OPTIMUM PLANS OF FARM PRODUCTION FOR THE REGION OF MANI, GREECE

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ABSTRACT

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The major problem in rural Greece is its depopulation. From 1961 to 1971 the urban population of Greece increased from 43.3 to 53.2 percent, while at the same time its rural population decreased from 43.8 to 35.1 percent. This movement away from farming has reached very high levels in some poor and distant regions of the country. Mani, located on the extreme southern part of continental Greece, is such a region.

The urbanization movement, resulting mainly from the lower returns to labor employed in farming, as compared to that employed in most non-farm occupations and from the centralization of industry in the bigger urban centers, has resulted in accumulating population near Athens and Salonica, (in 1971, the population of Athens proper was 29.0 percent of the whole country). This concentration, in combination with the country's adverse physical conditions, which limit the substitution of labor for capital in farming, has caused important questions about the demand for and supply of farm products.

Various suggestions have been made for decreasing out-migration Some people argue that a change in crop patterns of some regions and reallocation of their productive resources could achieve a substantial increase in the farm incomes and thus stop or decrease the depopulation. Others believe that the key is the decentralization of industry to

increase employment in the rural areas.

In response to the above, the main objectives of this study are:

(1) To determine an optimum plan of farm production for the region of Mani, under the existing resources and unlimited capital supply,

(2) To evaluate the economic consequences of the optimum plan, as well as its effect on the region's depopulation, and

(3) To determine the amount of short and long-term capital needed for application of the optimum plan.

The year 1970 is taken as the base year, and all comparisons are made with respect to the country's and region's economic records during that year.

Linear programming techniques are used to determine the pattern of crops and livestock enterprises that would maximize the region's total income which is calculated on the basis of existing resources, prices and technology during the base year (1970). The objective functions include the value added by crop and livestock enterprises, as well as the receipts from resource selling.

Data concerning resources, prices, technology, as well as the region's economic situation during the base year, are provided from records collected by the writer in 1970, as part of an investigation about the region's economic development carried out by the Agricultural Bank of Greece. Estimates by the writer have also been used with respect to some input-output coefficients and the region's capacity for some crops or livestock enterprises. Generally, the writer's knowledge of the region (an accumulation of six years in the region as a loan analyst for the Agricultural Bank of Greece) has greatly

contributed to establishing various estimates and restrictions.

The main conclusions of the study are as follows:

(1) The per capita income that can be achieved by reallocating the region's farm resources is less than the country's average.

(2) The region's depopulation would continue under present conditions, if the employment outside the region is possible.

(3) It would be impossible for the region's farm population to achieve full employment throughout the year by farming alone, even if the capital supply is unlimited.

(4) A substantial improvement in the second zone's economic conditions could be achieved by expanding irrigated land and reallocating resources.

(5) Long-term capital amounting to 267.44 million drachmas is needed for achieving an increase in the region's per capita income by 6,116.5 drs, under the constant population assumption. The amount of short-term capital needed for the above purpose amounts to 66.32 million drachmas.

Finally, it should be emphasized that the above conclusions are based on the assumptions made in the models.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLEAUS

CHAPTER I

INTRODUCTION

1. Location of Study Area

Mani Peninsula is located on the extreme southern portion of continental Greece. It administratively belongs to the Laconia Region (nomos), and it consists of the Gythion and Etylon Counties (eparchies). Mani is bordered by the Laconian Sea to the east, Messinian Sea to the west, Kithiron Sea to the south, and the Lacedaemonos County to the north.

2. Physical Environment

a. Physiography

The mountains of Mani are the southern extensions of the Taygetos range. The lone limestone ridges form the backbone of the peninsula, running on a N-NE to S-SW direction. The topography is very steep, with elevations reaching 1,500 meters above sea level. Subsequently, the soils of these mountains have suffered from eons of severe erosion, particularly in the southern portion of the region. The lower portions of the mountain sides are the only available agricultural lands in the region, despite the steep terrain.

The area is dissected by numerous torrential intermittent streams, causing great flood and sedimentation damages to cultivated fields. Several alluvial plains have been formed along the stream

mouths near the sea, predominently in the northern part of the region. The total area of such plains is approximately 17,000 stremma (1 stremma = .25 acre). Table 1.1 summarizes the land types found in Mani, and compares them with that of Greece as a whole.

Table 1.1 Total Area of Mani and Greece

Classification of areas[a]	Region of Mani		Total of Greece	
	Area in str.	Percentage	Area in str.	Percentage
Plain (level)	122,900	24.7	38,383,600	30.0
Semi-mountainous	133,800	26.9	34,504,000	27.0
Mountainous	240,400	48.4	55,067,500	43.0
Total	497,100	100.0	127,955,100	100.0

Source: National Statistical Service of Greece

[a]This classification is according to that which has been adopted by the National Statistical Service of Greece for the communities.

This table indicates that:

- The region under study is very small (.39 percent) part of the total area of the country.
- The region can be characterized as mountainous, since about half of its area falls in this category.
- The percentage of each category in this region is about the same as that for the rest of the country.

b. Climate

Precipitation records show an average annual rainfall of 913.6mm. Precipitation data have been summarized from Appendix A, Table A-2:

Spring	148.5mm	or 16.3 percent of the total
Summer	18.0mm	2.0 percent of the total
Fall	257.2mm	28.1 percent of the total
Winter	489.9mm	53.6 percent of the total

Precipitation data were recorded in the northern part of the region, and, therefore, are not reliable indicators for the rainfall conditions of the southern part. The average annual rainfall for the southern part is estimated at 550-600mm.

Other complete and reliable climatic data are not available for this region. However, in nearby Gythion-Mavrovounion plains the following temperatures were recorded during the Fall of 1968 and Winter of 1969.

Table 1.2 Air Temperature in Fall 1968 and Winter 1969

Months	Minimum in °C	Maximum in °C	Average in °C
November	6.0	22.0	14.8
December	3.0	19.0	11.5
January	1.0	16.0	9.0
February	1.0	18.0	11.6
March	5.0	26.0	12.8
April	6.0	35.0	17.0

Source: Data provided by Agronomy Department of the Agricultural Bank of Greece (Gythion Branch).

Freezing temperatures are rare in the northern part of the region, and extremely rare in the south. It is estimated that the average temperature during the winter and summer months is 10 °C and 30 °C respectively. With the exception of the high mountainous portions of the region, snow is a rarity.

Based on the available data, as well as personal observations, the following statements can be formulated:

-- The region is characterized by typical Mediterranean climate; mild winters, and hot, dry summers.

-- Low rainfall levels and relatively high spring and summer temperatures require crop irrigation and/or utilization of drought resistant crop strains. Water is the limiting factor for the agricultural development of the region.

-- Mild winters can facilitate the production of spring and summer vegetable crops during the winter, with only elementary protection from low temperatures, i.e. greenhouse without heating.

In summary, the relative advantage of mild winters can counterbalance the other climatic extremities of the region, and must be seriously considered in any attempt for crops reallocation.

c. Water Resources

The types and levels of farm activities are inevitably related to knowledge on existing and potential water resources and their use in irrigation.

Water in the southern part of the region is scarce. The few fresh water springs supply the domestic needs of villages, and provide for the irrigation of 80-100 str. No significant ground water resources

exist, and, therefore, the potential for expansion of the irrigated fields is limited or non-existent.

Conditions in the northern part of the region are more favorable. Shallow wells (6-40mm) are used to pump abundant ground water to irrigate about 8,000 str. and to supply the domestic water needs of villages.

In addition to ground water, a large volume of water can be obtained from the torrential streams of the area. With appropriate improvements and storage facilities this additional water resource can be used for irrigation.

In conclusion, it can be stated that the water scarcity and the low quality of the land in the southern part of the region are the limiting factors in crop reallocation. These factors limit the number of crops and trees to very few, the returns of which are extremely low. In contrast, favorable conditions in the northern part make possible the full utilization of the land. Thus, throughout this study the region will be divided into two zones as follows:

First zone: Includes the southern part of the region.

Second zone: Includes the northern part of the region.

3. Sociology

The changing population pattern, the employment trends and the educational levels of the inhabitants of the region are considered fundamental in the development plan for the region.

Table 1.3 represents the population picture for 1951, 1961, and 1970. The population of each zone can be found in Appendix A, Table A-3.

Table 1.3 Total Population of the Region of Mani in 1951, 1961, and 1970

Geographic Zone	1951		1961		1970	
	Population	Percentage	Population	Percentage	Population	Percentage
Plain	10,662	44.2	9,828	48.4	7,164	52.3
Index	100.0	-	92.2	-	67.2	-
Semi-mountainous	6,101	25.3	4,785	23.6	3,063	22.3
Index	100.0	-	78.4	-	50.2	-
Mountainous	7,348	30.5	5,680	28.0	3,482	25.4
Index	100.0	-	77.3	-	47.4	-
Region	24,111	100.0	20,293	100.0	13,709	100.0
Index	100.0	-	84.2	-	56.8	-

Sources: (a) National Statistical Service of Greece.

(b) Unpublished data collected by the writer in 1970.

The above data indicates that the total population of the region has decreased during the period from 1951 to 1970 by 43.2 percent (52.6 percent in the mountainous portion and 32.8 percent in the plains). This decline was greater (52.6 percent) in the first zone than in the second one (34.9 percent).

These sharply declining rates are attributed to the low per capita income, and to the lack of employment in other sectors of the economy besides agriculture. This results in the migration of the inhabitants towards the urban industrialized centers of the country, i.e. Athens and Peraeus, and quite often, abroad. The data further indicates that the population decline was greater (32.5 percent) during the 1961-1970 period, than in the 1951-1961 period. This is attributed to increasing opportunities for employment in the above industrial and urban centers during the 1960's.

The density of population expressed in number of persons per 1,000 str. of land was 27.6 in 1970 (Appendix A, Table A-4). The distribution of the total population on the basis of age and sex, as well as the active population are presented in Appendix A, Tables A-5 and A-6.[1]

The percentage of persons older than 64 years is respectively high (18.2 percent). This percentage ranges from 22.2 (first zone) to 15.7 (second zone). This high percentage is due to the movement of the active population to the bigger urban and industrial centers of the country. The active population is 56.7 percent of the total

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[1]Active population is characterized as the population in the age group 15 to 64 years. This is in accordance with child labor laws and social security legislation in Greece.

population. This rate ranges from 54.5 percent (first zone) to 58.2 percent (second zone).

Farming is the main occupation of the working population throughout the region. The percentage of the active population that was employed in farming was 79.8 in 1970, ranging from 86.3 (first zone) to 75.9 (second zone).

In summary:

-- The total population of the region has greatly declined. This must be attributed to the low family farm income, the lack of employment and the unfavorable living conditions. The rates of decline are higher in the mountainous part and in the first zone because the above causes are more pronounced in these areas than they are in the rest of the region.

-- The region has a definite agricultural character, since 77.1 percent of its active population is occupied in farming. The percentage of families that are mainly occupied in farming was 71.8 (Appendix A, Table A-7). Finally, the average number of persons per family was 3.1 (2.9 for the first zone and 3.2 for the second one).[1]

The above brief examination of the physical and social conditions of the region should characterize it as unfavorable for agriculture. The low land productivity, steep topography and scarcity of water combined with uneven precipitation patterns, restrict the number of agricultural activities, and make difficult further agricultural development of the region. Such poor conditions coupled with the lack of adequate non-farm activities are the causes for emigration

[1] It was computed from the distribution of families on the basis of their size (Appendix A, Table A-8).

of the active and progressive fraction of the population, thus accelerating the deterioration of the quality of life, and further decreasing the hopes for future economic rejuvenation of the region.

4. Farm Resources

a. Land

The agricultural land (cultivated land) is 27.1 percent of the region's total area (Appendix A, Table A-1). This percentage ranges from 23.4 (first zone) to 32.9 (second zone). The greatest part (82.7 percent) of the agricultural land is forested mainly by olive trees (Appendix A, Table A-9).

The grazing areas (private and public pastures) cover 62.9 percent of the region's total area. The productivity of the grazing areas is very low, especially in the summer, due to the hot and dry weather, and the lack of water.

The irrigated land is 6.22 percent of the region's total area, ranging from .15 percent (first zone) to 13.09 percent (second zone) (Appendix A, Table A-10).

In regard to the quality of agricultural land, it can be classified as follows:

(1) The unproductive, stony and steep areas of the first zone. They are mainly covered by olive trees, leaving a very small portion sutiable for growing crops. The steep topography makes impossible the use of cultivating machinery and thus, the output of labor is restricted to very low levels.

(2) The highly productive plain areas that are located along the torrents and coasts of the second zone. A portion of these areas is

irrigated and a larger portion could be irrigated if improvements in water reclamation were undertaken. Basically the farm activity of the second zone is centered in these irrigated areas.

(3) The remaining areas of the second zone which are mainly located in the slopes of hills. These areas are covered by olive trees, but they are low productivity.

b. Labor

The task here is to calculate the available farm labor for the region, for each zone and for each farming season. The concept of available farm labor is defined as the product of active population, expressed in man-units, multiplied by the number of workdays per season; that is:

$$AFL_i = AMU.WD_i \qquad i = 1,2,3,4$$

where:

AFL_i = Available farm labor in season i^{th}

AMU = Total population expressed in man-units

WD_i = Workdays in i^{th} season

Workdays are defined as the days which are not Sundays or holidays and in which there is not rainfall or the rainfall is less than 5mm; that is:

$$WD_i = TD_i - SH_i - ID_i$$

where:

TD_i = Total days in i^{th} season

SH_i = Number of Sundays or holidays in i^{th} season

ID_i = Number of inclement days (days with a rainfall of 5mm or more) in i^{th} season

The per season number of workdays in each zone, according to the above definition, is presented in the Table 1.4. The second step in the calculation is the conversion of total population in active man-units in the following way:

$$AMU = \sum_{j=1}^{n} K_j P_j \qquad j = \text{number of cohorts}$$

where:

K_j = Weight applied to the member of j^{th} cohort.

P_j = Number of persons in j^{th} cohort.[1]

Table 1.4 Workdays Per Season in Each Zone[a]

Season	First Zone	Second Zone
Spring	62	60
Summer	72	72
Fall	62	59
Winter	54	51
Year	250	242

[a]The calculation of workdays is based on collected records by the writer in 1970.

The weights k are the factors that adjust the labor for qualitative differences in the human agent that affect the marginal productivity of labor. The sources of such differences are sex, age, skill, experience, etc. The rational way to construct these weights

[1]P.A. Yotopoulos, "Allocative Efficiency in Economic Development," Center of Planning and Economic Research, Athens, Greece, 1967, p. 90.

is to calculate them on the basis of relative market values of the wages. The sources of the wage variation in the region are the sex and the age (for the persons in cohort 15-20 years). The values of the weights in the region, based on the relative market values of wages, are presented in Table 1.5.[1]

Table 1.5 Weights for Conversion of Different Age-Sex Cohorts Into Equivalent Units[a]

Sex	Age			
	14 and Under	15-20	21-64	65 and over
Male	0	.9	1.0	0
Female	0	.7	.8	0

[a]The calculation of these weights is based on records collected by the writer in 1970.

The assigning of weights to persons 64 or older needs more explanation. Actually, some persons in this cohort supply labor the quality of which is the same as that of persons in cohort 21-64. For persons in cohort 65-70 a weight .7-.8 may be more realistic.[2] Unfortunately, the collected data in the region do not provide information on the number of persons in the cohort 65-70.

[1]In Greece the coefficients .8 for women and .3 for children under 15 and men and women over 65 have been used by A.L. Adamopoulos and E.G. Papageorgiou, "Farm Management Research and Planning in Northern Greece," Salonica, 1963; the coefficient .6 for girls and .7 for boys and women have been used by A.A. Pepelasis and P.A. Yotopoulos, "Surplus Labour in Greek Agriculture, 1953-60," Athens: Center of Economic Research, 1962.

[2]P.A. Yotopoulos, ibid., p. 92.

Actually, the persons older than 64 years are usually occupied with househhld chores (females) or some light jobs (males). Thus, the supplied work by the persons in this cohort can be taken as equivalent to the labor supplied by housewives. Based on this, it is assumed in this study, that the supplied labor by the persons in cohort 65 and over is equal to the labor needed for household chores.

According to the above, the available farm labor in man-workdays (1 workday = 10 hours) per season in the region, and each zone, is presented in Table 1.6.

Table 1.6 Available Farm Labor in Thousand Man-Workdays Per Season

Season	First Zone	Second Zone	Region
Spring	138.2	193.9	332.1
Summer	160.5	232.7	393.2
Fall	138.2	190.7	328.9
Winter	120.3	164.9	285.2
Year	557.2	782.2	1,339.4

Source: Tables 1.4, 1.5 and Appendix A, Table A-11.

c. Farm Industries and Mechanization

The working industries in the region are those of olive oil extraction. They are small and operate only during the harvesting period (Fall-Winter).

The number of tractors in the region amounts to 87 (5 in the first zone and 82 in the second zone). The tractors in the first

zone are usually used for the transportation of products. The steep slopes and the stony terrain make it impossible to use tractors in plowing.

The per tractor agricultural area in the second zone is 770 stremmas.[1] Given that a portion of agricultural land in this zone cannot be cultivated by tractors (due to the steep topography), the existing number of tractors seems to be sufficient.

Generally, the degree of mechanization is very low in the first zone and some parts (mountainous part) of the second one. The topography of these areas and the crop type (mainly olive groves) restrict the possibilities for increase in the degree of mechanization.

On the contrary, in the greatest portion of the second zone and especially in the plain areas the degree of mechanization is very high. The margins for more mechanization in this part are wide for some crops (cotton, vegetables).

5. Farm Size

The available agricultural land, the number of olive trees and irrigated land per family associated with farming are presented in Table 1.7.[2]

Generally, most farms are small. A very low percentage of farms in the second zone can be characterized as large. The existing conditions, especially in the first zone, limit the potential for expansion and establishment of large farms.

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[1] It is calculated as a simple average: per tractor agricultural land = total agricultural land of zone ÷ number of tractors in zone.

[2] The number of farms is taken equal to the number of farm families in each zone.

Table 1.7 Agricultural Land, Number of Olive Trees and Irrigated Land Per Farm Family[a]

Zone	Agricultural Land in Str.	Number of Olive Trees	Irrigated Land in Str.
1st	44.5	750	.08
2nd	38.9	515	5.1
Region	41.2	632	2.6

Source: Appendix A, Tables A-1, A-7, A-9 and A-10.

[a]These records are calculated as simple averages.

The only source of labor for farms is the family. In the second zone and during the peak season hired labor can sometimes be utilized.

CHAPTER II

FARM ACTIVITIES AND ECONOMIC RESULTS IN 1970

1. Agricultural Activities

The basic activity in the whole region is the olive groves for oil production. It contributes to the total value of agricultural product of the region by 77.1 percent (Appendix B, Table B-1). This contribution ranges from 95.9 percent (first zone) to 54.9 percent (second zone).

The contribution of annual arable crops to the TVP is very small in the first zone (2.1 percent), while it is more important (19.9 percent) in the second zone. The TVP of fallow land comes from the natural grass that is cut and used as substitute for hay and alfalfa. The average value product (AVP) of agricultural land amounts to 586.6 drs in the first zone, while that in the second zone reaches 1,021.9 drs (Appendix B, Table B-1). This AVP of agricultural land in the first zone is considered as very low, since, due to the low degree of mechanization in this zone, the required per unit (stremma) labor must be high.

2. Livestock Activities

The livestock in the region and their total value product (TVP) and average value product (AVP) in 1970, are presented in

Appendix B, Tables B-2 and B-3.

The livestock activities in the region are:

a. Sheep - Goats. The sheep and goats operations are divided in two types:

(i) "Domestic sheep and goats": These are small enterprises, including 1-6 improved breed animals. The labor required for these operations is mainly supplied by the housewives.

(ii) Sheep and goats "in flocks": They range from small enterprises (20-30 animals) to large ones (500-900 animals). These herds usually consist of semi-improved animals. The feed requirements of these operations are basically met by grazing in pastures throughout the year. They receive a very small amount of additional feed (grain, hay) during the winter.

b. Cattle. The predominant type of cattle operation is that of small enterprises in mixed family-farm situations. The types of cattle operations are:

(i) Cattle kept in barns: These are very limited operations involving 2-4 animals (cows and calves). They consist of improved or semi-improved, dual-purpose animals. The calving rate amounts to 80-85 percent and the replacement rate to 16 percent. The produced calves (heifers and bulls) are kept in the herd and marketed at the age of 18 months. The surplus heifers, after replacement, are usually sold as live animals. The milk production per cow ranges from 500kg. to 1,500kg. per year, depending on breed and feeding practices. The animals in this type of operations are fed a regular ration, (corn, alfalfa, etc.), the most components of which are purchased (especially in the first zone).

(ii) Cattle kept in barns and pastured: They are small enterprises that involve 3-18 animals of semi-improved breeds. The calving rate is approximately 80 percent and the replacement rate 16 percent. This type of operation is used for calf and beef production. Heifer replacements are also produced and the surplus heifers are kept, fattened, or sold as live animals at the age of 18-20 months. Bull calves are raised on the same farm up to 18-20 months of age. Cows and calves graze together on the pastures during the spring, summer and fall. They are confined in barns only in winter and are fed additional rations. Feeds are partly produced

in the farm and partly purchased from the Agricultural Bank of Greece at reduced (subsidized) prices. This type of operation has the advantage of utilizing the grazing areas and of requiring less labor per unit of cattle than the first one. It is more suitable for the first zone.

(iii) Cattle in herds: The herds of this type consist of 10-40 animals of domestic unimproved breeds. This type of operation has low productivity and exists mainly in the first zone. It is used for calf and beef production. With calving rate approximately 70 percent and a replacement rate of 16 percent, the surplus heifers either remain in the same operation (if the operator has the desire and the ability to expand his herd size) or are slaughtered for beef markets. Bull calves are raised in the same farm and sold at the age of 18-20 months. Cows and calves of this type of operation pasture together on grazing areas throughout the year.

c. Hogs. These are limited activities involving 1-2 animals in the first zone. Some large scale enterprises, involving 100-500 animals, operate in the second zone.

d. Beehives. This enterprise is important for the first zone because, due to the existing vegetation (thymes), the product (honey) is of very high quality and enjoys high market prices.

3. Employment

The required labor, expressed in man-workdays per unit of activities, is presented in Appendix B, Table B-4.

These coefficients are the approximate averages for each zone. They come from an investigation, carried out by the writer in 1970 and sponsored by the Agricultural Bank of Greece. The labor utilized in farming in 1970, as it is calculated by these coefficients, is presented in Table 2.1.

The labor surplus, defined as that which is available over and

Table 2.1 Utilized Labor in Farming in 1970 (Thousand Man-Workdays)

Season	First Zone	Second Zone	Region
Spring	73.4	62.7	136.1
Summer	31.4	57.0	88.4
Fall	124.2	85.1	209.3
Winter	65.4	97.4	162.8
Year	294.4	302.2	596.6

Source: Appendix A, Table A-9; Appendix B, Table B-1 and B-4.

above the peak season's actual employment, amounts to 36.36 percent of the region's available labor during the fall.[1] According to this definition, the labor surplus in each zone is:

First zone: 10.1 percent of the zone's available labor during the fall.

Second zone: 40.9 percent of the zone's available labor during the winter.

This concept of labor surplus, using as criterion the maintenance of farm output, is of limited usefulness, since it overlooks efficiency considerations.[2] Actually, there is no incentive for labor to remain in farming, if it can earn more outside farming.

[1] Peplasis, A.A. and P.A. Yotopoulos, "Surplus Labour in Greek Agriculture, 1953-60," Athens: Center of Economic Research, 1962.

[2] Pepelasis, A.A., "Labor Shortage in Greek Agriculture, 1963-73," Athens: Center of Economic Research, 1963.

4. Feed Requirements

The required quantities of feed per head of stock are presented in Appendix B, Table B-5, while the feed production in each zone and in the whole region is presented in Appendix B, Table B-6.

The feed deficit is covered by purchase from other regions (forages) and from the Agricultural Bank of Greece (grain).

5. Economic Results

a. Economic Results per Unit of Activity

The average value added (AVA) by farm activities is presented in Appendix B, Table B-7.

Thei average value added is defined as a simple average; that is:

$$AVA_j = \frac{TVA_j}{X_j} \text{ , for } j = 1, 2 \ldots n$$

where:

AVA_j = Average value added by j^{th} activity in 1970.

TVA_j = Total value added by j^{th} activity in 1970.

X_j = Level of j^{th} activity in 1970.

The total value added (TVA) by j^{th} activity is defined as the part of total value produce of j^{th} activity that is not paid to other activities (enterprises) for their contribution to its production. Thus, the TVA by j^{th} activity is the cash income plus the home consumption. Algebraically, the TVA by j^{th} activity can be written:

$$TVA_j = TVP_j - PVI_j$$

where:

TVP_j = Total value product of j^{th} activity and

PVI_j = Paid value of inflows of j^{th} activity.

The PVI_j includes the value of units of input of j^{th} activity, that are purchased either from other activities in the zone or from outside the zone. It does not include sums paid for labor because it is assumed that all the labor needs in each zone and in the whole region are met by their own available manpower. This assumption is realistic since the employment rate in both zones is very low. The calculation of PVIs is based on the market prices of various inputs in 1970.

By definition, PVI consists of two parts as follows:

(1) The value of inputs supplied from other activities in the zone or region and

(2) The value of inputs supplied from outside the zone or region.

Therefore, the PVI of j^{th} activity can be written:

$$PVI_j = PVDI_j + PVIMI_j$$

where:

$PVDI_j$ = Paid value of domestic inputs of j^{th} activity.

$PVIMI_j$ = Paid value of "imported" inputs of j^{th} activity.[1]

Therefore, the average value added by j^{th} activity can be written:

$$AVA_j = \frac{TVA_j}{X_j} = \frac{TVP_j - PVI_j}{X_j} = AVP_j - APVI_j = AVP_j - APVDI_j - APVIMI_j$$

where:

AVP_j = Average value product of j^{th} activity.

$APVDI_j$ = Average paid value of domestic inputs of j^{th} activity.

$APVIMI_j$ = Average paid value of "imported" inputs of j^{th} activity.

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[1] "Imported" inputs are those purchased from outside the zone's farm sector.

b. Total Economic Results

The total income that the farm population of each zone (or the whole region) received in 1970 is composed of:

(1) The part of total value of farm product that was either consumed by the zone's farm population, or sold to other consumers outside the zone's farm sector.

(2) The value of resources sold outside the zone's farm sector, and

(3) The amount of payments to zone's farm population by the government (pensions) and individuals (remittances) living outside the zone's farm sector.

The first component, defined as total value added by farming (TVAF), can be written:

$$TVAF_i = TVFP_i - TVI_i \quad , \quad \text{for } i = i,2$$

where:

$TVAF_i$ = Total value added by i^{th} zone's farm sector.

$TVFP_i$ = Total value farm product of i^{th} zone.

TVI_i = Total value of inflows of i^{th} zone.

The total value of inflows consists of the total value of used domestic resources and "intermediate"[1] goods as well as the total value of "imported" inputs. Therefore, the TVAF can be written:

$$TVAF_i = TVFP_i - TVDRIG_i - TVIMI_i \quad , \quad i = 1,2$$

where:

$TVDRIG_i$ = Total value of domestic resources and "intermediate goods" used during this year in i^{th} zone.

$TVIMI_i$ = Total value of "imported" inputs of i^{th} zone.

The TVA by farming in the i^{th} zone is equal to the sum of TVA

[1] "Intermediate" goods are inputs produced and utilized within the zone (or region).

by all the j^{th} activities of i^{th} zone:

$$TVAF_i = \sum_{j=1}^{n} TVA_{ij} = \sum_{j=1}^{n} TVP_{ij} - \sum_{j=1}^{n} PVDI_{ij} - \sum_{j=1}^{n} PVIMI_{ij} \quad , \; i = 1,2$$

This is consistent with the above mentioned, since:

$$\sum_{j=1}^{n} PVDI_{ij} = TVDRIG_i \text{ and } \sum_{j=1}^{n} PVIMI_{ij} = TVIMI_i.$$

The TVA by j^{th} activity can be written in terms of average value added as follows:

$$TVA_j = AVA_j \cdot X_j \quad , \; j = 1,2.....n$$

Therefore, the TVA by i^{th} zone's farm sector becomes:

$$TVAF_i = \sum_{j=1}^{n} AVA_{ij} \cdot X_{ij} \qquad i = 1,2 \text{ (zones)}$$

The resources sold outside the zone's (or region's) farm sector were only labor and its value in drachmas (30 drachmas = $1) is presented in Table 2.2.

The transfer payments to the farm population of each zone were:[1]

First Zone : 6,440.0 thousand drachmas

Second Zone : 7,600.0 thousand drachmas

Region : 14,040.0 thousand drachmas

Assuming that there is not a labor movement from each zone to another, the total income of the region's farm population in 1970 is presented in Table 2.3

The gross income per family occupied in farming was:[2]

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[1] These are estimations of the writer, based on the amount of paid pensions and on the remittances from abroad.

[2] It is computed as simple average: Gross Income per farm family = Farm population's gross income ÷ Families occupied in farming.

Table 2.2 Labor Sold Outside the Region's Farm Sector and its Value[a]

Season	First Zone		Second Zone		Whole Region	
	Labor in Thousand Man-Workdays	Value in Thousand drachmas	Labor in Thousand Man-Workdays	Value in Thousand drachmas	Labor in Thousand Man-Workdays	Value in Thousand drachmas
Spring	4.2	756.0	12.7	2,286.0	16.9	3,042.0
Summer	9.4	1,504.0	22.3	3,791.0	31.7	5,295.0
Fall	-	-	8.6	1,548.0	8.6	1,548.0
Winter	-	-	4.1	738.0	4.1	738.0
Year	13.6	2,260.0	47.7	8,363.0	61.3	10,623.0

[a]Data of labor sold were collected by the writer in 1970. The value of labor is based on the wages market value in 1970.

First Zone: : 36,690.1

Second Zone : 48,679.3

Region : 42,710.7

Table 2.3 Gross Income of Zones' and Region's Farm Population in 1970

Source	Gross Income in Thousand Drachmas		
	First Zone	Second Zone	Region
Farming	50,803.9	64,288.9	115,092.8
Labor Sale	2,260.0	8,363.0	10,623.0
Transfer payments	6,440.0	7,600.0	14,040.0
Total	59,503.9	80,251.9	139,755.8
Minus paid interest[a]	542.9	1,342.8	1,885.7
Farm population gross income	58,961.0	78,909.1	137,870.1

[a]It includes interests paid in 1970.

Finally, the per capita gross income was:[1]

First Zone : 12,651.8

Second Zone : 15,212.3

Region : 13,777.6

The above per capita gross income, compared with that of the entire country in 1970 (31,530) is considered as very low. It is indicative of the economic conditions of the region.

[1]It is computed as simple average: Per capita gross income = Gross income per farm family ÷ Average number of persons per family.

CHAPTER III

ANALYTICAL PROCEDURE - THE STRUCTURE OF THE LINEAR PROGRAMMING MODELS

1. Definition of Optimum Plan of Farm Production

The main objective of this study is to define an optimum plan of farm production for the region of Mani. The question is which farm production plan can be characterized as optimal? The concept of "optimum" for a region has not been uniquely defined. Its definition depends on the standpoint from which the problem has been examined; i.e., for a farmer, the optimum plan of production may be that which maximizes his net farm income; for a firm, that which achieves certain production or employment goals. The problem becomes more complicated if some social variables are considered; i.e., a farmer may prefer a lower income rather than a higher one if, in order to earn it, he must move outside the region. Generally, it can be stated that each farm family in the region considers the plan of production optimal if it maximizes its welfare function, expressed as:

$$W_r = f_r(X_r) \qquad r = 1,2.....k = \text{number of farm families}$$

where:

W_r = Welfare of r^{th} family.

X_r = a vector of n elements that represent the amount of goods and services consumed or received by r^{th} family.[1] The term

[1] Labor is treated as negative consumption.

"services" includes all those social variables that affect the family's welfare.

One is now faced with the problem of measuring qualitative variables, and assigning values to these variables according to the satisfaction or dissatisfaction that individual families derive from them. To avoid the problems arising from considerations of non-monetary values, the present study will be based on the following assumptions:

(a) The objective of the region's farmers is to maximize their families' satisfaction.

(b) The farm families' satisfaction is a linear function of their income.

Thus, the family achieves maximum satisfaction when its annual income becomes maximum. Therefore, the plan of farm production, that maximizes the farm families' annual income should be optimum from the farm family standpoint.

The annual income of farm families is equal to the sum of the value added by its farm enterprises (activities) plus the transfer payments and the value of the resources sold during the year:

$$AI_r = \sum_{j=1}^{n} TVA_{rj} + \sum_{i=1}^{m} b_{ri} \cdot P_{si} + TP_r \ , \ r = 1,2.....k$$

where:

AI_r = Annual income of r^{th} family.

TVA_{rj} = Total value added by j^{th} activity (enterprise) of r^{th} family. (If an activity does not take place in the family's farm, then the TVA by this activity will be zero.)

b_{ri} = Amount of i^{th} resource sold by the r^{th} family during the year.

P_{si} = Selling prices, on a flow basis, of i^{th} resource.

TP_r = Transfer payments to r^{th} family.

The sum of annual incomes received by the zone's or the region's farm families is equal to the annual gross income of the zone's or the region's farm population:

$$\sum_{r=1}^{k} AR_r = \sum_{r=1}^{k}\sum_{j=1}^{n} TVA_{rj} + \sum_{r=1}^{k}\sum_{i=1}^{m} b_{ri} \cdot P_{si} + \sum_{i=1}^{k} TP_r$$

But, the $\sum_{r=1}^{k}\sum_{j=1}^{n} TVA_{rj}$ is equal to the total value added by the zone's or the region's farm sector,[1] while the $\sum_{r=1}^{k}\sum_{i=1}^{m} b_{ri} \cdot P_{si}$ is equal to the flow value of the resources occupied (sold) outside the zone's or the region's farm sector.[2] The $\sum_{k=1}^{k} TP_r$ is also equal to the transfer payments to the zone's or the region's farm population.[3]

Using the above information and assuming that the income distribution remains constant, any plan of farm production which maximizes the gross annual income of the zone's or the region's farm population should be optimum for every farm family in the zone or the region. Assuming that the transfer payments to the zone's or the region's farm population remain constant, a plan of farm production will be optimum if it maximizes the sum of the total value added by the zone's

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[1] It is based on the assumption that the farm families are occupied only in farming. This is valid and real assumption.

[2] It is based on the assumption that there is not resource sold from one family to another within the zone or the region. Given the type of farms in the region, this assumption approaches reality.

[3] It is based on the assumption that there are no transfer payments from one family to another within the zone or the region; an assumption which is also realistic.

or the region's farm sector and the value of the resources sold outside the farm sector.

Therefore, an optimum plan of farm production for each zone or for the whole region is defined as that which maximizes the total value added by each zone's or the whole region's farm sector plus the value of resources sold outside the corresponding zone's or the whole region's farm sector.

It must be noted that the above definition of the optimum plan of production is based on the assumptions (a) and (b) (pg. 27) as well as to the following ones:

(1) The income distribution within each zone's or the whole region's farm sector remains constant.

(2) The transfer payments to the zone's or the region's farm population remain constant.

2. Analytical Procedure - Theoretical Considerations

As mentioned in the preceding section, the main objective of this study is to define an optimum plan of farm production; a plan of farm production that maximizes the annual income to farm resources.[1]

Linear programming analysis will be the main analytical approach used in this study. The objective function to be maximized is the annual gross income of each zone's or the whole region's farm sector; that is:

$$Z = \sum_{j=1}^{n} C_j X_j + \sum_{i=1}^{m} P_{si} b_{si} - \sum_{i=1}^{m} P_{aq.i}\, b_{aq.i}$$

where:

[1] It is being defined as the sum of the total value added by the farm sector plus the income from selling resources outside the farm sector.

Z = Objective function to be maximized.

C_j = Average value added by j^{th} activity (enterprise).

X_j = Level of j^{th} activity (enterprise).

P_{si} = Selling price, on a flow basis, of i^{th} resource.

b_{si} = Units of i^{th} resource sold outside the farm sector.

$P_{aq.i}$ = Acquisition price, on a flow basis, of i^{th} resource.

$b_{aq.i}$ = Units of i^{th} resource purchased outside the farm sector.

The mathematical formulation of the model in matrix notation is as follows:

$$\text{Max. } Z = C'X + P_s'B_s - P_{aq.}'B_{aq.}$$

subject to:

$$AX + B_s - B_{aq.} \leq B \text{ and } X \geq 0,\ B_s \geq 0,\ B_{aq} \geq 0$$

where:

C = n x 1 vector of average value added by the farm activities.

X = n x 1 vector of farm activities level.

P_s = m x 1 vector of resource selling prices, on a flow basis.

B_s = m x 1 vector of resources sold outside the farm sector.

$P_{aq.}$ = m x 1 vector of resources acquisition prices, on a flow basis.

$B_{aq.}$ = m x 1 vector of resources hired outside the farm sector.

B = m x 1 vector of the available resources in 1970.

The above model assumes that:

(a) The state of arts (technology) is constant. It accepts the technology existed in 1970.

(b) The average value added by the farm activities remains constant and equal to that of 1970.

(c) The prices of products and resources remain constant and equal to that in 1970.

(d) The assumption (b) and (c), under static technological condition, imply that the average physical product of the

farm activities is also constant.

(e) The number of resource units that could be sold or purchased is unrestricted. This assumption can be relaxed by imposing some restriction on the corresponding variables; i.e., $B_s \leq Q_1$, or $B_{aq.} \leq Q_2$ (Q_1, Q_2 = amount of units).

3. The Structure of the Linear Programming Models

The preceding discussion in Chapters I and II indicates the existence of two distinctly different zones in the region. Therefore, the study will define optimum plans of farm production for each zone separately, as well as for the whole region. This section will provide the structural components of these models in terms of the activities included, resource levels and input-output coefficients.

a. The Structure of the Linear Programming Model for Zone I

a1. Model Activities

The model includes all the substantial activities of the zone. Activities (enterprises) with a small share in the total value added by zone's farm sector have been excluded. The quality of land, the natural conditions and the restrictions due to the zone's topography were also taken into consideration.

Seven general tyeps of Activities were included:

1. Crop and tree activities (A_1 - A_7)
2. Tree expansion and reduction activities (A_8 - A_{11})
3. Feed selling and buying activities (A_{12} - A_{19})
4. Livestock activities (A_{20} - A_{39})
5. Breeding stock decreasing and increasing activities (A_{40} - A_{51})
6. Sell and hire labor activities (A_{52} - A_{59})

7. Capital borrowing activities (A_{60} - A_{66})

i. Crop and Tree Activities

Crop and tree activities are wheat-barley, hay, vegetables grown outdoors, old olive groves for oil, old almond trees, "fallow land" and grazing areas.

Vegetable growing is permitted only on irrigated land, while all other crops and trees are permitted on non-irrigated land. The expansion of grazing areas is permitted by reducing the cultivated land. The objective function coefficients (C_j) of the feed growing activities indicate the average paid value for inflows (APVI).

The crop and tree activities and their requirements for land, labor and capital are presented in Tableau I.[1] For all tableaus, negative signs in front of the objective function coefficients indicate paid value for inflows and no signs (implying positive) indicate value added by the unit of activities. Negative signs in front of coefficients indicate additions to resources, and no (+) signs indicate use of the resources.

ii. Tree Expansion and Reduction Activities

Reducing tree and establishing new tree activities were considered. The land freed by abandoning trees can be used either for growing crops or for grazing.

The objective function coefficients of new tree activities are estimated on the basis of present value analysis as follows:

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[1]The crop and tree activities (except olive groves) requirements for operating capital are estimated to be equal to their average paid value for inflows (Appendix B, Table B-7).

Tableau I: Crop and Tree Activities and Tree Expansion and Reduction Activities[a] (Zone I)

Row No.	Resources	Unit	Crop and Tree Activities						Tree Expansion and Reduction Activities				
			A_1	A_2	A_3	A_4	A_5	A_6	A_7	A_8	A_9	A_{10}	A_{11}
			WB_1 str.	H_1 str.	V_1 str.	FLL_1 str.	$OOGO_1$ str.	$OALT_1$ str.	GA_1 str.	$NOGO_1$ str.	$NALT_1$ str.	$ROGO_1$ str.	$RALT_1$ str.
		C_j	-105.5	-91.8	1,604.2	-6.2	566.6	151.9	-	285.5	141.5	-	-
1	FRL_1	str.	1	1	1	1	1	1	1	1	1		
2	AL_1	str.	1	1	1	1	1	1		1	1		
3	IL_1	str.			1								
4	LWB_1	str.	1										
5	$LHNTP_1$	str.	1	1						1	1		
6	OGO_1	str.					1					1	
7	ALT_1	str.						1					1
8	GA_1	str.							1				
9	WBC_1	kg.	-97.5										
10	$STRC_1$	kg.	-112.2										
11	HC_1	kg.		-356.6		-45.0							
14	GAC_1	str.							-1				
32	SPL_1	days	.4	.8	5.9	.6	.8	.5		.8	.5		
33	SL_1	days	1.1		4.8		.3	.7		.3	.7		
34	FL_1	days	1.2	.8	4.9		1.9			1.9			
35	WL_1	days			3.5		.7			.7			
36	OPC_1	drs	105.5	91.8	212.8	6.2	65.2	87.8		65.2	87.8		
37	$LTCNTP_1$	drs								800.0	600.0		
43	CFC_1	drs	-105.5	-91.8	1,604.2	-6.2	566.6	151.9		-69.0	-43.0		

[a]The explanation of abbreviations used in the above and following tableaus are given in Appendix C, Table C-2.

First, it is based on the assumption that:

(a) The farmers are more interested in short term satisfaction rather than in long term or future one.

(b) The farmer's time horizon is limited. The study limits the farmer's time horizon to 40 years.[1]

The income that farmers will receive from one unit (stemma) of new trees consists of two components:

-- The average value added stream over 40 years and

-- The increase in the value of land by planting.

The sum of the PVs of these two components is the present value of income that the farmers will receive from one unit of the new trees. According to the first assumption, this income gives the farmers the same satisfaction as any other income stream with the same PV and over the same time period. Therefore, from the farmer's satisfaction point of view, this income is equivalent to the income stream that is uniformly distributed over 40 years, and its present value is equal to the sum of the above two components. Based on this, it is found that the annual income that the farmers receive from one unit of new trees is equal to the annual term of 40 years annuity with 4.0 percent interest rate and PV equal to the sum of the above two components (Appendix C, Table C-1).[2]

As has been mentioned above, the analysis considers the new tree income as uniformly distributed; this is very unrealistic, since this income is very low during the first few years (negative during the first 3-7 years) and high for the next years. Two additional

[1]The 40 year limit is based on the region's conditions and it is realistic.

[2]The interest rate used here is that which the Agricultural Bank of Greece charges for long-term loans to farmers.

alternatives (AVA during the first 3 years and during the third decade) are also considered with respect to the objective function coefficients of these activities to reflect the effects of unevenly distributed average value added.

The new tree requirements for labor and operating capital are considered equal to those of the corresponding old trees. This consideration overestimates the labor and capital requirements for the first 10 years, but it secures the workability of the optimum plan when the new trees come into full production.

iii. Feed Selling and Buying Activities

Feed buying was considered for all feedstuffs. The price for purchased feedstuffs was higher than the corresponding selling price (Appendix C, Table C-3).

All the required grain quantities can be purchased from the Agricultural Bank of Greece at prices lower than those of the free market. The grain quantity that a farmer can purchase from the Bank is not unlimited. It depends on the number of livestock owned by the farmer. A ceiling per animal quantity has been established by the Bank,[1] and the product of this ceiling quantity with the number of livestocks owned by the farmer defines the grain quantity that the farmer can purchase from the Bank. The ceiling per animal quantities established by the Bank are greater than the unit requirements for feeds in the zone. Therefore, farmers can theoretically purchase almost unlimited quantities of wheat, barley and corn.

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[1]Actually, these quantities are eatablished by the government.

Forages and straw can be purchased from neighboring regions (Skala, Kalamata, Sparta) at the reported acquisition prices. Since the zone's demand for these feeds is only a very small portion of the neighboring region's supply of forages and straw, the quantity that can be purchased is also considered unlimited.

Other types of feeds or various vitamins and minerals included in the ration of some stocks were taken into account in computing the average paid value for inflows.

Feed selling activities are considered only for wheat-barley, straw and hay, since corn and alfalfa are not produced in this zone.

The objective function coefficients of "feed selling activities" indicate the selling prices, while those of "feed buying activities" indicate the acquisition prices.

The "feed selling and buying activities are presented in Tableau II.

iv. Livestock Activities

The activities included are all the livestock enterprises operated in the zone.

Three cow and calf activities are included to reflect the three raising systems in the zone. The cow activities assume 70-85 percent calving rate and 16.6 percent of the cows are culled every year. The model, based on the zone's natural conditions, permits the cow replacement only by (1) raising replacement heifers or (2) purchasing from outside at the age of six minths. "Cows in herds" replacement is permitted only be raising home produced heifers. Raising calves[1] come

[1]Raising calves are those bulls and heifers 6-18 months old.

Tableau II: Feed Selling and Buying Activities (Zone I)

Row No.	Resources	Units	Feed Selling Activities			Feed Buying Activities				
			A_{12}	A_{13}	A_{14}	A_{15}	A_{16}	A_{17}	A_{18}	A_{19}
			SWB_1 kg	$SSTR_1$ kg	SH_1 kg	BWB_1 kg	$BSTR_1$ kg	BH_1 kg	$BCORN_1$ kg	$BALF_1$ kg
		C_j	2.5	.8	1.0	-2.7	-1.0	-1.2	-3.0	-2.1
9	WBC_1	kg	1			-1				
10	$STRC_1$	kg		1			-1			
11	HC_1	kg			1			-1		
12	$CORNC_1$	kg							-1	
13	$ALFC_1$	kg								-1
36	OPC_1	drs	-2.5	-.8	-1.0	2.7	1.0	1.2	3.0	2.1
43	CFC_1	drs	2.5	.8	1.0	-2.7	-1.0	-1.2	-3.0	-2.1

either from bulls and heifers produced in the zone or from purchased ones outside the zone at the age of six months. Bulls and heifers six months old are allowed to be sold because at this age they are transferred from cow activities to calf activities. Raising calves in herds come only from bulls and heifers produced in the zone.

According to the above considerations, the model permits the zone's specialization either in raising cows and producing calves (bulls and heifers) six months old, or in raising calves purchased from outside the zone. (This specilization is not permitted for "cattle in herds.")

The labor and feed requirements of calves six months old, as well as their value are included in the corresponding requirements and average value added by cow activities. Therefore, the cow activities imply the raising of calves up to six months old. The objective function coefficients of cow activities are calculated as follows:

$$C_j = AVA_j - VCAL6_j + VFIN_j$$

where:

C_j = Objective function coefficient of j^{th} cow activity.

AVA_j = Average value added by j^{th} cow activity (Appendix B, Table B-7).

$VCAL6_j$ = Value of calf six months old. It is calculated as the product of calving rate with the selling prices of calves (bulls and heifers) six months old.[1]

$VFIN_j$ = Value of feedstuffs included in the model; that is, value of forage, straw and grain quantity consumed by

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[1]The selling prices of bulls and heifers six months old are the same.

the unit of j^{th} cow activity. It is calculated as the sum of the products of unit requirements for feeds with the feed selling prices ($VFIN_j = \sum_i a_{ij} \cdot P_{si}$).

The objective function coefficients of "raising calves" activities[1] indicate the APVI decreased by the value of calves six months old and the value of unit requirements for forage, straw and grain:

$$C_j = APVI_j - VCAL6_j - VFIN_j$$

The objective function coefficients of the cow and the "raising calves" activities are presented in Tables 3.1 and 3.2. The unit requirements, as well as the objective function coefficients of the "raising replacement heifers" activities are the same as that of the "raising calves" activities.[2]

Table 3.1 Objective Function Coefficients of Cow Activities

Cow Activity	AVA	VCAL6 · (Calving rate) Drs	VFIN Drs	C_j Drs
Cow kept in barns	5,512.9	5,950.0	4,292.0	3,854.9
Cow kept in barns and pastured	3,970.1	4,800.0	1,526.0	696.1
Cow in herds	3,171.8	2,800.0	-	371.8

Source: Appendix B, Tables B-5, B-7 and Appendix C, Table C-3.

[1] "Raising calves" activities include raising bulls and heifers from six to eighteen months old.

[2] The heifer requirements for feed and labor are equal to that of bulls; this is due to the inadequacy of the records in providing separate estimates.

Table 3.2 Objective Function Coefficients of "Raising Calves" Activities

"Raising Calves" Activity	$APVI_j$	$VCAL6_j$	$VFIN_j$	C_j
Raising calves kept in barns	11,313.6	7,000.0	4,038.0	-275.6
Raising calves kept in barns and pastured	7,965.7	6,000.0	1,720.0	-245.7
Raising "calves in herds"	4,248.2	4,000.0	-	-248.2

Source: Appendix B, Tables B-5, B-7 and Appendix C, Table C-3.

According to the above consideration, the following additional activities are included:

-- Raise calves (bulls and heifers) from 6 to 18 months old kept in barns.

-- Raise calves (bulls and heifers) from 6 to 18 months old kept in barns and pastured.

-- Raise "calves (bulls and heifers) in herds" from 6 to 18 months old.

-- Sell calves (bulls and heifers 6 months old kept in barns.

-- Sell calves (bulls and heifers) 6 months old kept in barns and pastured.

-- Buy calves (bulls and heifers) 6 months old kept in barns.

-- Buy calves (bulls and heifers) 6 months old kept in barns and pastured.

-- Sell calves (bulls and heifers) 18 months old kept in barns.

-- Sell calves (bulls and heifers) 18 months old kept in barns and pastured.

-- Sell "calves (bulls and heifers) in herds" 18 months old.

-- Raise replacement heifers kept in barns.

-- Raise replacement heifers kept in barns and pastured.

-- Raise replacement "heifers in herds."

The objective function coefficients of the "selling and buying calves 6 months old" activities indicate the selling and acquisition prices of calves at this age (Appendix C, Table C-3), while those of the "selling calves 18 months old"indicate the corresponding AVP (Appendix B, Table B-3). Finally, a loss of 5.0 percent is accepted for the "raising calves" activities during the raising period.

Dual purpose sheep and goat herds are permitted. They produce milk and lamb meat that is highly preferred by Greek consumers. It is not permitted for the zone to be specialized in the production of only one of the two. Sheep and goat replacement is permitted only by raising home produced ewes-kids.

The objective function coefficients of "sheep and goat" and "hog" activities indicate the sum of AVA and the value of consumed quantities of forage and grain. The number of "domestic" sheep and goats raised by each farm family is not unlimited. It is assumed that the "domestic" sheep and goats per farm family cannot be 7 head or more. This assumption is real, since an increase in the number of "domestic" animals per farm family will result in the loss of the advantage of "domestic" (better feeding, care, etc.).

The number of beehives should also be restricted, since the zone's flower capacity is not unlimited. According to the existing technology and the zone's natural conditions, it is estimated that its beehive capacity is 18,000 hives. The unit requirements of

livestock activities for operating capital must be estimated to be equal to the APVI (Appendix B, Table B-7). This consideration overestimates the actual needs for operating capital, since a great portion of raising calves and utilized feedstuffs is produced in the same farm. To avoid this overestimation, the unit requirements for operating capital are estimated equal to the APVI minus the value of unit requirements for forage, straw and grain (the value of calves 6 months old is also subtracted from APVI of the "raising calves" activities). This consideration applied to the base year (1970) gives an estimate of needed operating capital that approaches the amount of short-term loans granted by the Bank to the farmers.

The needed long-term capital can be distinguished in two categories as follows:

(a) Long-term capital for livestock purchase if the zone's herds increase; calves (bulls and heifers) and hogs are not included becuase their purchase is covered by operating capital. The needs for this category of long-term capital will be examined in the next section "breeding stock decreasing and increasing activities."

(b) Long-term capital for livestock housing facilities. Assuming that the existent housing facilities in base year (1970) were sufficient for that year's livestock enterprises, the long-term capital needed is for the housing facilities of the increase in the zone's herds. Thus, the long-term capital needed for livestock housing facilities is:

$LTCSHF_j = (X_j - A_j) \cdot AVUF_j$, $j = 1,2....T$ = number of livestock enterprises,

where:

$LTCSHF_j$ = Long-term capital needed for housing facilities of the j^{th} livestock enterprise.

X_j = Level of j^{th} livestock enterprise in the optimum plan.

A_j = Level of j^{th} livestock enterprise in 1970.

$AVUF_j$ = Aquisition value of housing facilities needed per unit of j^{th} livestock enterprise.

Some facilities can be used for more than one livestock enterprise, while others are more specialized. According to that, the long-term capital needed for livestock housing facilities can be classified into four categories as follows:

-- Long-term capital for cattle housing facilities.

-- Long-term capital for hog and "domestic sheep and goats" housing facilities.

-- Long-term capital for housing facilities of "sheep and goats in flocks."

-- Long-term capital for beehive equipment.

The above calculation of long-term capital assumes that facilities freed by decreasing enterprises can be used by increasing ones in the same category. It also assumes that the facilities freed by reducing one enterprise in some farm can be used by the increase in the same enterprise in other farms. Generally, this consideration treats the whole zone as one unit that could reallocate the stock housing facilities without any additional payment in order to maximize its objective. This implied assumption is consistent with farmers' rationality; it is rational for the farmer to rent his facilities if he owns more than he needs. The paid rent is not inflows for the activity since its facilities are part of its resources. Under the zone's

social conditions, however, this assumption seems to be unrealistic for some enterprises; i.e. "domestic sheep and goats." An additional implied assumption is that the "flow value" of the new acquired housing facilities is equal to that of the existent ones. This is not unrealistic under the constant technology assumption.

The acquisition value of housing facilities needed for a unit of livestock enterprises is estimated as follows:[1]

Cow kept in barns	4,500 drs
Cow kept in barns and pastured	3,200
Cow "in herds"	1,500
Cavles kept in barns[2]	3,500
Calves kept in barns and pastured[2]	2,200
Calves "in herds"[2]	1,500
Domestic sheep and goats	600
Sheep and goats "in flocks"	400
Hog	700
Beehive	100

The livestock activities are presented in Tableau III.

v. Breeding Stock Decreasing and Increasing Activities

Breeding stock decreasing and increasing activities were included for any livestock enterprise.

The level of livestock activities in the optimum plan can be written:

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[1] These estimates, based on both zone's conditions (farm size, etc.) and on the constant technology assumption, are developed from data collected by the writer in 1970.

[2] Replacement heifers are also included.

Tableau III: Livestock Activities (Zone I)

Row No.	Resources	Units	Livestock Activities						
			A_{20}	A_{21}	A_{22}	A_{23}	A_{24}	A_{25}	A_{26}
			SGD_1 head	SGF_1 head	CWB_1 head	$CWBP_1$ head	CWH_1 head	$RCALB_1$ head	$RCALBP_1$ head
		C_j	847.8	590.5	3,854.9	696.1	371.8	-275.6	-245.7
9	WBC_1	kg	15.0	12.0		180.0			
10	$STRC_1$	kg				200.0			200.0
11	HC_1	kg	28.0	21.0	354.0	580.0		210.0	580.0
12	$CORNC_1$	kg	6.0		680.0	120.0		840.0	350.0
13	$ALFC_1$	kg			1,130.0			820.0	
14	GAC_1	str	2.0	6.0		11.0	12.0		8.0
15	$CALB_1$	head			-.85			1	
16	$CALBP_1$	head				-.80			1
17	$CALH_1$	head					-.70		
18	$CALB18_1$	head						-.95	
19	$CALBP18_1$	head							-.95
20	$CALH18_1$	head							
21	HRB_1	head			.166				
22	$HRBP_1$	head				.166			
23	HPH_1	head					.166		
24	$SGDC_1$	head	1						
25	$SGFC_1$	head		1					
26	$CWBC_1$	head			1				
27	$CWBPC_1$	head				1			
28	$CWHC_1$	head					1		
29	$BHVC_1$	head							
30	$CSGD_1$	head	1						
31	$CBHV_1$	hives							
32	SPL_1	days	.8	.6	3.9	1.8	.4	2.8	1.8
33	SL_1	days	.6	.5	3.4	.8	.3	2.7	.4
34	FL_1	days	.8	.6	3.9	.8	.4	2.8	.4
35	WL_1	dayd	1.5	1.4	4.9	3.2	.8	3.3	2.7
36	OPC_1	drs	30.0	20.2	1,001.8	400.4	375.2	275.6	245.7
39	$LTCCHF_1$	drs			4,500.0	3,200.0	1,500.0	3,500.0	2,200.0
40	$LTCDHF_1$	drs	600.0						
41	$LTCSGFHF_1$	drs		400.0					
42	$LTCBHV_1$	drs							
43	CFC_1	drs	847.8	590.5	3,854.9	696.1	371.8	-275.6	-245.7

Tableau III: (Continued)

Row No.	Resources	Units	Livestock Activities						
			A_{27}	A_{28}	A_{29}	A_{30}	A_{31}	A_{32}	A_{33}
			$RCALH_1$ head	$SCAL6B_1$ head	$SCAL6BP_1$ head	$BCAL6B_1$ head	$BCAL6BP_1$ head	$SCAL18B_1$ head	$SCAL18BP_1$ head
		C_j	-248.2	7,000.0	6,000.0	-7,300.0	-6,200.0	12,714.3	9,124.3
9	WBC_1	kg							
10	$STRC_1$	kg							
11	HC_1	kg							
12	$CORNC_1$	kg							
13	$ALFC_1$	kg							
14	GAC_1	str	9.0						
15	$CALB_1$	head		1		-1			
16	$CALBP_1$	head			1		-1		
17	$CALH_1$	head	1						
18	$CALB18_1$	head						1	
19	$CALBP18_1$	head							1
20	$CALH18_1$	head	-.95						
21	HRB_1	head							
22	$HRBP_1$	head							
23	HPH_1	head							
24	$SGDC_1$	head							
25	$SGFC_1$	head							
26	$CWBC_1$	head							
27	$CWBPC_1$	head							
28	$CWHC_1$	head							
29	$BHVC_1$	head							
30	$CSGD_1$	head							
31	$CBHV_1$	hives							
32	SPL_1	days	.4						
33	SL_1	days	.3						
34	FL_1	days	.3						
35	WL_1	days	.8						
36	OPC_1	drs	248.2	-7,000.0	-6,000.0	7,300.0	6,200.0		
39	$LTCCHF_1$	drs	1,500.0						
40	$LTCDHF_1$	drs							
41	$LTCSGFHF_1$	drs							
42	$LTCBHV_1$	drs							
43	CFC_1	drs	-248.2	7,000.0	6,000.0	-7,300.0	-6,200.0		

Tableau III: (Continued)

Row No.	Resources	Units	Livestock Activities					
			A_{34}	A_{35}	A_{36}	A_{37}	A_{38}	A_{39}
			$SCAL18H_1$ head	$RRHB_1$ head	$RRHBP_1$ head	$RRHH_1$ head	HG_1 head	BHV_1 hives
		C_j	5,742.3	-275.6	-245.7	-248.2	502.8	150.4
9	WBC_1	kg					45.0	
10	$STRC_1$	kg			200.0			
11	HC_1	kg		210.0	580.0			
12	$CORNC_1$	kg		840.0	350.0		24.0	
13	$ALFC_1$	kg		820.0				
14	GAC_1	str			8.0	9.0		
15	$CALB_1$	head		1				
16	$CALBP_1$	head			1			
17	$CALH_1$	head				1		
18	$CALB18_1$	head						
19	$CALBP18_1$	head						
20	$CALH18_1$	head	1					
21	HRB_1	head		-1				
22	$HRBP_1$	head			-1			
23	HPH_1	head				-1		
24	$SGDC_1$	head						
25	$SGFC_1$	head						
26	$CWBC_1$	head						
27	$CWBPC_1$	head						
28	$CWHC_1$	head						
29	$BHVC_1$	head						1
30	$CSGD_1$	head						
31	$CBHV_1$	hives						1
32	SPL_1	days		2.8	1.8	.4	1.4	
33	SL_1	days		2.7	.4	.3	1.1	
34	FL_1	days		2.8	.4	.3	1.5	
35	WL_1	days		3.3	2.7	.8	.5	
36	OPC_1	drs		275.6	245.7	248.2	392.5	25.6
39	$LTCCHF_1$	drs		3,500.0	2,200.0	1,500.0		
40	$LTCDHF_1$	drs					700.0	
41	$LTCSGFHF_1$	drs						
42	$LTCBHV_1$	drs						100.0
43	CFC_1	drs	5,742.3	-275.6	-245.7	-248.2	502.8	150.4

$$X_j = A_j - DA_j + IA_j \quad \text{or} \quad X_j + DA_j - IA_j = A_j$$

where:

Xj = Level of j^{th} livestock activity in the optimum plan.

DA_j = Decrease in j^{th} livestock activity.

IA_j = Increase in j^{th} livestock activity.

A_j = Level of j^{th} livestock activity in 1970.

The value of increase in the size of the zone's herds represents the demand of the zone for "long-term capital for livestock purchases." It is equal to the product of the increase in the herd size with the acquisition prices of breeding stocks. The value of the decrease in the zone's herd size and the borrowed long-term capital of this category represent the supply of "long-term capital for livestock purchases." Therefore, the zone's needs for "long-term capital for livestock purchases" are:

$$-\sum_j DA_j \cdot P_{sj} + \sum_j IA_j \cdot P_{aq.j} - BLTCSP \leq 0 \quad j = j,2,3,\ldots t-4$$

where: P_{sj} and $P_{aq.j}$ represent the j^{th} breeding stock selling and acquisition price respectively, while BLTCSP represents the borrowed long-term capital for livestock purchases.

This consideration implies the same assumptions as those made in the calculation of long-term capital for livestock housing facilities. The objective function coefficients of breeding stock decreasing activities indicate the annual interest rate that a savings account pays. The value added by one unit increase in the zone's livestock activities is equal to that of the existent units minus the durable capital cost, because it is not included in the reported records of APVI. Therefore, the objective function coefficients of

"breeding stock increasing" activities indicate the increase in average paid value for inflows (this increase is calculated with respect to the APVI of the livestocks existing in 1970). These coefficients, calculated on the basis of PV analysis, are presented in Table 3.3.

Table 3.3 Objective Function Coefficients of "Breeding Stock Increasing" Activities

"Breeding Stock Increasing" Activity	Acquisition Value (drs)	Salvage Value (drs)	PV of Salvage Value (6 years, 4%)	(2)-(4)	C_j
(1)	(2)	(3)	(4)	(5)	(6)
Domestic sheep and goats	500.0	450.0	365.34	234.66	44.77
Sheep and goats "in flocks"	400.0	350.0	276.6	123.4	23.54
Cow kept in barns	10,000.0	7,000.0	5,532.1	4,467.9	852.31
Cow kept in barns and pastured	8,000.0	6,000.0	4,741.8	3,258.2	621.55
Cow "in herds"	6,000.0	4,500.0	3,656.35	2,443.65	466.16
Behive	400.0	150.0	118.55	281.46	53.69

The "breeding stock decreasing and increasing" activities are presented in Tableau IV.

vi. Sell and Hire Labor Activities

Labor hiring activities were included for every season during the year. The labor available to be hired is considered unlimited for all seasons. This consideration is realistic, since the

Tableau IV: "Breeding Stock Decreasing and Increasing" Activities (Zone I)

Row No.	Resources	Units	Breeding Stock Decreasing Activities						Breeding Stock Increasing Activities					
			A_{40}	A_{41}	A_{42}	A_{43}	A_{44}	A_{45}	A_{46}	A_{47}	A_{48}	A_{49}	A_{50}	A_{51}
			$DSGD_1$ head	$DSGF_1$ head	$DCWB_1$ head	$DCWBP_1$ head	$DCWH_1$ head	$DBHV_1$ hives	$ISGD_1$ head	$ISGF_1$ head	$ICWB_1$ head	$ICWBP_1$ head	$ICWH_1$ head	$IBHV_1$ hives
		C_j	.0525	.0525	.0525	.0525	.0525	.0525	-44.77	-23.54	-852.31	-621.55	-466.16	-53.69
24	$SGDC_1$	head	1						-1					
25	$SGFC_1$	head		1						-1				
26	$CWBC_1$	head			1						-1			
27	$CWBPC_1$	head				1						-1		
28	$CWHC_1$	head					1						-1	
29	$BHVC_1$	hives						1						-1
38	$LTCSP_1$	drs	-570.0	-380.0	-9,600.0	-7,600.0	-5,300.0	-350.0	600.0	400.0	10,000.0	8,000.0	6,000.0	4,000.0
43	CFC_1	drs	.0525	.0525	.0525	.0525	.0525	.0525						

unemployment level in the second zone and in the other neighboring mountainous regions was very high.

With respect to the "sell labor" activities, two alternatives were considered as follows:

(a) The labor that could be sold during any season is considered unlimited.

Since the opportunities for home employment outside the zone's farm sector were very limited (almost non-existent), "labor sale" implies the movement of the worker either to other regions or to the bigger urban and industrial centers. This movement usually results in permanent settlement of the worker and his family at the new work place. Seasonal movements of the workers, very unusual in the region, are not permitted. Therefore, the selling of one's labor means the migration of his whole family. This consideration permits the zone's depopulation, since it takes into account the labor efficiency. According to this consideration the number of zone's farm families becomes a function of the level of "sell labor" activities:

$$FF = FF_{1970} - \frac{SL_s}{SLFF_s} \quad , \quad s = 1,2,3,4$$

where:

FF = Number of zone's farm families estimated by the model.

FF_{1970} = Number of zone's farm families in 1970.

SL_s = Labor sold (man-workdays) during the s^{th} season.

$SLFF_s$ = Average labor supplied (man-workdays) by the zone's farm families during the s^{th} season.

The average labor supplied by each farm family is calculated as follows:

$$SLFF_s = \frac{AVL_s}{FF_{1970}} \quad , \quad s = 1,2,3,4$$

where:

AVL_s = Available labor (Table (1.6) during the s^{th} season.

Since the model does not permit the seasonal movements of the workers, the labor sold must be provided only by the families moving outside the region. Therefore, a relationship among the "sell labor" activities should be established. This relationship is:

$$\frac{SSPL}{SLFF_{sp}} = \frac{SSL}{SLFF_s} = \frac{SLF}{SLFF_f} = \frac{SWL}{SLFF_w}$$

where: SSPL, SSL, SFL, SWL are labor sold during the spring, summer, fall and winter, respectively, and $SLFF_{sp}$, $SLFF_s$, $SLFF_f$, $SLFF_w$ are average labor supplied by the zone's farm families during the spring, summer, fall and winter, respectively.

The average labor supplied by the zone's farm families is presented in Table 3.4

Table 3.4 Average Labor Supplied by the Zone's Farm Family

Season	Available Labor in the Zone in 1970 (Thousand Man-workdays)	Zone's Farm Families in 1970	Average Labor Supplied by the Zone's Farm Family (Man-workdays)
Spring	138.2	1,607	86.00
Summer	160.5	1,607	99.88
Fall	138.2	1,607	86.00
Winter	120.3	1,607	74.86
Year	557.2	1,607	346.73

Source: Table 1.6; Appendix A, Table A-7

This consideration will provide an estimate of the farm families that will remain in the zone, if the labor sale is possible at the accepted wage rates. Thus, the degree of expected depopulation can be estimated.

(b) Labor sale is not permitted; that is, the "sell labor" activities are omitted.

This assumption is considered to reflect the effects of the constant population on the optimum plan of farm production.[1] Under this assumption, the optimum plan provides the maximum per capita income that could be achieved by the reallocation of the existent resources.

The above two assumptions about the "sell labor" activities reflect the two extreme cases; first, the labor is considered as absolutely variable resource, and second, it is considered as an infinitely fixed resource. Both are realistic. The first one approaches reality, when the possibilities for employment throughout the country are taken into consideration. The second is realistic, if the employment consideration is confined only within the zone. In both circumstances home employment outside the zone's farm sector is assumed constant.

The wage rates during any season are presented in Appendix C, Table C-3. The "sell and hire labor" activities are presented in Tableau V.

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[1] It actually reflects the assumption of a constantly active farm population.

Tableau V: Sell and Hire Labor Activities and Capital Borrowing Activities (Zone I)

Row No.	Resources	Units	Sell Labor Activities[a]				Hire Labor Activities				Capital Borrowing Activities						
			A_{52}	A_{53}	A_{54}	A_{55}	A_{56}	A_{57}	A_{58}	A_{59}	A_{60}	A_{61}	A_{62}	A_{63}	A_{64}	A_{65}	A_{66}
			$SSPL_1$ days	SSL_1 days	SFL_1 days	SWL_1 days	$HSPL_1$ days	HSL_1 days	SFL_1 days	HWL_1 days	$BOPC_1$ drs	$BLTCTP_1$ drs	$BLTCSP_1$ drs	$BLTCCHF_1$ drs	$BLTCDHF_1$ drs	$BLTCFHF_1$ drs	$BLTCBHV_1$ drs
		C_j	180.0	160.0	180.0	180.0	-200.0	-190.0	-200.0	-200.0	-.04	-.0505	-.04	-.0578	-.0736	-.0736	-.1908
30	$CSGD_1$	head	.06977														
32	SPL_1	days	1				-1										
33	SL_1	days		1				-1									
34	FL_1	days			1				-1								
35	WL_1	days				1				-1							
36	OPC_1	drs					200.0	190.0	200.0	200.0	-1						
37	$LTCNTP_1$	drs										-1					
38	$LTCSP_1$	drs											-1				
39	$LTCCHF_1$	drs												-1			
40	$LTCDHF_1$	drs													-1		
41	$LTC5GFHF_1$	drs														-1	
42	$LTCBHV_1$	drs															-1
43	CFC_1	drs	348.84				-200.0	-190.0	-200.0	-200.0	-.04	-.1066	-.1908	-.1233	-.1233	-.1233	-.1908
44	$SPSLR_1$	days	1	-.8607													
45	$SFLR_1$	days		1	-1.1618												
46	$FWLR_1$	days			1	-1.1486											

[a]It is omitted when "sell labor" is not permitted.

vii. Capital Borrowing Activities

The needed capital was divided into two broad categories: operating capital and long-term capital.

The long-term capital is further subdivided into six categories based on the type of improvement to be financed.

The livestock sector demand for operating capital have been discussed in detail in the section "livestock activities" (pg. 42). The crop and tree requirements for operating capital are considered equal to their APVI (Appendix B, Table B-7). The "olive groves for oil" requirements for operating capital are calculated as follows:

OPCUR = APVI - .1.TVP

where:

OPCUR = "Olive groves for oil" unit requirements for operating capital.

This calculation was adopted because a portion of APVI of this enterprise represents the "oil extraction" payment, which is paid at the end of the production process. These "oil extraction" dues amount to 10.0 percent of TVP.

The supply of operating capital is the short-term loans the Agricultural Bank of Greece grants to farmers. These loans are charged with an annual interest rate of 4-5 percent and their repayment period ranges from 6 to 12 months, depending on the time that the production process requires.[1] The amount of loans the farmers can receive from the Bank is not unlimited, but it is subjected to the Bank's rules.

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[1]The charged interest rate was 4.0 percent for the farmers who are members of farmer cooperatives and 5.0 percent for non-members. Since the most of the farmers have joined the farmer cooperatives, the interest rate of 4.0 percent was adopted. One year time is adopted here.

These rules dealing mainly with the security of loans are not too strict, since the security requirements can be easily satisfied. Actually, the Bank covers any actual need of "small" and "dwarf" farms for capital, since a relatively large amount (100,000 drs) of loans is granted without any collateral security.

The capital generated during the year by selling of feeds and calves six months old is another source of operating capital. Thus, the "borrowing operating capital" can be written:

$$\sum_{j=1}^{n} a_{opc.j} \cdot X_j - \sum_{i=1}^{n} P_{si} \cdot B_{si} - \sum_{p=1}^{m} P_{sp} \cdot Q_p - BOPC = 0$$

where:

$a_{op.j}$ = Unit requirement of j^{th} activity for operating capital.

P_{si} and P_{sp} = Selling price of i^{th} resource and p^{th} product respectively.

B_i, Q_p = Units of i^{th} resource and p^{th} product sold outside the zone's farm sector. (The value of sold labor is not included when the labor sale implies depopulation.)

BOPC = Amount of operating capital to be borrowed.

The objective function coefficient of "borrowing operating capital" activity indicates the annual interest rate (4.0 percent) that the Bank charges for short-term loans to farmers. The livestock sector demand for long-term capital was discussed in detail in the section "breeding stock decreasing and increasing" activities (pg. 48). The demand of crops and trees for long-term capital is estimated equal to the planting cost of new trees. This cost (per unit of

activity) is presented in Appendix C, Table C-1 (ft. 1C).

The supply of long-term capital is represented by the medium/long-term loans the Agricultural Bank of Greece grants to farmers for various improvements. These loans are charged with an annual interest rate of 4.0 percent and their repayment period ranges from 3 to 20 years. As was mentioned in the case of operating capital, the amount of medium/long-term loans the farmer can make in the Bank is defined by the Bank's security rules. The security requirements for this type of loan usually include collateral security or mortage, but the value of the financed improvement is usually taken into account in the calculation of the property value. The decision on whether a loan will be granted or not is essentially based on the farmer's repayment capacity. Generally, it is safe to say that improvements that are considered as necessary for the region's development or for the farm's operation are usually financed.

The "borrowing long-term capital" activities included were the six categories that this type of capital is classified into. The objective function coefficients of these activities, except that of long-term capital for livestock purchase, indicate the capital cost calculated on the basis of PV analysis:

$$ULTCC_a = \frac{r}{1 - \frac{1}{(1 + r)^L}} \quad , \quad a = 1,2....5$$

where:

$ULTCC_a$ = The annual cost per unit of the a^{th} category long-term capital.

r = Interest rate (an interest rate of 4.0 percent is adopted).

L = Number of years the financed improvement lasts.

With respect to the assigned values of L, the study, based on the assumption that the farmer's horizon is limited to 40 years, adopts this value of L in the calculation of the cost of borrowed long-term capital for new trees. The values of L used in the cost calculation of the other categories of long-term capital are:

Long-term capital for cattle housing facilities:	30 years
Long-term capital for hog and "domestic sheep and goats" housing facilities:	20 years
Long-term capital for housing facilities of sheep and goats "in flocks":	20 years
Long-term capital for beehive equipment:	6 years

The objective function coefficient of the "borrowing long-term capital for livestock purchase" activity indicates the annual interest rate (4.0 percent) that the Bank charges for this loan category, because of the other items of capital cost are included in the coefficients of "breeding stock increasing" activities.

The short-term (operating) capital supplied by the Bank is considered unrestricted, whereas the long-term one is limited to the repayment capacity of the zone's farmers. The repayment capacity of the zone's farmers is defined as the amount of farm income above their family living expenses. According to the zone's economic conditions, it is estimated that the per family living expenses amount to 30,000 drs.

Therefore, the amount of long-term loans that the farmers could make in the Bank is:

$$\sum_{j=1}^{n} AVA_j \cdot X_j + \sum_{i=1}^{m} P_{si} b_s - \sum_{i=1}^{m} P_{aq.i} b_{aq.i} - \sum_{k} APLTC_k \geq (\text{farm families}) \cdot (30{,}000),\ k = 1,2....6$$

where:

$APLTC_k$ = Annual payments of k^{th} category long-term loan.

The repayment period for each category of long-term loans is as follows:

Long-term loans for livestock purchase:	6 years
Long-term loans for livestock housing facilities:	10 years
Long-term loans for tree planting:	12 years
Long term loans for beehive equipment:	6 years

It must be noted that the number of zone's farm families is not constant when the labor sale is permitted.

a2. Resource Availability and Restrictions

The resources existing during the base year (1970) are used. Some restrictions are imposed upon the use of land according to its suitability. Transfer rows are also included to "provide a vehicle whereby the services or output of one activity may be transferred in the model to another activity."[1]

The resource levels and the imposed restrictions are presented in Table 3.5 and discussed below:

(i) Farm Land: The sum of agricultural land and grazing areas is characterized as farm land. The farm land area is assumed constant in the base year level.

(ii) Agricultural Land: The sum of "fallow" land and crop-tree land is characterized as agricultural land. Some tree activities

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[1] R.R. Beneke and R. Winterboer, "Linear Programming Applications to Agriculture," (Ames, Iowa: Iowa State University Press, 1973), p.38

Table 3.5 Available Resources and Restriction in the First Zone

Row No.	Resources	Units	Level
1	Farm land	str[a]	252,800
2	Agricultural land	str	70,600
3	Irrigated land	str	120
4	Land for wheat-barley growing[b]	str	500
5	Land for hay growing and for new tree planting	str	4,000
6	Old olive groves for oil	str	57,300
7	Old almond trees	str	700
8	Grazing areas	str	192,200
24	Domestic sheep and goats	head	4,127
25	Sheep and goats in flocks	head	5,983
26	Cow kept in barns	head	15
27	Cow kept in barns and pastured	head	1,034
28	Cow "in herds"	head	481
29	Beehives	hives	7,149
30	Zone's capacity for domestic sheep and goats	head	9,642
31	Zone's beehive capacity	hives	18,000
32	Spring labor	days	134,000
33	Summer labor	days	151,100
34	Fall labor	days	138,200
35	Winter labor	days	120,300
36	Operating capital	drs[c]	u[d]

[a] 4.047 str = 1 acre

[b] It is included in the land for hay growing and for new tree planting.

[c] 30 drs = $1.00

[d] unrestricted

were omitted because they were not considered important enough under the zone's conditions. The agricultural land area is reduced by the area covered by the omitted tree activities.

(iii) Irrigated Land: The irrigated land in base year is used.

(iv) Land for Wheat-Barley Growing: It represents the part of crop land that is suitable for wheat-barley growing.

(v) Land for Hay Growing and for New Tree Planting: It represents a restriction imposed on the use of land due to the zone's natural conditions.

(vi) Grazing Areas: The land covered by the omitted tree activities is transferred to grazing areas. The level of grazing areas is not allowed to be less than that during the base year. Expansion of grazing areas is permitted through the reduction to the agricultural land level.

(vii) Labor: The available labor in the zone is estimated equal to that which can be supplied from the zone's farm population (Table 1.6). Home employment outside the zone's farm sector is assumed constant. Therefore, the supply of labor in any season during the year is equal to the available labor in the same season minus home employment outside the zone's farm sector in the corresponding season.

(viii) Capital: The operating capital is considered unrestricted, while the supply of long-term capital is limited only by the farmer's repayment capacity.

b. The Structure of the Linear Programming Model for Zone II

b1. Model Activities

The activities included are those considered as the most important for the zone. Activities with a small share in the total value added by the zone's farm sector are excluded. The possibilities of developing some new activities (enterprises), by expanding the irrigated land, and the restrictions on the use of land imposed by the existing crop and tree pattern and by the physical environment are also taken into account in the model's structure.

Eight general types of activities were included:

(1) Irrigated land activities (A_1 - A_7)

(2) Crop and tree activities (A_8 - A_{20})

(3) Tree expansion and reduction activities (A_{21} - A_{25})

(4) Feed selling and buying activities (A_{27} - A_{36})

(5) Livestock activities (A_{37} - A_{51})

(6) Breeding stock decreasing and increasing activities (A_{52} - A_{59})

(7) Sell and hire labor activities (A_{60} - A_{67})

(8) Capital borrowing activities (A_{58} - A_{76})

i. Irrigated Land Activities

As it was mentioned in Chapter I, water is a primary and limiting factor for the region's agriclutural development. Therefore, any possibility for expansion of irrigated land must be considered and investigated.

In the south part of the zone there are underground water resources that are partly utilized. In addition, the water of the

torrential streams exists. These water resources could be utilized for irrigation by making some small and large-scale improvements.

According to the preliminary studies and the writer's personal estimations, the zone's irrigated land could be expanded as follows:

(a) An increase by 2,750 str could be achieved by small-scale irrigation projects (wells), that are usually made by individual farmers. The per unit (stremma) cost of this type of improvements is estimated[1] at 1,500 drs. The use of this area in the base year (1970) was as follows:

Annual crops: 870 str

Olive groves for edible olive: 720 str

Olive groves for oil: 680 str

Miscellaneous fruit trees (mainly fig trees): 480 str

This type (small-scale) of irrigation improvement can be financed by Agricultural Bank of Greece. The interest rate that the Bank would charge on this medium-term loan category is 2-4 percent.[2]

(b) An additional increase by 4,300 str could be achieved by small and large-scale irrigation improvements (Artesian wells drilled by groups of farmers, a dam near to "Platanos" village etc.). The per unit (stremma) cost of this expansion of irrigated land is estimated[3] at 4,100 drs. The use of this area in the base year (1970)

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[1]The area could be irrigated and the per unit cost are estimates of the writer. They are based on the zone's conditions.

[2]The loans in this category of less than 50,000 drs are charged with interest rate of 2.0 percent. Loans that are more than 50,000 drs are charged with the 2.0 percent for the portion of up to 50,000 drs, and 4.0 percent for the portion beyond 50,000 drs. The interest rate of 2.0 percent is accepted because most of these loans are less than 50,000 drs.

[3]The estimates of cost and area that could be irrigated were

was as follows:

Annual crops: 730 str

Olive groves for edible olive: 1,060 str

Olive groves for oil: 2,510 str

This type of improvement, characterized as large-scale irrigation projects, cannot be financed by the Agricultural Bank of Greece. The only source of this type of capital is the Government Public Investment Budget. It is assumed[1] that the cost of this capital is 3.0 percent.

(c) A furthermore expansion of 15,950 str could be achieved by constructing a dam in the "Sminos" torrent (near the village of "Archontico"). This improvement could additionally irrigate both previously mentioned areas. By constructing this dam the zone's total irrigated area would expand to 31,260 str. The total cost of this improvement would be approximately[2] 186.0 million drachmas. The use of this area in the base year (1970) was as follows:

Olive groves for edible olive: 630 str

Olive groves for oil: 14,080 str

Miscellaneous fruit trees (mainly fig trees): 1,240 str

The possible financial source for this improvement and the capital cost are the same as for the case (b). Given that an area of

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developed from the writer's records and from data provided by the local Division of Agriculture in 1970.

[1]Actually, the government does not charge these funds with interest rate. The farmers are obliged to pay only the operation and maintenance cost of the improvement. The reported cost is an estimate of these expenses.

[2]The area could be irrigated and the total cost derived from records provided by the local Division of Agriculture in 1970.

8,260 str was irrigated in 1970, the possible levels of irrigated land and the total cost of these levels are presented in Table 3.6.

Table 3.6 Possible Levels of Irrigated Land and Their Total Cost

No.	Improvement	Possible Levels of Irrigated Land str	Total Cost Million drs
1	None	8,260	0
2	Small-scale irrigation improvements	11,010	4.125
3	Small and large-scale irrigation improvements	12,560	17.63
4	Both No. 2 and No. 3	15,310	21.755
5	Large-scale irrigation improvements	31,260	186.00

This table indicates that the cost of transforming non-irrigated land into irrigated increases as the area of irrigated land increases. Thus, the irrigation total cost is not a linear function of irrigated area, but it is a convex one. Since the irrigation cost affects the value added by the irrigated crops and trees, the objective function to be maximized will not be linear, but it will be concave. Therefore, a non linear programming problem arises. It can be treated as a separable programming problem. The technique applied to these problems is "to construct a constrained optimization model that linearly approximates the original problem."[1] To construct this model,

[1] H.M. Wagner: "Principal of Operation Research with Applications to Managerial Decision" 2nd edition (Prentice Hall Inc., New Jersey, 1975) p. 562.

the bounds (lower and upper) of the variable (irrigated land) must be defined and a set of grid values must be construced, such that:

$$\text{Lower bound} \equiv IL_1 < IL_2 < IL_3 < IL_4 < IL_5 \equiv \text{Upper bound}$$

Then, the variable (irrigated land) is expressed in terms of a weighted average of the grid values:[1]

$IL = \lambda_1 IL_1 + \lambda_2 IL_2 + \lambda_3 IL_3 + \lambda_4 IL_4 + \lambda_5 IL_5$ where the weights must satisfy:

$$\sum_{j=1}^{5} \lambda_j = 1 \text{ and } \lambda_j \geq o \text{ for } j = 1,2....5$$

The grid of values in the problem under study will consist of five possible levels of irrigated land. Thus, the irrigated land can be written:

$$IL = 8{,}260\lambda_1 + 11{,}010\lambda_2 + 12{,}560\lambda_3 + 15{,}310\lambda_4 + 31{,}260\lambda_5$$

Therefore, the "irrigate land" activities considered are the five possible levels of irrigated land.

The objective function coefficients (cj) of these activities indicate the increase in PVI relatively to that of the existing irrigated land. These coefficients are presented in Table 3.7.

Table 3.7 Objective Function Coefficients of "Irrigated Land" Activities

"Irrigated Land" Activities	Objective Function Coefficients (drs)
Irrigated land 8,260 str (λ1)	0
Irrigated land 11,010 str (λ2)	307,783.67
Irrigated land 12,560 str (λ3)	528,900.0
Irrigated land 15,310 str (λ4)	836,683.67
Irrigated land 31,260 str (λ5)	5,580,000.0

[1] Ibid.

The calculation of the above coefficients are as follows:

- Irrigated land 11,010 str (λ_2)

Each irrigation improvement of this category consists of two components: well digging or drilling and equipment purchasing. It is estimated that these two components contribute equally to the total cost of the irrigation improvement. The durable capital cost, for the first component, is allocated over forty years.[1] A lifetime of 10 years and a salvage value equal to 20.0 percent of the acquisition value is accepted for irrigating equipment.

- Irrigated land 12,560 str (λ_3)

The operation and maintenance cost of the improvements is considered to be the increase in the paid value of inflows.

- Irrigated land 15,310 str (λ_4)

It is equal to the sum of two previous coefficients.

- Irrigated land 31,260 str (λ_5)

It is calculated in the same way as that of λ_3.

The fact that some of the land could be irrigated is occupied by trees, imposes certain restrictions on its use. Changes in the crop and tree pattern are imposed on the areas covered by "miscellaneous fruit trees," whereas this change is not permitted for areas occupied by olive groves. This restriction makes necessary the consideration of the following additional activities:

- Irrigated old olive groves for edible olive.
- Irrigated old olive groves for oil.

The average value added by these activities and their unit

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[1] It is based on the assumption that the farmer's horizon is bounded to 40 years.

requirements for labor and operating capital are presented in Table 3.8.

Table 3.8 Unit Requirements and Average Value Added by "Irrigated Olive Groves"[a] Activities

"Irrigated Olive Groves" Activities	AVP Drs	AVPI Drs	AVA Drs	Unit Requirements				
				Oper. Cap. Drs.	Spring Labor Days	Summer Labor Days	Fall Labor Days	Winter Labor Days
Olive groves for edible olives	2,100.0	590.0	1,510.0	590.0	1.1	1.8	1.6	1.4
Olive groves for oil	1,500.0	460.0	1,040.0	310.0	.9	1.4	1.0	2.0

[a]These esitmates developed from records of neighboring regions, since this type of activity did not exist in the region under study.

The "irrigated land" activities are presented in Tableau VI.

ii. Crop and Tree Activities

Crop and tree activities are considered for all of the zone's crops and trees during the base year, except "miscellaneous fruit trees," which are omitted.

Vegetables (grown in greenhouse and outdoors), corn, alfalfa, cotton and orange trees are allowed only on irrigated land, while the remaining crops and trees are allowed on non-irrigated land. Expansion of grazing areas is permitted through reduction to the agricultural land area. The increase in the area of the greehouse vegetables requires the construction of new greenhouses. The per

Tableau VI: Irrigated Land Activities (Zone II)

Row No.	Resources	Units	Irrigated Land Activities						
			A_1	A_2	A_3	A_4	A_5	A_6	A_7
			λ_1	λ_2	λ_3	λ_4	λ_5	$IOGED_2$ str	$IOGO_2$ str
		C_j	-	-307.783.67	-528,900.0	-836,683.67	-5,580.000.0	1,510.0	1,040.0
1	FRL_2	str						1	1
2	AL_2	str						1	1
3	IL_2	str	-8,260.0	-11,010.0	-12,560.0	-15,310.0	-31,260.0	1	1
5	OGO_2	str							1
6	$OGED_2$	str						1	
7	$IOGO_2$	str		-680.0	-2,510.0	-3,190.0	-17,370.0		1
8	$IOGED_2$	str		-720.0	-1,060.0	-1,780.0	-2,410.0	1	
29	SPL_2	days						1.1	.9
30	SL_2	days						1.8	1.4
31	FL_2	days						1.6	1.0
32	WL_2	days						1.4	2.0
33	OPC_2	drs						590.0	310.0
34	$LTLIR_2$	drs		4,125,000.0		4,125,000.0			
35	$LTCPIB_2$	Mdrs[a]			17.63	17.63	186.0		
42	CFC_2	drs			-528,900.0	-528,900.0	-5,580,000.0	1,510.0	1,040.0
43	SPR_2	-	1	1	1	1	1		

[a]Million drachmas.

unit (stremma) construction cost of greenhouse is estimated at 13,500.0 drs. The land freed by abandoning trees could be used either for growing crops and trees, or for grazing. The area covered by the omitted tree enterprise "miscellaneous fruit trees" is included in the agricultural land area. It implies that this area could also be used either for growing crops and trees, or for grazing.

The objective function coefficient of feed growing activities indicate the APVI. The crop and tree requirements for operating capital are estimated in the same manner as in the model for the Zone I.

The crop and tree activities are presented in Tableau VII.

iii. Tree Expansion and Reduction Activities

"Tree Reduction" activity is considered only for olive groves for oil. "Tree Expansion" activities are included for all tree activities under consideration. In addition, irrigated new olive groves for edible olive are included. The reduction of olive groves for edible olive and the orange trees is not allowed. The land freed by abandoning olive groves could be used either for growing crops and trees, or for grazing.

The objective function coefficients of new tree activities indicate their AVA (Appendix C, Table C-2), calculated in the same way as in the model for the Zone I. The additional alternatives (AVA during the first 3 years and during the third decade) are also considered with respect to the objective function coefficients of these activities to reflect the effects of non-uniform distribution of

Tableau VII: Crop and Tree Activities and Tree Expansion and Reduction Activities (Zone II)

Row No.	Resources	Units	Crop and Tree Activities									
			A_8	A_9	A_{10}	A_{11}	A_{12}	A_{13}	A_{14}	A_{15}	A_{16}	A_{17}
			WB_2 str	H_2 str	$CORN_2$ str	ALF_2 str	COT_2 str	V_2 str	VG_2 str	FLL_2 str	$OOGO_2$ str	$OGED_2$ str
		C_j	-154.3	-118.6	-186.5	-482.4	1,295.3	2,676.2	8,261.8	-5.4	796.6	1,035.4
1	FRL_2	str	1	1	1	1	1	1	1	1	1	1
2	AL_2	str	1	1	1	1	1	1	1	1	1	1
3	IL_2	str			1	1	1	1	1			
4	LVG_2	str							1			
5	OGO_2	str									1	
6	$OGED_2$	str										1
9	ALT_2	str										
10	ORT_2	str										
11	GA_2	str										
12	WBC_2	kg	-179.6									
13	$STRC_2$	kg	-211.4									
14	HC_2	kg		-400.9						-38.8		
15	$CORNC_2$	kg										
16	$ALFC_2$	kg			-856.0							
17	GAC_2	str										
29	SPL_2	days	.1	.5	.9	1.4	2.5	4.1	12.4	.4	.7	.9
30	SL_2	days	.9		2.8	2.8	4.0	3.7			.3	.4
31	FL_2	days	.9	.7	.2	1.1	2.8	3.8	4.4		1.2	1.8
32	WL_2	days	.1					1.9	18.1		1.5	.8
33	OPC_2	drs	154.3	118.6	186.5	482.4	162.7	444.2	4,952.7	5.4	71.2	168.4
36	$LTCNTP_2$	drs										
37	$LTCGH_2$	drs							13,500.0			
42	CFC_2	drs	-154.3	-118.6	-186.5	-482.4	1,295.3	2,676.2	8,261.8	-5.4	796.6	1,035.4

Tableau VII: (Continued)

Row No.	Resources	Units	Crop and Tree Activities			Tree Expansion and Reduction Activities					
			A_{18}	A_{19}	A_{20}	A_{21}	A_{22}	A_{23}	A_{24}	A_{25}	A_{26}
			$OALT_2$ str	ORT_2 str	GA_2 str	$NOGO_2$ str	$NOGED_2$ str	$NALT_2$ str	$NIOGED_2$ str	$NORT_2$ str	$ROGO_2$ str
		C_j	538.9	1,428.7	-	457.1	500.5	399.4	696.4	827.1	-
1	FRL_2	str	1	1	1	1	1	1	1	1	
2	AL_2	str	1	1		1	1	1	1	1	
3	IL_2	str		1					1	1	
4	LVG_2	str									
5	OGO_2	str									
6	$OGED_2$	str									
9	ALT_2	str	1								
10	ORT_2	str		1							
11	GA_2	str			1						
12	WBC_2	kg									
13	$STRC_2$	kg									
14	HC_2	kg									
15	$CORNC_2$	kg									
16	$ALFC_2$	kg									
17	GAC_2	str			-1						
29	SPL_2	days	.4	.9		.7	.9	.4	1.1	.9	
30	SL_2	days	1.6	2.5		.3	.4	1.6	1.8	2.5	
31	FL_2	days	.5	1.3		1.2	1.8	.5	1.6	1.3	
32	WL_2	days		1.8		1.5	.8		1.4	1.8	
33	OPC_2	drs	116.2	183.8		71.2	168.4	116.2	590.0	183.8	
36	$LTCNTP_2$	drs				1,200.0	1,300.0	800.0	1,500.0	1,700.0	
37	$LTCGH_2$	drs									
42	CFC_2	drs	538.9	1,428.7		-85.0	-96.0	-52.0	-117.0	-184.0	

of their AVA.

The unit requirements of these activities for labor and operating capital are treated in the same manner as in the model for the first zone.

iv. Feed Selling and Buying Activities

"Feed selling and buying" activities are considered for all the feedstuffs.

The objective function coefficients of "feed selling and buying" activities and the assumptions made about the feed quantities which can be purchased, are the same as those in the model for the first zone.

The "feed selling and buying" activities are presented in Tableau VIII.

v. Livestock Activities

The livestock activities considered and the general idea of the model are the same as in the model for the first zone. "Cattle in herds" and beehives are omitted since their share in the value added by the zone's farm sector are relatively small.

The objective function coefficients of cow and "raising calves" activities, calculated in the same manner as in the model for the first zone (pg. 38) are presented in Tables 3.9 and 3.10.

The objective function coefficients for all of the other activities are derived in the same way as in the model for the first zone. The unit requirements for operating capital and the needs for long-term capital are also thus derived. Finally, the acquisition value of housing facilities needed per unit of livestock is likewise estimated.

Tableau VIII: Feed Selling and Buying Activities (Zone II)

Row No.	Resources	Units	Feed Selling Activities					Feed Buying Activities				
			A_{27}	A_{28}	A_{29}	A_{30}	A_{31}	A_{32}	A_{33}	A_{34}	A_{35}	A_{36}
			SWB_2 kg	$SSTR_2$ kg	SH_2 kg	$SCORN_2$ kg	$SALF_2$ kg	BWB_2 kg	$BSTR_2$ kg	BH_2 kg	$BCORN_2$ kg	$BALF_2$ kg
		C_j	2.5	.8	1.0	2.8	1.8	-2.7	-.9	-1.20	-3.0	-2.0
12	WBC_2	kg	1					-1				
13	$STRC_2$	kg		1					-1			
14	HC_2	kg			1					-1		
15	$CORNC_2$	kg				1					-1	
16	$ALFC_2$	kg					1					-1
33	OPC_2	drs	-2.5	-.8	-1.0	-2.8	-1.8	2.7	.9	1.2	3.0	2.0
42	CFC_2	drs	2.5	.8	1.0	2.8	1.8	2.7	-.9	-1.2	-3.0	-2.0

Table 3.9 Objective Function Coefficients of Cow Activities

Cow Activity	AVA Drs	VCAL6·(Calving Rate) Drs	VFIN Drs	C_j Drs
Cow kept in barns	5,750.8	6,375.0	4,866.0	4,241.8
Cow kept in barns and pastured	3,274.7	4,800.0	2,204.0	678.7
Cow in herds	3,292.2	2,940.0	-	352.2

Source: Appendix B, Tables B-5, B-7 and Appendix C, Table C-3.

Table 3.10 Objective Function Coefficients of "Raising Calves" Activities

"Raising Calves" Activities	APVI Drs	VCAL6 Drs	VFIN Drs	C_j Drs
Raising calves kept in barns	12,476.3	7,500.0	4,526.0	- 450.3
Raising calves kept in barns and pastured	8,932.4	6,000.0	2,494.0	- 438.4
Raising "calves in herds"	4,578.2	4,200.0		- 378.2

Source: Appendix B, Tables B-5, B-7 and Appendix C, Table C-3.

The livestock activities are presented in Tableau IX.

vi. Breeding Stock Decreasing and Increasing Activities

"Breeding stock decreasing and increasing" activities are included for any livestock enterprise. The considerations regarding these activities and the appropriate assumptions are identical with those in the model for the first zone; the objective function coefficients of "breeding stock increasing" activities, calculated in

Tableau IX: Livestock Activities and "Breeding Stock Decreasing and Increasing" Activities (Zone II)

Row No.	Resources	Units	Livestock Activities											
			A_{37}	A_{38}	A_{39}	A_{40}	A_{41}	A_{42}	A_{43}	A_{44}	A_{45}	A_{46}	A_{47}	A_{48}
			SGD_2 head	SGF_2 head	CWB_2 head	$CWBP_2$ head	$RCALB_2$ head	$RCALBP_2$ head	$SCAL6B_2$ head	$SCAL6BP_2$ head	$BCAL6B_2$ head	$BCAL6BP_2$ head	$SCAL18B_2$ head	$SCAL18BP_2$ head
		C_j	964.8	647.3	4,241.8	678.7	-450.3	-438.4	7,500.0	6,000.0	-7,700.0	-6,200.0	13,966.8	10,532.9
12	WBC_2	kg	20.0	16.0		200.0		100.0						
13	$STRC_2$	kg			150.0	250.0	130.0	100.0						
14	HC_2	kg	43.0	28.0	410.0	620.0	110.0	320.0						
15	$CORNC_2$	kg	10.0		790.0	200.0	910.0	350.0						
16	$ALFC_2$	kg			1,180.0	180.0	980.0	480.0						
17	GAC_2	str		5.0		8.0		7.0						
18	$CALB_2$	head			-.85		1		1		-1			
19	$CALBP_2$	head				-.80		1		1		-1		
20	$CAL18B_2$	head					-.95						1	
21	$CAL18BP_2$	head						-.95						1
22	HRB_2	head			.166									
23	$HRBP_2$	head				.166								
24	$SGDC_2$	head	1											
25	$SGFC_2$	head		1										
26	$CWBC_2$	head			1									
27	$CWBPC_2$	head				1								
28	$CSGD_2$	head	1											
29	SPL_2	days	.8	.6	3.9	1.8	2.8	1.8						
30	SL_2	days	.6	.5	3.4	.8	2.7	.4						
31	FL_2	days	.8	.6	3.9	.8	2.8	.4						
32	WL_2	days	1.5	1.4	4.9	3.2	3.3	2.7						
33	OPC_2	drs	20.6	20.4	1001.0	400.7	450.3	438.4	-7,500.0	-6,000.0	7,700.0	6,200.0		
38	$LTCSP_2$	drs												
39	$LTCCHF_2$	drs			4,500.0	3,200.0	3,500.0	2,200.0						
40	$LTCDHF_2$	drs	600.0											
41	$LTCFHL_2$	drs		400.0										
42	CFC_2	drs	964.8	647.3	4,241.8	678.7	-450.3	-438.4	7,500.0	6,000.0	-7,700.0	-6,200.0	13,966.8	10,532.9

Tableau IX: (Continued)

Row No.	Resources	Units	Livestock Activities			"Breeding Stock Decreasing and Increasing" Activities							
			A_{49}	A_{50}	A_{51}	A_{52}	A_{53}	A_{54}	A_{55}	A_{56}	A_{57}	A_{58}	A_{59}
			$RRHB_2$ head	$RRHBP_2$ head	HG_2 head	$DSGD_2$ head	$DSGF_2$ head	$DCWB_2$ head	$DCWBP_2$ head	$ISGD_2$ head	$ISGF_2$ head	$ICWB_2$ head	$ICWBP_2$ head
		C_j	-450.3	-438.4	663.2	.0525	.0525	.0525	.0525	-43.69	-29.26	-922.47	-736.93
12	WBC_2	kg		100.0	53.0								
13	$STRC_2$	kg	130.0	100.0									
14	HC_2	kg	110.0	320.0									
15	$CORNC_2$	kg	910.0	350.0	31.0								
16	$ALFC_2$	kg	980.0	480.0	6.0								
17	GAC_2	str		7.0									
18	$CALB_2$	head	1										
19	$CALBP_2$	head		1									
20	$CAL18B_2$	head											
21	$CAL18BP_2$	head											
22	HRB_2	head	-1										
23	$HRBP_2$	head		-1									
24	$SGDC_2$	head				1				-1			
25	$SGFC_2$	head					1				-1		
26	$CWBC_2$	head						1				-1	
27	$CWBPC_2$	head							1				-1
28	$CSGD_2$	head											
29	SPL_2	days	2.8	1.8	1.4								
30	SL_2	days	2.7	.4	1.1								
31	FL_2	days	2.8	.4	1.5								
32	WL_2	days	3.3	2.7	.5								
33	OPC_2	drs	450.3	438.4	423.8								
38	$LTCS_2$	drs				-600.0	-400.0	-10,700.0	-8,600.0	640.0	430.0	11,000.0	9,000.0
39	$LTCCHF_2$	drs	3,500.0	2,200.0									
40	$LTCDHF_2$	drs			700.0								
41	$LTCFHL_2$	drs											
42	CFC_2	drs	-450.3	-438.4	663.2	.0525	.0525	.0525	.0525				

the same manner as in the model for the first zone, are presented in Table 3.11.

Table 3.11 Objective Function Coefficients of "Breeding Stock Increasing" Activities

"Breeding Stock Increasing" Activity	Acquisition Value Drs	Salvage Value Drs	PV of Salvage Value Drs	(2)-(4)	C_j
(1)	(2)	(3)	(4)	(5)	(6)
Domestic sheep and goats	640.0	520.0	410.96	229.04	43.69
Sheep and goats "in flocks"	430.0	350.0	276.6	153.4	29.26
Cow kept in barns	11,000.0	7,800.0	6,164.34	4,835.66	922.37
Cow kept in barns and pastured	9,000.0	6,500.0	5,136.95	3,863.05	736.93

vii. Sell and Hire Labor Activities

The Activities included in this section are the same as those in the model for the first zone. Labor that could be hired is considered unlimited during all seasons. Alternatives with respect to "sell labor" activities and assumptions made about employment outside the zone's farm sector are identical with those of the first zone. Seasonal movements of workers are also not permitted and, thus, labor sale implies movement of the family outside the region. The average labor supplied by the zone's farm family was calculated

in the same manner as that on p. 51, and it is presented in Table 3.12.

The relationship among the "sell labor" activities are also calculated in the same manner as in the model for the first zone.

Table 3.12 Average Labor Supplied by the Zone's Farm Family

Season	Available in the Zone Labor in 1970 (Thousand Man-workdays)	Zone's Farm Families in 1970	Average Labor Supplied by the Zone's Farm Family (Man-workdays)
Spring	193.9	1621	119.6175
Summer	232.7	1621	143.5534
Fall	190.7	1621	117.6434
Winter	164.9	1621	101.7273
Year	782.2	1621	482.5416

Source: Table 1.6, Appendix A, Table A-7.

viii. Capital Borrowing Activities

The consideration adopted in the first zone's model is also applied here with respect to the operating capital and to the long-term capital for livestock purchase and livestock housing facilities. Three additional long-term capital activities are included to reflect the needs for capital for irrigation improvements and for greenhouse construction. The long-term capital for irrigation improvements is divided into two categories on the basis of the source that supplies it.

- Long-term loans for irrigation improvements.

Tableau X: Sell and Hire Labor Activities and Capital Borrowing Activities (Zone II)

Row No.	Resources	Units	Sell Labor Activities[a]				Hire Labor Activities			
			A_{60}	A_{61}	A_{62}	A_{63}	A_{64}	A_{65}	A_{66}	A_{67}
			$SSPL_2$ days	SSL_2 days	SFL_2 days	SWL_2 days	$HSPL_2$ days	HSL_2 days	HFL_2 days	HWL_2 days
		C_j	180.0	170.0	180.0	180.0	-200.0	-190.0	-200.0	-200.0
28	$CSGD_2$	head	.05016							
29	SPL_2	days	1				-1			
30	SL_2	days		1				-1		
31	FL_2	days			1				-1	
32	WL_2	days				1				-1
33	OPC_2	drs					200.0	190.0	200.0	200.0
34	$LTLIR_2$	drs								
35	$LTCPIB_2$	Mdrs								
36	$LTCNTP_2$	drs								
37	$LTCGH_2$	drs								
38	$LTCSP_2$	drs								
39	$LTCCHF_2$	drs								
40	$LTCDHF_2$	drs								
41	$LTCFHF_2$	drs								
42	CFC_2	drs	250.799				-200.0	-190.0	-200.0	-200.0
44	$SPSLR_2$	days	1	-.83326						
45	$SFLR_2$	days		1	-1.2202					
46	$FWLR_2$	days			1	-1.15646				

[a]It is omitted when "labor sale" is not permitted.

Tableau X: (Continued)

Row No.	Resrouces	Units	Capital Borrowing Activities								
			A_{68}	A_{69}	A_{70}	A_{71}	A_{72}	A_{73}	A_{74}	A_{75}	A_{76}
			$BOPC_2$ drs	$BLTCIR_2$ drs	$LTCPIB_2$ Mdrs	$BLTCTP_2$ drs	$BLTCGH_2$ drs	$BLTCSP_2$ drs	$BLTCCHF_2$ drs	$BLTCDHF_2$ drs	$BLTCFHF_2$ drs
		C_j	-.04	-.02	-	-.0505	-.1485	-.04	-.0578	-.0736	-.0736
28	$CSGD_2$	head									
29	SPL_2	days									
30	SL_2	days									
31	FL_2	days									
32	WL_2	days									
33	OPC_2	drs	-1								
34	$LTLIR_2$	drs		-1							
35	$LTCPIB_2$	Mdrs			-1						
36	$LTCNTP_2$	drs				-1					
37	$LTCGH_2$	drs					-1				
38	$LTCSP_2$	drs						-1			
39	$LTCCHF_2$	drs							-1		
40	$LTCDHF_2$	drs								-1	
41	$LTCFHF_2$	drs									-1
42	CFC_2	drs	-.04	-.113		-.1066	-.1485	-.1908	-.1233	-.1233	-.1233
44	$SPSLR_2$	days									
45	$SFLR_2$	days									
46	$FWLR_2$	days									

- Long-term capital supplied by Public Investiment Budget

According to the adopted consideration of "irrigated land" activities (p.66), the demand for these two categories of durable capital can be written as:

$4.125\lambda_2 + 4.125\lambda_4 = LTL1R$ and $17.63\lambda_3 + 17.63\lambda_4 + 186.0\lambda_5 = LTCPIB$

where:

LTL1R = Long-term loans for irrigation improvements.

LTCPIB = Long-term capital supplied by Public Investment Budget.

The supply sources of these two types of capital are the long-term loans the Bank grants to farmers and the Government Public Investment Budget. As it has been mentioned (p. 64), the Bank can finance only the small-scale irrigation improvements, while the only source of the capital for the large-scale improvements is the Government Public Investment Budget. With respect to the amount of loans that the Bank can supply, it is treated in the same way as the other categories of long-term loans. In regard to the supplied capital by the Government Public Investment Budget, two alternatives were considered[1] as follows:

(a) It is assumed that the Government is willing to finance any required improvement. It implies that the supply of capital is unrestricted. This assumption, although basically unrealistic, or at least very optimistic, will provide an estimate of this category capital needed for the optimum plan application.

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[1]Both of the alternatives seem to be unrealistic, since the government's decision to finance a project is based on various factors, both economic as well as non-economic.

(b) It is assumed that the total amount of the Public Investment in the country's farm sector is distributed to the various regions proportionately to their agricultural land. Under this assumption the capital supplied by the Public Investment Budget is estimated[1] at 19.442 million drs. The objective function coefficient of the "borrowing long-term capital for irrigation improvements" activity indicates the annual interest rate (2.0 percent) that the Bank charges for this type of loan, whereas the coefficient of the "capital supplied by Public Investment Budget" activity is equal to zero, because the government charges no interest nor requires repayment.

The durable capital demand for greenhouse construction is considered equal to the acquisition value of the increase in this activity above the base year. This consideration implies the same assumptions and the same shortcomings as those assumed in the calculation of the capital needed for livestock housing facilities. The objective function coefficient of this activity is calculated on the basis of the PV analysis, with L = 8 and interest rate of 4.0 percent. Finally, the borrowing long-term capital for tree planting is used in the same way as in the model for the first zone.

b2. Resource Availability and Restriction

The resources existing during the base year (1970 are used, too. Restrictions imposed on the use of land and on the available capital

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[1]This estimate was developed from the following sources: (a) the total amount of Public Investment (5,647.4 million drs) in the country's farm sector in 1970, provided by the Greek Center for Productivity (Athens) and (b) the country's and the region's area of agricultural land comes from records of the National Statistical Service of Greece, "Statistical Yearbook of Greece" Athens, 1972, p. 152.

and labor have been discussed in detail in the corresponding sections. Generally, the idea of establishing the resources' intitial level is the same as in the model for the first zone.

The resources and the considered alternatives are presented in Table 3.13.

Table 3.13 Available Resources and Restriction in the Second Zone

Row No.	Resources	Units	Level	
			Base	Alterna-tive
1	Farm land	str	184,400	-
2	Agricultural land	str	53,100	-
3	Irrigated land	str	u[a]	-
4	Land for greenhouse vegetables	str	3,500	-
5	Old olive groves for oil	str	43,400	-
6	Old olive groves for edible olive	str	2,900	-
9	Old almond trees	str	1,100	-
10	Old orange trees	str	2,200	-
11	Grazing areas	str	121,300	-
24	Domestic sheep and goats	head	3,615	-
25	Sheep and goats "in flocks"	head	6,630	-
26	Cows kept in barns	head	73	-
27	Cows kept in barns and pastured	head	360	-
28	Zone's capacity for domestic sheep and goats	head	9,726	-
29	Spring labor	days	181,200	-
30	Summer labor	days	210,400	-
31	Fall labor	days	182,100	-
32	Winter labor	days	160,800	-
33	Operating capital	drs	u	-
35	Long-term capital supplied by Public Investiment Budget	Mdrs[b]	u	19.442

[a]Actually it is limited between 8,260 str and 31,260 str.

[b]Million drachmas.

Tableau XI: Irrigated Land Activities (Whole Region)

Row No.	Resources	Units	Irrigated Land Activities						
			A_1	A_2	A_3	A_4	A_5	A_6	A_7
			λ_1	λ_2	λ_3	λ_4	λ_5	IOGED str	IOGO str
		C_j	-	-307,783.67	-528,900.0	-836,683.67	-5,580,000.0	1,510.0	1,040.0
1	FRL	str						1	1
3	AL_2	str						1	1
5	IL_2	str	-8,260.0	-11,010.0	-12,560.0	-15,310.0	-31,260.0	1	1
9	OGO	str							1
10	OGED	str						1	
11	IOOGO	str		-680.0	-2,510.0	-3,190.0	-17,270.0		1
12	IOOGED	str		-720.0	-1,060.0	-1,780.0	-2,410.0	1	
39	SPL	days						1.1	.9
40	SL	days						1.8	1.4
41	FL	days						1.6	1.0
42	WL	days						1.4	2.0
43	OPC	drs						590.0	310.0
44	LTLIR	drs		4,125,000.0		4,125,000.0			
45	LTCPIB	Mdrs			17.63	17.63	186.0		
53	CFC	drs			-528,900.0	-528,900.0	-5,580,000.0	1,510.0	1,040.0
54	SPR	-	1	1	1	1	1		

c. The Structure of the Linear Programming Model for the Whole Region

c1. Model Activities

The activities included here are the same as the ones used in the previous models. Labor and feed trade between the two zones are permitted. Generally, this model appears as the sum of the two preceding models, except that the livestock activities, as well as some other activities are combined.

Eight general types of activities were included:

(1) Irrigated land activities (A_1 - A_7)

(2) Crop and tree activities (A_8 - A_{26})

(3) Tree expansion and reduction activities (A_{27} - A_{35})

(4) Feed selling and buying activities (A_{36} - A_{45})

(5) Livestock activities (A_{46} - A_{65})

(6) Breeding stock decreasing and increasing activities (A_{66} - A_{77})

(7) Sell and hire labor activities (A_{78} - A_{85})

(8) Capital borrowing activities (A_{88} - A_{95})

i. Irrigated Land Activities

The "irrigated land" activities considered are identical with those in the model for the second zone.

ii. Crop and Tree Activities

The crop and tree activities of both zones are included separately, since their unit requirements and returns are quite different. The restriction imposed on the use of land are identical with those in the models for the zones.

The crop and tree activities are presented in Tableau XII.

iii. Tree Expansion and Reduction Activities

All new tree activities of both preceding models are treated separately. The reduction of olive groves is considered common for both zones. Olive groves for edible olive and orange trees are not allowed to be reduced.

The "tree expansion and reduction" activities are presented in Tableau XIII.

iv. Feed Selling and Buying Activities

The "feed selling and buying" activities are considered to be common for both zones. The assumptions made about the feed quantities that could be purchased from outside the region's farm sector, are the same as those in the two previous models.

The "feed selling and buying" activities are presented in Tableau XIV.

v. Livestock Activities

The livestock activities are considered to be common for both zones. The unit requirements and the objective function coefficients of these aggregated activities are calculated as the weighted average of the zone's corresponding activities; that is:

$$aij = (Aj1 \cdot aij1 + Aj2 \cdot aij2) \div (Aj1 + Aj2) \text{ and}$$

$$cj = (Aj1 \cdot cj1 + Aj2 \cdot cj2) \div (Aj1 + Aj2)$$

where Aj1, Aj2 = Level of j^{th} activity in zone I and II respectively, during the base year (1970).

aij1, aij2 = Unit requirements of j^{th} activity in zone I and II

Tableau XII: Crop and Tree Activities (Whole Region)

Row No.	Resources	Units	Crop and Tree Activities									
			A_8	A_9	A_{10}	A_{11}	A_{12}	A_{13}	A_{14}	A_{15}	A_{16}	A_{17}
			WB_1 str	WB_2 str	H_1 str	H_2 str	CORN str	ALF str	COT str	V_1 str	V_2 str	VG str
		C_j	-105.5	-154.3	-91.8	-118.6	-186.5	-482.4	1,295.3	1,604.2	2,676.2	8,261.8
1	FRL	str	1	1	1	1	1	1	1	1	1	1
2	AL_1	str	1		1					1		
3	AL_2	str		1		1	1	1	1		1	1
4	IL_1	str								1		
5	IL_2	str					1	1	1		1	1
6	LWB_1	str	1									
7	$LHNTP_1$	str	1		1							
8	LVG	str										1
9	OGO	str										
10	OGED	str										
13	ALT	str										
14	ORT	str										
15	GA	str										
16	WBC	kg	-97.5	-179.6								
17	STRC	kg	-112.4	-211.4								
18	HC	kg			-356.6	-400.9						
19	CORNC	kg					-369.9					
20	ALFC	kg						-856.0				
21	GAC	str										
39	SPL	days	.4	.1	.8	.5	.9	1.4	2.5	5.9	4.1	12.4
40	SL	days	1.1	.9			2.8	2.8	4.0	4.8	3.7	
41	FL	days	1.2	.9	.8	.7	.2	1.1	2.8	4.9	3.8	4.4
42	WL	days		.1						3.5	1.9	18.1
43	OPC	drs	105.5	154.3	91.8	118.6	186.5	482.4	162.7	212.8	444.2	4,952.7
47	LTCGH	drs										13,500.0
53	CFC	drs	-105.5	-154.3	-91.8	-118.6	-186.5	-482.4	1,295.3	1,604.2	2,672.6	8,261.8

Tableau XII: (Continutd)

Row No.	Resources	Units	Crop and Tree Activities								
			A_{18}	A_{19}	A_{20}	A_{21}	A_{22}	A_{23}	A_{24}	A_{25}	A_{26}
			FLL_1 str	FLL_2 str	$OOGO_1$ str	$OOGO_2$ str	OOGED str	$OALT_1$ str	$OALT_2$ str	ORT str	GA str
		C_j	-6.2	-5.4	566.6	796.6	1,035.4	151.9	538.9	1,428.7	
1	FRL	str	1	1	1	1	1	1	1	1	1
2	AL_1	str	1		1			1			
3	AL_2	str		1		1	1		1	1	
4	IL_1	str									
5	IL_2	str								1	
6	LWB_1	str									
7	$LHNTP_1$	str									
8	LYG	str									
9	OGO	str			1	1					
10	OGED	str					1				
13	ALT	str						1	1		
14	ORT	str								1	
15	GA	str									1
16	WBC	kg									
17	STRC	kg									
18	HC	kg	-45.0	-38.8							
19	CORNC	kg									
20	ALFC	kg									
21	GAC	str									
39	SPL	days	.6	.4	.8	.7	.9	.5	.4	.9	
40	SL	days			.3	.3	.4	.7	1.6	2.5	
41	FL	days			1.9	1.2	1.8		.5	1.3	
42	WL	days			.7	1.5	.8			1.8	
43	OPC	drs	6.2	5.4	65.2	71.2	168.4	87.8	116.2	183.8	
47	LTCGH	drs									
53	CFC	drs	-6.2	-5.4	566.6	796.6	1,035.4	151.9	538.9	1,428.7	

Tableau XIII: Tree Expansion and Reduction Activities (Whole Region)

Row No.	Resources	Units	Tree Ezpansion and Reduction Activities								
			A_{27}	A_{28}	A_{29}	A_{30}	A_{31}	A_{32}	A_{33}	A_{34}	A_{35}
			$NOGO_1$ str	$NOGO_2$ str	NOGED str	$NALT_1$ str	$NALT_2$ str	NIOGED str	NORT str	ROGO str	$RALT_1$ str
		C_j	285.5	457.1	500.5	141.5	399.4	696.4	827.1		
1	FRL	str	1	1	1	1	1	1	1		
2	AL_1	str	1			1					
3	AL_2	str		1	1		1	1	1		
5	IL_1	str						1	1		
7	$LHNTP_1$	str	1			1					
9	OGO	str								1	
13	ALT	str									1
39	SPL	days	.8	.7	.9	.5	.4	1.1	.9		
40	SL	days	.3	.3	.4	.7	1.6	1.8	2.5		
41	FL	days	1.9	1.2	1.8		.5	1.6	1.3		
42	WL	days	.7	1.5	.8			1.4	1.8		
43	OPC	drs	65.2	71.2	168.4	87.8	116.2	590.0	183.8		
46	LTCNTP	drs	800.0	1,200,0	1,300.0	600.0	800.0	1,500.0	1,700.0		
53	CFC	drs	-69.0	-85.0	-96.0	-43.0	-52.0	-117.0	-184.0		

Tableau XIV: Feed Selling and Buying Activities (Whole Region)

Row No.	Resources	Units	A_{36}	A_{37}	A_{38}	A_{39}	A_{40}	A_{41}	A_{42}	A_{43}	A_{44}	A_{45}
			SWB kg	SSTR kg	SH kg	SCORN kg	SALF kg	BWB kg	BSTR[a] kg	BH kg	BCORN kg	BALF[a] kg
		C_j	2.5	.8	1.0	2.8	1.8	-2.7	-1.0	-1.2	-3.0	-2.1
16	WLB	kg	1					-1				
17	STRC	kg		1					-1			
18	HC	kg			1					-1		
19	CORNC	kg				1					-1	
20	ALFC	kg					1					-1
43	OPC	drs	-2.5	-.8	-1.0	-2.8	-1.8	2.7	1.0	1.2	3.0	2.1
53	CFC	drs	2.5	.8	1.0	2.8	1.8	-2.7	-1.0	-1.2	-3.0	-2.1

[a]The acquisition prices in the first zone are used.

respectively during the base year (1970).

cj1, cj2 = Objective function coefficient of j^{th} activity in zone I and II respectively during the base year (1970).

The region's capacity for raising domestic sheep and goats is calculated in the same menner as in the models for the zones. Finally, the region's beehive capacity is estimated at 25,000 hives.

The livestock activities are presented in Tableau XV.

vi. Breeding Stock Decreasing and Increasing Activities

The "breeding stock decreasing and increasing" activities are treated in the same manner as the livestock ones, and they are presented in Tableau XVI.

vii. Sell and Hire Labor Activities

"Sell and hire labor" activities are considered to be common for both zones. The employment outside the region's farm sector and the assumptions made about the labor which could be sold, are similar to those used in the preceding two models. Seasonal movements of the workers within the region are permitted. This assumption implies the utilization of a good transportation system which actually does not exist.

The average labor supplied by the region's farm family, calculated in the same manner as in the two preceding models, is presented in Table 3.14.

The "sell and hire labor" activities are presented in Tableau XVII.

Tableau XV: Livestock Activities (Whole Region)

Row No.	Resources	Units	Livestock Activities									
			A_{46}	A_{47}	A_{48}	A_{49}	A_{50}	A_{51}	A_{52}	A_{53}	A_{54}	A_{55}
			SGD head	SGF head	CWB head	CWBP head	CWH head	RCALB head	RCALBP head	RCALH head	SCAL6B head	BCAL6B head
		C_j	902.43	620.36	4,175.85	691.61	370.36	-427.4	-272.32	-263.86	7,414.77	6,000.0
16	WBC	kg	17.33	14.10		185.16			13.82			
17	STRC	kg			124.43	212.91		112.96	186.18			
18	HC	kg	35.00	24.68	400.45	590.33		123.11	544.08			
19	CORNC	kg	10.19		771.25	140.66		900.82	350.00			
20	ALFC	kg			1,171.48	46.49		959.03	66.32			
21	GAC	str	1.07	5.47		10.23	11.85		7.86	8.94		
22	CALB	head			-.85			1			1	
23	CALBP	head				-.80			1			1
24	CALH	head					-.70			1		
25	CAL18B	head						-.95				
26	CAL18BP	head							-.95			
27	CAL18H	head								-.95		
28	HRB	head			.166							
29	HRBP	head				.166						
30	HRH	head					.166					
31	SGDC	head	1									
32	SGFC	head		1								
33	CWBC	head			1							
34	CWBPC	head				1						
35	CWHC	head					1					
36	BHVC	hives										
37	CSGD	head	1									
38	CBHV	hives										
39	SPL	days	.8	.6	3.9	1.8	.4	2.8	1.8	.4		
40	SL	days	.6	.5	3.4	.8	.3	2.7	.4	.3		
41	FL	days	.8	.6	3.9	.8	.4	2.8	.4	.3		
42	WL	days	1.5	1.4	4.9	3.2	.8	3.3	2.7	.8		
43	OPC	drs	25.61	20.31	1,001.1	400.5	376.62	427.4	272.32	263.86	-7,414.77	-6,000.0
49	LTCCHF	drs			4,500.0	3,200.0	1,500.0	3,500.0	2,200.0	1,500.0		
50	LTCDHF	drs	600.0									
51	LTCFHF	drs		400.0								
52	LTCBHV	drs										
53	CFC	drs	902.43	620.36	4,174.85	691.61	372.36	-427.4	-272.32	-263.86	7,414.77	6,000.0

Tableau XV: (Continued)

Row No.	Resources	Units	Livestock Activities									
			A_{56}	A_{57}	A_{58}	A_{59}	A_{60}	A_{61}	A_{62}	A_{63}	A_{64}	A_{65}
			BCAL6B head	BCAL6BP head	SCAL18B head	SCAL18BP head	SCAL18H head	RRHB head	RRHBP head	RRHH head	HG head	BHV head
		C_j	-7,647.57	-6,200.0	13,802.61	9,488.07	5,763.23	-427.4	-272.32	-263.86	560.24	144.82
16	WBC	kg							13.82		47.87	
17	STRC	kg						112.96	186.18			
18	HC	kg						123.11	544.08			
19	CORNC	kg						900.82	350.00		26.51	
20	ALFC	kg						959.03	66.32		2.15	
21	GAC	str							7.86	8.94		
22	CALB	head	-1					1				
23	CALBP	head		-1					1			
24	CALH	head								1		
25	CAL18B	head			1							
26	CAL18BP	head				1						
27	CAL18H	head					1					
28	HRB	head						-1				
29	HRBP	head							-1			
30	HRH	head								-1		
31	SGDC	head										
32	SGFC	head										
33	CWBC	head										
34	CWBPC	head										
35	CWHC	head										
36	BHVC	head										1
37	CSGD	head										
38	CBHV	hives										1
39	SPL	days						2.8	1.8	.4	1.4	.3
40	SL	days						2.7	.4	.3	1.1	.3
41	FL	days						2.8	.4	.3	1.5	.1
42	WL	days						3.3	2.7	.8	.5	.2
43	OPC	drs	7,647.57	6,200.0				427.4	272.32	263.86	403.71	25.12
49	LTCCHF	drs						3,500.0	2,200.0	1,500.0		
50	LTCDHF	drs									700.0	
51	LTCFHF	drs										
52	LTCBHV	drs										100.0
53	CFC	drs	-7,647.57	-6,200.0	13,802.61	9,488.67	5,763.23	-427.4	-272.32	-263.86	560.24	144.82

Tableau XVI: Breeding Stock Decreasing and Increasing Activities (Whole Region)

Row No.	Resources	Units	Decrease Breeding Stock Activities						Increase Breeding Stock Activities					
			A_{66}	A_{67}	A_{68}	A_{69}	A_{70}	A_{71}	A_{72}	A_{73}	A_{74}	A_{75}	A_{76}	A_{77}
			DSGD	DSGF	DCWB	DCWBP	DCWH	DBHV	ISGD	ISGF	ICWB	ICWBP	ICWH	IBHV
			head	head	head	head	head	hives	head	head	head	head	head	hives
		C_j	.0525	.0525	.0525	.0525	.0525	.0525	-44.27	-26.55	-910.51	-651.35	-466.16	-51.78
31	SGDC	head	1						-1					
32	SGFC	head		1						-1				
33	CWBC	head			1						-1			
34	CWBPC	head				1						-1		
35	CWHC	head					1						-1	
36	BHVC	hives						1						-1
48	LTCSP	drs	-584.01	-390.51	-10,512.1	-7,858.25	-5,300.0	-350.0	618.68	415.77	10,829.55	8,258.25	6,000.0	396.0
53	CFC	drs	.0525	.0525	.0525	.0525	.0525	.0525						

Tableau XVII: Sell and HIre Labor Activities and Capital Borrowing Activities (Whole Region)

Row No.	Resources	Units	Sell Labor Activities[a]				Hire Labor Activities			
			A_{78}	A_{79}	A_{80}	A_{81}	A_{82}	A_{83}	A_{84}	A_{85}
			SSPL days	SSL days	SFL days	SWL days	HSPL days	HSL days	HFL days	HWL days
		C_j	180.0	170.0	180.0	180.0	-200.0	-190.0	-200.0	-200.0
37	CSGD	head	.0583							
39	SPL	days	1				-1			
40	SL	days		1				-1		
41	FL	days			1				-1	
42	WL	days				1				-1
43	OPC	drs					200.0	190.0	200.0	200.0
44	LTLIR	drs								
45	LTCPIB	Mdrs								
46	LTCNTP	drs								
47	LTCGH	drs								
48	LTCSP	drs								
49	LTCCHF	drs								
50	LTCDHF	drs								
51	LTCFHF	drs								
52	LTCBHV	drs								
53	CFC	drs	291.602				-200.0	-190.0	-200.0	-200.0
55	SPSLR	days	1	-.8446						
56	SFLR	days		1	-1.1955					
57	FWLR	days			1	-1.1533				

[a]It is omitted when "labor sale" is not permitted.

Tableau XVII: (Continued)

Row No.	Resources	Units	Capital Borrowing Activities									
			A_{86}	A_{87}	A_{88}	A_{89}	A_{90}	A_{91}	A_{92}	A_{93}	A_{94}	A_{95}
			BDPC drs	BLTCIR drs	LTCPIB Mdrs	BLTCTP drs	BLTCGH drs	BLTCSP drs	BLTCCHF drs	BLTCDHF drs	BLTCFHF drs	BLTCBHV drs
		C_j	-.04	-.02	-	-.0505	-.1485	-.04	-.0578	-.0736	-.0736	-.1908
37	CSGD	head										
39	SPL	days										
40	SL	days										
41	FL	days										
42	WL	days										
43	OPC	drs	-1									
44	LTLIR	drs		-1								
45	LTCPIB	Mdrs			-1							
46	LTCNTP	drs				-1						
47	LTCGH	drs					-1					
48	LTCSP	drs						-1				
49	LTCCHF	drs							-1			
50	LTCDHF	drs								-1		
51	LTCFHF	drs									-1	
52	LTCBHV	drs										-1
53	CFL	drs	-.04	-.1113		-.1066	-.1485	-.1908	-.1233	-.1233	-.1233	-.1908
55	SPSLR	days										
56	SFLR	days										
57	FWLR	days										

Table 3.14 Average Labor Supplied by the Region's Farm Family

Season	Available in the Region Labor in 1970 (Man-Work-days thousands)	Region's Farm Families in 1970	Average Labor supplied by the Region's Farm Family (Man-Workdays)
Spring	332.1	3,228	102.88
Summer	393.2	3,228	121.81
Fall	328.9	3,228	101.89
Winter	285.2	3,228	88.35
Year	1,339.4	3,228	414.93

Source: Table 1.6, Appendix A, Table A-7.

viii. Capital Borrowing Activities

Common capital borrowing activities are considered for both zones. The calculation of needs for capital and the objective function coefficients, as well as the restrictions imposed on the available capital, are the same as those in the preceding models.

c2. Resource Availability and Restrictions

The resources existing in both zones are used either separately (land), or in combination (labor, grazing areas). The restrictions imposed on the use of land and on the available labor and capital are identical with those in the models for zones.

The resources and the considered alternatives are presented in Table 3.15.

Table 3.15 Available Resources and Restrictions in the Whole Region

Row No.	Resources	Units	Level	
			Base	Alterna-tive
1	Farm land	str	447,200	-
2	Agricultural land of the frist zone	str	70,600	-
3	Agricultural land of the second zone	str	63,100	-
4	Irrigated land in the first zone	str	120	-
5	Irrigated land in the second zone	str	u[a]	-
6	Land for wheat-barley in the first zone	str	500	-
7	Land for hay and new tree planting in the first zone	str	4,000	-
8	Land for greehnouse vegetables in the second zone	str	3,500	-
9	Old olive groves for oil	str	100,700	-
10	Old olive groves for edible olive	str	2,900	-
13	Old almond trees	str	1,800	-
14	Old orange trees	str	2,200	-
15	Grazing areas	str	313,500	-
31	Domestic sheep and goat	head	7,742	-
32	Sheep and Goats "in flocks"	head	12,613	-
33	Cows kept in barns	head	88	-
34	Cows kept in barns and pastured	head	1,394	-
35	Cows "in herds"	head	519	-
36	Beehives	hives	8,936	-
37	Region's capacity for domestic sheep and goats	head	19,368	-
38	Region's beehive capacity	hives	25,000	-
39	Spring labor	days	315,200	-
40	Summer labor	days	361,500	-
41	Fall labor	days	320,300	-
42	Winter labor	days	281,100	-
43	Operating capital	drs	u	-
45	Long-term capital supplied by the Public Investment Budget	Mdrs	u	19.442

[a]Actually it is limited between 8.260 str and 31,260 str.

CHAPTER IV

OPTIMUM PLANS OF FARM PRODUCTION FOR THE REGION OF MANI

The previous chapters have provided the framework for analyzing whether regional reallocation of recources would increase the farm income of the region's population. This chapter presents optimum plans of production for the two zones and the whole region under (1) existing resources (without any possibility for employment outside the region's or the zone's farm sector); and (2) selling labor outside the region or the zone.

Before the optimum production plans are presented and analyzed, it is useful to sumarize the assumptions made, as well as to state certain explanations and the order of presentation which follows:

1. Assumptions

The optimum plans hold under the assumptions made with respect to technology, prices, resources levels, as well as governmental and farmer behavior. The main assumptions are as follows:

(a) Technology: Technology represented by the technological coefficients which were found in the region during the base year (1970), is assumed constant throughout the analysis; thus, the study does not examine the effects of introducing new technologies.

The input-output coefficients used throughout the analysis are

the average values for the areas in the region. The range of these coefficients, being large for some crops, suggests that the resulting optimum plans must be viewed as providing general trends rather than exact specifications in crop and enterprise patterns.

(b) Prices: The optimum plans presented in this study are based on the 1970 product and resource prices; thus, throughout the analysis the prices are assumed constant. In Greece the prices of nearly all the farm products are regulated by Government (security and ceiling prices). This assumption implies constant government price policy.

(c) Resources: The base year (1970) resources are used. The resources are assumed homogenous, although some differences are taken into account for the land and labor.

(d) Government: It is assumed that the farm government policy will remain constant. It also implies that the policy and the behavior of the Agricultural Bank of Greece will remain the same as in the base year. This means that the government will continue to subsidize the farm activities subsidized during the base year, and will continue to provide short and long-term loans to farmers with the same terms.

(e) Farmers' behavior: First, rationality of the farmers is assumed. In addition, the optimum plans presented here are based on the assumption that the farmers are interested only in maximizing their families' satisfaction. The families' satisfaction is assumed to be an increasing function of annual farm income. If the farmers' interest is focused on other than the above objectives, then the optimality of the plans is lost.

2. Computed Optimum Plans - Presentation Scheme

Two optimum plans were determined for each zone and the whole region as follows:

(a) The first plan, referred to as base plan, is determined under the assumptions:

(i) The population of the zones or region is constant and

(ii) There is no possibility for employment outside the zones' or region's farm sector.

This plan, treating labor as a fixed resource, determines the potential increase in per capita income achievable by reorganizing the region's farm resources. The needed short and long-term capital, as well as the extent of labor utilization under the optimum organization of the region's farm resources are also obtained.

The assumptions made in the "base" plan imply no increase in employment opportunities of the zone's or region's non-farm sector. It also reflects indirectly the cost to society of stopping depopulation of the region.

(b) The second plan, referred to as depopulation plan, assumes the free out migration of labor. Two alternatives were considered as follows:

(i) Off farm sale of labor equal to the labor supplied by each family during each season implies the movement of one farm family outside the zone or the region. This alternative determines the number of farm families that continue to live in the region under the assumptions made. It also provides an estimate of per capita income that can be achieved by moving outside the zone, as well as the cost to farmers of staying in the region.

(ii) Labor selling does not imply movement of families outside the zone. This alternative assumes that the region's farm families will remain constant, while the workers will move seasonally for employment.

The crop and livestock enterprises under the two alternatives are almost the same, while a very small increase in total income appears under the seasonal movement plan. It indicates that whether the workers live in the region, move seasonally for employment, or move permanently outside the region has little effect on their income.

Some alternatives with respect to the value added by the new trees are also considered for both basic plans. These alternatives are analyzed in the following chapters if the crop and livestock enterprises are much different from those of the basic plans.

Generally, the results for the "base" (no labor sale) plan are analyzed in detail, while those for the "depopulation" plan are used to show the extent of the depopulation and the per capita income which could be achieved. The linear programming solutions were obtained by using the CDC-6500 computer at Michigan State University with the computing routine developed by J.R. Black and S. Harsh of M.S.U. (the APEX I computing routine was used for the whole region model).

The linear programming output information included the value of the objective function, activities included, resource use levels and their marginal value products, as well as the cost "of forcing non-optimum activities into the solution."

The presentation to be followed is as follows:

First, the crop and livestock enterprises included in both basic

plans, as well as their economic results would be presented and analyzed.

Second, the use levels for resources and their MVPS would be stated. Third, and finally, the cost of forcing non-basic activities into the "base" plan, as well as the stability limits for the "base" plan activities, are discussed.

3. Optimum Plans of Farm Production for Zone I

a. Crop and Livestock Enterprises Included - Economic Results

The crop and livestock enterprises, as well as the value added by the zone's farm sector under the present and optimum plans are presented in Table 4.1. The increase in value added under the "base" and "depopulation" plan amounts to 39.25 percent oand 133.94 percent of that under the present plan respectively.

The per capita incomes resulting from the optimum plans are:

"Base" plan: 17,047.9 drs

"Depopulation" plan[1]: 26,074.9 drs

These indicate that it is impossible for the zone's farm population to achieve a per capita income close to the country's average (31,530 drs) by reorganizing the existing resources, but it is approached by moving outside the zone.

Estimates of the number of farm families and people for the zone from the "Depopulation" plan are 102 and 296 respectively. These estimates are calculated as the ratio of home employed labor during each season to the average labor supplied by the zone's farm families

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[1]Transfer payments are reduced proportionately to the decrease in the number of the zone's farm families.

Table 4.1 Value Added and Crop-Livestock Enterprises Under the Present and Optimum Plans (Zone I)

Items	Units	Present Plan	"Base" Plan	"Depopulation" Plan
Value Added	th. drs	50,803.9	70,748.5	118,848.3
Wheat-Barley	str	200.0	-	-
Hay	str	1,800.0	4,000.0	-
Vegetables	str	100.0	120.0	-
Olive groves	str	57,400.0	57,300.0	-
Almond trees	str	700.0	700.0	-
Fallow land	str	10,500.0	-	-
Agricultural land	str	71,500.0	62,120.0	-
Grazing areas	str	191,300.0	200,680.0	262,800.0
Domestic sheep and goats	head	4,127	9,642	-
Sheep and goats "in flocks"	head	5,983	-	-
Cows:				
a) kept in barns	head	15	8,286	-
b) kept in barns and pastured	head	1,034	1,034	-
c) in herds	head	481	9,221	14,361
Calves:[a]				
a) kept in barns	head	35	1,447	-
b) kept in barns and pastured	head	1,023	180	-
c) in herds	head	365	6,443	10,052
Hogs	head	2,386	-	-
Beehives	hives	7,149	18,000	-

Source: Computed

[a]Replacement heifers are included.

during the same season. These estimates show that, under the assumptions made and the existing conditions, the depopulation of the zone will continue.

The present and "base" plan cropping patterns are almost the same. An increase in the "grazing areas," appearing in the optimum plans, indicates that it is more profitable to use the land for grazing than for crops and trees. The level of livestock enterprises included in the "base" plan is much higher than in the present one. This indicates that the livestock sector could bring about some improvement in the zone's income.

Under the second plan, all the land is used for grazing and the only farm activity is "raising cattle in herds." The results are also the same under the "seasonal movement" plan.

The important points with respect to the "base" plan are:

- It is more profitable for the farms to sell the calves at six than at 18 months.

- The numbers of "domestic" sheep and goats and beehives can be increased as much as possible. The resulting levels of these activities are equal to the accepted capacity of the zone, while their marginal value product are 154.4 drs and 26.2 drs respectively.

- No changes occur when the value added by the old trees is assigned to the new trees.

Generally, it is observed that the labor intensive enterprises (cows kept in barns, vegetables, olive groves) are included in the "base" plan, while the labor extensive ones ("cows in herds," grazing areas) are included in the "depopulation" plan.

The feed production, sales and purchases, under the present

and "base" plan, are presented in Table 4.2. No feed is in surplus under the present and optimum plans. The feed quantities that should be purchased under the "base" plan seem to be very high; especially that of alfalfa which may be an obstacle in the realization of this plan. No feed is needed under the "Depopulation" plan, since the "cattle in herds" are only pastured.

Table 4.2 Feed Production, Sales and Purchases Under the Present and "Base" Plan (Zone I)

Feed	Produced (ton)		Sold (ton)		Purchased (ton)	
	Present Plan	"Base" Plan	Present Plan	"Base" Plan	Present Plan	"Base" Plan
Wheat-Barley	19.5	-	-	-	407.7	330.8
Straw	22.4	-	-	-	389.0	242.9
Hay	1,113.3	1,425.4	-	-	335.0	2,785.6
Corn	-	-	-	-	603.8	7,096.3
Alfalfa	-	-	-	-	45.7	10,551.1

Source: Computed

The labor sold, hired and utilized in the zone's farm sector, under the present and optimum plans, are presented in Table 4.3

The labor surplus, defined as that which is available over and above the peak season employment, is equal to zero. Seasonal unemployment appears during the spring and summer, ranging from 16.26 percent (spring) to 53.34 percent (summer). It indicates that, under the existing resources, unemployment would continue, even if the capital supply was unlimited. The labor surplus during the spring and

Table 4.3 Labor Sold, Hired and Utilized in the Zone's Farm Sector Under the Present and Optimum Plans (Zone I)

Labor	Utilized (thousand days)			Sold (thousand days)			Hired (thousand days)		
	Existed Plan	"Base" Plan	"Depopulation" Plan	Existed Plan	"Base" Plan	"Depopulation" Plan	Existed Plan	"Base" Plan	"Depopulation" Plan
Spring labor	73.4	108.0	4.6	4.2	4.2	133.6	-	-	5.2
Summer labor	31.4	67.1	.7	9.4	9.4	159.8	-	-	6.6
Fall labor	124.2	138.2	8.8	-	-	129.4	-	26.9	-
Winter labor	65.4	120.3	7.6	-	-	112.7	-	-	11.9
Year	294.4	433.6	21.7	13.6	13.6	535.5	-	26.9	23.7

Source: Computed

summer is 25.0 thousand days and 84.0 thousand days respectively. It is worth mentioning that, although a labor surplus exists during the spring and summer, labor hiring is necessary during the fall because of high labor requirements of olive groves in the fall.

The short and long-term capital needed for the implementation of the optimum plans is presented in Table 4.4.

Table 4.4 Short and Long-Term Capital Needed for the Implementation of Optimum Plans (Zone I)

Items	Units	"Base" Plan	"Depopulation" Plan
Operating capital	thous. drs	29,396.6	12,563.4
Long-term capital	thous. drs	205,735.4	97,748.8
a) Stock purchase	thous. drs	140,476.2	68,147.5
b) Cattle housing facilities	thous. drs	62,535.3	29,601.3
c) Hog and Domestic animals housing facilities	thous. drs	1,638.8	-
d) Beehive equipment	thous. drs	1,085.1	-

Source: Computed

The amount of long-term capital needed for the implementation of the "base plan" is very high, since it is more than thirty times that utilized in 1970 (the long-term capital unilized in 1970 is estimated at 6.0 million drachmas), representing 4.24 percent of the Bank's total supply of long-term capital in 1970. Another critical point

of this optimum plan is the quantity of corn and alfalfa purchased, which is more than ten times that purchased in 1970 (the quantity of alfalfa is more than two hundred times that purchased in 1970).

The two critical points of the plan are due to the large increase in the level of livestock enterprises and especially that of "raising cows in barns." The increase in the level of this enterprise could be attributed to the almost uniform distribution of its labor requirements, which makes possible the labor utilization during the spring and summer.

Some discussion about these critical points is needed. First, it would be rational to expect that such an increase in the capital and feed demand should lead to a rise in prices if there were a freely operating market; however, the farm product market is regulated by the government in Greece. Corn is priced by the government and distributed to the farmers through the Agricultural Bank of Greece at prices which are lower than those in the free market. The corn quantity that is needed for the optimum plan implementation is a very small portion (.9 percent) of the country's total demand. Therefore, this increase in the demand would not substantially affect the country's level of prices. This is also true for alfalfa prices, although they are not regulated by the government. The alfalfa needed for the optimum plan implementation is also a very small portion (.68 percent) of the country's total supply. An increase in the transportation cost is expected, since the farmers would have to use the markets of Central or Northern Greece. The stability limits (Table 4.7) for the alfalfa aquisition price show that an increase of 13.8 percent (.29 drs) in the price of alfalfa does not affect the

optimum plan.

A different problem arises with respect to the capital. Although the interest rate, which is controlled by the government, is not expected to rise, the amount of needed capital represents a relatively large percentage of the Bank's total supply. Since the Bank's supply of long-term capital is not unlimited and the additional amount must be taken from other regions with higher returns than those of the studied zone, the implementation cost of this optimum plan would be very high.

b. Resource Use and "MVPs" for the Optimum Plan

The resources used by the optimum plans with their respective marginal value product (MVP) are presented in Table 4.5.

Agricultural land and labor during the spring and summer are not limiting factors as reflected by zero MVP. The MVP of farm land is equal to that of grazing areas for both of the plans. It indicates that any increase in farm land will be used for grazing. Although the MVPs of trees are greater than zero, the new trees are not included in the optimum plan. It indicates that the marginal cost of new trees is greater than the MVP of the existing ones.

The high MVP (208.0 drs) of fall labor reflects the shortage of labor during this season.

Finally, the MVP of capital (short and long-term) is equal to its cost, since the supply of all the capital categories was treated as perfectly elastic.

Table 4.5 Resource Use and Their "MVPs" for the Optimum Plans (Zone I)

Resources	Units	"Base" Plan		"Depopulation" Plan	
		Resource Level	MVP[a]	Resource Level	MVP[a]
Farm land	th. str	262.8	107.6	262.2	88.1
Agricultural land	th. str	62.12	-	-	-
Irrigated land	th. str	.12	231.2	-	-
Olive groves	th. str	57.3	13.7	-	-
Almond trees	th. str	.7	40.8	-	-
Grazing areas	th. str	200.68	107.6	262.8	88.1
Spring labor	th. days	108.0	-	134.0	208.0
Summer labor	th. days	67.1	-	151.0	197.6
Fall labor	th. days	165.1	208.0	138.2	83.9
Winter labor	th. days	120.3	67.9	120.3	208.0
Operating capital	th. drs	29,396.6	.04	12,563.4	.04
Long-term capital					
a) Stock purchase	th. drs	140,476.2	.04	68,147.5	.04
b) Cattle hous. facilities	th. drs	62,535.3	.0578	29,601.3	.0578
c) Hog and domestic an. hous. facilities	th. drs	1,638.8	.0736	-	-
d) Beehive equipment	th. drs	1,085.1	.1908	-	-

Source: Computed

[a]thousand drs/unit

c. Cost of Forcing the Non-Basis Activities Into the "Base" Plan - Stability Limits

The cost of forcing the non-basis activities into the base plan is presented in Table 4.6.

Table 4.6 Cost of Forcing the Non-Basis Activities into the "Base" Plan (Zone I)

Activities	Units	"Base" Plan
Wheat-Barley	dr/str	152.0
Fallow land	dr/str	57.9
New olive groves for oil	dr/str	343.0
New almond trees	dr/str	45.2
Reduction of olive groves	dr/str	13.7
Reduction of almond trees	dr/str	40.8
Sell wheat-barley	dr/kg	.21
Sell straw	dr/kg	.21
Sell hay	dr/kg	.21
Sheep and goats "in flocks"	dr/head	350.8
Sell calves 18 months old:		
a) kept in barns	dr/head	1,232.3
b) kept in barns and pastured	dr/head	1,163.9
Hogs	dr/head	111.6

Source: Computed

This cost indicates the compteitive position of the excluded enterprises. The higher the cost of an excluded enterprise, the lower is its comptetive position in the optimum plan.

The cost of forcing the "new olive groves" into the "base" plan is greater than that of forcing the "new almond trees." This can be explained by the distribution of their labor requirements over the seasons. Almond trees require labor during the spring and summer, while olive trees mainly during the fall and winter.

The cost of reducing the trees is equal to the MVPs of the existing trees. The relative low cost of forcing the "reduction of olive groves" activity into the "base" plan indicates that a small decline in the average yields of olive groves could lead to their abandonment. The "raising calves" activities are excluded from both optimum plans, and the cost of forcing them into the "base" plan ranges from 1,232.3 drs (calves kept in barns) to 1,163.9 drs (calves kept in barns and pastured). Table 4.7 presents the lower and upper limits of AVA or APVI and prices beyond which the "base" plan will change. It is important to know how much prices or yields would have to change before the optimum plan changes. The effects of these changes also appeared under the columns "entering variable" in Table 4.7. For example, the stability limits for the "grazing areas" range from -57.9 drs to 13.7 drs. This means that the optimum level of this activity remains stable unless the AVA exceeds the limits. If the AVA of "grazing areas" falls less than -57.9 drs the activity "fallow land" is the entering variable. If the AVA exceeds 13.7 drs, the activity "reduction of olive groves" is the entering variable.

If the AVA by olive groves were decreased by 2.4 percent, the activity would exit the solution, and the "reduction of olive groves" would enter the optimum plan. This means that some olive groves with

Table 4.7 Stability Limits for the "Base" Plan Activities with Respect to Average Value Added or Paid Value of Inflows (Zone I)

Activity	Units	Stability Limits				
		Initial AVA or APVI	Lower Limit	Entering Variable	Upper Limit	Entering Variable
H_1	dr/str	-91.8	-137.0	$NALT_1$	-	-
V_1	dr/str	1,604.2	1,373.0	$SLIL_1$	-	-
$OOGO_1$	dr/str	566.6	552.9	$ROGO_1$	-	-
$OALT_1$	dr/str	151.9	111.1	$RALT_1$	-	-
GA_1	dr/str	-	-57.9	FLL_1	13.7	$ROGO_1$
BWB_1	dr/kg	-2.7	-3.24	$DCWBP_1$	-2.49	SWB_1
$BSTR_1$	dr/kg	-1.0	-1.41	$DCWBP_1$	-.79	$SSTR_1$
BH_1	dr/kg	-1.2	-1.4	$DCWBP_1$	-1.07	$NALT_1$
$BCORN_1$	dr/kg	-3.0	-3.45	$SLWL_1$	-2.86	$ROGO_1$
$BALF_1$	dr/kg	-2.1	-2.39	$SLWL_1$	-2.01	$ROGO_1$
SGD_1	dr/head	765.5	611.06	$SLCSGD_1$	-	-
CWB_1	dr/head	5,512.9	5,140.92	$SLWL_1$	5,632.53	$ROGO_1$
$CWBP_1$	dr/head	3,970.1	3,874.47	$DCWBP_1$	4,511.97	$ICWBP_1$
CWH_1	dr/head	3,171.8	2,373.15	$ICWBP_1$	3,314.14	$DCWBP_1$
$RCALH_1$	dr/head	-248.2	-1,768.67	$ICWBP_1$	22.78	$DCWBP_1$
$SCAL6B_1$	dr/head	7,000.0	6,449.13	$SLWL_1$	7,177.16	$ROGO_1$
$SCAL6BP_1$	dr/head	6,000.0	5,845.78	$DCWBP_1$	6,208.0	$BCAL6BP_1$
$SCAL18H_1$	dr/head	5,742.3	4,141.8	$ICWBP_1$	6,027.55	$DCWBP_1$
BHV_1	dr/hive	150.4	124.18	SLCBHV	-	-
$BOPC_1$	dr/100 dr	-4.0	-10.31	FL_1	-.7	$DCWBP_1$
$BLTCSP_1$	dr/100 dr	-4.0	-7.72	$SLWL_1$	-3.07	$ROGO_1$
$BLTCCHF_1$	dr/100 dr	-5.78	-13.06	$SLWL_1$	-3.89	$ROGO_1$
$BLTCDHF_1$	dr/100 dr	7.36	-33.1	$SLCSGD_1$	-	-
$BLTCBHV_1$	dr/100 dr	-19.08	-45.3	SLCBHV	-	-

yields less than the average would be abandoned under the "base" plan. The stability limits for the "capital borrowing" activities are quite wide. The maximum cost above which borrowed capital is not profitable ranges from 7.72 percent (long-term capital for livestock purchase) to 45.3 percent (long-term capital for beehive equipment).

4. Optimum Plans of Farm Production for Zone II

a. Crop and Livestock Enterprises Included - Economic Results

The crop and livestock enterprises pattern, as well as the value added by the zone's farm sector under the present and optimum plans are presented in Tables 4.8 and 4.9. The increase in value added under the "base" and "depopulation" plans amounts to 56.79 percent and 114.83 percent of that under the present plan respectively. The per capital incomes resulting from these plans are:

"Base" plan: 22,510.4 drs

"Depopulation" plan: 28,718.3 drs

These indicate that the per capita income of the second zone's farm population can approach the country's average without any depopulation. Taken into account that living costs in the bigger urban and industrial centers are higher than in rural areas, the programmed income is close to the country's average.

Estimates of the numbers of farm families and people for the zone from the "depopulation" plan are 531 and 1699 respectively. These estimates, calculated in the same manner as that for the first zone, indicate that the depopulation of this zone will also continue.

All the available agricultural land is utilized under both

Table 4.8 Value Added and Crop Enterprises Under the Present and Optimum Plans (Zone II)

Items	Units	Present Plan	"Base" Plan	"Depopulation" Plan
Value added	thous. drs	64,288.9	100,803.3	138.115.0
Irrigated land	thous. str	8.26	15.31	11.01
Wheat-barley	thous. str	1.5	.8	.8
Corn	thous. str	2.4	-	7.0
Hay	thous. str	1.4	-	1.0
Alfalfa	thous. str	.5	-	.2
Cotton	thous. str	.3	-	-
Greenhouse vegetables	thous. str	.2	.2	.2
Vegetables outdoors	thous. str	1.6	7.9	-
Olive groves for edible olive				
a) Irrigated	thous. str	-	1.78	.68
b) Non-irrigated	thous. str	2.9	1.12	2.22
Olive groves for oil				
a) Irrigated	thous. str	-	3.19	.72
b) Non-irrigated	thous. str	43.4	40.21	42.78
Old almond trees	thous. str	1.1	1.1	1.1
New almond trees	thous. str	-	4.6	4.2
Orange trees	thous. str	2.2	2.2	2.2
Fallow land	thous. str	2.4	-	-
Agricultural land	thous. str	63.1	63.1	63.1
Grazing areas	thous. str	121.3	121.3	121.3
Farm land	thous. str	184.4	184.4	184.4

Source: Computed

Table 4.9 Livestock enterprises Under the Present and Optimum Plans (Zone II)

Livestock Enterprises	Units	Present Plan	"Base" Plan	"Depopulation" Plan
Domestic sheep and goats	head	3,615	9,726	3,185
Sheep and goats "in herds"	head	6,630	23,595	-
Cows:				
a) kept in barns	head	73	73	73
b) kept in barns and pastured	head	360	360	360
c) in herds	head	38	-	-
Calves:[a]				
a) kept in barns	head	232	13	13
b) kept in barns and pastured	head	164	63	63
c) in herds	head	50	-	-
Hogs	head	1,331	43,866	-
Beehives	hives	1,787	-	-

Source: Computed

[a]Replacement heifers are included.

plans. The increase in irrigated land is considered profitable under both plans. It is important to note that even though the government would provide the needed capital without any cost, the further increase in irrigated land by making large-scale irrigation improvements (dams) is not profitable. This is due to the imposed restrictions on the use of land that could be irrigated.

The total area of annual crops and trees is the same under the present and optimum plans, but the cropping system under the present and "depopulation" plan is more diversified than that under the "base"

plan. The level of livestock enterprises appears increased under the "base" plan, while it is almost the same under the present and "depopulation" plan. The greatest increase in the level of livestock enterprises appears in the "sheep and goats in flocks" and "hogs," while the level of the cattle activities remain unchangeable.

Generally, the important points with respect to the second zone's optimum plans are:

- Farming pays the labor about the same as off-farm wage rates, since the levels of farm activities are almost the same under both optimum plans.

- As in the first zone, the optimum plans suggest that the selling calves at six months is more profitable than at 18 months.

- New almond trees are included in all the optimum plans, although their value added has been calculated on the present value analysis basis. Much change occurs in crop and livestock enterprises under the "base" plan, when the AVA by the existing trees is assigned to the "tree expansion" activities. The principal changes which occurred are the increase in "olive groves for edible olive" with corresponding decrease in "olive groves for oil."

- The crop and livestock enterprises under the present plan are almost the same as those under the "depopulation" plan. Probably, this is due to the fact that off-farm work is more available in this zone than in the first one.

- The results under the "seasonal movement" plan are the same as those under the "depopulation" plan. Feed production, sales and purchases under the present and optimum plans are presented in Table 4.10. Feeds are sold under the present and "depopulation"

Table 4.10 Feed Production, Sales and Purchases Under the Present and Optimum Plans (Zone II)

Feed	Produced (ton)			Sold (ton)			Purchased (ton)		
	Present Plan	"Base" Plan	"Depopulation" Plan	Present Plan	"Base" Plan	"Depopulation" Plan	Present Plan	"Base" Plan	"Depopulation" Plan
Wheat-Barley	269.4	143.7	143.7	-	-	-	67.9	2,849.6	-
Straw	317.1	169.1	169.1	169.6	39.0	-	-	-	-
Hay	654.5	-	400.9	-	-	-	17.7	1,353.6	-
Corn	887.7	-	2,589.3	412.1	-	2,411.6	-	1,620.4	-
Alfalfa	428.0	-	171.2	-	-	-	37.0	456.8	-

Source: Computed

Table 4.11 Labor Sold, Hired and Utilized in the Zone's Farm Sector Under the Present and Optimum Plans (Zone II)

Labor	Utilized (thousand days)			Sold (thousand days)			Hired (thousand days)		
	Present Plan	"Base" Plan	"Depopu-lation" Plan	Present Plan	"Base" Plan	"Depopu-lation" Plan	Present Plan	"Base" Plan	"Depopu-lation" Plan
Spring labor	62.7	181.2	50.8	12.7	12.7	143.1	-	-	-
Summer labor	57.0	131.4	53.9	22.3	22.3	178.8	-	-	-
Fall labor	85.1	182.1	69.6	8.6	8.6	136.9	-	-	15.8
Winter labor	97.4	160.8	83.3	4.1	4.1	114.2	-	3.3	32.6
Year	302.2	665.5	257.6	47.7	47.7	573.0	-	3.3	48.4

Source: Computed

plan, while almost all the feeds are purchased under the "base" plan.

The labor sold, hired and utilized in the zone's farm sector under the present and optimum plans are presented in Table 4.11.

The labor surplus, defined in the same manner as in the first zone, is also equal to zero. Seasonal unemployment (33.95 percent) appears also, under the "base" plan, during the summer. Therefore, although unemployment does not disappear, the second zone provides a high level of employment to its farm population. The labor surplus during the summer amounts to 79.0 thousand days. The short and long-term capital needed for the implementation of the optimum plans is presented in Table 4.12.

Table 4.12 Short and Long-term Capital Needed for the Implementation of the Optimum Plans (Zone II)

Capital	Units	"Base" Plan	"Depopulation" Plan
Operating Capital	thous. drs	44,314.1	9,342.5
Long-term capital	thous. dr	76,917.8	7,492.3
a) for irrigation improvements (loan)	thous. drs	4,125.0	4,125.0
b) for irrigation improvements (Public Invest. Budget)	thous. drs	17,630.0	-
c) for tree planting	thous. drs	3,728.3	3,367.3
d) for livestock purchase	thous. drs	11,206.4	-
e) for hog and domestic animals housing facilities	thous. drs	33,441.7	-
g) for housing facilities of "sheep and goats in flocks"	thous. drs	6,786.4	-

Source: Computed

The amount of short and long-term capital needed for the realization of both plans is reasonable. That for the "depopulation" plan being the same level as utilized in 1970. The capital needed for the "base" plan, although much higher than utilized in 1970, lies within the Bank's capacity. Therefore, the cost of attaining both plans is probably not very high.

b. Resource Use and "MVP's" for the Optimum Plans

The resources used by the optimum plans with their respective marginal value products are presented in Table 4.13.

Agricultural land is not a limiting factor for the plans as reflected by zero MVP. Also, summer labor is not a limiting factor for the "base" plan. The high MVP for irrigated land indicates that expansion of irrigation is profitable under both plans. However, no plan includes the top level of irrigated land. The answer to this is given by the MVPs for the "irrigated olive groves." The MVP for both of them is negative, indicating that an expansion of these enterprises would decrease the total value added by the farm sector. Therefore, restriction on the use of land for irrigation are the main causes for exclusion of the top level of irrigated land from the optimum plans. The MVP for orange trees is also negative under both plans. This, combined with the negative MVPs for irrigated olive groves, indicates that the zone's irrigated land is more profitably used for growing annual crops than trees.

The MVP for summer labor is less than the wage rate under the "depopulation" plan. This can be explained by the greater supply of labor during this season, as well as by the imposed relationships

Table 4.13 Resource Use and Their MVPs for the Optimum Plans (Zone II)

Resources	Units	"Base" Plan		"Depopulation" Plan	
		Resource Level	MVP[a]	Resource Level	MVP[a]
Farm land	thous. str	184.4	21.3	184.4	8.7
Agricultural land	thous. str	63.1	255.4	63.1	-
Irrigated land	thous. str	15.31	1,396.6	11.01	369.4
Olive groves for oil	thous. str	40.21	19.1	42.78	48.8
Olive groves for edible olive	thous. str	1.12	306.8	2.22	253.2
Irrigated olive groves					
a) for oil	thous. str	3.19	-1,236.0	.72	-348.2
b) for edible olive	thous. str	1.78	-1,032.9	.68	-174.8
Almond trees	thous. str	5.7	180.0	5.3	180.0
Orange trees	thous. str	2.2	-827.9	2.2	-35.3
Grazing areas	thous. str	121.3	-	3.3	-
Spring labor	thous. days	181.2	.7	181.2	207.0
Summer labor	thous. days	131.4	-	210.4	99.0
Fall labor	thous. days	182.1	154.5	182.1	208.0
Winter labor	thous. days	160.8	208.0	160.8	208.0
Operating capital	thous. drs	44,314.1	.04	9,342.5	.04
Long-term capital					
a) for irrigation improvements (loan)	thous. drs	4,125.0	.02	4,125.0	.02
b) for irrigation improvements (Public Invest. Budget)	thous. drs	17,360.0	-	-	-
c) for tree planting	thous. drs	3,728.3	.0505	3,367.3	.0505
d) for stock purchase	thous. drs	11,206.4	.04	-	-
e) for hog and dom. animals housing facilities	thous. drs	33,441.7	.0736	-	-
f) for housing facilities of "sheep and goats in flocks"	thous. drs	6,786.4	.0736	-	-

Source: Computed

[a]thousand drachmas/unit

among the labor sold during the season. Actually, under the "de-population" plan, any increase in the supply of summer labor should be employed in the zone's farm sector. Thus, the MVP for the summer labor indicates how much the value added by farming would increase if the summer labor is increased by one day. It is also important that the MVP for spring labor is close to zero (.7) under the "base" plan. Therefore, spring and summer labor are not limiting factors for the "base" plan. Finally, the MVPs for all the categories of capital are equal to their cost, since the supply of them was treated as perfectly elastic.

c. Cost of Forcing the Non-Basis Activities Into the "Base" Plan - Stability Limits

The costs of forcing the non-basis activities into the "base" plan are presented in Table 4.14. The cost of forcing the top level of irrigated land into the "base" plan is very small. Thus, a small decrease in the cost of irrigation improvements or a small increase in product prices would make further expansion of irrigated land profitable. The cost of forcing one stremma of corn into the plan is 744.7. An increase either in the price of corn by 2.08 dr/kg, or in the yields of 265.9 kg/str would make corn growing profitable.

The cost of forcing the irrigated new trees into the plan is very high,which further confirms the previous statement that the irrigated land is more profitably used for annual crops than trees. Also, the marginal cost of growing cotton is high, which reflects unfavorable conditions for cotton and favorable ones for competitive crops (vegetables).

The calf raising activities are relatively more competitive in

Table 4.14 Cost of forcing the Non-Basis Enterprises into the "Base" Plan (Zone II)

Activities	Units	"Base" Plan
Irrigated land 8,260 str	dr/8,260 str	3,145,584.6
Irrigated land 11,010 str	dr/11,010 str	1,279,330.1
Irrigated land 12,560 str	dr/12,560 str	1,866,254.5
Irrigated land 31,260 str	dr/31,260 str	438,306.3
Corn	dr/str	744.7
Hay	dr/str	8.2
Alfalfa	dr/str	565.5
Cotton	dr/str	818.9
Fallow land	dr/str	234.2
New Tree-plants:		
a) Olive groves for oil	dr/str	381.0
b) Olive groves for edible olive (non-irrigated)	dr/str	293.8
c) Olive groves for edible olive (irrigated)	dr/str	1,615.5
d) Orange trees	dr/str	1,515.3
Reduction of olive groves for oil	dr/str	19.13
Sell wheat-barley	dr/kg	.73
Sell hay	dr/kg	2.76
Sell corn	dr/kg	.21
Sell Alfalfa	dr/kg	.21
Sell calves 18 months old:		
a) kept in barns	dr/head	-
b) kept in barns and pastured	dr/head	292.3

Source: Computed

this zone than in the first one, especially, the raising calves in barns which is the most promising candidate.

Stability limits for the "base" plan activities are presented in Table 4.15.

Table 4.15 Stability Limits for the "Base" Plan Activities with Respect to Average Value Adder, or Average Paid Value of Inflows (Zone II)

Activity	Units	Stability Limits				
		Initial AVA or APVI	Lower Limit	Entering Variable	Upper Limit	Entering Variable
WB_2	dr/str	-154.3	-236.9	$SLSPL_2$	-62.0	SWB_2
V_2	dr/str	2,676.2	2,608.9	$BLTCGH_2$	3,029.7	λ_5
VG_2	dr/str	8,261.8	6,324.3	SLLTCGH	8,329.0	$BLTCGH_2$
$IOGED_2$	dr/str	1,510.0	303.1	λ_2	2,205.7	λ_5
$IOGO_2$	dr/str	1,040.0	530.3	λ_2	1,071.1	λ_5
$OOGO_2$	dr/str	796.6	777.5	$ROGO_2$	1,306.3	λ_2
$OGED_2$	dr/str	1,035.4	728.6	$SLOGED_2$	2,242.3	λ_2
$OALT_2$	dr/str	538.9	358.9	$SLOALT_2$	-	-
ORT_2	dr/str	1,428.7	-	-	2,256.6	$SLORT_2$
$NALT_2$	dr/str	399.3	391.1	H_2	418.4	$ROGO_2$
GA_2	dr/str	-	-	-	255.5	$ROGO_2$
$SSTR_2$	dr/kg	.8	.41	$SLSPL_2$	-	-
BWB_2	dr/kg	-2.7	-3.18	SWB_2	-2.37	SWB_2
BH_2	dr/kg	-1.2	-1.22	H_2	-.78	$ICWB_2$
$BCORN_2$	dr/kg	-3.0	-3.43	$DCWBP_2$	-2.79	$SCORN_2$
$BALF_2$	dr/kg	-2.0	-2.42	$DCWBP_2$	-1.87	$ICWB_2$
SGD_2	dr/head	843.8	570.44	$SLCSGD_2$	-	-
SGF_2	dr/head	579.3	472.9	$SLGA_2$	638.6	$DCWBP_2$
CWB_2	dr/head	5,750.8	4,995.1	$DCWB_2$	5,929.5	$ICWB_2$
$CWBP_2$	dr/head	3,274.7	3,165.2	$DCWBP_2$	3,918.1	$ICWBP_2$
$SCAL6B_2$	dr/head	7,500.0	6,380.9	$DCWB_2$	7,708.0	$BCAL6BP_2$
$SCAL6BP_2$	dr/head	6,000.0	5,824.9	$DCWBP_2$	6,208.0	$BCAL6BP_2$
HG_2	dr/head	433.1	376.3	$ICWB_2$	474.0	$ROGO_2$
$BOPC_2$	dr/100 dr	-4.0	-5.42	H_2	-3.1	BLTCGH
$LTLIR_2$	dr/100 dr	-2.0	-12.63	λ_5	-	-
$LTCTP_2$	dr/100 dr	-5.05	-6.08	H_2	-2.66	$SLOGO_2$
$LTC5P_2$	dr/100dr	-4.0	-5.4	$DCWBP_2$	-2.38	$ICWB_2$

Source: Computed

An increase in the AVA of irrigated "olive groves for oil" by 3.0 percent could lead to further expansion of irrigated land, while an increase of 63.98 percent in the AVA of non-irrigated olive groves would lead to a reduction of irrigated land. Generally, the olive groves appear to compete with the "irrigated land" activities due to the restrictions imposed on the land that could be irrigated.

If the AVA by "olive groves for oil" decreases by 19.7 drs the activity exits the solution, and the competing activity "reduction of olive groves" enters the solution. This shows that some olive groves with yields below the average could also be abandoned under the "base" plan.

A decrease in the acquisition price of alfalfa of 6.5 percent would lead to an increase in the level of the "cows kept in barns" activity. The same thing also takes place when the acquisition price of hay decreases by 35 percent. The stability limits for the "borrowing operating capital" activity ranges from 3.1 percent to 5.42 percent. Therefore, the borrowed short-term capital remains stable unless the interest rate exceeds these limits. Finally, the maximum cost above which the borrowed long-term capital is not profitable ranges from 5.4 percent (long-term loan for irrigation improvements) to 12.63 percent (long-term capital for livestock purchase).

5. Optimum Plan of Farm Production for the Whole Region

a. Crop and Livestock Enterprises Included - Economic Results

The crop and livestock enterprises, as well as the value added by the region's farm sector under the present and optimum plans are presented in Tables 4.16 and 4.17. The increase in value added under

Table 4.16 Value Added and Crop-tree Enterprises Under the Present and Optimum Plans (Whole Region)

Items	Units	Present Plan	"Base" Plan		"Depopulation" Plan[a]
			Unrestricted Capital Supplied by the Public Investment Budget	Limited Capital Supplied by the Public Investment Budget	
Value Added	thous. drs	115,092.8	184,736.4	184,407.1	266,921.3
Irrigated land	thous. str	8.38	31.38	15.43	11.01
Wheat-Barley	thous. str	1.7	11.83	11.16	15.2
Corn	thous. str	2.4	-	-	-
Hay	thous. str	3.2	4.0	4.0	-
Alfalfa	thous. str	.5	-	-	-
Cotton	thous. str	.3	-	-	-
Vegetables:					
a) in greenhouse	thous. str	.2	3.5	3.5	.2
b) outdoors	thous. str	1.7	6.0	4.76	7.21
Olive groves for edible olive:					
a) Irrigated	thous. str	-	2.41	1.78	.72
b) Non-irrigated	thous. str	3.0	.49	1.12	2.18

Table 4.16 (Continued)

Items	Units	Present Plan	"Base" Plan		"Depopulation Plan[a]
			Unrestricted Capital Supplied by the Public Investment Budget	Limited Capital Supplied by the Public Investment Budget	
Olive groves for oil					
a) Irrigated	thous. str	-	17.27	3.19	.68
b) Non-irrigated	thous. str	100.7	83.43	97.51	34.71
Almond trees	thous. str	1.8	1.8	1.8	-
Orange trees	thous. str	2.2	2.2	2.2	2.2
Fallow land	thous. str	12.9	-	-	-
Agricultural land	thous. str	134.6	132.93	131.02	63.1
Grazing areas	thous. str	312.6	314.27	316.18	384.1
Farm land	thous. str	447.2	447.20	447.20	447.2

Source: Computed

[a]The results of the "depopulation" plan are the same whether the capital supplied by the Public Investment Budget is restricted or not.

Table 4.17 Livestock Enterprises Under the Present and Optimum Plans (Whole Region)

Livestock Enterprises	Units	Present	"Base" Plan		"Depopulation" Plan
			Unrestricted Capital Supplied by the Public Investment Budget	Limited Capital Supplied by the Public Investment Budget	
Domestic sheep and goats	head	7,742	19,368	19,368	-
Sheep and goats "in flocks"	head	12,613	-	-	-
Cows:					
a) kept in barns	head	88	2,802	4,509	-
b) kept in barns and pastured	head	1,394	-	-	-
c) in herds	head	519	16,210	16,316	21,212
Calves[a]					
a) kept in barns	head	267	440	788	-
b) kept in barns and pastured	head	1,187	-	-	-
c) in herds	head	415	11,347	11,421	14,848
Hogs	head	3,717	37,372	34,803	-
Beehives	hives	8,936	25,000	25,000	-

Source: Computed

[a]Replacement heifers are included.

the "base" and "depopulation" plans amounts to 60.22 percent and 131.92 percent of that under the present plan respectively. The per capita incomes resulting from the optimum plans are:

"Base" plan: 20,892.8 drs (20,925.7 drs, under unlimited capital supplied by the Public Investment Budget)

"Depopulation" plan: 28,135.0 drs

These records indicate that the per capita income of the region's farm population can not reach the country's average without labor selling outside the region. But, it comes close to the country's average when out migration is permitted.

The unlimited supply of long-term capital from the Public Investment Budget provides a very small increase (32.9 drs) in the per capita income. Given that the capital needed for this purpose amounts to 168.37 million drachmas, the cost of this increase is very high.

The estimates of the number of farm families and people for the region from the "depopulation" plan are 919 and 2,850 respectively. These estimates, calculated in the same manner as in the first zone, indicate that the region's depopulation will continue.

Almost all the agricultural land is used under the "base" plan, while most of it is transformed into grazing areas under the "depopulation" plan. Expansion of irrigated land is profitable under both plans. It reaches the top level (32,380 str) under the "base" plan, when long-term capital supplied by the Public Investment Budget is unlimited. Greenhouse vegetables, which are labor intensive, increase under the "base" plan and use all land appropriate for them. Also, the level of "vegetables outdoors" is greatly increased. Abandonment of olive groves under the "depopulation" plan is greater than that in

other models for both zones. It indicates that the second zones olive trees are also abandoned even though they were considered profitable when the second zone was studied separately.

An increase in the levels of all the livestock enterprises appears under the "base" plan, while the "cattle in herds" is the only livestock activity in the "depopulation" plan. It is also more profitable to sell calves at six months than at 18 months.

The "domestic sheep and goats" and the "beehives" can be increased profitably as much as possible under the "base" plan. Level of these activities in the "base" plan equals the region's capacity, while their MVPs are 256.6 drs and 23.6 drs respectively.

No new trees are included in the optimum solutions, even if the value added for old trees is assigned to the new trees.

The results under the "seasonal movement" plan are almost the same as under the "depopulation" plan.

Feed production sales and purchases under the present and optimum plans are presented in Table 4.18. Straw is in excess under both of the optimum plans. Some substitution of straw for hay may be possible in the rations. The feed quantities (especially that of corn and alfalfa) which must be purchased under the "base" plan seem very large which may be an obstacle. No feed is needed under the "depopulation" plan, since the "cattle in herds" are only pastured.

The quantities of labor sold, hired and utilized under the present and optimum plans are presented in Table 4.19.

The labor surplus is also equal to zero. Seasonal unemployment appears during the spring and summer, ranging from 18.54 percent (spring) to 52.03 percent (summer). Rates of unemployment are not

Table 4.18 Feed Production, Sales and Purchases Under the Present and Optimum Plans (Whole Region)

Feed	Produced (ton)			Sold (ton)			Purchased (ton)		
	Present Plan	"Base" Plan[a]	"Depopulation" Plan	Present Plan	"Base" Plan[a]	"Depopulation" Plan	Present Plan	"Base" Plan[a]	"Depopulation" Plan
Wheat-Barley	288.9	2,011.5	2,729.9	-	-	2,729.9	475.6	-	-
Straw	339.5	2,367.7	3,217.3	-	1,706.0	3,217.3	219.4	-	-
Hay	1,758.8	1,426.4	-	-	-	-	352.7	1,154.3	-
Corn	887.7	-	-	-	-	-	191.7	5,307.7	-
Alfalfa	428.0	-	-	-	-	-	82.7	6,113.1	-

Source: Computed

[a]Limited capital supplied by the Public Investment Budget.

Table 4.19 Labor Sold, Hired and Utilized in the Region's Farm Sector Under the Present and Optimum Plans (Whole Region)

Labor	Utilized (thousand days)			Sold (thousand days)			Hired (thousand days)		
	Present Plan	"Base" Plan[a]	"Depopulation" Plan	Present Plan	"Base" Plan[a]	"Depopulation" Plan	Present Plan	"Base" Plan[a]	"Depopulation" Plan
Spring labor	136.1	253.3	77.6	16.9	16.9	254.5	-	-	-
Summer labor	88.4	156.9	70.2	31.7	31.7	323.0	-	-	-
Fall labor	209.3	320.3	105.1	8.6	8.6	243.9	-	-	20.1
Winter labor	162.8	281.1	107.8	4.1	4.1	208.1	-	-	30.7
Year	596.6	1,011.6	360.7	61.3	61.3	1,029.5	-	-	50.8

Source: Computed

[a]Limited capital supplied by the Public Investment Budget.

reduced by considering the zone's together. The distribution of seasonal unemployment shows that the full employment is difficult to be achieved only by farming.

The quantities of short and long-term capital needed for the implementation of the optimum plans are presented in Table 4.20.

The long-term capital needed for the implementation of the plans is very large, which indicates the high costs of the plans.

b. Resource Use and MVP's for the Optimum Plans

The resources used by the optimum plans with their respective marginal value products are presented in Table 4.21.

Spring and summer labor are not limiting factors. The MVP of irrigated land is the highest, indicating the great importance of irrigation in the region's development. The MVP of irrigated trees (olive groves, orange trees) is also negative, indicating that the use of irrigated land for growing trees is less profitable than for growing annual crops.

The MVPs of fall and winter labor are below off-farm rates, indicating that labor is more profitably employed in non-farm sector than in farming. Finally, the MVP for the long-term capital supplied by the Public Investment Budget amounts to 8.68 percent, which indicates that it is not profitable for this capital category to be used, if its cost exceeds 8.68 percent. The expansion of irrigated land is profitable, even if the capital needed is charged at an interest rate of 8.68 percent.

Table 4.20 Short and Long-term Capital Needed for the Implementation of the Optimum Plan (Whole Region)

Items	Units	"Base" Plan		"Depopulation" Plan
		Unrestricted Capital Supplied by the Public Investment Budget	Limited Capital Supplied by the Public Investment Budget	
Operating capital	thous. drs	67,739.3	66,324.5	23,090.8
Long-term capital	thous. drs	407,000.7	267,438.9	148,473.4
a) for irrigation improvements (loans)	thous. drs	-	4,080.6	4,125.0
b) for irrigation improvements (Public Invest. Budget)	thous. drs	186,000.0	19,442.0	-
c) for greenhouse construction	thous. drs	44,550.0	44,550.0	-
d) for livestock purchase	thous. drs	121,220.3	140,548.2	99,701.7
e) for cattle housing facilities	thous. drs	46,219.1	53,311.8	44,646.7
f) for hogs and domestic animals housing facilities	thous. drs	7,404.9	1,899.9	-
g) for beehive equipment	thous. drs	1,606.4	1,606.4	-

Source: Computed

Table 4.21 Resource Use and Their MVPs for the Optimum Plans (Whole Region)

Resources	Units	"Base" Plan[a]		"Depopulation" Plan	
		Resource Level	MVP[b]	Resource Level	MVP[b]
Farm land	thous str	447.2	111.2	447.2	89.0
Agric. land of the Zone I	thous str	67.92	-	-	-
Agric. land of the Zone II	thous str	63.1	233.3	63.1	14.7
Irrig. land in Zone I	thous str	.12	343.0	-	-
Irrig. land in Zone II	thous str	15.31	1,528.6	11.01	271.8
Land for greenhouse vegetables	thous str	3.5	1,325.4	.2	-
Olive groves for edible olive					
a) Irrigated	thous str	1.78	-1,115.4	.72	-167.4
b) Non-irrigated	thous str	1.22	324.4	2.18	216.5
Olive groves for oil					
a) Irrigated	thous str	3.19	-1,327.0	.68	-317.2
b) Non-irrigated	thous str	97.51	90.8	34.71	-
Almond trees	thous str	1.8	117.1	-	-
Orange trees	thous str	2.2	-861.5	2.2	-139.7
Grazing areas	thous str	316.18	-	384.1	89.0
Spring labor	thous days	253.3	-	315.2	107.3
Summer labor	thous days	156.9	-	361.5	177.7
Fall labor	thous days	320.3	145.3	320.3	208.0
Winter labor	thous days	281.1	122.7	281.1	208.0
Region's capacity for dom. sheep and goats	thous str	19,368	256.6	-	-
Region's Beehive capacity	thous str	25,000	23.6	-	-
Long-term capital supplied by the Public Investment Budget	thous str	19.442	1.98	-	-

Source: Computed

[a]Limited capital supplied by the Public Investment Budget

[b]thousand drachmas/unit.

c. Cost of Forcing the Non-Basis Activities Into the "Base" Plan

The costs of forcing the non-basis activities into the "base" plan are presented in Table 4.22.

"Cows kept in barns and pastured" and "raising calves in barns" are the most likely candidates to enter the optimum solution. Cotton and irrigated new trees are the most expensive enterprises. New almond trees are more competitive than the other non-irrigated new trees.

Table 4.22 Cost of Frocing the Non-Basis Activities Into the "Base" Plan (Whole Region)

Activities	Units	"Base" Plan[a]
Irrigated land 8,380 str	drs/8,260 str	3,603,821.1
Irrigated land 11,130 str	drs/11,010 str	1,495,979.2
Irrigated land 12,680 str	drs/12,560 str	2,107,841.9
Irrigated land 31,380 str	drs/31,260 str	-
Corn	drs/str	942.1
Alfalfa	drs/str	665.2
Cotton	drs/str	991.2
New trees:		
a) Olive groves for edible olive (irrigated)	drs/str	1,604.6
b) Olive groves for edible olive (non-irrigated)	drs/str	210.4
c) Olive groves for oil	drs/str	248.7
d) Almond trees	drs/str	22.4
e) Orange trees	drs/str	1,463.1
Fallow land	drs/str	301.7
Sell wheat-barley	drs/kg	.03
Sell hay	drs/kg	.21
Sell corn	drs/kg	.21
Sell alfalfa	drs/kg	.31
Sheep and goats in flocks	drs/head	325.9
Cows kept in barns and pastured	drs/head	-
Sell calves 18 months old:		
a) kept in barns	drs/head	-
b) kept in barns and pastured	drs/head	1,162.2

Source: Computed

[a]Limited capital supplied by the Public Investment Budget

CHAPTER V

CONCLUSIONS AND POLICY IMPLICATIONS

1. Interpreting the Results

Before stating the conclusions, some discussion of their appropriate interpretation is needed.

To start with, it should be emphasized that the conclusions are obtained by making particular assumptions in the models and that changes in the set of assumptions may lead to quite different conclusions. Therefore, policy makers should take into serious account the assumptions before using the results for decision making.

Another important point is that the analysis is based on the average values of input-output coefficients during the base year (1970). The extent to which this year represents the average year and the standard errors of input-output coefficients are factors seriously affecting the results. The standard errors of input-output coefficients, although it was not calculated, seem to be large for crops, especially olive groves.

In order to estimate the farm population that will continue to live in zones or regions under unlimited labor selling, it is assumed that labor selling leads necessarily to the movement of the worker and his family outside the zone or the region. The reported estimates are computed on the basis of the average family size and

the average labor supplied by the farm family during the seasons. The standard errors of these averages, as well as the fact that the available labor has been calculated on the basis of the active population (people that are able to work) should also be taken into account in the interpretation of the results.

It should also be recalled that because of the constant technology assumption, the model does not include other than the existing enterprises. Introduction of new crops and livestock enterprises may lead to quite different results.

Another warning to be considered is that the models are regional linear programming models. Thus, they do not evaluate the effects of optimum plans on the region's individual farms.

2. Conclusions

The main conclusions from this study are as follows:

(1) The per capita farm income of the region could not reach the country's average by reorganizing the farm resources.

(2) Regional outmigration will continue if employment outside the region is available at acceptable wage rates and will be greater for the first than the second zone.

(3) It would be impossible for the region's farm population to achieve full employment throughout the year by farming, even if capital supply was unlimited. It is a strong argument against stopping the region's depopulation and this must be taken into serious account by policy makers. During spring and summer, a labor surplus is observed under any optimum plan. This is due to the existing crop and livestock enterprises and region's physical characteristics which restrict the number of crops which can be grown.

(4) The long-term capital needed for application of an optimum plan ranges from 148.47 million drachmas to 400.7 million drachmas, while the short-term capital ranges from 23.09 million drachmas to 67.74 million drachmas. The first (lower) estimates of the capital result from models involving depopulation. The greatest part of the long-term capital is needed for the first zone's reorganization.

(5) Reorganization of the first zone's resource utilization, without selling labor, provides a small improvement in its income. The per capita income of farm population, rising by 4,396.1 drs, reaches a level of 17,047.9 drs. The long-term capital needed for this reorganization is 205.74 million drachmas, which is very large.

(6) A substantial improvement could be achieved in the second zone's economic conditions by reorganizing its farm resources. The per capita income of farm population, rising by 7,298.1 drs, reaches a level of 22,510.4 drs, which is inferior to the country's average by 9,020.6 drs. The short and long-term capital needed for this reorganization is 44.31 million drachmas and 76.92 million drachmas respectively. This shows that the zone's depopulation could be stopped or reduced. The main factor of this potential improvement in the second zone could be considered the expansion of irrigated land, which is profitable under all the optimum plans.

(7) Livestock of the first zone can contribute more to its income than cropping. However, livestock sector development requires large quantities of feedstuffs to be supplied from other regions. The supply of these feedstuffs must be ensured before attempting to develop livestock enterprises.

(8) The first zone's land would be more profitably used for

grazing than for crops or trees, if labor selling is possible at the reported market wages because of lack of water, adverse topography and poor quality of land.

(9) Raising "cattle in herds" is the most profitable enterprise for the first zone, when the labor sale is possible at the reported wage rates. This shows that the MVP of grazing areas is greater when they are used for pasturing "cattle in herds" than for any other use.

Domestic sheep and goats and beehives would be profitable enterprises for the first zone, if labor sale is not possible. The zone's flower capacity is a physical resource that should be improved and utilized fully.

(10) The existing crop pattern in the second zone comes close to the optimum one, under the assumption of unlimited labor selling. The level of livestock enterprises, except "hogs," are the same as in the present plan. The above indicates that the farmers in the second zone use labor efficiently.

(11) The second zone's crop and tree enterprises and an expansion of irrigated land would contribute more than its livestock enterprises. Any possibility of reducing irrigation costs should be examined and investigated.

(12) With respect to the second zone's crops, the conclusions are:

(a) Irrigated land is more profitably used for growing annual crops than trees.

(b) Olive groves for edible production are more profitable than those for oil.

(c) Expansion of almond trees is considered profitable, although the AVA assigned to the new trees has been calculated on the basis of the PV analysis.

(d) Expansion of greenhouse vegetables is not considered profitable when the second zone is studied separately. However, it is included in the optimum plans when the zones are studied together.

(13) Raising calves for veal or beef is unprofitable for both zones, even if the labor is priced on opportunity cost basis. Calves provide more value added when they are sold at six months than when they are raised for 18 months.

(14) The unemployment rate is not reduced by considering the zones together, which is due to the similar crops (olive groves) in both zones. Thus, reallocation of region's population would not provide substantial improvement in the region's economic conditions.

3. Policy Implication

Given the above mentioned conclusions, this section will concentrate on policy implications.

After the above discussion on the results interpretation, the policy implications are stated. One conclusion of this study is that the reorganization of region's resources could not provide a level of per capita income equal to the country's average, although this reorganization requires a very large amount of long-term capital. So, under the existing conditions, the region's depopulation will continue. The possibilities for introducing new technology, and especially a labor intensive one, as well as the possibilities for the region's

non-farm sector development should draw the attention of policy makers. The inability of farming to employ the available labor, even though it was considered as fixed, shows that a substantial development would be difficult to achieve by farming. Only the growth of the region's non-farm sector, and especially of those enterprises which require labor during the summer, could provide a high rate of employment and reduce the region's depopulation to reasonable level. The livestock of the first zone could contribute more to its development than cropping. The opposite is true for the second zone. Therefore, the attempt of the local extension service and the various incentives should be directed to these goals. Expansion and improvement of grazing areas should also be stimulated in the first zone.

Raising calves for veal and beef production is not considered profitable for both zones. But raising cows and selling the calves at the six months age is profitable. Therefore, the subsidy for raising calves should be reexamined.

The expansion of irrigated land is the basic factor for the development of the second zone. Further study and research on the zone's water resources and on the possibilities for their utilization should be the first step of any attempt to develop the zone. A decrease in the cost of irrigation improvements would permit a large expansion of irrigated land. This, in combination with the introduction of new technology, may present the solution to the depopulation of the region.

Finally, further research, taking into account changes in technology and growth in the region's non-farm sector, is needed to provide a complete idea of the potential improvement in the region's economic conditions.

APPENDICES

APPENDIX A

Table A-1 Distribution of Region's Area on the Basis of Its Use

Zone	Agricultural land (thous. str)	Grazing Areas (Pastures) (thous. str)	Forests (thous. str)	Useless Areas (thous. str)	Total Area (thous. str)
First	71.5	191.3	-	42.5	305.3
Second	63.1	121.3	1.7	5.7	191.8
Region	134.6	312.6	1.7	48.2	497.1

Source: National Statistical Service of Greece

Table A-2 Average Rainfall Per Month

Month	Rainfall in mm
January	196.9
February	86.1
March	89.4
April	35.7
May	23.4
June	7.4
July	4.6
August	6.0
September	39.5
October	89.5
November	128.2
December	206.9
Year	913.6

Source: Ministry of Public Work - Water Reclamation Department

Table A-3 Zones' Population in 1951, 1961 and 1970

Zone	1951	1961	1970
First	11,323	8,761	5,380
Index	100.0	77.4	47.5
Second	12,788	11,532	8,329
Index	100.0	90.2	65.1
Region	24,111	20,293	13,709
Index	100.0	84.2	56.8

Source: (a) National Statistical Service of Greece
(b) Data collected by the writer in 1970

Table A-4 Density of Population (Persons Per 1,000 str Land)

Zone	1951	1961	1970
First	37.1	28.7	17.5
Second	66.7	60.1	43.4
Region	48.5	40.8	27.6

Source: Appendix A, Tables A-1 and A-2

Table A-5 Distribution of Region's Population in 1970 on the Basis of Age and Sex.

Zone	Age							
	14 and Under		15-20 Years		21-64 Years		65 and Over	
	Female	Male	Female	Male	Female	Male	Female	Male
First	672	582	233	216	1,285	1,196	678	518
Second	1,108	1,066	427	382	2,140	1,899	731	576
Region	1,780	1,648	660	598	3,425	3,095	1,403	1,094

Source: Data collected by the writer in 1970.

Table A-6 Active Population of Each Zone in 1970

Zone	Active Population Occupied in Framing	Active Population Occupied in Non-farm Sector	Total Active Population
First	2,528	402	2,930
Second	3,677	1,171	4,848
Region	6,205	1,573	7,778

Source: Data collected by the writer in 1970.

Table A-7 Distribution of the Region's Families on the Basis of Their Occupation in 1970

Zone	Farming	Nonfarm Sector
First	1,607	260
Second	1,621	1,005
Region	3,228	1,265

Source: Data collected by the writer in 1970.

Table A-8 Distribution of Region's Families on the Basis of Their Size

Persons Per Family	Number of Families		
	First Zone	Second Zone	Region
1	491	480	971
2	548	767	1,315
3	252	373	625
4	199	377	576
5	166	323	489
6	119	164	283
7	59	86	145
8	21	32	53
9	6	12	18
10	4	9	13
11	2	3	5
Total	1,867	2,626	4,493

Source: Data collected by the writer in 1970.

Table A-9 Distribution of Region's Agricultural Land on the Basis of the Groups of Crops and Trees in 1970

Crops and Trees	Area in Thousand Str		
	First Zone	Second Zone	Region
Wheat-Barley	.2	1.5	1.7
Corn	-	2.4	2.4
Hay	1.8	1.4	3.2
Alfalfa	-	.5	.5
Cotton Irrigated	-	.3	.3
Vegetables:			
a) in greenhouse	-	.2	.2
b) outdoors	.1	1.6	1.7
	2.1	7.9	10.0
Olive groves			
a) for edible olive	.1	2.9	3.0
b) for oil	57.3	43.4	100.7
Almond trees	.7	1.1	1.8
Orange trees	-	2.2	2.2
Miscellaneous fruit trees	.8	3.2	4.0
	58.9	52.8	111.7
Fallow land	10.5	2.4	12.9
Total	71.5	63.1	134.6

Source: Data collected by the writer in 1970.

Table A-10 Irrigated Land in Each Zone in 1970

Zone	Irrigated Land in str
First	120
Second	8,260
Region	8,380

Source: Data collected by the writer in 1970.

Table A-11 Distribution of Region's Active Population Occupied in Farming on the Basis of Sex and Age

Zone	15-20 Years		21-65 Years	
	Female	Male	Female	Male
First	191	173	1,124	1,040
Second	292	268	1,651	1,466
Region	483	441	2,775	2,506

Source: Data collected by the writer in 1970.

APPENDIX B

Table B-1 Total Value Product and Average Value Product of Crops and Trees in 1970

Crops and Trees	First Zone		Second Zone	
	TVP in thous. drs	AVP in drs	TVP in thous. drs	AVP in drs
Wheat-Barley	66.7	333.5	927.1	618.1
Corn	-	-	2,485.8	1,035.8
Hay	641.9	356.6	561.3	400.9
Alfalfa	-	-	770.4	1,540.8
Cotton irr.	-	-	437.4	1,458.0
Vegetables				
a) in greenhouse	-	-	2,642.9	13,214.5
b) outdoors	181.7	1,817.0	4,992.6	3,120.4
	890.3	424.0	12,817.5	1,622.5
Olive groves[a]				
a) for edible olive	23.6	236.0	3,490.9	1,203.8
b) for oil	40,226.1	702.0	41,847.9	964.2
Almond trees	167.8	239.7	720.6	655.1
Orange trees	-	-	3,547.5	1,612.5
Miscellaneous fruit trees	165.1	206.4	1,962.7	613.3
	40,582.6	689.0	51,569.6	976.7
Fallow land[b]	472.4	45.0	93.2	38.8
Total	41,945.3	586.6	64,480.3	1,021.9

Source: Data Collected by the writer in 1970.

[a]nonirrigated

[b]The value of harvested natural grass is only calculated.

Table B-2 Livestocks in Each Zone in 1970

Livestock	First Zone	Second Zone	Region
Domestic sheep and goats	4,127	3,615	7,742
Sheep and Goats "in flocks"	5,983	6,630	12,613
Cows:			
a) kept in barns	15	73	88
b) kept in barns and pastured	1,034	360	1,394
c) "in herds"	481	38	519
Calves:[a]			
a) kept in barns	35	232	267
b) kept in barns and pastured	1,023	164	1,187
c) "in herds"	365	50	415
Hogs	2,286	1,331	3,717
Beehives	7,149	1,787	8,936
Hens "Domestic"	18,000	15,000	33,000

Source: Data collected by the writer in 1970.

[a]Bulls and heifers 6 - 18 months old are included.

Table B-3 Total Value Product and Average Value Product of Livestock Enterprises in 1970

Livestock Enterprisees	First Zone		Second Zone	
	TVP in thous. drs	AVP in drs	TVP in thous. drs	AVP in drs
Domestic sheep and goats	3,622.7	877.8	3,562.4	985.4
Sheep and goats "in flocks"	3,653.9	610.7	4,426.8	667.7
Cows:[a]				
a) kept in barns	162.1	10,806.7	848.1	11,617.8
b) kept in barns and pastured	6,097.0	5,896.5	2,116.6	5,879.4

Table B-3 (Continued)

Livestock Enterprises	First Zone		Second Zone	
	TVP in thous. drs	AVP drs	TVP in thous. drs	AVP in drs
c) "in herds"	1,706.1	3,547.0	140.1	3,686.8
Calves				
a) kept in barns	445.0	12,714.3	3,240.3	13,966.8
b) kept in barns and pastured	9,334.2	9,124.3	1,727.4	10,532.9
c) "in herds"	2,095.9	5,742.2	295.8	5,916.0
Hogs	2,136.1	895.3	1,446.8	1,087.0
Beehives	1,258.5	176.0	260.4	145.7
Hens "domestic"	1,558.1	86.6	1,489.4	99.3
Total	32,069.6	-	19,554.1	-

Source: Data collected by the writer in 1970.

[a]The value of the calves at the age of six months is included.

Table B-4 Required Labor in Man-Workdays Per Unit of Farm Activities

Farm Activities	First Zone				Second Zone			
	SPRING	SUMMER	FALL	WINTER	SPRING	SUMMER	FALL	WINTER
Wheat-Barley	.4	1.1	1.2	-	.1	.9	.9	.1
Corn	-	-	-	-	.9	2.8	.2	-
Hay	.8	-	.8	-	.5	-	.7	-
Alfalfa	-	-	-	-	1.4	2.8	1.1	-
Cotton irrigated	-	-	-	-	2.5	4.0	2.8	-
Vegetables								
a) in greenhouse	-	-	-	-	12.4	-	4.4	18.1
b) outdoors	5.9	4.8	4.9	3.5	4.1	3.7	3.8	1.9
Olive groves non-irrigated								
a) for edible olive	.8	.3	1.1	.4	.9	.4	1.8	.8
b) for oil	.8	.3	1.9	.7	.7	.3	1.2	1.5
Almond trees	.5	.7	-	-	.4	1.6	.5	-
Orange trees	-	-	-	-	.9	2.5	1.3	1.8
Miscellaneous fruit trees	.4	1.2	.2	.9	.5	3.2	.9	.2
Domestic sheep and goats	.8	.6	.8	1.5	.8	.6	.8	1.5
Sheep and goats "in flocks"	.6	.5	.6	1.4	.6	.5	.6	1.4
Cows[a]								
a) kept in barns	3.9	3.4	3.9	4.9	3.9	3.4	3.9	4.9
b) kept in barns & pastured	1.8	.8	.8	3.2	1.8	.8	.8	3.2
c) "in herds"	.4	.3	.4	.8	.4	.3	.4	.8
Calves:								
a) kept in barns	2.8	2.7	2.8	3.3	2.8	2.7	2.8	3.3
b) kept in barns & pastured	1.8	.4	.4	2.7	1.8	.4	.4	2.7
c) "in herds"	.4	.3	.3	.8	.4	.3	.3	.8
Hogs	1.4	1.1	1.5	.5	1.4	1.1	1.5	.5
Beehives	.3	.3	.1	.2	.3	.3	.1	.2
Fallow land	.6	-	-		.4	-	-	

Source: Data collected by the writer in 1970.

[a]The calf requirements up to 6 months old are inlcuded.

Table B-5 Feed and Grazing Area Requirements Per Unit of Stock

Stocks	First Zone						Second Zone					
	Hay[a] kg	Dry Alfalfa kg	Straw kg	Wheat-Barley kg	Corn kg	Grazing Areas str	Hay[a] kg	Dry Alfalfa kg	Straw kg	Wheat-Barley kg	Corn kg	Grazing Areas str
Domestic Sheep & goats	28.0	-	-	15.0	6.0	2.0	43.0	-	-	20.0	10.0	-
Sheep and goats "in herds"	21.0	-	-	12.0	-	6.0	28.0	-	-	16.0	-	5.0
Cows:												
a) kept in barns	354.0	1,130.0	-	-	680.0	-	410.0	1,180.0	150.0	-	790.0	-
b) kept in barns and pastured	580.0	-	200.0	180.0	120.0	11.0	620.0	180.0	250.0	200.0	200.0	8.0
c) "in herds"	-	-	-	-	-	12.0	-	-	-	-	-	10.0
Calves:[b]												
a) kept in barns	210.0	820.0	-	-	840.0	-	310.0	980.0	130.0	-	910.0	-
b) kept in barns and pastured	580.0	-	200.0	-	350.0	8.0	520.0	280.0	100.0	100.0	350.0	7.0
c) "in herds"	-	-	-	-	-	9.0	-	-	-	-	-	8.5
Hogs	-	-	-	45.0	24.0	-	-	6.0	-	53.0	31.0	-

Source: Data Collected by the writer in 1970.

[a]Harvested natural grass is included.

[b]For raising bulls or heifers from 6 to 18 months old.

Table B-6 Feed Production in 1970

Crops	First Zone		Second Zone		Region	
	TPP in tons	APP in kg	TPP in tons	APP in kg	TPP in tons	APP in kg
Wheat-Barley	19.5	97.5	269.4	179.6	288.9	169.9
Straw	22.4	112.0	317.1	211.4	339.5	199.7
Hay	641.9	365.6	561.3	400.9	1,203.2	376.0
Harvested natural grass[a]	472.4	45.0	93.2	38.8	565.6	43.8
Alfalfa (dry)	-	-	428.0	856.0	428.0	856.0
Corn	-	-	887.7	369.9	887.7	369.9

Source: Data collected by the writer in 1970

[a]It is cut from the "fallow land"

Table B-7 Average Value Added (AVA) by Region's Farm Activities in 1970

Activities	First Zone			Second Zone		
	AVP drs	APVI[a] drs	AVA drs	AVP drs	APVI drs	AVA drs
Wheat-Barley	333.5	105.5	228.0	618.1	154,3	463.8
Corn	-	-	-	1,035.8	186.5	849.3
Hay	356.6	91.8	264.8	400.9	118.6	282.3
Alfalfa	-	-	-	1,540.8	482.4	1,058.4
Cotton irr.	-	-	-	1,458.0	162.7	1,295.3
Vegetables						
a) in green-house	-	-	-	13,214.5	4,952.7	8,261.8
b) outside	1,8.7.0	212.8	1,604.2	3,120.4	444.2	2,676.2

Table B-7 (Continued)

Activities	First Zone			Second Zone		
	AVP drs	APVI[a] drs	AVA drs	AVP drs	APVI drs	AVA drs
Olive groves non-irrigated						
a) for edible olive	236.0	42.4	193.6	1,203.8	168.4	1,035.4
b) for oil	702.0	135.4	566.6	964.2	167.6	796.6
Almond trees	239.7	87.8	151.9	655.1	116.2	538.9
Orange trees	-	-	-	1,612.5	183.8	1,428.7
Miscellaneous fruit trees	206.4	41.2	165.2	613.3	107.4	505.9
Domestic sheep and goats	877.8	112.3	765.5	985.4	141.6	843.8
Sheep and goats "in flocks"	610.7	71.2	539.5	667.7	88.4	579.3
Cows:						
a) in barns	10,806.7	5,293.8	5,512.9	11,617.8	5,867.0	5,750.8
b) in barns & pastured	5,896.5	1,926.4	3,970.1	5,879.4	2,604.7	3,274.7
c) "in herds"	3,547.0	375.2	3,171.8	3,686.8	394.6	3,292.2
Calves:						
a) in barns	12,714.3	11,313.6	1,400.7	13,966.8	12,476.3	1,490.5
b) in barns & pastured	9,124.3	7,965.7	1,158.6	10,532.9	8,932.4	1,600.5
c) "in herds"	5,742.3	4,248.2	1,494.1	5,916.0	4,578.2	1,338.8
Hogs	895.3	572.2	323.1	1,087.0	653.9	433.1
Beehives	176.0	25.6	150.4	145.7	23.2	122.5
Fallow land	45.0	6.2	38.8	38.8	5.4	33.4

Source: Tables B-1, B-3 and data collected by the writer in 1970.

[a]Paid interest is not included. Feed value is calculated at the selling prices.

Table B-8 Total Value Added (TVA) by Region's Farm Sector (thousand drs)

Activities	First Zone	Second Zone	Region
Wheat-Barley	45.6	695.7	741.3
Corn	-	2,038.3	2,038.3
Hay	476.6	395.2	871.8
Alfalfa	-	529.2	529.2
Cotton irr.	-	388.6	388.6
Vegetables			
a) in greenhouse	-	1,652.4	1,652.4
b) outside	160.4	4,281.9	4,442.3
Olive groves non-irrigated			
a) for edible olive	19.4	3,002.7	3,022.1
b) for oil	32,466.2	34,572.4	67,038.6
Almond trees	106.3	592.8	699.1
Orange trees	-	3,143.1	3,143.1
Miscellaneous fruit trees	132.2	1,618.9	1,751.1
Fallow land	407.4	80.2	487.6
	33,814.1	52,991.4	86,805.5
Domestic sheep and goats	3,159.2	3,050.3	6,209.5
Sheep and goats "in flocks"	3,227.8	3,840.8	7,068.6
Cows:			
a) kept in barns	82.7	419.8	502.5
b) kept in barns & pastured	4,105.1	1,178.9	5,284.0
c) "in herds"	1,525.6	125.1	1,650.7
Calves:			
a) kept in barns	49.0	345.8	394.8
b) kept in barns & pastured	1,185.3	262.5	1,447.8
c) "in herds"	545.4	66.9	612.3
Hogs	770.9	576.5	1,347.4
Beehives	1,075.2	218.9	1,294.1
Hens "domestic"	1,263.6	1,212.0	2,475.6
Total	50,803.9	64,288.9	115,092.8

Source: Tables A-9, B-2 and B-7

APPENDIX C

Table C-1 Average Value Added by New Tree-Plants

No.	Years	Average Value Added Stream[a] in drs						
		First Zone		Second Zone				
		Olive Trees for Oil Production	Almond Trees (non-irrig.)	Olive Trees for Edible Olive Production (Irrigated)	Olive Trees for Edible Olive Production (non-irr.)	Olive Trees for Oil Production (non-irr.)	Almond Trees (non-irrig.)	Orange Trees (Irrigated)
1	1-3	-69.0	-43.0	-117.0	-96.0	-85.0	-52.0	-184.0
2	4-7	-13.0	+25.0	-84.0	-66.0	-24.0	+32.0	-67.0
3	8-10	+98.0	+110.0	+185.0	+125.0	+168.0	+190.0	+435.0
4	11-15	+208.0	+151.9	+495.0	+386.0	+395.0	+538.9	+792.0
5	16-20	+330.0		+753.0	+593.0	+574.0		+985.0
6	21-30	+480.0		+1,235.0	+875.0	+796.6		+1,428.7
7	31-40	+566.6		+1,510.0	+1,035.4			
8	$\sum_{i=1}^{7} PV_i$	+4,608.3	+1,967.9	+11,492.3	+8,239.3	+7,588.9	+6,655.3	+13,869.3
9	Increase in land value by planting	5,000.0	4,000.0	11,000.0	8,000.0	7,000.0	6,000.0	12,000.0
10	Present value of 9	1,041.5	833.2	2,291.3	1,666.4	1,458.1	1,249.8	2,499.6
11	Sum of PV_i (8 + 10)	5,649.8	2,801.1	13,783.6	9,905.7	9,046.0	7,905.1	16,368.9
12	Averabe value added	285.5	141.5	696.4	500.5	457.1	399.4	827.1

[a]These estimates are developed from records collected by the writer in 1970 and based on the following:

(a) The cost of tree planting is covered by long-term loan, 10 years, with 4 percent interest rate.

(b) The annual installment payment on loans is not included.

(c) The cost of tree planting was estimated as follows:

First Zone:

Olive groves for oil - 800 drs

Almond trees - 600 drs

Second Zone:

Olive groves for edible olive (irrigated) 1,500 drs

Olive groves for edible olive (non-irrigated) 1,300 drs

Olive groves for oil (non-irrigated) 1,200 drs

Almond trees (non-irrigated) 800 drs

Orange trees (irrigated) 1,700 drs

Table C-2 Explanation of Abbreviations Used in Matrices

1. Resources (Rows)

Row No. in the Model for the:			Abbreviation	Complete Heading
First Zone (i=1)	Second Zone (i=2)	Whole Region		
1	1	1	FRL_i	Farm land
2	-	2	AL_1	Agricultural land of the first zone
-	2	3	AL_2	Agricultural land of the second zone
3	-	4	IL_1	Irrigated land in the first zone
-	3	5	IL_2	Irrigated land in the second zone
4	-	6	LWB_1	Land for wheat-barley in the first zone
5	-	7	$LHNTP_1$	Land for hay growing and new tree planting in the first zone
-	4	8	LVG	Land for greenhouse vegetables in the second zone
6	5	9	OGO_i	Old olive groves for oil
-	6	10	$OGED_i$	Old olive groves for edible oil
-	7	11	$IOOGO_i$	Irrigated old olive groves for oil
-	8	12	IOOGED	Irrigated old olive groves for edible olive
7	9	13	ALT_i	Old almond trees
-	10	14	ORT	Old orange trees
8	11	15	GA_i	Grazing Areas
9	12	16	WBC_i	Wheat-barley control
10	13	17	$STRC_i$	Straw control
11	14	18	HC_i	Hay control
12	15	19	$CORNC_i$	Corn Control
13	16	20	$ALFC_i$	Alfalfa control
14	17	21	GAC_i	Grazing areas control
15	18	22	$CALB_i$	Calves[a] 6 months old kept in barns
16	19	23	$CALBP_i$	Calves 6 months old kept in barns and pastured

Table C-2 (Continued)

Row No. in the Model for the:			Abbreviation	Complete Heading
First Zone (i=1)	Second Zone (i=2)	Whole Region		
17	-	24	$CALH_i$	"Calves in herds" 6 months old
18	20	25	$CALB18_i$	Calves 18 months old kept in barns
19	21	26	$CALBP18_i$	Calves 18 months old kept in barns and pastured
20	-	27	$CALH18_i$	"Calves in herds" 18 months old
21	22	28	HRB_i	Heifers replacement kept in barns
22	23	29	$HRBP_i$	Heifers replacement kept in barns and pastured
23	-	30	HRH_i	Heifers replacement in herds
24	24	31	$SGDC_i$	Domestic sheep and goat control
25	25	32	$SGFC_i$	Sheep-goats "in flocks" control
26	26	33	$CWBC_i$	Cow kept in barns control
27	27	34	$CWBPC_i$	Cow kept in barns and pastured control
28	-	35	$CWHC_i$	"Cow in herds" control
29	-	36	$BHVC_i$	Beehive control
30	28	37	$CSGD_i$	Zones' or region's capacity for domestic sheep and goats
31	-	38	$CBHV_i$	Zone's or region's beehive capacity
32	29	39	SPL_i	Spring labor
33	30	40	SL_i	Summer labor
34	31	41	FL_i	Fall labor
35	32	42	WL_i	Winter labor
36	33	43	OPC_i	Operating capital
-	34	44	$LTLIR_i$	Long-term loans for irrigation improvements
-	35	45	$LTCPIB_i$	Long-term captial supplied by the Public Investment Budget
37	36	46	$LTCNTP_i$	Long-term capital for tree planting

Table C-2 (Continued)

Row No. in the Model for the:			Abbreviation	Complete Heading
First Zone (i=1)	Second Zone (i=2)	Whole Region		
-	37	47	$LTCGH_i$	Long-term capital for greenhouse construction
38	38	48	$LTCSP_i$	Long-term capital for livestock purchase
39	39	49	$LTCCHF_i$	Long-term capital for cattle housing facilities
40	40	50	$LTCDHF_i$	Long-term capital for hog and domestic sheep and goats housing facilities
41	41	51	$LTCSGFHF_i$	Long-term capital for housing facilities of sheep-goats "in flocks"
42	-	52	$LTCBHV_i$	Long-term capital for beehive equipment
43	42	53	CFC_i	Cash flow constraint
-	43	54	SPR_i	Sererable programming restriction
44	44	55	$SPSLR_i$	Relationship between spring and summer labor sale
45	45	56	$SFLR_i$	Relationship between summer and fall labor sale
46	46	57	$FWLR_i$	Relationship between fall and winter labor sale

Table C-2 (Continued) 2. Activities (Columns)

Column No. in the Model for the:			Abbreviation	Complete Heading
First Zone (i=1)	Second Zone (i=2)	Whole Region		
-	1	1	λ_1	Weight for 8,260 str irrigated land
-	2	2	λ_2	Weight for 11,010 str irrigated land
-	3	3	λ_3	Weight for 12,560 str irrigated land
-	4	4	λ_4	Weight for 15,310 str irrigated land
-	5	5	λ_5	Weight for 31,260 str irrigated land
-	6	6	$IOGED_i$	Irrigated old olive groves for edible olive
-	7	7	$IOGO_i$	Irrigated old olive groves for oil
1	-	8	WB_1	Wheat-barley in the first zone
-	8	9	WB_2	Wheat-barley in the second zone
2	-	10	H_1	Hay in the first zone
-	9	11	H_2	Hay in the second zone
-	10	12	$CORN_i$	Corn
-	11	13	ALF_i	Alfalfa
-	12	14	COT_i	Cotton
3	-	15	V_1	Vegetables growing "outdoors" in the first zone
-	13	16	V_2	Vegetables growing "outdoors" in the second zone
-	14	17	VG_i	Greenhouse vegetables
4	-	18	FLL_1	"Fallow" land in the first zone
-	15	19	FLL_2	"Fallow" land in the second zone
5	-	20	$OOGO_1$	Old olive groves for oil in the first zone
-	16	21	$OOGO_2$	Old olive groves for oil in the second zone
-	17	22	$OGED_i$	Olive groves for edible olive
6	-	23	$OALT_1$	Old almond trees in the first zone
-	18	24	$OALT_2$	Old almond trees in the second zone

Table C-2 (Continued)

Column No. in the Model for the:			Abbreviation	Complete Heading
First Zone (i=1)	Second Zone (i=2)	Whole Region		
-	19	25	ORT_i	Orange trees
7	20	26	GA_i	Grazing areas
8	-	27	$NOGO_1$	New olive groves for oil in the first zone
-	21	28	$NOGO_2$	New olive groves for oil in the second zone
-	22	29	$NOGED_2$	New olive groves for edible olive in the second zone
9	-	30	$NALT_1$	New almond tree in the first zone
-	23	31	$NALT_2$	New almond tree in the second zone
-	24	32	$NIOGED_i$	New irrigated olive groves for edible olive
-	25	33	$NORT_i$	New orange tree
10	26	34	$ROGO_i$	Reduction of olive groves for oil
11	-	35	$RALT_i$	Reduction of almond trees in the first zone
12	27	36	SWB_i	Sell wheat-barley
13	28	37	$SSTR_i$	Sell straw
14	29	38	SH_i	Sell hay
-	30	39	$SCORN_i$	Sell corn
-	31	40	$SALF_i$	Sell Alfalfa
15	32	41	BWB_i	Buy wheat-barley
16	33	42	$BSTR_i$	Buy straw
17	34	43	BH_i	Buy hay
18	35	44	$BCORN_i$	Buy corn
19	36	45	$BALF_i$	Buy alfalfa
20	37	46	SGD_i	Domestic sheep and goats
21	38	47	SGF_i	Sheep and goats "in flocks"
22	39	48	CWB_i	Cows kept in barns

Table C-2 (Continued)

Column No. in the Model for the:			Abbreviation	Complete Heading
First Zone (i=1)	Second Zone (i=2)	Whole Region		
23	40	49	$CWBP_i$	Cows kept in barns and pastured
24	-	50	CWH_i	Cows "in herds"
25	41	51	$RCALB_i$	Raise calves from 6 to 18 months old kept in barns
26	42	52	$RCALBP_i$	Raise calves from 6 to 18 months old kept in barns and pastured
27	-	53	$RCALH_i$	Raise "calves in herds" from 6 to 18 months old
28	43	54	$SCAL6B_i$	Sell calves 6 months old kept in barns
29	44	55	$SCAL6BP_i$	Sell calves 6 months old kept in barns and pastured
30	45	56	$BCAL6B_i$	Buy calves 6 months old kept in barns
31	46	57	$BCAL6BP_i$	Buy calves 6 months old kept in barns and pastured
32	47	58	$SCAL18B_i$	Sell calves 18 months old kept in barns
33	48	59	$SCAL18BP_i$	Sell calves 18 months old kept in barns and pastured
34	-	60	$SCAL18H_i$	Sell calves 18 months old raised in herds
35	49	61	$RRHB_i$	Raise replacement heifers kept in barns
36	50	62	$RRHBP_i$	Raise replacement heifers kept in barns and pastured
37	-	63	$RRHH_i$	Raise replacement heifers in herds
38	51	64	HG	Hogs
39	-	65	BHV	Beehives
40	52	66	$DSGD_i$	Decrease in the "domestic sheep and goats" herd
41	53	67	$DSGF_i$	Decrease in the herd of "sheep and goats" in flocks

Table C-2 (Continued)

Column No. in the Model for the:			Abbreviation	Complete Heading
First Zone (i=1)	Second Zone (i=2)	Whole Region		
42	54	68	$DCWB_i$	Decrease in the herd of cows kept in barns
43	55	69	$DCWBP_i$	Decrease in the herd of cows kept in barns and pastured
44	-	70	$DCWH_i$	Decrease in "cows in herds"
45	-	71	DBHV	Decrease in beehives
46	56	72	$ISGD_i$	Increase in the herd of "domestic sheep and goats"
47	57	73	$ISGF_i$	Increase in the herd of "sheep and goats" in flocks
48	58	74	$ICWB_i$	Increase in the herd of cows kept in barns
49	59	75	$ICWBP_i$	Increase in the herd of cows kept in barns and pastured
50	-	76	$ICWH_i$	Increase in "cows in herds"
51	-	77	IBHV	Increase in beehives
52	60	78	$SSPL_i$	Sell spring labor
53	61	79	SSL_i	Sell summer labor
54	62	80	SFL_i	Sell fall labor
55	63	81	SWL_i	Sell winter labor
56	64	82	$HSPL_i$	Hire spring labor
57	65	83	HSL_i	Hire summer labor
58	66	84	HFL_i	Hire fall labor
59	67	85	HWL_i	Hire winter labor
60	68	86	$BOPC_i$	Borrow Operating Capital
-	69	87	$BLTCIR_i$	Borrow long-term capital for irrigation improvements
-	70	88	$LTCPIB_i$	Long-term capital supplied by the Public Investment Budget

Table C-2 (Continued)

Column No. in the Model for the:			Abbreviation	Complete Heading
First Zone (i=1)	Second Zone (i=2)	Whole Region		
61	71	89	$BLTCTP_i$	Borrow long-term capital for tree planting
-	72	90	$BLTCGH_i$	Borrow long-term capital for green-house construction
62	73	91	$BLTCSP_i$	Borrow long-term capital for livestock purchase
63	74	92	$BLTCCHF_i$	Borrow long-term capital for cattle housing facilities
64	75	93	$BLTCDHF_i$	Borrow long-term capital for hog and "domestic sheep and goats" housing facilities
65	76	94	$BLTCFHF_i$	Borrow long-term capital for "sheep and goats in flocks" housing facilities
66	-	95	$BLTCBHV_i$	Borrow long-term capital for beehives equipment

[a]The term "calves" includes bulls and heifers.

Table C-3 Resource Product and Livestock Prices in 1970

Items	Unit	First Zone		Second Zone	
		Selling Price	Acquisition Price	Selling Price	Acquisition Price
Spring labor	drs/day	180.0	200.0	180.0	200.0
Summer labor	drs/day	160.0	190.0	170.0	190.0
Fall labor	drs/day	180.0	200.0	180.0	200.0
Winter labor	drs/day	180.0	200.0	180.0	200.0
Wheat-barley	drs/kg	2.5	2.7	2.5	2.7
Straw	drs/kg	.8	1.0	.8	.9
Hay	drs/kg	1.0	1.2	1.0	1.2
Corn	drs/kg	2.8	3.0	2.8	3.0
Alfalfa	drs/kg	1.8	2.1	1.8	2.0
Calves six months old:					
a) kept in barns	drs/head	7,000.0	7,300.0	7,500.0	7,700.0
b) kept in barns & pastured	drs/head	6,000.0	6,200.0	6,000.0	6,200.0
c) "in herds"	drs/head	4,000.0	4,000.0	4,200.0	4,200.0
Breeding stock					
a) cow kept in barns	drs/head	9,600.0	10,000.0	10,700.0	11,000.0
b) cow kept in barns and pastured	drs/head	7,600.0	8,000.0	8,600.0	9,000.0
c) cow "in herds"	drs/head	5,300.0	6,000.0	5,300.0	6,000.0
d) Sheep-goats "Domestic"	drs/head	570.0	600.0	600.0	640.0
e) Sheep-goats "in flocks"	drs/head	380.0	400.0	400.0	430.0
Beehives	drs/hive	350.0	400.0	350.0	380.0

Table C-3 (Continued)

Items	Unit	First Zone		Second Zone	
		Selling Price	Acquisition Price	Selling Price	Acquisition Price
Culled stock					
a) cow kept in barns	drs/head	7,000.0	-	7,800.0	-
b) cow kept in barns and pastured	drs/head	6,000.0	-	6,500.0	
c) cow "in herds"	drs/head	4,500.0	-	4,500.0	-
d) sheep-goats "domestic"	drs/head	450.0	-	520.0	-
e) sheep-goats "in flocks"	drs/head	350.0	-	350.0	-

Source: Data collected by the writer in 1970.

BIBLIOGRAPHY

BIBLIOGRAPHY

Adamapoulos, A. "A Study of Agricultural Economic Development in the Region of Varicon, Vlasti, Klissoura and Lechovon, West Macedonia." The University of Thessaloniki, 1972.

_____ and Papageorgiou, E.G. "Farm Management Research and Planning in Northern Greece." Thessaloniki, 1963.

Agricultural Bank of Greece. "Research on Economic Development of Evritanias Department (Nomos)." Athens, 1973.

Ananikas, L.I. "Potential Livestock Production Adjustments on Family Farms in Central Macedonia, Greece." Ph.D. dissertation, Michigan State University, 1975.

Beneke, R.R. and Winterboer, R. "Linear Programming Application to Agriculture" Ames, Iowa: Iowa State University Press, 1973.

Branson, W. "Macroeconomic Theory and Policy." Harper and Row, New York, 1972.

Johnson, G.L. and Zerby, L.K. "What Economists Do About Values." Michigan State University, 1973.

Morgan, T. "Economic Development Concept and Strategy." Harper and Row, New York, 1975.

National Statistical Service of Greece, "Statistical Yearbook of Greece 1970," Athens.

Nelson, A., et al. "Agricultural Finance," Sixth Edition, Ames, Iowa: Iowa State University Press, 1973.

Pepelasis, A.A. "Labor Shortages in Greek Agriculture, 1963 - 1973." Center of Economic Research, Athens, 1963.

_____ and Yotopoulos, P.A. "Surplus Labour in Greek Agriculture, 1953-60." Athens: Center of Economic Research, 1962.

Spivey, W. and Thrall, R. "Linear Optimization." Holt, Rinehart and Winston, Inc.: New York, 1970.

Tselepis, N. "Production Cost of Crop and Livestock Products." Athens, 1968.

Wagner, H.M. "Principal of Operation Research with Application to Managerial Decisions." 2nd edition. Prentice Hall Inc.: New Jersey, 1975.

Yotoupolos, P. "Allocative Efficiency in Economic Development." Center of Economic Research; Athens, 1967.