto de Colonizacion de Santo Domingo de Los Colorados was an experiment in completely directed settlement. A contract was signed with the United States government in April 1957 for a \$2 million loan to finance the project and, on June 6, 1957, Emergency Decree Law No. 12 created the National Colonization Institute to plan and direct the project with the advice of international experts (CIDA, 1965: 343). The project was to be completed by the end of 1959.

The project originally contemplated the establishment of 89 farms of diverse size with a total extension of 5,150 hectares, together with family gardens, demonstration farm, reserve areas and unservicable land for a total of 8,000 hectares (CIDA, 1965: 352). The Colonization Institute was to make preliminary studies and plans, lay out the farmsteads, clear land and plant the basic crops, build housing for the settler, select the settlers on the basis of a point system, provide them with a subsistence allowance, build roads and a civic center, provide technical assistance and agricultural credit and establish cooperative marketing institutions.

Perhaps this catalogue of undertakings is sufficiently long to suggest the nature of the project's final outcome. A detailed summary of the factors contributing toward the failure of Plan Piloto is provided in CIDA, Tenencia de la Tierra y Desarrollo Socio-Economico del Sector Agricola: Ecuador, pp. 342-382. In a word, the project was undertaken without any sort of plan; when the plan finally was prepared it was never followed. The selection of basic crops (African palm and cocoa) was inappropriate and in many instances plantings were poorly established. The selection of settlers was nonexistent, of the first group of 33 farms adjudicated in 1960 only 13% went to farmers. Nevertheless, the results of the Plan Piloto project proved invaluable in the formation of a general settlement policy and in suggesting the most effective approaches within the Ecuadorian context. A major conclusion was that Ecuador would restrict herself to programs of assistance to spontaneous settlement and to semi-directed settlement in some areas.

Assistance to Spontaneous Settlement

In 1962, the government of Ecuador obtained a loan of \$2.6 million from the Inter-American Development Bank for a project of "Assistance to Spontaneous Settlement" in Santo Domingo de Los Colorados. The project originally contemplated an area of influence of 170,000 hectares and 1,600 beneficiary families.

In the course of administration of the project the area of influence was expanded to approximately 270,000 hectares and an estimated 3,000 beneficiary families. The project was to be completed by April, 1968, but bad weather forced extension of the project to January 1, 1969.

The principal activities of the project were the rectification and legalization of old land titles, surveying and the issuance of new titles, construction of access roads, supervising agricultural credit, school construction and technical assistance to farmers. IERAC actually identified 5,324 farms within the project area. The estimated 3,000 beneficiary families excludes in the main larger, longer established farmers not requiring or not eligible for the project's services.

As of February 29, 1968, 256 kilometers of access roads had been constructed, S/.27,796,000,00 in agricultural loans had been granted, and 34 schools had been constructed or were nearing completion. Another 100 kilometers of roads were projected as well as additional schools. Surveying of the project was completed. By the end of September, 1967, 3,278 land titles had been issued, covering 123,062 hectares of land. The average grant was for 37.3 hectares.^{5/}

^{5/} Estimates of 1966 agricultural production in the BID Polygon Project are reported elsewhere (Gladhart, 1968; 1970, pp. 69-84).

CHAPTER II

AGRICULTURAL PRODUCTION AND FAMILY INCOME IN THE
COOPERATIVE RIOBAMBENOS DEL RIO CHILIMPEChoice of Study Area

In a land where the tax collector has traditionally been the only person interested in gathering farm production and finance data, institutional legitimization of survey research is essential to the success of research projects.

A principal consideration in the design of this research project was to devise an institutional context for the research which would give it legitimacy in the eyes of the respondents. The author undertook a joint survey with "El Consorcio," the Union of Agricultural Cooperatives of Santo Domingo de Los Colorados. Original plans were to administer the final questionnaire in two cooperatives in conjunction with a program of economic evaluation and assistance which the Consorcio planned as a service to member coops. As the result of unexpected changes in Consorcio personnel and resources, the full questionnaire was administered in only one cooperative, Ríobambeños del Río Chilímpe.

The Ríobambeños cooperative was considered exemplary within the project area for the high degree of unity and cooperation among the members. As producers they appeared reasonably typical of the smaller farmers of the area in terms of resource base and access to capital. With completion of the road in late 1966 they had better than average access to markets for their products. The road itself is a prime testimonial to the members' capacity for group endeavor and their sensitivity to the relevant power structure in the project area.

The Ríobambeños have their lands in a block on the rolling plains west of Santo Domingo. The Chilímpe River and several lesser streams meander across the cooperative in a northwest-westerly direction. Most of the farms are ranged in rectangles 300 to 500 meters wide and 800 to 1200 meters deep. The streams are generally parallel, about 200 to 400 meters apart, and less than two meters wide except for the Chila Chiquita River on the northern boundary. This river is five to six meters wide but only one or two meters deep. The stream-cut depressions in the alluvial plain are about 20 meters deep and 30 to 50 meters wide. Farm houses are usually located on a slight rise or bluff above a stream to provide drainage, a good view of the property and easy access to fresh water.

History of the Ríobambeños del Río Chilímpe

The cooperative was not settled as a group undertaking. It was legally constituted in 1966, in compliance with IERAC regulations for grants of title to former state lands.

The present cooperative is simply a group of farms which grew up around the nucleus of the first settlers, who came to the region in 1950.

Benjamín Agualsaca Pérez, the informal patriarch of the cooperative, and his brother Tomás were working as laborers in a hacienda along the via Chone prior to 1950. Unwilling to remain peones all their lives, they set out to claim land for themselves. Since speculators had already claimed wide belts of land along the projected highways new land claims would have to be some distance from the roads. With a compass as guide and starting at about KM. No. 20, the brothers and three other men hacked their way with machetes to a spot 4 kilometers north of the road. It was here they laid out the first five claims of the present cooperative. With the aid of the compass they paced off five parcels, each 500 meters in width, and built a crude lean-to on the future site of Tomás' home above the banks of the Chilímpe River. In 1950 the five went to Quito and registered claims to fifty hectares each.

On New Year's Day 1952, Benjamín Agualsaca Pérez, with "three children, three chickens, and a wife," went into the forest to live. He was 42 years old, his children were 14, 11 and 8. He planted two hectares of maize; the harvest was good and he carried it out to the via Chone on his back.

Tomás Agualsaca arrived with his family in 1953, and was followed by the remaining claim holders. In 1955, Benjamin went to Ríobamba and returned with four men to work as peones. Three later became landholders. Other settlers followed. Each new settler's claim was laid out with the aid of Benjamín's compass. As a consequence there were never any boundary disputes among the settlers. The compass was still in use in 1968 as Benjamín lined up the building site for the new school.

In 1962 a large "comuna" was organized embracing much of what is now Ríobambeños del Río Chilímpe, San Pablo de Chila, El Laurel and other groups. (The comuna was a type of farmer association favored at the time by Ecuadorian land law, essentially an extension by analogy from the indigenous comunas in the highlands.) Subsequently, people began to withdraw from the comuna when confronted with litigation over conflicting claims and the attendant expenses for lawyers and surveyors. Ambush was a tool employed in the intense disputes over the right to use a trail from the Ríobambeños' lands to the via Chone. The comuna went out of existence after four years. In 1966 the Ríobambeños and several other small cooperatives were formed in accordance with the stipulations of the new Agrarian Reform Law.

Peaceable among themselves, the Ríobambeños nevertheless had boundary conflicts with their neighbors. When the coop was formed in 1966, they established their northern boundary at the Chila Chiquita River. Members of the coop in San Jacinto, to the northwest, also claimed some of the same land and tried to take away the land held by two of the settlers. An order from the Ministry of Government directed the Political Lieutenant of the Santo Domingo Parroquia to impede formation of any other cooperative in the vicinity of the Ríobambeños.

At the same time, the director of Public Lands advised the Ríobambeños to clear land along their claimed boundary as their best preparation for possible lawsuit. At least among litigants of similar importance, Ecuadorian law favors the owners of improvements in disputes over common claim to public lands. The right to be compensated for improvements is generally recognized even when the improver's claims

to lands are denied. Accordingly the Ríobambeños cleared a strip nearly 1 kilometer long and from 50 to 100 meters deep along the south bank of the Chila Chiquita River, some standing guard with shotguns while the rest cleared brush and felled trees. "Con escopetas a guardar mientras que trabajaba para defender derechos."

During this time the members raised plantain for food, not for sale, and sometimes they lacked food. They stole plantain shoots, "cepas," from abandoned plantations and also fruit planted along the trails to the highway. For cash crops they relied on rice, peanuts and maize.

Tropical climate and insects dictate that houses be raised somewhat above ground level. Farmers from the central highlands build open wooden houses with a large veranda open on two sides as the principal center of activity. Most of these houses contain little more than a kitchen and one or two bedrooms. They are built about a meter above the ground. Settlers from Manabi Province on the coast tend to follow their traditional methods and often build their houses fully three meters in the air. The houses are completely enclosed, of split bamboo, and a narrow ladder the bridge to the rest of the world. Grain is stored on the half-ceiling above the living quarters and at night small animals may be penned beneath the house. There is neither electricity nor piped water in the cooperative.

Supports for houses are made of Chonta, an extremely hard variety of palm. They will last ten years in the soil before they need replacement. If flooring and walls are made of split bamboo they must be replaced in three to five years. As farmers become more affluent they replace the bamboo with sawn lumber which will last indefinitely given proper ventilation and air circulation. The roofs are of palm thatch and require replacement every three years. Longer roof-life is desirable and galvanized iron or cement tile roofs are becoming more prevalent.

The farm yard always contains some sort of raised platform, the sotea, for drying cocoa, coffee, rice and maize. It measures about two meters by three meters and may have a sliding roof which can be pulled back quickly in the event of a shower. One of the Ríobambeños has a wheeled sotea which rolled from under the house on split palm rails. Small elevated thatched chicken houses are common and there is often a pig pen close by. Most families have some flowering plants or shrubs around the house.

Buses make several trips daily between San Jacinto to the west of the Ríobambeños, and Santo Domingo. By walking two kilometers to the main road one can ride into Santo Domingo for two sucres in only 45 minutes, when nothing breaks down. The new road enters the cooperative from the north, passes through the public square and then continues from east to west across 10 of the 25 farms. On Sundays, a bus comes into the cooperative at seven in the morning and takes people and produce to Santo Domingo, returning about five in the evening. Truckers come into the coop to purchase plantain on an irregular basis, usually by prior arrangement between the trucker and the farmer. None of the Ríobambeños owns a motor vehicle, but one had plans to buy a truck when his son returned from chauffers' apprentice training.

At the time the farms were surveyed, Benjamín and Tomás Agualsaca donated 4.4 hectares between their claims for a civic center. Thus, they have their houses on the public square and at the same time live in the middle of their farms. Other than a

large leveled soccer field, the two farmers' houses and a dilapidated school building there were no notable features on the public square.

The expectation is that farmers will gravitate to the civic center and build homes there on little lots to be assigned to them. The civic center will in time become a small village with the amenities of village life: small shops, a school, perhaps electricity, etc. None of the Ríobambeños seemed concerned about moving into the center at the present, but it has begun to happen in some other cooperatives. As with all potential municipal developments the civic center had a place set aside for the Ministry of Education to have a school, for the future governmental office, etc.

In the spring of 1968 the old school served as the residence of a Peace Corps Volunteer who was supervising the construction of a new school, partially financed by the IERAC-BID settlement project. The Ríobambeños provided all the structural timbers and sawn lumber and all of the labor to build the school. IERAC supplied roofing, nails, cement, tools and some other materials. The new school was being built alongside the old school rather than in the spot set aside for the Ministry of Education, among the cocoa trees across the soccer field. The coop had obtained a commitment from the Ministry of Education to build a concrete school and supply a second teacher, "soon," but that this would never come to pass if the site was occupied. Although willing to devote considerable materiel and effort to the construction of the IERAC-sponsored, self-help school, the cooperative members were sufficiently far sighted to set the building on their own property with the expectation that they would have a fine community center of their own whenever the Ministry of Education was able to fulfill its promise.

Farm and Family Characteristics

The magnitude of farmers' incomes can be expected to vary with respect to the amount and quality of resources controlled and the intensity and pattern of their use, as dictated by marketing possibilities, availability of family labor, liquidity, availability of credit, time preference, and a host of other factors. An implicit assumption of much farm management analysis is that the group of farms under consideration is essentially homogenous with respect to most of these factors. Analysis then centers upon the relative profitability of certain use and intensity combinations of essentially similar resources. To the extent that farmers differ widely in quality or scale of resources, one attempts to segregate them into groups which are as homogenous as possible before engaging in comparative analysis.

In a new settlement area such as Santo Domingo de Los Colorados, the variation among farms at any point in time is extreme for any factor or variable one cares to choose. IERAC land surveys indicate a very high degree of uniformity in the total size of farms held: 61 percent are between 20 and 50 hectares in size, 29 percent between 50 and 100 hectares. However, in a spontaneous settlement area, production and productive capacity are principally a function of the capital assets and technical skills which a farmer brings with him, the number of years he has been working the farm, the transportation and marketing possibilities available and their pattern of growth over time. Consequently, total land area is not particularly helpful as a classification variable in the analysis of production or income.

Among the members of the Ríobambéños cooperative, residence on the farm ranged from 1 to 23 years, the total farm size from 8 to 72 hectares and the area cleared at the end of 1967 ranged from 3 to 33.5 hectares. About 48 percent of the total land area was included in farms between 20 and 39.9 hectares in size. Three farms were between 8 and 20 hectares and 3 were between 69 and 72 hectares in size. In such circumstances, the reporting of a single mean value for any item of production or income is not terribly informative, nor does the standard deviation of such a spread distribution shed much additional light on the matter.

In view of the foregoing considerations, the 22 farms were divided into 3 groups on the basis of size of business. Classification was based on value, in sucres, of the total farm inventory on January 1, 1967. Land values and livestock are the preponderant weights in such a measure. Uniform values were used for all forest lands. This measure reflects the total area of holdings and is highly correlated with length of residence on the farm. To the extent that different possibilities for future expansion will dictate different patterns of production activity, such a classification will tend to segregate farmers in more homogenous groupings. For crop land, pastures, and livestock, differences among farms reflect differences in size of plantings and numbers of animals. A measure of size expressed in terms of value thus is closely correlated with the number of years an individual farmer has been working his farm, the size of his family labor force, and the size of the income stream which he has been able to generate over past years. Value of plantations and livestock holdings is essentially a measure of current productive capacity and it serves rather well to separate farmers into different classes of production and income. General practice will be to report the simple mean of those observations under consideration, together with the mean values of the 3 groups: (1) the six smallest farms, (2) the 10 medium-sized farms, and (3) the six largest farms.

Size of Farm

Selected measures of farm size as well as a breakdown of inventory value as of January 1, 1967 are summarized in Table 4. The value of initial farm inventory for group one, the six smallest farms, ranged from S/.18,500 to S/.24,700 with a group mean of S/.22,000. Initial farm inventory for the ten middle-sized farms, group two, ranged from S/.29,200 to S/.61,300 with a group mean of S/.45,800. Initial farm inventory for group three, the six largest farms, ranged from S/.78,000 to S/.133,800 with a group mean of S/.103,600.

The average size for all 22 farms was 32.39 hectares. By January 1, 1967 the Ríobambéños had cleared an average of 14.15 hectares and had an average of 18.25 hectares still remaining in forest. Permanent crops occupied 57 percent and pastures 31 percent of the average cleared land area.

Two items in Table 4 deserve special comment. The value of tools owned by these farmers was extremely low, ranging from an average of S/.162 for the small farms to S/.556 for the large ones, equivalent to \$8 to \$28 U.S. in 1967. Tools always included one or more machetes, perhaps an ax or a shovel and sometimes nothing more. A few farmers owned a modest set of carpentry tools and one or two possessed sawyer's saws for felling trees and ripping lumber. The cooperative manager purchased a backpack sprayer for cattle disinfection and weed control during 1967; he also owned a veterinarian's small hypodermic syringe. The community school teacher possessed

a very extensive set of carpentry tools valued at about \$50 U.S. No one possessed anything which could be classed as machinery, not even a small hand coffee depulper. The several sewing machines were classed as personal household property and not included in the value of farm inventory.

TABLE 4. INITIAL FARM INVENTORY, RÍOBAMBEÑOS DEL RÍO
CHILÍMPE, JANUARY 1, 1967*

	All farms	Small farms	Medium sized farms	Large farms
Number of farms	22	6	10	6
	<u>Average hectares</u>			
Total land in farm	32.39	14.16	29.82	54.9
Land in forest	18.25	6.62	14.34	36.38
Land cleared	14.15	7.55	15.48	18.52
Permanent crops	8.12	4.5	9.19	9.95
Pasture	4.45	2.25	4.45	6.67
	<u>Average value, sucres</u>			
Forest	18,064	5,361	14,160	37,275
Cleared land	22,005	11,679	19,812	35,983
Stocks on hand, crops in field	3,687	662	2,008	9,509
Value of tools	338	162	313	556
Value of house and other buildings	3,066	1,477	2,045	6,358
Livestock	7,952	2,715	7,493	13,954
Total value of initial inventory	55,112	22,056	45,831	103,636

* The Ecuadorian Sucre (S/.) exchanged at approximately 20 to 1 Dollar U.S. in 1967-1968.

While the average land cleared on the six large farms was only modestly greater than on the ten medium-sized farms, the value of the former was nearly twice that of the latter. This is a reflection of the greater age and lower per-hectare value of many plantations in the middle group as well as the lower ratio of improved pasture to common pasture for these farms. One of the largest farmers valued his property higher than the others because of its proximity to the Chila-San Jacinto Road.

General Family Characteristics

Farmers in group one are on the average younger than those in groups two and three, their families are smaller and they have resided on their farms for shorter periods of time. Their average level of schooling is higher than that of group two, but lower than that of group three. Table 5, Selected Family Characteristics, permits

comparison of the family size of the three groups as well as the level of formal instruction of the farm owners and their years of residence on the farm. Fifty percent of all the farmers had received more than 3 years of education and more than 25 percent had received 6 years or more. When compared with the general level of Ecuador's agricultural population, this is quite high for a population with a mean age of 43 years, although perhaps fairly typical for settlers. In September 1966 Lekis drew a sample of 53 applications for agricultural credit on file in the IERAC-BID project office in Santo Domingo. He found that 39 percent of the applicants had completed 6 years of primary education and an additional 18.5 percent had received secondary or university education. Only 9.4 percent indicated they could not read or write. The illiteracy rate for the general Ecuadorian population is currently about 45 percent. The average age of the applicants was 40 years and 75 percent reported farming as their profession prior to becoming a colonist. (Himebaugh, Leck and Lekis, 1966: 66-85).

TABLE 5. SELECTED FAMILY CHARACTERISTICS, 1967

	All farms	Small farms	Medium sized farms	Large farms
Number of farms	22	6	10	6
	<u>Average</u>			
Age of farm owner	43.1	40.3	43.7	44.7
Size of family	6.6	5.3	6.2	8.7
Years of residence on farm	10.5	6.0	11.1	14.0
Farm owners: Years of schooling	3.1	3.0	1.9	5.3
	<u>Totals</u>			
Farm owner's schooling:				
1 or 2 years	6	1	4	1
3, 4 or 5 years	5	3	2	0
6 or more years	6	1	1	4
No recorded school	5	1	3	1
Illiterate	3	1	2	0

The coop member with the highest initial inventory has completed secondary school. He has served as schoolmaster since he came to claim land 14 years ago. The Ríobambeños have always maintained a school for their children, paying the schoolmaster's salary themselves until recently when the Ministry of Education took over this responsibility. Six grades have been offered for a number of years. The schoolmaster receives 3,000 sucres a year.

Land Use

Any attempt to typify land use patterns among the Ríobambeños runs afoul of their practice of interplanting two or more permanent crops in varying ratios. The proportion of permanent crop land planted in this fashion also varied from farm to farm. Plantain is ordinarily planted at five meter intervals. Interplanting of coffee and cocoa then consists of placing one or both of these in the same rows as the plantain also at five meter intervals. The space between the rows is left open to facilitate harvesting and brush control. Thus an initial planting might be 400 to 420 plantain, 200 cocoa and 200 coffee trees per hectare, but the variations are endless. The practice may reflect an attempt to minimize the consequences of risk and uncertainty in the initial establishment of the farms. Planting three crops with different harvest cycles and different external price determinants tends to enhance the stability of future income as well as distribute it more evenly throughout the year.

Cocoa and coffee were more important than plantain as commercial crops when all produce was carried the five to ten kilometers to the nearest road on the backs of horses. The road which entered the cooperative in 1966 has made plantain production much more profitable to the Ríobambeños. Cocoa plantings are badly diseased with witches' broom and other fungus-like infections. The region is so cloudy that agronomists recommend unshaded coffee growing. Interplanting of coffee and plantain undoubtedly lowers coffee production through excessive shading. Low prices for their coffee reflects the rudimentary way in which the Ríobambeños prepare their coffee for market. No interplanting of coffee or cocoa was anticipated for the 31 hectares of new plantain established in 1967.

The distribution of farm size and land use was shown in Table 4. Average permanent crop area at the beginning of 1967 was 4-1/2, 9, and 10 hectares for the small, middle and large groups, respectively.

Crop Areas

At the end of 1967 the 22 farmers surveyed had cleared 351 of the 710.4 hectares owned. Pasture occupied 107.5 hectares, equally divided between improved and unimproved grasses. Plantain as a sole crop occupied 80.2 hectares in production during 1967; another 14 hectares of plantain were interplanted with cocoa, 9.5 hectares were interplanted with coffee and an additional 8.5 hectares of plantain were interplanted with both cocoa and coffee, making a total of 112.2 hectares of plantain in production during the year. Young plantain not producing during 1967 occupied 5.9 hectares and an additional 31 hectares of plantain were established during the year. Thus the total number of hectares with plantain as the sole or principal crop was 149.1 at the end of 1967.

Cocoa planted as sole crop occupied 25.6 hectares at the end of 1967. Coffee as a sole crop was planted on 2.5 hectares; 5.5 hectares were interplanted with cocoa and coffee. One farmer had one-half hectare of pineapple and another one-half hectare of sugar cane.

Maize was cultivated as the principal crop on 18.3 hectares during 1967. In some cases a second crop was planted on the same land. It was grown as a temporary crop

on an additional 19.5 hectares which had been planted to pasture or plantain. Maize was harvested from 28 hectares during the year. While normally planted from November through January, the beginning of the wet winter season, it is also not uncommon to plant maize in May and June, or in September. It was grown by 16 of the 22 farmers during 1967 and most farmers had between 1.5 and 3 hectares in maize.

Twelve farmers grew rice during 1967. It was planted as the sole crop on 11.6 hectares, and an additional 4 hectares were interplanted in new permanent crops. The largest area in rice for any farmer was 2.5 hectares. Four farmers planted some peanuts during the year, an average of 1/2 hectare each. Two farmers also had small patches of yucca both under 1.2 hectare. Both peanuts and yucca have potential as commercial crops in the area, but neither is feasible if the Ríobambeños continue the practice of letting pigs roam to scavenge plantain.

Small garden plots of green beans and other vegetables are maintained during the dry season. Most farmers had some citrus and avocado trees around their houses or in their pastures. Surplus vegetables and fruits are frequently harvested for sale in Santo Domingo. Other crops, not widely grown in the coop included cocoa, planted at ten by ten meter intervals in one or two hectares of pasture land by two farmers, mandarines, planted five by ten meters in 1.35 hectares of pasture, by another, and one farmer with only ten hectares who compromised by planting 2.5 hectares of cocoa five meters by ten meters, so he would also have pasture for his horses and hopefully, a cow.

There was little evidence of shifting cultivation among the Ríobambeños. Only 25 hectares of cleared land had remained idle for more than a year at the end of 1967. Only one farmer had more than three hectares in rastrojo, or "fallow"

Plantain Production

With completion of the road, plantain are the economic mainstay of most farmers in the cooperative. For the 22 farmers studied, plantain sales averaged 79 percent of crop sales and 47 percent of total cash receipts.

The principal variety grown by the Ríobambeños is locally known as Dominico (Musa Paradisico). Some settlers also have a sizeable planting of the variety known locally as Barraganete. Both are cooking fruit, to be prepared either green or ripe in soups, fried, boiled, steamed, baked, or dried as flour or meal. A stem of Dominico has individual fruit about 10 inches in length and will weigh from 40 to 60 pounds. The fruit of the Barraganete are much larger, perhaps 15 inches in length but the stem is smaller weighing 20 to 25 pounds. As a rough measure of equivalence, five stems of Barraganete are considered to contain 100 "fingers," dedos, and will sell on the farm for 10 to 14 sucres per 100 while full size Dominico stems sell for 5 to 6 sucres each.

This difference in value of the two varieties explains much of the disparity in income between certain farmers. Barraganete plantings are owned by six of the early settlers who lived close enough to the Chone highway to make plantain growing profitable in the days before the new coop road was built. The only road out to the rest of the country went to Quito and the highlands; consequently settlers planted Barraganete,

the variety preferred by the people of the highlands. New highways to Esmeraldas, Chone and Guayaquil have opened up the large urban coastal markets. These early settlers now find themselves with most of their plantain of an inferior variety and at an advanced age.

The normal practice among the *Ríobambeños* is to set plantains at 5 meter intervals, or 400 plants to a hectare. This grid is staked out when the ground is first cleared and planted to rice or maize. After one or more cycles of these crops have been harvested, the young plantain shoots are set out. A second crop and perhaps a third crop of maize will be grown during the year which it takes for the plantain to mature and bear fruit. During the course of this year, the root will have produced several new shoots which serve to replace the original when it is cut down to harvest the fruit. Each parent plant at any time will have one stem near maturity and 2 or 3 others in various stages of growth. A common rule of thumb for optimal production among the *Ríobambeños* was to have 1 stalk of fruit, 1 half way and 1 just sprouting at all times. The productive life of a plantain plantation under ordinary conditions is about ten years. This assumes no use of chemical fertilizers or other technical inputs.

The major variables affecting plantain yields among the *Ríobambeños* appear to be soil fertility, plant density both in the initial planting and as regulated through maintenance operations, control of the growth of underbrush which competes for sunlight, water and nutrients, and age of the plantation. Observation and inquiry suggests that soil fertility is the same from farm to farm within the coop although it may well decline with the age of the plantations. Rainfall is markedly lower in the June to November dry season and most farmers experience a drop in yields of 10 to 30 percent during these months. On two farms dry season yields did not fall off because of plentiful ground water supplied from advantageously located streams. For most farms, the stream beds are too deeply cut below field level for crops to profit from this effect.

With fertility and water availability assumed relatively constant from farm to farm, there remain large variations in physical yields and net returns per hectare to be explained by management practices and age. Maximization of the tonnage harvested per hectare involves approximation of some optimum number of plants at various stages of development with relation to levels of soil fertility and water supply. While most farmers plant at 5 meter intervals, there are some plantings at 6 meter intervals and 1 farmer has 9 hectares planted 5 meters by 10 meters, an initial average of 200 plants per hectare.

Maximization of net returns per hectare requires that farmers find the most profitable combination of frequency and intensity of brush clearing. All weeds and brush must be chopped out with a machete at least twice a year. Ten to 12 man-days per hectare are required for each *limpia* or "cleaning," depending on growth. All farmers with more than 2 or 3 hectares of plantain employ hired laborers to do this and nearly all work is contracted at a flat rate per hectare. The majority clean their plantations twice a year and pay S/.150 per hectare each time. Several farmers clean three times a year and pay S/.100 to S/.120 per hectare. Two of the most successful farmers have a sharecropping arrangement in which the sharecropper does all maintenance work in exchange for half the gross production from 2 to 4 hectares. Costs per hectare for these farmers are higher than the average but their gross returns are

enough higher to yield net returns per hectare more than twice the average for all plantain in the cooperative. Those farmers who felt 3 annual cleanings to be necessary were ones with older plantations and lower physical yields. This is consistent with the assumption that as physical yields decline over time, farmers will respond by increasing expenditures on yield maintaining activities before developing new plantations, particularly when room for expansion is limited and new plantings imply sacrificing current income for a year or more while maintaining costs at the same level.

Plantain production statistics are reported in Table 6.

TABLE 6. PRODUCTION AND SALES OF PLANTAIN, 1967

	All farms	Small farms	Medium sized farms	Large farms
Number of farms	22	6	10	6
<u>Production</u>				
Number of hectares in production:				
Total	112.2	15.0	61.2	36.0
Average per farm	5.1	2.5	6.1	6.0
Yield, stems per hectare	386.0	384.0	355.0	439.0
<u>Value of production</u>				
Sales per farm	4,786	2,424	4,117	8,261
Sales plus family consumption per hectare	1,177	1,417	877	1,588
Sales per hectare	938	970	673	1,377
Production costs per hectare	413	160	382	571
Net cash returns per hectare	525	810	291	806
<u>Percent</u>				
Percent of total production marketed	59.0	56.0	56.8	65.8

Plantain sales per farm were S/.2,424 for the small farms, S/.4,117 for the medium-sized farms, and S/.8,261 for the large farms. Small farms relied on family labor for the bulk of their maintenance operations so that their production costs per hectare were only one-third the coop average and their net returns per hectare were 50 percent greater than average. Medium-sized farms contained a higher proportion of over-aged, low density stands as well as most of the Barraganete planted in the coop. Their yields and net returns per hectare were considerably lower than those of the other groups. The large farms on the average had the same number of hectares per farm planted to plantain but twice the plantain sales per farm as did the middle-sized farms.

Two sub-groups of farms were segregated to illustrate the effects of variety and age upon farm incomes: 16 farms not having Barraganete and 12 farms with neither Barraganete nor plantations of advanced age (more than 9 years old). The performance of these two groups as compared with the coop average is presented in Table 7. Several of the best farms reported annual yields of between 500 and 600 stems per hectare, accounting for the high average yields of the group of 12 farms. Forty-nine hectares of Dominico from 1 to 6 years of age averaged net returns of S/.947. These returns are perhaps most indicative of the returns to be expected from the 31 hectares of Dominico planted by coop members during 1967.

TABLE 7. EFFECTS OF VARIETY AND AGE UPON PLANTAIN PRODUCTION AND SALES, 1967

	All farms	Excluding farms with variety Barraganete	Excluding Barraganete and very old plantations
Number of farms	22	16	12
		<u>Production</u>	
Number of hectares in production:			
Total	112.2	72.8	48.5
Average per farm	5.1	4.6	4.0
Yield of stems per hectare	386.0	397.0	476.0
		<u>Value of production, sucres</u>	
Plantain sales per farm	4,786	5,349	5,766
Sales per hectare	938	1,163	1,427
Production costs per hectare	413	425	480
Net cash returns per hectare	525	728	947
		<u>Percent</u>	
Percent of production marketed	59.0	58.8	61.7

Other Crops

The practice of mixing coffee, cocoa and plantain in the same plantation makes calculations of per-hectare costs and returns for individual crops extremely difficult. Even if detailed information were available on the cost of operations exclusively related to each crop, the allocation of brush and weed clearing costs among plantain, cocoa and coffee would still be a subjective, arbitrary procedure. In the foregoing analysis all costs of brush clearing were charged to the plantain operation. The external economies which this provides to the associated cocoa and coffee enterprises

were ignored. If one considers land area as the relevant unit of analysis and disregards the different uses of the land, the costs and returns of farming one hectare of mixed enterprises can be calculated.

It should be recalled that the total value of plantain sales and family consumption for 112.2 hectares of plantain in the cooperative was found to have an average value of S/.1,177 per hectare (Table 6). The average production costs for the cooperative were S/.413 per hectare. When the total sales and family consumption of cocoa and coffee from 32 hectares with mixed plantings are included, the average value of total sales and consumption from all 112.2 hectares of mixed and unmixed plantain is S/.1,266 per hectare. Inclusion of harvesting costs for cocoa and coffee in the mixed areas raises the average costs per hectare from 413 to 420 sucres for 112.2 hectares. The resultant net return of S/.846 per hectare is perhaps the best single measure of income from permanent crop production among the Ríobambeños.

Rice and maize are primarily non-commercial crops as grown by the Ríobambeños. As pioneer crops they are important in reducing the net cost of clearing land and establishing pasture or plantain. Yields of both maize and rice are quite variable; maize is subject to heavy losses from insects, rodents and parrots; rice yields often suffer from inadequate pollination of the flower. Frequently the costs of production of these grains exceed the value of production. A number of the farmers interviewed expressed a willingness to produce high cost rice in order to be assured of a supply for family consumption. Rice and maize harvest may employ family labor whose opportunity cost in other farm enterprises is quite low. Young boys who can't wield a machete can harvest rice. In sum, two complementary explanations seem reasonable: (1) farmers are willing to pay some premium in order to insure a supply of rice and maize; (2) given a decision to clear land and establish plantain or pasture, the marginal returns of growing an intervening crop of maize or rice will generally exceed the marginal costs by 200 to 500 sucres per hectare.

Livestock

Livestock are an important source of family income for the Ríobambeños and averaged S/.4,213 per family in 1967. Three-fourths of the average livestock income was in the form of cash sales and family consumption, with sales about twice as large as consumption. For the small and medium-sized farms, however, sales and consumption were less than one-half total family income from livestock, the remainder reflecting an increase in value over the course of the year. The livestock accounts for the cooperative are presented in Table 8. Most of the family consumption reported for the small and medium-sized farms represents poultry. Family consumption of swine was mainly confined to the largest farms.

Cattle raising has two objectives for the Ríobambeños: to provide the family with a supply of milk and to provide cash income through sales of beef animals. Reported family consumption of milk ranged from 2 to 8 liters of milk a day for those families with cattle. Two or more cows are necessary to insure a constant supply of milk. Aside from pasture maintenance, the only significant cash expenses in cattle production were salt and parasite control, although some farmers with unfenced pastures purchased picket ropes. Most of the cattle would be considered "criollo" (native) stock with evidence of Holstein-Fresian blood apparent in markings, but not in milk production.

TABLE 8. CHANGE IN VALUE OF LIVESTOCK* DURING YEAR 1967

	All farms	Small farms	Medium sized farms	Large farms
Number of farms	22	6	10	6
	<u>Average value, sucres</u>			
1. Value of livestock-- beginning of year	7,952	2,716	7,493	13,954
2. Purchases	2,035	233	1,047	5,433
3. Sales	1,940	871	1,053	4,487
4. Family consumption	1,006	406	516	2,423
5. Value of livestock-- end of year	11,254	4,175	9,953	20,502
6. Income = 3 + 4 + 5 - (1 + 2)	4,213	2,503	2,952	8,024
7. Gross change in value 5 - 1	3,301	1,459	2,460	6,547
8. Net change in value 7 - 2	1,267	1,226	1,384	1,114

* Does not include consumption or sales of eggs and milk.

For all 14 farms with cattle at the beginning of the year, the average increase in value of cattle per farm was nearly 50 percent of the average initial value. As Table 9 indicates the increase was largely the result of a growth of herd size. Fourteen head of cattle were sold during the year for a total of 24,040 sucres. One steer worth 1,700 sucres was consumed at home. Eleven farmers purchased no cattle during the year.

Small scale swine production can be a profitable adjunct to a plantain operation. The pigs are allowed to scavenge in the plantation during the day where they clean up the fruit which falls before maturity and would otherwise be wasted. In the evenings they are fed green plantain chopped and cooked with salt. Care is minimal and can be performed by the women and children. Sales and consumption of swine by coop members totaled S/.21,670 during 1967. A farmer can become a swine producer by investing a day or two of labor in the construction of a small pen and then borrowing a sow from a friend or relative. After maintaining the sow and her next litter through weaning time he returns the sow and half the litter to the owner keeping the other half for his own. The changes in swine holdings among the coop members differed in several respects from those in cattle. The small and medium-sized farms expanded vigorously while the largest farms showed modest reductions in numbers and value per farm. In addition, by the end of the year the 6 remaining members of the coop had added swine to their inventory and owned an average of 7 pigs each (Table 10).

TABLE 9. CHANGES IN CATTLE HOLDINGS, 1967

	All farms	Small farms	Medium sized farms	Large farms
Number of farms with cattle, beginning of year*	14	2	7	5
	<u>Average</u>			
Number of head, beginning of year	5.93	4.5	5.71	6.8
Value per animal, sucres, beginning of year	1,424	1,654	1,315	1,485
Value per farm, sucres, beginning of year	8,064	7,200	7,443	9,280
Increase in number of animals	1.29	1.5	.57	2.2
Change in value per animal, sucres	94	-55	35	237
Change in value per farm, sucres	3,522	2,650	800	7,680
Percent change in numbers	22	33	10	32
Percent change in value per animal	6.6	-3.3	2.7	16.0

* Two farmers in the medium-sized category purchased 2 head of cattle each during 1967; the average value was S/.2,800 per farm at the end of 1967.

For many farmers in the coop, a major objective in livestock expansion is simply one of providing more milk and meat for family consumption, a minimum goal of 2 or 3 cows and several sows. Beyond this, the larger farmers are thinking of initial increments of 5 to 10 hectares of pasture and 8 to 15 cows. Such rapid growth clearly will depend upon credit. While such an enterprise may be profitable, it is difficult to see how the net returns per hectare can compete with those of plantain or other, industrial crops.

TABLE 10. CHANGES IN SWINE HOLDINGS, 1967

	All farms	Small farms	Medium sized farms	Large farms
Number of farms with swine, beginning of year	16	5	6	5
	<u>Average</u>			
Number of head, beginning of year	6.25	3.2	4.33	11.6
Value per animal, sucres, beginning of year	177	146	152	237
Value per farm, sucres, beginning of year	1,129	421	568	2,512
Change in number of animals	1.5	2.4	4.2	-2.6
Change in value per animal, sucres	26	65	-32	57
Change in value per farm, sucres	289	549	469	-188
Percent change in numbers	24	75	96	-22
Percent change in value per animal	14.7	44.2	-21.3	24.1
Number of head, end of year	7.3	5	8	7
Value per farm in sucres, end of year	983	250	812	2,400
Number of farms first acquiring swine during 1967	6	1	4	1

Family Income

Certain methodological differences between this and many other studies of farm management should be noted. Family income has been defined as the sum of net cash receipts, farm produce consumed and changes in farm inventory. Net cash receipts is the total of all receipts of the family (both farm and non-farm) minus all cash production expenses and minus all cash investment expenses. Thus, it is a measure of the total cash available to the family for consumption purposes during the year. Cash receipts have also been classified according to source so that it is possible to see the relative contribution of different sources to cash income.

Farm products consumed by the family include those used by the family and those given to workers in partial payment of wages, but excludes items used for animal feed. Net inventory change is simply the difference between the farm inventories at the beginning and the end of the year, inasmuch as costs of investments were netted out in the determination of net cash receipts.

No attempt was made to evaluate unpaid family labor nor the rental value of the farmer's house. It is felt that these items as traditionally employed in the calculation of returns to the factors of production are not particularly relevant within the socio-economic context of pioneer settlements in an underdeveloped country such as Ecuador. Beyond this, the computation of actual labor performed in a situation of continuous production and generally unlimited opportunity for farm expansion is quite impossible.

It was assumed that in the dynamic circumstances of the frontier, the relevant economic factors for the farmer's decision making were the magnitudes of his cash flows and the rate at which they permitted him to expand his operation. Analysis of one coop member's labor records over a 12-year period suggests that the effective constraint on the employment of hired labor is simply anticipated ability to pay. The principal criteria employed by farmers attempting to allocate the entire bundle of their resources--land, family labor, hired labor, managerial ability--will be the family standard of living and the growth of productive capital which such allocation affords. Accordingly an attempt has been made to use similar measures in the presentation and analysis of these family resource allocations.

In Table 11 the major accounts in the determination of family income among the Ríobambeños del Río Chilímpe have been summarized. For all 22 farmers, average total cash receipts were S/.13,486, net cash receipts S/.3,639, farm products consumed averaged S/.4,922 and average change in farm inventory was S/.9,811. Average family income was S/.18,372, about \$920 at an exchange rate of 20 sucres equals U.S. \$1.00.

TABLE 11. FAMILY INCOME ACCOUNTS, 1967

	All farms	Small farms	Medium sized farms	Large farms
Number of farms	22	6	10	6
	<u>Average</u>			
Farm inventory, beginning of year	55,112	22,056	45,831	103,636
Total cash receipts	13,486	9,454	6,550	29,078
Less: production expenses	3,558	1,058	3,643	5,917
Less: investment expenses	6,289	5,559	2,416	13,473
Equals: net cash receipts	<u>3,639</u>	<u>2,837</u>	<u>491</u>	<u>9,688</u>
Plus: farm products consumed by the family	4,922	3,468	4,078	7,782
Plus: change in farm inventory	9,811	7,274	5,539	19,469
Equals: family income	<u>18,372</u>	<u>13,579</u>	<u>10,108</u>	<u>36,939</u>
Value of inventory, end of year	64,923	29,329	51,370	123,105

The high values for total cash receipts on the part of the largest and the smallest farmers deserves some comment. One of the six smallest farms, as measured on the basis of total initial assets, was purchased by the current owner at the beginning of 1967. He is credited with outside income of S/.25,000 resulting from the sale of cattle in the sierra before he owned the farm. Corresponding entries equal to the purchase price of the farm and the cost of new improvements were made for this farmer's investment expenses, which partly explains the relatively high level of investment expenses for the smallest group. When this S/.25,000 is excluded from the total cash receipts of the six smallest farms, the resultant average per family is S/.5,287 compared with S/.9,454 when the item is included in the account.

One of the largest farmers received a production loan of S/.32,000 from the National Development Bank for livestock purchase and pasture establishment under the auspices of the BID Santo Domingo Project. Expenditures of these funds were credited to investments in the same manner as the case discussed above. When this loan is excluded, the average net cash receipts of the six largest farms was S/.23,745.

Components of Cash Receipts

Crop sales were the major source of cash receipts in the cooperative although several farmers had livestock sales greater than their crop sales. One farmer in the largest group had timber sales of S/.19,050, and crop sales of only S/.11,015. Two farmers, previously described, had outside income as the largest single contributor to total cash receipts. Mean values for the major categories of cash receipts and crop sales are listed in Table 12. High variability in the importance of specific sources of income distorts generalizations which can be made from group averages. Thus, while crop sales accounted for only 48 percent of total cash flows into the cooperative, crop sales averaged 59 percent of family income among the 22 families. Correspondingly, high value timber sales from a few large farms have exaggerated the importance of timber sales to the majority of families. Plantain sales were 36 percent of total cash receipts for the cooperative in 1967 and they accounted for 75 percent of total crop sales. The medium sized farms as a group relied most heavily upon plantain for family income with plantain sales averaging 63 percent of total receipts.

Timber resources in this area are extremely heterogeneous and the valuable species are rather thinly distributed on the Ríobambenos' land. A number of species are sold for veneer logs, the rest for common sawn lumber and construction timbers. The sale of S/.19,050 of timber by one farmer represents perhaps one-half of the valuable trees found on about 35 hectares of virgin forest. Several farmers have planted woodlots of one or more hectares of laurel, but none of them is yet in production. Most early settlers destroyed timber in the course of clearing their land since there was no possibility of marketing it at the time.

TABLE 12 COMPONENTS OF CASH RECEIPTS, 1967

	All farms	Small farms	Medium sized farms	Large farms
	<u>Average, sucres</u>			
Crop sales	6,418	3,034	4,806	12,489
Plantain sales	4,786	2,424	4,117	8,261
Cocoa	857	466	320	2,143
Coffee	128	33	68	322
Maize	177	50	220	233
Rice	243	0	55	800
Fruits and miscellaneous	227	61	25	730
Livestock sales	1,940	871	1,053	4,487
Timber sales	1,641	282	198	5,407
Off-farm labor	449	445	420	500
Egg sales	164	121	70	365
Other receipts	2,874	4,701	4	5,831
Total cash receipts*	13,486	9,454	6,551	29,079

* Detail may not add to total due to rounding.

Cash Expenses

Farm expenses have been considered under two broad categories, production and investment expenses. All expenses associated with the production of current income--maintenance of plantations, planting and harvesting, packing and transportation costs, livestock medicines, etc.--have been classed as production expenses. All expenses toward the creation of new capital assets or the improvement of old ones have been classed as investments. In practice, it is recognized that the maintenance of plantations also involves their improvement; to the extent that this takes place, investment is underestimated. On the other hand, proper care of a plantain or cocoa plantation prior to its bearing age permits a farmer to produce one or more crops of maize for little more than the harvest costs. These considerations do not imply any serious distortions in the picture presented here, but they should dispel impressions of an unnatural congruence between abstraction and reality in the present study.

Personal consumption expenditures by the family were not systematically investigated in this study, nor was any attempt made to ascertain the value of household articles. The apparent level of living of all families as judged from clothing, housing, food and family possessions was highly similar despite apparently large differences in income.

Production Expenses

Average expenses for hired labor were 85 percent of the average total production expenditures for all 22 farmers. The mean of S/.3,013 is roughly equivalent to 200

man-days per farm per year when a wage of 15 sucres a day (without meals) is assumed. Hired labor use and total production costs are summarized in Table 13.

TABLE 13. HIRED LABOR USED IN PRODUCTION, 1967

	All farms	Small farms	Medium sized farms	Large farms
Number of farms	22	6	10	6
	<u>Average, sucres</u>			
Total production costs	3,558	1,058	3,643	5,917
Hired labor costs	3,013	742	3,138	5,076
	<u>Percent</u>			
Labor as percent of total cost	85.2	70.1	86.1	85.8
	<u>Equivalent Man-days</u>			
Hired labor	201	49	209	338

* Assuming average wage = 15 sucres per day.

The low average level of production costs for the smallest farmers can be explained by the fact that two of these farmers used no hired labor for production, a third spent only 150 sucres. The remaining three farmers spent from S/.960 to S/.2,340 for hired labor which made up 80 to 85 percent of total production expenses. Most of the labor requirement on these small farms can be met by the family. This no longer is the case for many of the middle sized farms.

The combined crop and livestock sales of the medium-sized farms are 50 percent greater than those of the small farms while production expenses for the medium-sized farms are nearly 3.5 times greater than the small farm production expenses. "Profit," crop and livestock sales less production expenses, on the small farms is greater than on the medium sized farms (see Table 14).

Investment Expenditures

The level of cash income and the claims of production expenditures influence the availability of cash for investment purposes. Cash investment expenditures are closely related to the level of income which a family receives as increased valuation of year-end farm inventory. Investment expenditures were reported by 19 of the 22 farmers, but the investments of the six largest farms comprised 58 percent of total cash investments for the 19 farmers. A detailed treatment of cash investment expenditures will be found in the next chapter.

TABLE 14: SALES AND EXPENSES COMPARED, SMALL AND MEDIUM-SIZED FARMS, 1967

	Small farms	Medium farms	Medium as a percent of small
Number of farms	6	10	
		<u>Average, sucres</u>	
Crop and livestock sales	3,904	5,859	150.0
Production costs	1,058	3,643	344.0
Sales minus costs	2,846	2,216	77.9

Family Consumption

The average levels of family consumption reported in Table 11 require little further explanation. The quantity of farm produce consumed rises as family size increases and as the use of hired labor increases. Families with higher incomes consume more eggs, chickens and more pork than do their poorer neighbors. And family milk consumption increases as livestock owned increases. Among 22 farmers, only one beef animal was reported as consumed by the family.

Changes in Inventory

As indicated in the definition of family income, change in inventory represents the total change in farm value between the beginning and the end of the year 1967. Any cash costs associated with this change have been netted out in the determination of net cash income. The method of evaluation assumes no inflation of land values during the course of the year. The changes in land value reflect the net effect of physical changes or improvements made by the farmer during the year. Insofar as possible, change in inventory represents the change in the marketable value of the farm. As a general policy, forest land was valued at S/.1,000 per hectare, natural pasture at S/.1,000, improved pasture (guinea grass, elephant grass, pangola grass, etc.) at S/.1,500 and plantain, cocoa and coffee were valued at S/.2,000 to S/.2,500. Fallow land was valued at S/.800 to S/.1,000. In an area where rainfall is 2.5 to 3 meters a year, land "at rest" becomes overgrown in six to eight months. Planting a crop in rastrojo, "fallow," may involve more than the clearing of a virgin forest. The brush is much denser and the rastrojo contains no timber to help offset the costs of reclearing.

By reclearing a hectare of fallow and planting permanent pasture a farmer could increase his final inventory by S/.500 to S/.700, although his establishment costs would likely equal this gain, and could exceed it. This situation reflects the nature of the local market for land and as such, the change in inventory concept gives an indication of the relative improvement in a farmer's economic position. As a measure of income, change in inventory has the desirable property of evaluating a farmer's expansionary efforts in terms of the market's current willingness to pay for them.

To the extent that the market for land and cattle reflects the conditions of demand for their production, inventory change becomes a useful proxy for judging the profitability of expansionary activities vis-a-vis productive ones.

Average change in inventory for all 22 farmers was S/.9,811. For ease of comparison, selected components of family income from Table 11 have been reproduced in Table 15. For all three size classes the average increase in inventory was by far the largest component of total family income. Here the difference in scale between the largest farmers and all the rest is most apparent. Inventory increase for the largest farmers averaged three times that of the medium-sized farmers and more than two and one-half times that of the smallest farmers.

TABLE 15. MAJOR COMPONENTS OF FAMILY INCOME, 1967

	All farms	Small farms	Medium sized farms	Large farms
Number of farms	22	6	10	6
	<u>Average, sucres</u>			
Net cash income	3,639	2,837	491	9,688
Family consumption	4,922	3,467	4,078	7,782
Change in inventory	9,811	7,274	5,539	19,469
Family income	18,372	13,579	10,108	36,939

A breakdown of the different contributors to farm inventory change is presented in Table 16. Farm inventory has been classified under six headings: 1) Forest land, 2) cleared land, 3) stocks on hand, annual crops in the field, fruit trees, etc., 4) tools, 5) houses and other buildings, 6) livestock. Increase in the area of cleared and cultivated lands and additions to livestock holdings were the principal contributors to inventory increase as might have been anticipated from earlier discussion. The insignificance of tools as a capital item is reflected in the lack of change in this item. Seventy-five sucres worth of new tools could reflect no more than the accident of owning three old machetes at the beginning of the year and three new ones at the year's end.

TABLE 16. ANNUAL INCREASE IN VALUE OF FARM INVENTORY,
JANUARY 1, 1967 - JANUARY 1, 1968

	All farms	Small farms	Medium sized farms	Large farms
Number of farms	22	6	10	6
	<u>Average, sucres</u>			
Value of inventory January 1, 1967	55,112	22,056	45,831	103,636
Net changes in value during 1967:				
Forest land	-2,256	563*	-1,280	-6,700
Cleared land	5,171	2,731	2,408	12,217
Stocks on hand, crops in field, fruit trees	2,205	920	682	6,028
Tools	75	1	8	261
House - other buildings	1,314	1,600	1,260	1,117
Livestock	3,301	1,459	2,460	6,547
Total change in value:	9,811	7,274	5,539	19,469
Value of inventory January 1, 1968	64,923	29,330	51,370	123,105

* This value should normally be negative, indicating that the average forest area decreased during the year. One farmer in this group purchased his farm at the beginning of 1967 from a settler desperate to leave. When his cattle and improvements were inventoried at their full value, the residual of the total purchase price assigned to forest land was quite modest. This forest was assessed at full standard value at the end of 1967.

Continued reference to three groups of farmers tends to over-emphasize the immutability of such a classification. For the smallest farmers, average change in inventory was one-third of their average initial inventory. At this rate, small farmers soon cease to be small farmers, and the smallest this year may not be the smallest at the beginning of the next. The size grouping of smallest, medium sized and largest farms was chosen in part for convenience of reporting and reflects two rather large gaps in an otherwise comparatively continuous ordering of initial farm sizes. Using the same principle, the 22 farms at the end of 1967 could be grouped as four farms whose value ranged from S/.19,300 to S/.28,900; 12 farms whose value ranged from S/.34,400 to S/.68,900 and 6 farms ranging in value from S/.94,800 to S/.154,300. By contrast, initial farm inventory ranged from S/.18,500 to S/.24,700 for six small farms, S/.29,200 to S/.61,300 for ten medium size farms, and S/.78,000 to S/.133,800 for six large farms.

Seasonal Pattern of Family Income

One advantage of farming in a region such as Santo Domingo de Los Colorados is the continuous nature of agricultural production when contrasted with the highly seasonal character of production in the sierra. While the lowlands do experience definite wetter and dryer seasons, plantain and other permanent crops grow the year around while maize can be harvested at least twice during the year. A settler who has been established a few years can always find something to eat; the steady flow of cash sales means that he is less dependent on the grain dealers and money lenders who exploit the sierra peasants in the long dry spell between planting and harvest.

Family Income Explained

Family income has been explained on the basis of yield and area of permanent crops, size and composition of livestock holdings, production loans, sale of timber, external employment. The striking aspect of all these items is the degree to which their importance for a particular farmer can be understood simply as a consequence of the length of time which each settler has resided on his farm.

- a) Farmers who settled earlier tend to have older and more numerous children so that their family work force is larger.
- b) Farmers who settled earlier usually could locate closer to the existing road and thus have better access to markets.
- c) The longer a farmer has worked his holdings, the larger his area in plantations and thus the larger his potential sales.
- d) The earlier settlers destroyed much valuable timber before the road came.
- e) Several of the earliest farmers cleared all their land and planted most of it to Baraganete. They had no room for rapid expansion and received relatively less for their produce in 1967 than some who settled later.
- f) The passage of time accentuates the effects of management skills, particularly in an agriculture of permanent cash crops. Day to day decisions are cumulative; an error in plantain spacing will prejudice earnings for years to come.

All correlations with time are not positive.

The limiting factors affecting family income and the growth of the farm enterprise are cash flows and managerial ability. The discussion of plantain production highlighted the importance of managerial decisions in determining physical yields and net returns per hectare. The age and density of plantations as well as their maintenance are all aspects of management. Clearly the expansion of a farm's productive base is largely a function of a farmer's ability to maximize current cash income given the high labor costs of expansion and the small labor force available. Only seven families out of 22 in 1967 had more than one man in the family over 18 years old. When the potential family labor force is calculated in man equivalents per year, the average

family labor force among the Ríobambeños in 1967 was only 2.7. Considering that women, girls and young boys are of marginal value in machete wielding, most of the important work of these farms must be done by hired laborers.

The rudimentary level of technology employed by most farmers together with a wide variation in crop yields among this group suggests wide scope for general improvement of yields and incomes through improvement of management skills and the employment of improved technology, particularly in regard to plant spacing, possible use of fertilizers and pesticides, introduction of new crops, etc. Such changes will be heavily dependent upon effective guidance by agricultural extension personnel. The farmers studied were quite interested in obtaining advice about better farming practices. The Union of Agricultural Cooperatives in Santo Domingo was instrumental in securing the assistance of ministry of agriculture specialists who initiated programs of pasture and citrus expansion in the Ríobambeños cooperative in June 1968.

Under current levels of technology in the cooperative it requires superior management ability to support a small family respectably by local standards on a 10 hectare farm. To replace the aging plantations will require more funds, and it will be difficult on such a farm to produce greater profits per hectare than is presently the case. These farmers and those farmers with most of a 10 to 25 hectare farm in run-down plantain and unimproved pasture will undoubtedly require credit and technical assistance. The study also suggests that superior managerial skills and currently available technology can permit a farm family to live quite well by current standards with 20 to 30 hectares and some credit assistance. The present cooperative manager was producing a substantial cash surplus from only 10 hectares of crops.

Family Income Levels Evaluated

There is no doubt that the 1967 income of families in this study is far superior to that which they enjoyed before coming to the Río Chilímpe. When asked to estimate the value of assets which they brought to their new farms, the great majority replied, "nothing". The school teacher used his carpentry skills to earn S/.30,000 building houses along the Chone highway before taking up land in 1953. Another farmer brought swine which he fattened and sold for S/.8,000; a settler from Colombia said he brought S/.9,400, and two settlers estimated their initial capital as S/.3,000. The settler who, with his brother, purchased a farm at the beginning of 1967 had invested S/.25,000, money received from the sale of cattle in the sierra. He was convinced that his prospects were superior on his new property. For most of the settlers studied, however, their initial worldly goods were not different from those of Don Benjamín: "Three children, three chickens, and a wife."

Most of the Ríobambeños worked as day laborers when they first came to the area, even after they had begun farming for themselves.

In contrast with these humble beginnings, the results of the analysis of family income accounts indicate that the average value of assets held by the twenty-two farmers at the end of 1967 was S/.64,923 (Table 16). In terms of U.S. dollars the smallest farm was worth \$1,000, the largest \$7,750 at the end of 1967, levels which raise one well out of the ranks of the rural poor in Ecuador by any standard.

Among the Ríobambéños, the group of farmers with the lowest average level of gross receipts was the middle-sized group: S/.6,550 in 1967. The average total income of this group was S/.10,108, clearly superior to a farm laborer's income of perhaps 4,500 sucres per year. A roughly comparable income might have been earned by a truck driver or mechanic in the town of Santo Domingo de Los Colorados who worked 250 days a year and received 45 sucres a day. While the associated difference in life styles limits the validity of any such comparison, since the truck driver would have had to pay rent and purchase food at city prices it is likely that he would have been at a disadvantage vis-a-vis the average of middle-sized farm owners used in the comparison.

The evidence from the families studied overwhelmingly supports the proposition that land settlement will result in substantial improvement in family income for those who settle. The evidence does not consider families who were unsuccessful in their new environment. The coop member who sold out in 1967, "despairing of life itself", is not in this sample. The proposition merely asserts that where families successfully adapt, poor families can achieve prosperity in exchange for years of hard work.

We should call to mind the bleak future of the majority of Ecuador's poor agricultural class, the sub-family sized tenure group and landless laborers mentioned in Chapter I. Caught in the ever contracting cycle of increasing population pressure upon land resources in steady decline from over-use, these people can only hope that a life of hard work will keep them from slipping over the edge from subsistence into starvation. In contrast, the prospect of prosperity and human dignity awaiting settlers who stick it out is revolutionary.

CHAPTER III

SAVINGS AND INVESTMENT AMONG THE RÍOBAMBEÑOS
DEL RÍO CHILÍMPE

Savings and investment are central to the process of economic growth. Inasmuch as Ecuador's economic development will remain closely linked to the growth of the agricultural sector for some time to come, the rate of investment in agriculture will play a significant part in determining the rate of expansion of the entire economy. Much development theory addresses itself to the problem of extracting a surplus from the traditional sector for investment in the modern sector of the economy (Mellor, 1967: 21-36).

Perhaps because many large underdeveloped countries have reached the effective limit of their agricultural land resources, most agricultural development theory has emphasized a more intensive agriculture as the key to generation of a surplus. Strategies for agricultural intensification usually imply the creation of a modern technology suitable for implantation in the traditional environment with traditional agriculturalists choosing to adopt the modern approach. It is characteristic of these modern technologies that they cannot be created through investment of the resources of the traditional sector, e.g., unskilled labor. Rather they require funds, capital goods and highly trained scientific personnel from the modern sector of the economy. Consequently, agricultural development theory has tended to concentrate on the transfer of these scarce resources from the modern sector to the traditional agricultural sector so as to maximize the growth of output.^{6/}

By contrast, the possibilities of large increases in the area under cultivation through frontier settlement in Ecuador mean that agricultural growth can rely on investments from the traditional agricultural sector to a significant degree. While it is recognized that such investments in land settlement involve resources of low opportunity cost (when land settlement is carried out spontaneously as in Santo Domingo de Los Colorados) and high potential productivity, little has been written about the nature of investment under conditions of spontaneous settlement. It would be useful to know more about the behavior of the settler: What rate of land clearing can he sustain over time, given only his own resources? Is this rate constant or does it change over time? What form does investment take beyond land clearing? How do changes in market possibilities affect the investment rate? Answers to these questions could aid Ecuadorian planners in anticipating the growth of agricultural production in settlement projects. They would also permit a better appreciation of the contribution of the traditional agricultural sector to agricultural development in Ecuador.

This chapter has two objectives. The first is a descriptive one, to provide a closer look at the behavior of the settler and the evolution of the farmstead as a stock of

^{6/} In this regard see Parts I, II, and V of Developing Rural India, Plan and Practice by Mellor, Weaver, Lele and Simon, 1969.

reproducible agricultural capital. The second is an attempt, in analytical fashion, to provide answers to some of the questions raised above.

Trends in Land Clearing

The first members of the present Ríobambeños cooperative filed claims for their land in 1950 and settled about 1952. The most recent member has been in the coop less than six months at the end of 1967. The farm production questionnaire included a sketch of each farm indicating the size of each plot and the date at which it was first cleared. The reported size of these plots was verified by visual inspection and comparison with aerial photos. Farmers were also asked how long they had resided on the farm. From this information it was possible to reconstruct the growth of each farm over time and the growth of cleared land for the cooperative as a whole. The following analysis of land clearing refers to 20 members of the cooperative who could supply all of the information requested.

Figure 1 shows the total amount of land cleared by the settlers between 1951 and 1967. The cumulative number of farms is also presented. The growth in amount of cleared land is remarkably steady even though not more than half of the settlers cleared land in any one year.

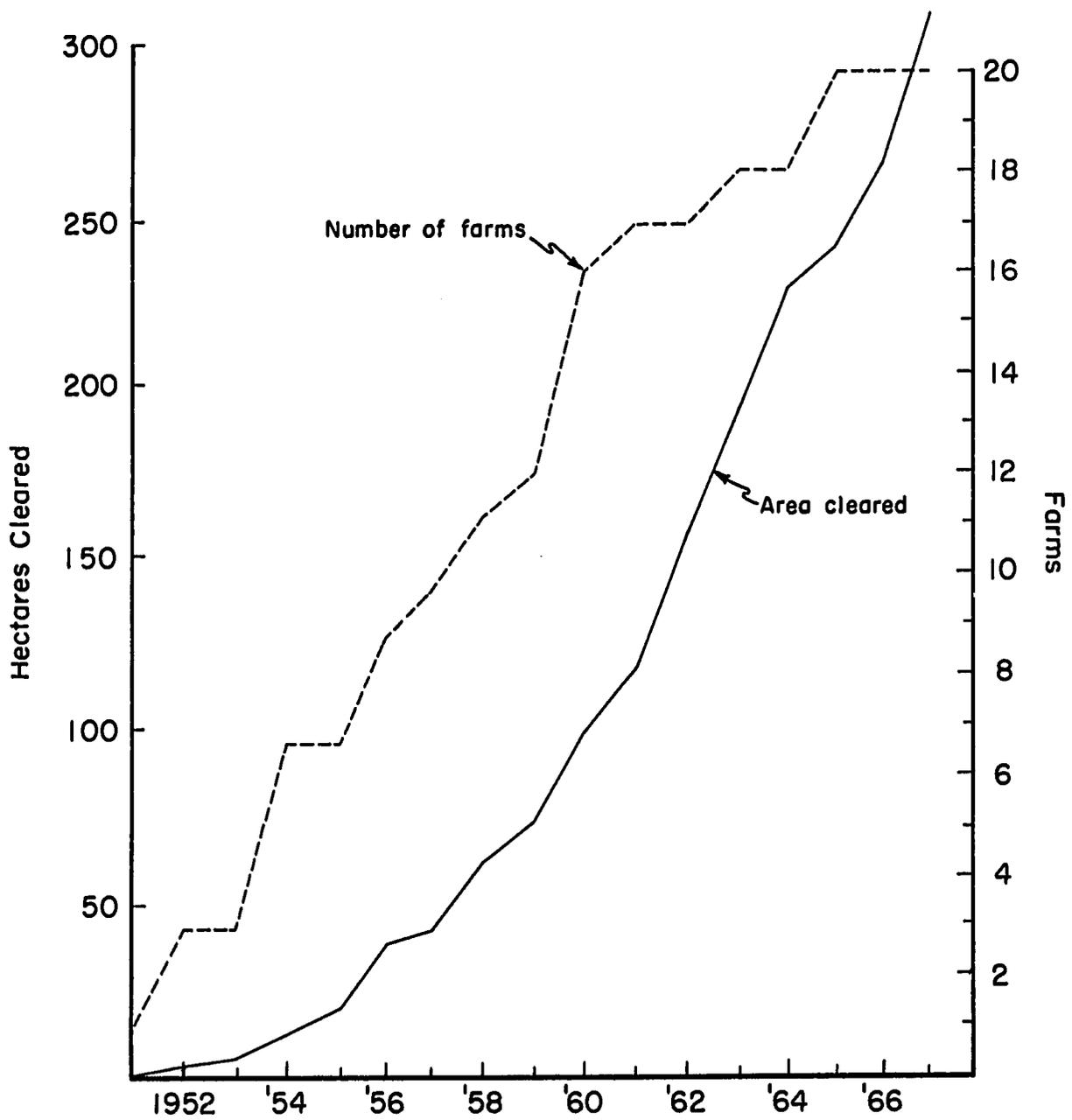
A "land clearing" investment is considered as all the land cleared by a settler in any one year. The cumulative total of 311.2 hectares cleared by the 20 settlers over a 16 year period is the result of 84 separate annual clearings ranging in size from 0.5 to 18.5 hectares. Most farmers made small clearings of less than three hectares in extent every one to three years.

Only six annual clearings of more than three hectares were made by individual farmers before 1959. While the number of settlers increased nearly every year through 1965, four settlers exhausted their forest land and ceased clearing activity between 1961 and 1966.

One would prefer to analyze settlers' investment behavior under assumptions of reasonable homogeneity with respect to their resource base, size of family, level of current income, etc. This is manifestly impossible if some settlers have ten hectares under cultivation at a point when others are just scratching in their first small plot of maize. Two possible alternative assumptions come to mind: (1) Settlers come to the frontier in similar circumstances, consequently we can assume them to be homogeneous with respect to resource endowment in the year in which they take up residence on their new farm; and (2) Although settlers come to the frontier with different resource endowments, it is plausible that a certain minimum is necessary in order to begin land clearing and farming. Therefore, we can assume that settlers have homogeneous resource endowments in the year in which their first recorded land clearing takes place.

If assumption (1) were adopted, the base year for each family's land clearing series would be the first year of residence. The average land cleared for each year of residence could then be calculated. The resultant trend will surely be more informative concerning "average" behavior than one derived from an unmodified historical series.

FIGURE I. LAND CLEARED BY SETTLERS, RIOBAMBENOS DEL RIO CHILIMPE, 1952-1967



Nevertheless, there are some obvious problems in applying this approach to the Ríobambeños. A few settlers arrived on their new farms with capital assets of several thousand sucres, enough to finance the clearing of three to five hectares. Other settlers' assets were limited to a willingness to work. In addition, several came as adolescents while others had wives and families. When the annual land clearing series for each farmer is adjusted so that the first year of residence becomes year one for the aggregate series, it is striking that only ten of the 20 settlers cleared land during the first year of residence. Several exhibit a lag of three to five years between the time they took up residence and the time they had amassed enough capital working as common laborers to begin land clearing.

Assumption (2) seems an improvement over assumption (1) on several counts. When the first year of recorded land clearing is used as the base year for each farmer, the result is to start all farmers with a basic farm of 4.7 hectares. For three farmers who took over existing claims of previous settlers, the land already cleared was considered to be their base area. The subsequent series, referred to as the "Clearing" series represents as close an approximation to an assumption of equal initial resource endowments as is possible with the available data.

One final caveat: By disturbing the historical continuity between settlers, both the "Residency" and the "Clearing" series assume that there is no significant interdependence between settlers in the level of their investment activity. By rearranging the time dimension, it is assumed that the amount of land a man clears is unaffected by the number of neighbors he has or the relative size of their farms. This assumption doubtless does some violence to reality but this damage is judged not serious in the example at hand.

The distribution of average land clearing over time for the Residency and the Clearing series is given in Tables 17 and 18, the number of years of residency or clearing, the number of observations for each year, the average area cleared per farm, the average size of clearing and the cumulated average land cleared per farm. The number of observations refers to the number of farmers who were potential land clearers in each year of the series. Farmers who had no more uncleared land were dropped from each series in succeeding years. Whether land clearing is measured from the first year of residence or the first recorded land clearing, the long term rate of growth approximated two hectares per farm per year.

The Clearing series shows an interesting shift in investment rate between the first 11 years and the last four. Starting from an average of 4.7 hectares each at the end of the first year, land investment measured by this series progressed at an overall rate of 1.18 hectares per year until the end of the 11th year. There were still five farms in the series at the eleventh year. The investment rate between the eleventh and fifteenth years of the series was 3.2 hectares cleared per farm per year.

The Residence series exhibits a similar pattern, eight years of clearing at a rate of 1.08 hectares per year followed by eight years of clearing at a rate of 2.39 hectares per year.

TABLE 17. DISTRIBUTION OF AVERAGE LAND CLEARING PER
SETTLER BY NUMBER OF YEARS OF RESIDENCE ON THE FARM,
RÍOBAMBEÑOS DEL RÍO CHILÍMPE, 1952 - 1967

Years of residency	Number of observations	Average area cleared	Average clearing size	Accumulated average cleared
			<u>Hectares</u>	
1	20	1.7	3.5	1.7
2	20	1.0	3.2	2.7
3	19	1.9	4.6	4.6
4	17	.7	2.9	5.3
5	17	1.2	3.3	6.5
6	16	1.2	2.3	7.7
7	15	.5	1.8	8.2
8	14	2.1	3.3	10.3
9	11	3.9	6.2	14.2
10	9	1.6	2.9	15.8
11	9	1.3	2.4	17.1
12	8	3.5	5.5	20.6
13	5	3.8	3.8	24.4
14	5	1.2	3.0	25.6
15	2	3.0	6.1	28.6
16	2	.8	1.5	29.4

The Clearing series seems more appropriate for drawing implications about "typical" performance of settlers under assumptions of equal initial levels of resources. The analysis suggests three tentative hypotheses concerning investment behavior of spontaneous settlers in Santo Domingo de Los Colorados which might be subjected to further test:

- 1) There is a minimum initial farm size of four to five hectares.
- 2) From this initial base, land clearing will take place at an average rate of one hectare per year among settlers dependent upon self-generated resources.
- 3) Once farms have grown to 15 hectares in size, the surplus generated in excess of family consumption needs is sufficient to permit clearing at a significantly higher rate, perhaps three hectares and more per year.

Alternatively one may consider the average rate of land clearing which individual settlers have maintained over time. If the farmers with more years of residence have higher average clearing rates, this would tend to support the preceding analysis. Calculating average land cleared per year for each farmer indicated an upward trend in annual clearings after a brief decline following the relatively large clearings during the earliest years of residence. Increasing physical sizes of farms implies changes in cash costs and labor costs and the mechanisms through which farm surplus is transformed into productive farm capital.

TABLE 18. DISTRIBUTION OF AVERAGE LAND CLEARING PER
SETTLER BY NUMBER OF YEARS OF CLEARING ACTIVITY,
RÍOBAMBEÑOS DEL RÍO CHILÍMPE, 1952 - 1967

Years of clearing	Number of observations	Average area cleared	Average clearing size	Accumulated average cleared
			<u>Hectares</u>	
1	20	4.7	4.7	4.7
2	19	1.6	3.8	6.3
3	18	1.9	3.1	8.2
4	17	1.0	2.4	9.2
5	14	1.6	3.8	10.8
6	14	1.4	1.9	12.2
7	11	.6	2.2	12.8
8	9	2.5	3.8	15.3
9	7	.4	1.0	15.7
10	5	.6	1.5	16.3
11	5	1.4	2.3	17.7
12	5	6.8	6.8	24.5
13	3	1.5	2.3	26.0
14	3	3.7	5.5	29.7
15	2	.8	1.5	30.5

The Importance of Labor Credit in Farm Growth

The case history of one settler is summarized below. The farmer had kept an account of all the labor hired by him between 1955, the year he settled, and 1967. It charts the ebb and flow of farm income and investment, and suggests a mechanism through which surplus agricultural labor is converted into productive farm capital. It would appear from the records that farmers can "borrow" large amounts of labor on a sustained basis in an effective policy of "invest now, pay later," in circumstances where the availability of cash and of monetary credit is quite limited. Farm laborers in the area generally are single, and willingly work for their board and a promise of cash wages to be paid at some later date.

After an apparent balance of payments crisis between the farmer and his workers toward the end of 1962, farm activity was slowed until 1966. The farmer continued to pay his debts, and payments were much higher in 1966 and 1967, reflecting a jump in income from plantain sales made possible by the new road. Table 19 records the annual labor used, wages actually paid and hectares of land cleared on this farm between 1955 and 1967. Of the total 29 hectares cleared, three were donated to the community plaza, leaving 26 cleared hectares in the farm in 1967. (The farmer continued to harvest some cocoa from the community plot.)

TABLE 19. LABOR HIRED, WAGES PAID AND LAND CLEARED, 1955 - 1967

Year	Labor used man-days	Wages paid, sucres	Hectares cleared
1955	260.0	1,009	6.0
1956	176.5	1,143	4.0
1957	127.5	1,213	3.0
1958	208.5	1,360	1.0
1959	57.5	943	-
1960	288.0	1,528	-
1961	391.5	1,768	2.5
1962	188.5	593	-
1963	42.5	1,292	6.0
1964	-	1,169	-
1965	141.0	1,078	-
1966	204.0	2,288	1.5
1967	190.5	2,077	5.0
	<u>2,284.0</u>	<u>17,461</u>	<u>29.0</u>

New land settlement in the vicinity of Santo Domingo de Los Colorados has been oriented toward market production since before 1950. While the farmer lived more than 20 kilometers from Santo Domingo and five kilometers from the nearest road, he could always sell the crops he produced if he was able to transport them to market. As long as frontier agriculture is linked with the cash economy, it is possible to transfer substantial human capital from surplus labor areas to areas of expansion. The contribution of Ecuador's traditional agricultural sector to agricultural development has included the managerial skills and labor power of the families who settled as well as the labor of a large number of temporary migrants who have been employed in the formation and maintenance of new pastures and plantations. Without the possibility of selling produce so as to pay workers, settlers' ability to expand is constrained by the labor which the family can generate. The transfer of capital which takes place in such circumstances is limited to the number of families who actually become settlers. This has been the fate of many stagnating tropical land settlement areas in South America. Surely a major explanation of the dynamic growth of the Santo Domingo de Los Colorados settlement region is to be found in its close integration with the national and international economy.

On February 25, 1967, provisional land titles on this farm were received from the Ecuadorian Agrarian Reform and Colonization Institute (IERAC). The title grants 70.7 hectares of land valued at S/.16,000.00 (S/.226.30/hectare) payable in 15 years with 2 percent annual interest. To secure the provisional title the farmer paid S/.1,434, part of the costs of surveying boundaries and of drawing the deed. Normal procedure requires the payment of 10% of the principal before IERAC will issue provisional titles, but members of the cooperative Ríobambeños were granted waivers of this rule. The price per hectare was an institutional price for all state land in the Santo Domingo Colonization project classified as tercer respaldo "third rank," i.e., lying between 4 and 6 kilometers straight line distance from a major highway. The price reflects only raw land values, not improvements.

The farm inventory on March 30, 1958, has been reproduced in Table 20 together with the inventory as of December 31, 1967. Land values are given in current prices and much of the change in inventory value was not the result of farm operations. Inflation in land values has increased the value of the farm by more than S/.50,000 over a ten year period.

TABLE 20. FARM INVENTORY FOR SAMPLE FARM 1958 AND 1967

	March 30, 1958		December 31, 1967	
	Quantity	Value	Quantity	Value
Horses	3	S/ 2,600	3	S/ 1,000
Pigs	14	2,000	15	1,670
Cattle			4	6,300
Chickens	80	2,000	50	590
Livestock	-	6,600	-	9,560
Plantain	3h.	3,000	7.5h.	14,000
Coffee and cocoa	2	5,000	3	6,000
Fruit trees			40	2,000
Permanent crops	-	8,000	-	22,000
Peanuts			.25h.	
Maize*	1+(1)h.	1,000	(2)	800
Rice*	(2)	2,000	(2)	2,000
Field crops	-	3,000	-	2,800
Pasture (improved)	6	3,600	6	7,200
Fallow	2	300	2.5	2,500
Other land	50	10,000	45.7	45,700
House	1	1,500	2	3,400
Household goods		1,500		est. 2,500
		S/ 34,800		S/ 104,660
(Forest adjustment)		1,200		
		S/ 36,000		

* Land areas in parenthesis refers to crops interplanted in permanent plantations.

Land cleared rose from 14 to 25.5 hectares (28.5 including the donation to the civic center); land in permanent crops from 5 to 10.5 hectares, pasture from 6 to 12 hectares. Forty fruit trees, avocado and citrus were planted, and 4 head of cattle were secured between 1958 and 1967. The value of the 1958 inventory was adjusted to reflect the total area of the farm as revealed in the land measurement survey of the agrarian reform agency.

The owner's estimate of total cash investment in the farm was S/.30,000. His records show payments to workers of S/.17,461 representing 2,284 man-days. If the average purchased component of wages paid in food were 2 sucres per day, the total cash wages would be more than S/.22,000. On this basis S/.30,000 is probably a conservative estimate of total production and investment expenditures from 1955 through 1967.

In 1967 this farmer invested S/.8,500 of his cash receipts of S/.15,800. His net cash receipts (after production and investment expenses) were S/.4,382, the family consumed farm products valued at S/.7,777 and the farm inventory increased in value by S/.11,390. Total family income for 1967 was S/.23,549. In the spring of 1968, he was one of the best situated farmers in the cooperative. He held title to a 70 hectare farm with 25 hectares of crops and pasture. Total cultivable potential should be at least 60 hectares. He had been granted a loan of S/.22,000 from the National Development Bank for pasture and livestock; he purchased 8 heifers and a bull in May, 1968. He had a new house fronting the road. His oldest son at age 18 was a strong and intelligent young farmer; his two younger sons were doing well in school and would soon be a real contribution to the family labor force. His current income needs were satisfied to the point where he could consider investing in a concrete coffee drying patio. His cash receipts exceeded S/.15,000 per year (\$750). His net worth, as near as one can estimate, exceeded S/.100,000 (\$5,000). He had come a long way from the days when he worked for 2 sucres a day on a banana plantation in the province of El Oro.

Investments in 1967

One farmer's strategy for maximizing his capital growth rate by borrowing against future earnings has been described. A consequence of this was to nearly double the effective labor force available to the family between 1955 and 1968. At least ten man-years of labor was employed on the farm in those twelve years. It should be explicitly understood that this was not a universal strategy--one prosperous farmer explained his lack of record books with the comment that he paid his workers at the end of the week, and so had no need for elaborate records. Having established this historical perspective we turn to a specific consideration of investment as measured in cash outlays and physical improvements in the year 1967.

Investment Expenditures

The composition of family income for the 22 farms in the cooperative was the subject of Chapter II. Table 21 has been constructed to show the relative magnitudes of investment expenditures compared to total receipts, family consumption and production expenses. Here again, mean values for all 22 farms as well as group means for the six smallest, ten medium sized and six largest farms are presented

Average cash investments for all 22 farms were 47 percent of average total cash receipts. If total cash receipts and the value of farm products consumed by the family are added to produce a measure of gross income (excluding inventory growth), the average cash investments of the 22 farms is seen to be 34 percent of gross income so defined. Even for the middle sized farms, (whose lower average incomes were discussed in Chapter II), average cash investments were 23 percent of gross income. For both the small and large producers, average investments were more than twice the production expenses.

TABLE 21. RELATIVE IMPORTANCE OF INVESTMENT EXPENDITURES, RIOBAMBENOS DEL RIO CHILIMPE - 1967

	All farms	Small farms	Medium sized farms	Large farms
Number of farms	22	6	10	6
	<u>Average, sucres</u>			
Farm inventory, beginning of year	55,112	22,056	45,831	103,636
Total cash receipts	13,486	9,454	6,550	29,078
Production expenses	3,558	1,058	3,643	5,917
Investment expenses	6,289	5,559	2,416	13,473
Net cash receipts	3,639	2,837	491	9,688
Farm products consumed by the family	4,922	3,468	4,078	7,782
	<u>Percent</u>			
Investment as a percentage of:				
Total cash receipts	47	59	37	46
Total receipts and family consumption	34	43	23	37
Production expenses	177	525	66	228

While the average coefficients of cash investment are high, it is well to keep in mind that they understate the level of physical improvements, since many farmers accomplished substantial investments through the use of family labor. These efforts are taken into account in the discussion of land improvements and capital growth.

Types of Investment

Farmers varied widely in the types and levels of investment undertaken in 1967. Table 22 shows the number of farmers in each sub-group actually incurring expenses in each investment category.

TABLE 22. NUMBER OF FARMERS WITH EXPENDITURES IN EACH INVESTMENT CATEGORY, 1967

	All farms	Small farms	Medium sized farms	Large farms
Total investment expenditure	19	5	8	6
Livestock purchase	9	2	5	2
Fencing and pasture establishment	10	1	3	6
Land clearing	7	1	1	5
Planting of permanent crops	9	1	3	5
Tool purchase	7	1	2	4
Housing	7	2	2	3
Land purchase	2	1	0	1

The average expenditures for all 22 farmers and the 3 sub-groups are presented in Table 23. The land purchase item of one farmer in the small farm group seriously distorts the comparison of group averages for total investment, and a column with averages for the remaining five farmers has been inserted.

TABLE 23. AVERAGE INVESTMENTS IN MAJOR CATEGORIES, 1967

	All farms	Small farms	Medium sized farms	Large farms	
Number of farms	22	6	5*	10	6
			<u>Average, sucres</u>		
Total investment expenditure	6,272	5,559	1,955	2,417	13,411
Livestock purchase	2,035	233	280	1,077	5,433
Fencing and pasture establishment	883	19	33	235	2,827
Land clearing	541	25	30	60	1,858
Planting of permanent crops	525	5	6	232	1,533
Tool purchase	76	13	16	33	209
Housing	1,063	1,346	1,600	780	1,250
Land purchase	1,150	3,916	0	0	300

* Excluding one farm with large purchase of land.

When the investments of the five small farmers are compared with those of the middle sized group, they appear quite similar in all respects. Total investments for the middle sized farms was only S/.462 higher than that of the small farms on the average, although the middle group spent relatively more per farm on livestock and less on housing. Medium sized farmers on the average received only S/.1,263 more

than the five small farmers in total cash receipts, but spent much more on production costs. Farmers in the medium sized class simply spent more on the maintenance of lower quality resources so that they had less money available for investments than did the smaller farmers.

The average investment of the six largest farmers was more than 5 times as great as the average for the middle sized farmers. Total investments by the largest farmers were 58 percent of all the farm investments made by the 22 farmers in the study. Substantial expenditures were made for livestock purchase, fencing and pasture, land clearing and new plantations. Reference to Table 22 reveals that the livestock for the largest farms was purchased by only two farmers, but that nearly all spent money on land clearing, pastures and plantations.

Cash Investment and Inventory Growth

Growth in the value of farm inventory was more than 50 percent of family income among all three sub-groups of the Ríobambeños. The composition of inventory change was discussed in Chapter II. A breakdown of the contributions to inventory change was listed in Table 16.

Growth in farm assets is quite closely linked to the cash investments made in the farm. The data on investment expenditures from Table 23 can be regrouped in three broad classifications: land purchase and improvements, livestock purchase and housing. If the inventory growth data from Table 17 are regrouped in similar fashion, the similarities between investment and asset growth can be seen (Table 24).

If we considered only column one of Table 24, it would be easy to conclude that on the average all investments were in cash and that most of the discrepancy between investment and inventory growth could be explained by a large average increase in the value of stocks on hand. Clearly this was the case only for the six large farms. The remaining farms show substantial relative growth in assets over investment costs which must be explained in terms of family labor used in investment and the natural increase in livestock values.

For all but the medium sized group of farms, the cost of land investment exceeded the net change in value of land assets. Some types of improvements, such as pasture fencing, do not produce a change in the market value of the farm equal to the cost. The land purchase of one small farmer also served to push investment costs above land inventory change for that group. Average land inventory growth exceeded average cash investment in land for the middle group of farms because their owners did much less investing than the other groups and the relative importance of family efforts in land improvements was consequently much higher. For livestock, the excess of inventory growth over investment cost reflects the autonomous growth in value in excess of sales of general livestock holdings.

Most housing investments are principally labor costs. It is therefore reasonable to expect that unpaid family labor would cause the final value of improvements to exceed cash costs. Farmers in the largest class are beginning to use purchased materials, cement and asbestos or galvanized iron roofing in their houses, resulting in excess in cash costs over net change in asset value.

TABLE 24. INVESTMENT AND INVENTORY CHANGE,
RIOBAMBENOS DEL RIO CHILIMPE, 1967

	All farms	Small farms	Medium sized farms	Large farms
Number of farms	22	6	10	6
	<u>Sucres</u>			
Investment in land purchase, land clearing, fencing, pasture and permanent crops	3,099	3,965	527	6,518
Net change in land inventory	2,915	3,294	1,128	5,517
Livestock purchase	2,035	233	1,077	5,433
Change in livestock inventory	3,301	1,459	2,460	6,547
Housing investment	1,063	1,346	780	1,250
Change in housing inventory	1,314	1,600	1,260	1,117
Total investment expense*	6,272	5,559	2,417	13,411
Total inventory change*	9,811	7,274	5,539	19,469
Change in stocks on hand, crops in field, fruit trees	2,205	920	682	6,028

* Including value of tools.

Changes in Productive Capital and Implications for
Agricultural Development

It was asserted in Chapter II that a major criterion for the evaluation of a settler's endeavors (both from his point of view and from ours) should be the rate at which he increases his productive capacity. In evaluating the prospects for agricultural development of a settlement region, the first question one may ask is, "What is the level of current production?" Having secured an answer to this the next question is of even more importance, "How fast will production grow in the future and what direction(s) is it likely to take?" Lacking measures of changes in production, an attempt has been made to estimate changes in the capacity to produce using the difference in productive assets at the beginning and end of the year as a measure. The definition of productive assets differs from that of total farm inventory; thus, the long justification of inventory change as a measure of income was intended to be contrasted with a restricted definition of productive assets which is more relevant to the assessment of development potential.

Productive assets, or productive capital, consist of all crop lands and pastures, livestock, fruit trees or artificial forest, and agricultural tools and implements. Productive capital differs from farm inventory in that it excludes virgin forest lands and the farm dwelling. Growth of productive capital has been measured by taking the difference of productive assets (valued in sucres) at the beginning and the end of the

year. Table 25 presents value of productive capital at the beginning and end of 1967, the percent change in capital for the Ríobambesños del Río Chilímpe during the year and data on residence and family size.

TABLE 25. CHANGES IN PRODUCTIVE CAPITAL, 1967

	All farms	Small farms	Medium sized farms	Large farms
Number of farms	22	6	10	6
	<u>Average, sucres</u>			
Initial capital January 1967	33,440	16,113	28,793	58,511
Final capital January 1968	44,793	20,329	34,355	86,655
Capital growth	11,353	4,216	5,562	28,144
	<u>Percent</u>			
Average growth per farm	36.0	23.3	33.5	52.8
Growth in group averages	34.0	26.2	19.3	48.1
	- - - - -			
Persons in family	6.6	5.3	6.2	8.7
Years of residence as of January 1968	10.5	6.0	11.1	14.0
Years of farm exploitation	8.1	5.7	6.6	13.0

Productive capital more dramatically differentiates the three size groups than most measures considered heretofore. The implicit explanatory variables which have been suggested--size of family, length of residence and length of farming activity--all differentiate the 3 size classes in a similar fashion. The settlers who came into the area first have generally been working their property longest and also have larger family work forces to help them. They have been able to generate a stream of cash income, allowing them to employ more hired labor in production and expansion activities. The number of years a farm has been under exploitation is more closely related to present levels of production and expansion than is the number of years which the owner has resided on the farm. Some settlers reside several years before beginning work on their own farm.

For all 22 farms, productive capital grew by an average rate of 36 percent or S/.11,353 per farm during 1967. The six largest farms increased their average productive capital by an amount virtually equal to the total average capital of the 10 medium sized farms at the beginning of 1967. The growth rates of the small and medium sized farms are highly respectable and appear modest only when compared to those achieved by the large farms.

Two of the small and two of the medium sized farms had exhausted their forest reserve before the beginning of 1967. Consequently, these farms showed a much lower rate of capital growth than did the others. Table 26 segregates the four farms without forest reserve at the beginning of 1967. The average rate of growth of the four farms without reserve forest lands was only 14.5 percent for the year 1967, and had a marked dampening effect on the average growth rate for the small and medium sized farms.

TABLE 26. CHANGES IN PRODUCTIVE CAPITAL COMPARED: FARMS WITH AND WITHOUT FOREST RESERVE, JANUARY 1967

	Farms with forest reserve			Farms without forest reserve
	All farms	Small farms	Medium sized farms	
Number of farms	18*	4	8	4
	<u>Group means in sucres</u>			
Initial capital January 1967	35,281	14,769	28,114	25,155
Final capital January 1968	48,347	19,928	33,826	28,800
Capital growth	13,066	5,159	5,712	3,845
	<u>Percent</u>			
Average growth per farm	40.8	29.0	37.7	14.5
Growth in group averages	37.0	34.9	20.3	15.3

Persons in family	7.1	5.3	6.4	6.0
Years of residence as of January 1968	10.4	5.3	10.0	10.5
Years of farm exploitation	8.2	5.0	6.1	7.8

* Includes 6 large farms reported separately in column 4, Table 25.

Land Improvements

The trend is the same for land improvements considered in physical units. During 1967 the small farmers cleared or planted to pasture or permanent crops an average of 0.9 hectare. The medium sized farmers averaged 1.5 hectares and the large farmers averaged 8 hectares. Table 27 shows the group means for the number of hectares cleared during the year, the number of hectares of permanent pastures and permanent crops established and the total hectares per farm either cleared or planted to permanent crops during the year. Permanent crops planted were 31 hectares of plantain and 1 hectare of sugar cane. As indicated in the table, the total area cleared or planted does not involve double counting; it measures the total hectares on any farm which underwent major improvement during the year. The cooperative total was 68.6 hectares. Approximately 27.5 hectares of land were cleared and planted to permanent crops.

TABLE 27. AVERAGE SIZE OF LAND IMPROVEMENTS, 1967

	All farms	Small farms	Medium sized farms	Large farms
Number of farms	22	6	10	6
	<u>Average, hectares</u>			
Land cleared	1.91	.5	.3	6.0
Pasture established	1.00	0.0	.45	2.92
Permanent crops established	1.46	.42	.91	3.42
Total area cleared or planted (no double counting)	3.12	.92	1.51	8.0

Returns to Investment

Serious investment by the Ríobambeños in 1967 was confined to two productive enterprises, plantain and cattle. The incipient level of cattle raising among these settlers made it impossible to draw any conclusions about its profitability. The boom in cattle raising in the zone has reflected the strong demand for meat in Ecuador's urban markets. A drought of several years duration in Manabi province has driven cattle inland towards Santo Domingo at depressed prices. The costs of pasture renovation and livestock parasite control are high. Still, farmers are convinced that beef cattle are a good investment. Most of the credit provided through the BID Polygon project in Santo Domingo de Los Colorados is being used for livestock and pasture investments. Among the Ríobambeños, 11 farmers purchased no cattle during 1967. Their total initial holdings were 63 head. The value of sales, consumption and inventory increase for the year was approximately 30 percent of initial value.^{7/}

The net returns to a hectare of plantain are much more explicit. As indicated in Table 7, Chapter II, average sales per hectare for 48 hectares of Dominico variety plantain in full production (excluding very old stands) were S/.1,427 in 1967. Production costs were S/.480 per hectare and average net cash returns were S/.947 per hectare. On the average the inclusion of family consumption of plantain increased the value of returns per hectare by at least 200 sucres (see Table 6). If S/.200 were added to the net sales of S/.947 per hectare, the resultant average net return per hectare would be about S/.1,150 per year. This figure is perhaps most appropriate as an estimate of the expected net returns to new plantain investments made in 1967.

^{7/} For a discussion of the economics of successful beef and dairy operations under humid tropical conditions similar to those of Santo Domingo de Los Colorados see Juan Antonio Aguirre, The Economics of Milk and Beef Production In the Humid Tropics: A Case Study of San Carlos County, Costa Rica, 1969. Aguirre found that high levels of management skills and high capital intensity made possible very efficient and profitable beef operations within a general size range of 250 to 500 hectares of pasture.

This estimate of the value of production does not include the value of fruit fed to livestock. Average physical yields per hectare for the 48 hectares of plantain were 476 stems. Average yields for all 112.2 hectares of plantain in the coop were 386 stems per hectare. With market price for plantain expected to remain about five sucres per stem, the estimated gross value of production derived from total physical yields and market prices would lie in the range of S/.1,900 to S/.2,300 per hectare annually.

The cost of clearing and establishing one hectare of plantain was reported as 60 to 70 man-days from beginning until full production was reached about 15 months later. This implies a cash cost of S/.700 to S/.1,000 per hectare. The annual net returns on such an investment in 1967 were clearly at least equal to the total original cost.

Investment Response to Changed Conditions

Surveying of coop land was completed in 1966 so that provisional titles were available for issuance to the coop members after March, 1967. A farm to market road into the Ríobambeños cooperative was first completed for dry season use in August, 1966. It was surfaced with gravel for all weather use in the summer of 1967. The road enabled a majority of the settlers to sell plantain on a regular basis for the first time. Farmers indicated that as a result their incomes increased sharply. Since cash availability has been offered as a primary determinant of investment, we would expect to note a significant increase in investment activity in 1967 over that of previous years.

The average land cleared per resident settler with available forest reserve can be considered as 15 successive samples for the 15 years from 1952 through 1966. If the average land cleared per settler in 1967 were significantly greater than the mean of the sampling distribution, this would tend to confirm the hypothesis that investment increased in 1967. Average annual clearing per farmer was 1.462 hectares from 1952 through 1966. The average land cleared per farmer in 1967 was 2.81 hectares for 16 farmers with available forest for clearing.

The 22 settlers had about 90 hectares of plantain in production in 1965. They planted an additional 9.8 hectares in 1965, 10.7 in 1966 and 31 hectares in 1967. If the average permanent crops planted per year of residence up to the end of 1966 for each of the 22 settlers is considered as the universe of annual crop planting, one may test whether the average area planted to permanent crops in 1967 is a sample from the universe. The universe mean for 22 settlers was .9076 hectares per year. The average area planted to permanent crops in 1967 was 1.4590 hectares.

Investment by Spontaneous Settlers

The working assumption of this monograph asserts that settlers are economically rational entrepreneurs who respond rapidly and dynamically to changes in economic conditions. Where land clearing and crop establishment are the principal investment activities, the settlers examined were shown to have maintained a rate of land clearing of two hectares per farm per year between 1952 and 1968. The implied labor investment is 80 to 100 man-days per year in brush clearing, tree felling, and crop

planting activities. (In analyzing farm production 200 man-days was considered to equal 1 man-year among these settlers.) In an attempt to derive conclusions useful for settlement policy, the clearing behavior of 22 settlers was analyzed under the assumption that all were homogeneous with respect to resource endowment on the first year in which they cleared land. The analysis suggested that from an initial base of four to five hectares farms have expanded at the rate of one hectare per year until the cleared farm area equalled about 15 hectares. After 11 years of clearing activity, average clearing rates per farm rose to more than three hectares per year, suggesting that the enlarged resource base was providing substantially greater surplus which could be diverted from family consumption.

On this basis we would expect that a group of settlers who were to homestead in a similar region of Ecuador might respond in the same fashion. For settlement policy it suggests that without assistance growth will proceed slowly for 10 years or more. The provision of credit to permit higher levels of investment in the initial years of settlement should permit substantial acceleration of the capital formation process.

Analysis of one farmer's hired labor use from 1955 through 1967 detailed a mechanism whereby initial land investments could be charged against future production. Through a process of deferred payment to workers the farmer managed a remarkable conciliation of fluctuating labor needs for lumpy investments with a much more constant apparent availability of cash for wage payments. It was suggested that for such settlers the relative constraint on labor use was anticipated cash flows.

The integration of the Santo Domingo settlement area with the national economy was postulated as a necessary condition for the transfer of surplus labor resources to the frontier (in excess of pioneer families). Without the possibility of crop sales to pay workers, it would not have been possible to employ more than ten man-years of labor in thirteen years time as was done on one farm. In early stages of settlement, many workers used their wages to establish a land claim of their own. Thus, the possibility of converting agricultural surplus into labor via a cash medium fostered a high rate of reinvestment of frontier generated resources. These conclusions should emphasize the importance of farm to market roads and other measures to provide adequate markets for products of frontier regions.

When the accounts for 22 farms were analyzed for the year 1967, it was found that average cash investment out of current income was high, 47 percent of total cash receipts. On the average, cash investments were 34 percent of the sum of cash receipts and family consumption of farm products. For the group of farms with the lowest level of investment, the rate of investment was 23 percent of the combined value of receipts and consumption. The value of productive assets of all 22 farms, crop lands and pastures, tools and livestock, was found to have increased by an average of 36 percent in the course of 1967. This calculation excluded autonomous changes in price levels for land and livestock during 1967. Settlers responded to the introduction of a road into their property in late 1966 by dramatically increasing the area in plantain during the following year.

In addition to exporting labor to the frontier, Ecuador's traditional agricultural sector has exported a class of entrepreneurial farm managers who have many of the attributes of aspiring middle class citizens. Their capacity to defer consumption is high when presented with attractive investment opportunities. They are on the average

better educated than the typical rural population of Ecuador and the process of migration and settlement has no doubt contributed to a more worldly sophistication. The net effect has been the formation of a compact group of small holders with substantial resources at their command. They are relatively modern in their world view and will respond rapidly to agricultural policies which provide profitable alternatives for increasing production through improved technology and practices.

CHAPTER IV

THE ROLE OF LAND SETTLEMENT IN ECUADOR'S ECONOMIC DEVELOPMENT

The goals of Ecuador's agricultural policy are to promote an increase in agricultural income greater than the growth in population and to achieve a better distribution of this income within the agricultural population. The redistribution of agricultural income is to be achieved through structural reform of the agricultural sector including the redistribution of wealth and status. The national development plan views agrarian reform as the principal instrument of structural reform; the role of land settlement is to assist in structural transformation and the reduction of population pressures in traditional agricultural areas.

Land settlement will continue in Ecuador as fast as penetration routes can be opened into the forest irrespective of government policy. Demands for land among an increasingly articulate agricultural poor are strong and rising. Traditional rural elites have successfully resisted meaningful redistribution of private lands and their power to do so should persist for some time. In such circumstances land settlement programs appeal to politicians as an opportunity to satisfy one political group without alienating the other, with the possibility of gains in total agricultural production as an additional bonus. The task for policy makers is not deciding whether or not to support settlement movements, but rather finding the least expensive way of assisting settlers to become contented, self-sufficient producers so as to benefit the maximum number of families. Happily, Ecuador's large reserves of unused land and underemployed labor make new land settlement a very proper development activity, not simply a politically expedient one. The objectives of the colonization program identified by the national development plan are thus congruent with the realities of Ecuador's political environment.

If the evaluation exercise is to be meaningful, the criteria employed to test the results of settlement activities must be appropriate to the goals and objectives of settlement policy. It makes little sense to use a yardstick to measure color of materials. Similarly, little purpose is served when the techniques of economic efficiency analysis are used to measure the accomplishments of programs whose goals are little related to economic efficiency.

Chandler Morse has pointed out that efficiency criteria are incompatible with the goals of developmental programs.

...The task of economic development is not to achieve the most efficient or stable rate of growth possible in the existing economy; it is to involve the power structure in the task of creating a fundamentally different sort of economy. Since the aim is to alleviate institutionalized poverty, ignorance, and disease the appropriate device clearly is not to make nondistorting lump sum transfers of income ex post; it is to alter the economic activity patterns that determine

the distribution of "wealth" and "income" ex ante.... Economizing, stabilizing, or maximizing behavior does not, in itself, produce institutional change. Conversely, decisions primarily intended to change institutions, necessarily force the economy to depart to some extent from the path of most efficient growth (1969: 332).

While efficiency criteria are unsuitable for evaluating the developmental success of programs, they can be useful for assessing the costs of achieving various developmental goals. The objectives of Ecuador's colonization program as defined in the National Development Plan are as follows:

- 1) Reduce demographic pressures;
- 2) Promote the horizontal and vertical economic integration of the country;
- 3) Expand the agricultural frontier; increase the production of exports and internally consumed goods;
- 4) Stimulate the introduction and diffusion of useful new crops and livestock breeds, and the improvement of agricultural technology (JNPCE, 1963: 15).

These objectives are very much developmental in character: the promotion of institutional differentiation and complexity (2), the development of new skills and behavior patterns (4), and the redistribution of wealth and income out of new production (1) and (3). Only the objective of increased production is susceptible to analysis via efficiency techniques; the others require different criteria and different methods of estimation.

Procedures for approximating the efficiency benefits from government investment in the BID Polygon project have been described elsewhere (Gladhart, 1970; pp. 207-226). The analysis suggested that the internal rate of return for the project probably falls in the range of 25 to 45 percent annually over a ten year period. It was pointed out that the project benefited from other government investments in trunk highways and malaria control (properly excluded from the efficiency analysis) so that lower rates of return should be expected in other, less favorably located settlement projects where such costs must be borne by the projects themselves.

Further, such high projected returns to investment should alert us to the presence of social costs (and private costs) not incorporated in the efficiency analysis. The cost of adapting to the environment and learning to be successful tropical farmers has been borne by the settlers themselves. Speculation and uncertainty surrounding early land claims in the Santo Domingo region clearly occasioned much wasted effort and heavy losses for many settlers who abandoned hope of receiving title and let their claims go "for a song". Disease took its toll of persons of all ages, particularly children. In short, the social costs of completely spontaneous tropical settlement are quite high. It provides only minor consolation to observe that they were largely unavoidable in Ecuador in the 1950's and early 1960's.

Developmental Benefits of Land Settlement

Several developmental objectives of land settlement as envisioned by the national development plan have been identified: reduction of population pressures; economic integration; income redistribution; and the creation of a modern agricultural system. The growth of agricultural production in Santo Domingo de Los Colorados contributes much to economic integration. The bulk of the production estimated as sold in 1966 was for consumption in other regions of the country. There is a constantly rising demand in Santo Domingo for agricultural products of the highlands, fish from the coast and basic consumer goods produced in the major urban centers. Santo Domingo is an increasingly important consumer of cement and other construction materials. All of these factors have contributed to a strong and growing transportation industry centered in Santo Domingo.

The majority of the inhabitants of the BID Polygon are from the coastal provinces, most of them from Manabi. According to Lekis there is no highland indigenous family among all the settlers of the Project (Lekis, 1966: 75). Some do migrate to the coastal areas to work for a few months at a time, but they invariably return to their traditional homes in the sierra. Santo Domingo has made no discernible contribution to resolution of the man/land problem in the sierra.

Income Distribution

About 45 percent of the efficiency benefits calculated for the BID Polygon were direct payments to farmers and farm laborers. A significant proportion of the benefits from the value added in marketing of plantain represents wages to laborers and truck drivers as well as income to a host of small wholesalers and retailers. If 800 farms increase their cultivated area by 15 hectares of plantain (or equivalent crop) as a result of the project, the labor component for the establishment of 12,000 hectares would be 3,900 man years of 200 days. The maintenance of this level of production would require 1,200 man years annually. The expected increase in Ecuador's agricultural work force between 1963 and 1973 is about 220,000 persons (Bottomley, 1966).

Looked at in another way, if one assumes that 75 percent of the 270,000 hectares currently in the project will be brought under cultivation either in crops or pasture with an average annual labor requirement of 20 man days per hectare, the resulting labor requirement for the settlement region is 18,000 man-years when a man year of 200 days is assumed. In this study it has been assumed that cattle required 15 days per head, pasture maintenance, 20 man days per hectare per year, plantain, 30 days, banana, 60 days, and coffee 40 days per hectare. Given our ignorance of the future evolution of production patterns, technological changes and levels of work intensity it is difficult to be more precise in the estimation of future employment.

In sum, the income distribution effects of the project are highly desirable, providing a substantial increase in income to a modest proportion of the poor agricultural class. The Ecuadorian agricultural labor force engaged in manual labor in 1962 was 829,979 persons, of whom 18,252 were classified as employers and 408,258 as self-employed. Another 318,901 were classified as paid workers and 84,169 as unpaid workers. The agricultural census of 1954 estimated that there were 287,936 farms

which meet the CIDA classification of "Sub-Family" size, and 45,548 farms of "Family" size, "sufficient land to give nearly full time employment to from 2 to 4 men." If all the more than five thousand farms in Santo Domingo de Los Colorados were owned by former owners of sub-family units or landless laborers, the shift in the national income distribution resulting from this transition to large family sized farms would still be almost imperceptible. The fact that 7 to 10 thousand agricultural laborers have an opportunity to work at two to three times the national average agricultural wage represents a rather modest achievement when contrasted with the more than 400,000 paid and unpaid workers whose situation has presumably not changed as a result of the settlement project.

Evaluation of the Effects of Government Investment

It has been suggested that cultivation of 75 percent of the project area at minimal levels of labor use would employ annually about 10 percent of the expected increase in the agricultural labor force between 1963 and 1973. Since less than half of the titles issued by IERAC under the colonization program were for lands in the Santo Domingo Polygon, it is reasonable that other colonization areas taken together may provide as much employment as will be provided in Santo Domingo; about 20 percent of the expected increase in the labor force may thus be absorbed in colonization. This figure is a minimal estimate since it does not include the opening of new areas not settled at present. If the effects of the Santo Domingo experience are generalized, colonization can be expected to create substantial employment in the transportation and associated service sectors in addition to strictly agricultural employment. While a large number of jobs were not attributed to the direct effects of government investment, it should be clear that government investment permits the project area to reach its full potential employment many years sooner than would otherwise be the case.

A very high return to government investment was projected for the BID Polygon. The locational advantages of Santo Domingo make the settlement region an exceptional case. While other settlement regions in Ecuador are more isolated, they should have little difficulty in showing returns of 10 to 20 percent annually to government investment in social overhead similar to investments in Santo Domingo de Los Colorados.

Social Change and Development

Richard Patch has emphasized the importance to agricultural development of the freedom to make decisions on the basis of economic gain (1966). Lack of freedom to experiment, to innovate, to bear risk on the part of the subsistence producer of the Ecuadorian sierra severely limits his development potential. Availability of land and the nature of land tenure institutions are important determinants of the freedom to innovate; the barriers to innovation which they pose in Ecuador were discussed in Chapter I. Attitudes, values and beliefs, and the social matrix in which they are operative are also crucial for innovation. Certain values, attitudes and institutions are more compatible with modernization and development than others. Acceptance of one's place in a static and stratified social order where status is ascribed rather than achieved, fatalism as to the nature of the universe and man's control over it, economic levelling institutions of ritual feasting and extended kinship obligations--all are

characteristics of traditional, subsistence oriented societies; they stand as barriers to an agricultural development dependent upon the freedom of the individual to make choices which are economically "rational" in a Western sense.

Patch argues that agricultural development is now possible on the Bolivian Altiplano precisely because of changes in the peasants' self-conceptions and in social structures.

"The Bolivian peasant has accepted the postulate which is basic to modernization-- that the measure of the man is achieved, not ascribed." (Patch; 1966: 34) So it is in Santo Domingo de Los Colorados. The colono is a free man. He has made his fortune with his hands and his machete; he is master of his destiny and his status is measured by his accomplishments, not the accident of his birth. Colonos are not "indian" as the term is used in Ecuador, though their parents might have been. Colonos are free to innovate, to experiment, to fail. Failure is a luxury which they can now afford, a temporary reduction in income rather than possible starvation and loss of their land.

Settler Organizations and Institutions

Laws and regulations governing the alienation of public lands require that colonos be members of a cooperative in order to receive title to their land claims. This is a consequence of ideological conviction on the part of policy makers and a desire to obtain economies of scale in the use of IERAC's scarce personnel and resources. All groups have formed *de jure* cooperatives which in many instances are effective social organizations as in the case of the Ríobambeños del Río Chilímpe. The cooperatives have chosen leaders to negotiate with IERAC for the surveying of their properties, settling of legal disputes, the provision of roads, schools, social workers and other services.

More than 80 cooperatives have formed the Union of Agricultural Cooperatives of Santo Domingo, El Consorcio. Organized as a political pressure group, the Consorcio has evolved a special partnership with IERAC. It has assumed the role of cooperative promotion and leadership training among its members. IERAC subsidizes the operations of the Consorcio and supplies university trained personnel to serve as general manager and as agricultural and economic advisors. The Consorcio mediates between the colonos and IERAC, aggregating and articulating settler demands and disseminating policy and information. The IERAC employees within the Consorcio feel their loyalties to the colonos, not to IERAC. They are better able to deal with the lawyers in IERAC's legal division than a simple colono. In early 1968, the most important function of the Consorcio was to provide legal services and advice to members and to act as advocate in their dealings with IERAC and other legal institutions. The Consorcio had been granted a 1,000 hectare property and had hopes to begin land clearing and planting in the summer of 1968. It hoped in this way to achieve financial independence and to also use the property for demonstration and education purposes.

Another farmer organization, the Small Cattleman's Association of Santo Domingo de Los Colorados, was formed through the efforts of Peace Corps Volunteers in 1968. Composed of ranchers with properties under 300 hectares in size, its aims are herd improvement and the diffusion of improved technology among its members. The impetus for forming the association was provided by the competitive disadvantage of

small cattlemen vis-a-vis very large ones in obtaining herd improvement loans and extension services.

National Development

These, then, are the developmental effects of land settlement. Several thousand families have received large increases in wealth and income through their own efforts. Employment has been provided for several thousand agricultural and transportation workers. More than 5,000 farmers have been assembled in a compact area of 270,000 hectares of good agricultural land. These farmers are better educated than most of Ecuador's agricultural population, they are modern and progressive in values and attitudes. They command sufficient resources to have the freedom to take risky and innovative decisions; they have demonstrated a high capacity for savings and investment. Social structure in the new area is open and egalitarian; status is accorded on the basis of accomplishments, not birth. Farmers are politicized and have demonstrated a high capacity to organize for political and economic ends. They have a strong group of leaders who are articulate and effective in dealing with the regional and national power structure. They are prepared to demand agricultural extension, technical assistance and educational facilities.

Locally the conditions for rapid agricultural development are all present. The importance of the BID project has been to provide security of holdings through land titling, provide access to markets through the construction of feeder roads and foster the acceleration of the growth process through the provision of agricultural credit, a program not analyzed here for lack of data.

Because of the strategic location of Santo Domingo de Los Colorados, the region should have a strong demonstration effect on surrounding traditional agricultural areas. Beyond the contact of daily traffic through the zone, the Consorcio has already organized a National Congress of Campesinos in 1966 and an effort to promote peasant solidarity behind the aims of the Agrarian Reform Law and some Consorcio-based politicians. Campesino leaders are brought from all over Ecuador to leadership training conferences conducted at the site of Plan Piloto. Prices of sierra agricultural products and wages of agricultural laborers have remained substantially higher in Santo Domingo than in traditional agricultural areas. Rapid growth of income in Santo Domingo should reinforce both these tendencies. The settlement region will be a persistent disequilibrating force for the nation at large, economically and socially. For the long run, this is the real measure of the contribution of land settlement to national development.

CHAPTER V

SUMMARY AND CONCLUSIONS

Rapid increase in per capita agricultural incomes and redistribution of this income within the agricultural population constitute the goals of Ecuador's agricultural policy. Considerations of equity and the requirements of a modern agricultural sector support policies of land redistribution and new land settlement as necessary measures of income redistribution. Under Ecuador's Agrarian Reform and Colonization programs, 31,515 families received titles to 406,324 hectares between 1964 and mid-1968. About one-fourth of these land titles were received under the Colonization program, and averaged 36.5 hectares per family.

The central objective of the monograph was to describe in detail the agricultural production activities of spontaneous settlers, focusing upon the determinants of family income and investment and the rate of capital formation. A group of spontaneous settlers, the cooperative Riobambenos del Rio Chilimpe, was selected for intensive study. Agricultural production processes and the structure of family incomes among 22 farmers were analyzed for the calendar year 1967. The average farmer was 43 years old and had resided on his farm for 10.5 years. Average family size was 6.6 persons but the average family labor force was small -- only seven families of the 22 had more than one man aged 18 or over in 1967. Fifty percent of the farm owners had received 3 years of schooling and more than 25 percent had received 6 years or more. This educational level is quite high compared to the same age group in the general agricultural population and illustrates an important selective feature of spontaneous settlement.

The total value of farm inventory at the beginning of 1967 was chosen as the measure of farm size. This resulted in the designation of three size groups within the sample: six small farms, ten medium sized farms and six large farms. Their average assets on January 1, 1967 were S/.22,000, S/.45,800 and S/.103,600, respectively. For all 22 farms, the average initial value was S/.55,000. Of this total, the value of cleared land accounted for 40 percent, the value of forest land, 33 percent, and the value of livestock holdings, 15 percent. The average area of all 22 farms was 32 hectares, 18 in forest and 14 hectares cleared. The average value of all 22 farms at the end of 1967 was S/.29,000.

Family income was defined as the sum of net cash receipts, farm products consumed by the family and change in the value of farm inventory. Again reporting averages for all 22 families, gross cash receipts were S/.13,486, net cash receipts, S/.3,639, consumption of farm products, S/.4,922, the change in farm inventory, S/.9,811 and family income, S/.18,372. Calculation of net receipts reflects average production expenses of S/.3,558 and average investment expenses of S/.6,289.

The most important sources of income for the majority of farmers were crop sales, livestock sales and timber sales, in that order. Crop sales provided 59 percent of family receipts for the average farmer. Plantain was the most important crop

in terms of both land use and sales. Of the 351 hectares cleared at the end of 1967, 112 were in plantain production during the year. The weighted per hectare yield was 386 stems per year. Average sales per hectare were S/.938 reflecting a marketing coefficient equal to 59 percent of physical production. Net cash returns per hectare were S/.525 for all farms. When farms with very old plantations and those with an inferior variety were excluded, the 12 remaining farms had 48.5 hectares of plantain with an average physical yield of 476 stems per year. Per hectare sales for this group averaged S/.1,427 representing 62 percent of physical production. Average net cash returns were S/.947 per hectare.

These calculations ignore the value of plantain consumed by the family and the practice of growing cocoa and coffee intermixed with plantain. When the value of cocoa and coffee sales from 32 hectares of mixed plantations as well as the value of family consumed plantain were included, the average net return was seen to be S/.846 per hectare for 112 hectares of plantain and mixed permanent crops.

The limiting factors affecting family income and the growth of the farm enterprise were found to be cash flows and managerial ability. Both factors are intimately related to the length of residence on the farm, the size of the family labor force and past patterns of investment in response to changing conditions of demand. Low levels of technology together with wide variations in yields and income suggest that there is considerable scope for improvement of managerial skills through effective programs of extension education and technical support.

Among the Riobambenos, the group of farmers with the lowest average level of family income was the middle sized group. Their average family income in 1967 was S/.10,108, between two and one-half and five times the level of agricultural workers in the area

The process of capital formation through the efforts of spontaneous settlers was discussed at length. Most settlers reported coming to their new farms with no capital assets. Where land clearing and crop establishment are the principal investment activities, the settlers studied were shown to have maintained a rate of land clearing of two hectares per farm per year between 1952 and 1968. In an attempt to derive conclusions useful for settlement policy, the clearing behavior of 22 settlers was analyzed under the assumption that all were homogeneous with respect to resource endowment on the first year in which they cleared land. The analysis suggested that from an initial base of four to five hectares, farms have expanded at the rate of one hectare per year until the cleared farm area equalled about 15 hectares. After 11 years of clearing activity, average clearing rates per farm rose to more than three hectares per year, suggesting that the enlarged resource base was providing substantially greater surplus which could be diverted from family consumption. The implications for future settlement policy are clear: without government assistance, growth will proceed slowly for 10 years or more. The provision of farm credit and infrastructure to permit higher levels of investment in the initial years of settlement should induce substantial acceleration of the capital formation process.

Integration of the Santo Domingo settlement area with the national economy was postulated as a necessary condition for the transfer of surplus labor resources to the frontier in excess of pioneer families. Analysis of one farmer's hired labor use from 1955 through 1967 detailed a mechanism whereby initial land investments could be

charged against future production. It was suggested that for such settlers the relative constraint on labor use was anticipated cash flows. Without the possibility of crop sales to pay workers, it would not have been possible to employ more than ten man-years of labor in thirteen years time. In early stages of settlement, many workers used their wages to establish a land claim of their own. The possibility of converting agricultural surplus into labor via a cash medium thus fostered a high rate of reinvestment of frontier generated resources. These conclusions emphasize the importance of farm to market roads and other measures to provide adequate markets for products of frontier regions.

When the accounts for 22 farms were analyzed for the year 1967 it was found that average cash investment out of current income was very high, 47 percent of total cash receipts. (Cash investments were 34 percent of average cash receipts plus family consumption of farm products.) The value of productive assets on all 22 farms, crop lands and pastures, tools and livestock, was found to have increased by an average of 36 percent in the course of 1967. This calculation excluded autonomous changes in price levels for land and livestock during 1967. Settlers responded to the introduction of a road into their property in late 1966 by dramatically increasing the area in plantain groves by 31 hectares during the following year.

Demands for land among an increasingly articulate agricultural poor are strong and growing stronger. Meanwhile, traditional rural elites have successfully resisted redistribution of private lands and their power to do so should persist for some time. Land settlement programs present an opportunity to placate one political group without alienating the other, with possible gains in agricultural production as a bonus. The task of policy makers is to find the least expensive way of assisting settlers to become self-sufficient producers so that the maximum number of families can be benefited. Ecuador's large reserves of unused land and underemployed labor make new land settlement a very proper development activity, not simply a politically expedient one. However, land settlement will continue in Ecuador as fast as penetration roads can be opened into the forest, irrespective of government policy.

By its nature spontaneous land settlement is an inefficient activity. Still it provides the only practical means of selecting new settlers. Government programs to assist spontaneous settlers can greatly increase the efficiency of the settlement process through the provision of title security, farm-to-market roads and production credit. While it is instructive to calculate the returns to government investment in such projects, the results of an efficiency analysis are inappropriate measures of the effectiveness of land settlement in meeting national development goals.

The important developmental benefits of land settlement in Santo Domingo de Los Colorados include economic integration, redistribution of income and the creation of a modern agricultural sector. Agricultural production of Santo Domingo is exported to the sierra and the coast. Rapidly rising incomes in the settlement colonies create a growing demand for agricultural and manufactured products from both regions.

Most of the beneficiaries of land settlement are former members of the poorest agricultural class. Several thousand families have received large increases in wealth and income through their own efforts. Employment has been provided for many agricultural and transportation workers. More than 5,000 farmers have been assembled in a compact area of 270,000 hectares of good agricultural land. These farmers are

better educated than most of Ecuador's agricultural population, they are modern and progressive in values and attitudes. Settlers command sufficient resources to give them the freedom to take risky and innovative decisions; they have demonstrated a high capacity for savings and investment.

The colono went into the forest with an ax and a machete. He has emerged a landholder and a free man, beholden to no one, disdainful of all who have not earned their status in the same way. He is politicized, organized and articulate. He and his fellows form a prospering egalitarian enclave in the midst of a traditional agricultural society. Migrating laborers and truckers will transmit the strong demonstration effects of the settlement region to the rest of the nation. Santo Domingo de Los Colorados will be a persistent disequilibrating force in Ecuador, both economically and socially. For the long run, this is the most important contribution of land settlement to national development.

APPENDIX

Data Collection and Analysis

The primary source of information was a detailed questionnaire administered to 22 members of an agricultural cooperative, Ríobambeños del Río Chilímpe during March and April, 1968. The author spent much of March, April and May living in the cooperative, attending meetings, walking from farm to farm interviewing farmers, observing production operations and taking photographs. The survey was intended to provide as complete a picture as possible of all farm operations during the calendar year 1967. The total membership of the cooperative in April 1968 was 25 farm owners. One farmer refused to participate in the survey and a second was not available for interviewing in the time schedule. Since a third farmer had resided on his farm for only 5 months of 1967, his questionnaire was excluded from the final analysis. Consequently, the analysis of farm production and family income is based upon 22 questionnaires containing information for the full year of 1967.

Information obtained through the questionnaire included a beginning and end of year inventory of all assets, farm production and expenses, and family receipts from whatever source. A map of each farm was sketched and the area, current use, productivity and clearing history of each field within the farm was established. These sketches were compared with the farm survey map prepared by IERAC in order to establish with each farmer the amount of forest reserve still remaining to him. Farm sketches were cross-checked with July, 1967 air photos of the region in order to verify reported areas and land uses.

Production of permanent crops, plantain, cocoa, and coffee, was calculated from each farmer's estimates of the harvesting interval and the average quantity harvested per collection. Separate estimates were made for wet season and dry season production. The harvesting interval for plantain was generally 3 to 4 weeks, for cocoa and coffee it varied from one to 3 months in length. Quantities marketed and average prices received were also recorded. Separate estimates of family consumed produce were obtained; for plantain this was based on reported consumption per day or per week. Consumption of plantain was expressed in terms of marketable equivalents since small stems are saved for home consumption; after this standardization, plantain were valued at market prices (as reported by each farmer) in the calculation of the value of family consumption, as were all other products. Production and consumption of annual crops was calculated in a similar fashion. Calculations of total cash sales and total income were performed in the presence of the farmer and verified by him. Two farmers had records of sales receipts for 1966 and 1967 which were used to cross-check price levels and weather conditions reported in the questionnaire.

Costs of production were calculated by first asking each farmer how he accomplished the major maintenance operations of the farm: cleaning the permanent plantations and pastures of high weeds and brush several times a year. The response would be: (1) do it myself, (2) by contract work, or (3) by daily laborers. Virtually all responded that most work was done by contract. Consequently, they were then asked to indicate the price per hectare they customarily paid, the number of times a year the operation was performed, the number of hectares cleaned, and whether the price

included food. After going through all the farmer's crops in this fashion, he was then asked to estimate the additional miscellaneous labor hired during the year for harvesting and other activities. This figure was ordinarily quite small and easily approximated. The use of hired labor for investments was handled separately under that category. Where farmers had records of production or expenses these were used as the basis of the questionnaire and additional information was solicited as needed to fill in.

Livestock holdings at the beginning and end of the year as well as purchases, sales, family consumption, births and losses were recorded. The value of land included in the farm inventories represents reasonable market value for the different classes of plantations, pastures and fallow for the year of 1967. With few exceptions these values were uniform from farm to farm for lands in the same use class. Some farmers justified different rates on the ground that they were much closer to or farther from a principal highway. All forest land was valued at the same price. It is important to note that changes in land value from the beginning to the end of the year thus reflect improvements or a shift in productive capacity, not an inflation of land values.

Analysis of the data attempts to identify the determinants of three interrelated items: agricultural production, family income and capital formation. Attention is focused upon those factors susceptible to influence through government policy. Family income accounts provide evidence for current production, income and investment. Investment for 1967 as well as the historical record of land clearing permit inferences about the rate of capital formation under spontaneous land settlement.

Office space and valuable guidance in drawing up the questionnaire was provided by the Union of Agricultural Cooperatives in Santo Domingo, El Consorcio. Information garnered during this association and through long discussions with members of the IERAC technical staff in Santo Domingo helped round out the picture of settlement activities.

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