F472-7

The Economic Performance
of Proportional-Profit
Sugar Farms in Puerto Rico,
1950-62

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ABSTRACT

This study analyzes the economic performance of the proportional-profit sugar farms of Puerto Rico during 1950-62. The farms were established on lands acquired by the Puerto Rican Government under provisions of the Land Law of 1941. Net income from the farms is distributed to farm labor in proportion to wages received. The proximate goals of the program were the elimination of corporate latifundia, maintenance of productive efficiency, and wider distribution of benefits from the farms. The analysis shows that stated goals of eliminating corporate latifundia while retaining production efficiency were only partly achieved by the program. Also, the stated goals were in conflict with broader goals of economic policy--growth, full employment, and high sugar-export levels. The policies followed were consistent, however, with economic development objectives of the 1950's and later years.

Key Words: Proportional profit farms, Land reform, Puerto Rico, Economic development, Growth models.

PREFACE

This report is intended to provide analytical information on the process of land reform and its relationship to economic development. It is recognized that countries must evaluate their need for land reform, and the processes of accomplishing reform, in light of their own unique conditions. Nonetheless, it is believed that the experiences of Puerto Rico in its chosen program of reform will be of value to others in developing reform alternatives and assessing their consequences to the economy.

CONTENTS

SUMMARY

Proportional-profit sugar farms established on lands formerly held by corporate plantations in Puerto Rico were not able to maintain efficient performance levels over a representative 13-year period. Losses increased and total net returns declined from 1950 through 1962.

One of the most important reasons for the poor performance was that more capital and labor were used than was economically justified when measured in terms of operating efficiency. However, this practice did help maintain total sugar output and provided employment opportunities in a period of substantial unemployment. Thus, in competition with its own original goal of maintaining efficient production, the administering Land Authority pursued a goal that resulted in maintaining some uneconomic operations--but that did benefit the island as a whole.

Losses on the proportional-profit sugar farms also were caused by weather-related drops in percentage of sugar retrieved from the harvested cane. Labor shortages near the end of the study period also affected the retrieval rate.

In addition, mandatory distribution of profits to workers, at the time losses were being incurred by some operating units, made achievement of optimum efficiency difficult. Since wages on the farms were the same as in the sugar industry as a whole, the workers would have suffered no relative welfare decline had profit sharing been foregone. However, there were indications that the program would have been politically unacceptable without the profit-sharing feature.

Thus, while profit sharing may be questioned if the overriding goal is an increased rate of economic growth, a lower rate of growth may be an acceptable price for achieving a distribution of wealth more heavily weighted to labor.

THE ECONOMIC PERFORMANCE OF PROPORTIONAL-PROFIT
SUGAR FARMS IN PUERTO RICO, 1950-62

by

John E. Stahl [1/]

INTRODUCTION

In the early 1940's, the Government of Puerto Rico instituted a program of land reform embodied in the Land Law of 1941. Under Title IV, sugar plantation lands acquired under provision of the Land Law were to be organized as proportional-profit sugar farms, with net incomes distributed to labor in proportion to wages received. The proximate goals of the proportional-profit system were elimination of large corporate plantations (latifundia), maintenance of productive efficiency, and wider distribution of benefits from the farms.

This study examines the economic performance of these farms from 1950 through 1962. The starting year 1950 was chosen to avoid possible effects of dislocation from the major land acquisitions associated with initiation of the program and which were not completed until 1948. The period selected for analysis is believed to be sufficiently long to permit meaningful analysis of the experience gained.

Consideration is given to the degree to which the proportional-profit sugar farm program achieved the stated goals as set forth in the Land Law. Further consideration is given to goals not embodied in the law, but expressed by the framers of the legislation. Finally, the program is reviewed for its contribution to the overall development of the Puerto Rican economy during 1950-62.

PROVISIONS OF THE LAND LAW

The Puerto Rican legislature, under the Land Law of 1941, created the Land Authority of Puerto Rico and empowered it to expropriate lands in excess of 500 acres held by any "artificial" person (for example, a corporation or a trust). [2/] In addition, the Authority could acquire land by purchasing it directly or by requesting the Government of Puerto Rico to purchase or expro-

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[1/] Formerly, Agricultural Economist, Natural Resource Economics Division, Economic Research Service, USDA.

[2/] This provision effectively limited major land acquisitions to the coastal sugar areas. The coffee plantations in the western highlands traditionally had been family-owned haciendas. Tobacco, the other major crop, was cultivated on small family farms under contract to large processors.

priate it. In addition to providing for the proportional-profit sugar farm program (in Title IV), the Land Law provided for an agregado 3/ resettlement program (Title V) and an additional program for the creation of family farms (Title VI) (8).4/ These programs, together with the functions of the Land Authority, are discussed briefly below, prior to the main examination of the operations of the proportional-profit sugar farm system.

The Proportional-Profit Sugar Farm System

Under Title IV, the Land Authority was empowered to lease land in units of 100 to 500 acres--or more where deemed necessary--to qualified managers for the purpose of establishing proportional-profit sugar farms. The proportional-profit farms were created on these holdings to maintain efficiencies associated with size, while providing for a wider distribution of the benefits from sugarcane production. Koenig (7) has given a concise outline of the Land Authority's relationship to the proportional-profit farms: "In the operation of the sugarcane lands on the proportional-profit farms, officials and employees of the Land Authority are responsible for the following services and functions: (1) field management and supervision; (2) production methods and selection of cane varieties; (3) financing of land purchased and of crop production as well as collecting the proceeds of crops and receiving payments under the Sugar Act; (4) purchases of fertilizer, equipment, and other items required for farm operations; (5) irrigation and drainage; (6) repair of farming equipment; (7) cattle and pastures; (8) labor negotiations and relations; (9) representation in matters affecting the farm, such as legislation and hearings; and (10) all records and accounts relating to the farm and its operations. Thus the manager of a farm is left largely with the responsibility for direct supervision of the laborers and the day-to-day operations of the place.5/

"Each proportional-profit farm is required to bear its own operating costs, including charges for use of the land, services, depreciation, and interest. Laborers working on such a farm receive as an 'advance' the regular wage commonly paid in the area, or that may have been fixed by Puerto Rican or Federal laws or regulations, or by collective bargaining with the laborers.

3/ The Land Law of 1941 defined an agregado as: "The landless head of a family whose sole income was derived from wage labor in agriculture. His residence must have been established in a house and on lands belonging to another person, or his house erected on lands of another person."

4/ Underscored numbers in parentheses refer to works listed in References, page 21.

5/ An amendment to the Law in 1946 stated that the terms "leasee" and "lease contract" as they appear do not carry the full meaning as set forth in Puerto Rican law, but refer to "administrator" and "administration contract."

2

The manager receives a fixed salary. These payments are included in the operating costs. The net profits of the farm are shared. The manager receives a fixed percentage and an amount is set aside as a reserve for the farm to take care of future contingencies. The remainder of the net profits is distributed among the farm workers in proportion to the days each has worked and to the wages or salaries received as an advance for the work per-formed on the farm. Whether or not an individual works on a proportional-profit farm is a matter which the worker chooses for himself. All of the laborers on a proportional-profit farm are free to join or organize any labor union or group without interference." (7, page 253).

The statement requires but one qualification. After Koenig had published his study the contingency reserve was dropped. This reserve had always been opposed by the labor unions on the grounds that this money belonged in the net benefit "pool" to be divided among the workers. 6/

The Agregado Resettlement Program

Under Title V, lands acquired by the Authority not deemed suitable for the cultivation of sugar and lands expressly acquired for the resettlement program were to be distributed, in tracts of not less than one-fourth of a cuerda 7/ and not more than 3 cuerdas, to families of agregados who wished to own such parcels on which to erect their homes. Later amendments to the Law provided for distribution of tracts of less than one-fourth of a cuerda where deemed desirable. The benefits of the resettlement program also were extended to persons not meeting all the conditions set forth in the definition of an agregado.

Land distributed through this program was to be ceded in usufruct to the recipients. The one-fourth-cuerda minimum was free, with the recipient pay-ing for additional land up to the 3-cuerda maximum in yearly installments of not more than $3 per cuerda. The terms of the usufruct prohibited the usu-fructuary from alienating or encumbering the property, including making improvements or constructing on the property, without the express consent of the Authority. The usufructuary was further obligated to comply with regu-lations concerning sanitation and prohibited activities. Violations of these regulations could result in termination of the usufruct. Provisions were made for the accession of heirs to the usufruct in the event of the usufruc-tuary's death.

The Family Farm Program

Title VI provided for the creation of individual or family farms. This section extended the program to those areas not directly affected by Titles IV and V. The Law authorized the Authority to acquire and distribute land

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6/ Colon-Torres, Ramon, Former Director, Social Programs Administration, San Juan, P.R., private communication, 1963.
7/ 1 cuerda = 0.9712 acre.

holdings of 5 to 25 cuerdas (this was later amended to provide for a maximum
$5,000 valuation, rather than an acreage maximum). The farms were distributed
to qualified individuals, under contracts of usufruct, for life. The con-
tracts stipulated a level of semiannual rents to be paid to the Authority.
The usufructuary agreed to follow such conservation and production practices
as recommended by the Authority, except that he was free to cultivate any
crop he desired. As under Title V, the usufructuary was prohibited from
alienating or encumbering the holding in any way without the express consent
of the Authority, and devolution of the usufruct to heirs of the usufructuary
was provided for.

The Land Authority

Of the 188,817 acres of land held in excess of the 500-acre limit in
1940, the Authority had acquired 93,299, or 49 percent, by 1948, when major
land acquisitions ceased (12, page 74). At this same time, the Government
of Puerto Rico restructured the Land Authority substantially. In 1948, it
created the Social Programs Administration (SPA) within the Land Authority
for the purpose of administering Titles V and VI. In 1952, the SPA was
separated from the Authority and given independent status under the Secretary
of Agriculture and Commerce. Thus, activities that were primarily of a com-
mercial nature were separated from the rural development programs.

The Authority continues to administer the Title IV program. In addi-
tion, it has acquired two sugar mills which it operates to determine stand-
ards of performance. Also, the Authority has expanded its programs to
develop and diversify local agriculture. These activities encompass beef
and dairy cattle development projects and a pineapple development program,
as well as work with industrial laboratories on utilization of sugar by-
products.

OPERATION OF PROPORTIONAL-PROFIT SUGAR FARMS

The lands leased to the proportional-profit farms were organized in
seven projects in the major sugar-producing areas of the island. Land in
the projects varied widely in quality. Some on the northern and eastern
coastal plains was poorly drained swampy land. This land was to prove
marginal for the production of sugarcane except under the most favorable
price/cost relationships.

In 1950, when the amount of land leased to the program was at its peak,
63,598 acres were involved. The average value of this land was $200.46 an
acre. Between 1950 and 1962, the area fell to 42,293 acres, while the aver-
age value rose to $259.25. 8/ These changes in acreage and value may be
traced to transfers of land from the Authority to other governmental agen-
cies and/or other uses. The Authority attempted, whenever possible, to
consolidate its holdings and divest itself of some of its poorest holdings.

8/ These value figures refer to the acquisition cost of the land.

4

In addition, some lands held by the Authority were transferred to the Canos Tiburones drainage and reclamation project undertaken by the Authority on the north coast. Some land from adjacent projects was transferred to the Canos Tiburones project for administrative reasons. Because of this project's unique nature, it is not included in the following analysis.

From 1950 through 1962, gross income of the combined projects averaged $311.63 per acre (app. table 8). Nonland costs averaged $297.45 per acre (app. table 9) and land rental charges averaged $33.29 per acre (app. table 12), resulting in an average loss of $19.11 per acre.

These aggregate cost and return data for the combined projects are somewhat misleading, however, because of the accounting system employed by the Authority. Each project is divided into a number of farms, ranging in size from 250 acres to just over 1,000 acres. The individual farm is the accounting unit, with net incomes and losses registered at the farm level.

Data on costs and returns for 1950-62 show that some farms in each of the seven projects registered aggregate profits of slightly more than $6 million after payment of land rent (set at 5 percent of the acquisition price of the land) to the Authority (table 1). This profit, which was available for distribution to the workers on those farms, was equal to 13 percent of the total wage bill.

In contrast, the other farms in the system registered losses totaling $12.1 million during the same period (table 2). These losses were made up from the General Fund of the Land Authority, which derives its revenue principally from legislative appropriations and land rents paid by the proportional-profit farm system. Table 2 shows the relationship between losses incurred and rents due for the farms reporting losses in each project. Overall, these farms made no net payment to land and received an operating subsidy of $37,000.

Appendix tables 1 through 13 present a more detailed breakdown of the data on sugar operations of the Land Authority. Appendix tables 6 and 7 show annual net profits or losses registered by farms in each project for 1950 through 1962. These two tables show that losses registered by farms in the program increased over the 13 years, while total net returns declined. One of the reasons for this is the decline in the percentage of sugar retrieved from the harvested cane. 9/ Since the costs of production are tied to the percentage of sugar retrieved as well as the amount of cane produced, the percentage retrieved is an important factor in determining the operation's profitability.

9/ Over the period, the percentage of sugar retrieved on the Authority's holdings exhibited the following behavior:

$P = 11.49 - 0.43t$ $r = -0.75$ (significant at the 5-percent level)
where P = percentage of sugar retrieved and t = index of time.

Table 1.--Net profits earned by proportional-profit sugar farms reporting profits, by project, 1950-62

Project	Net profits
	1,000 dollars
Loiza------------------------------:	471
Fajardo----------------------------:	43
Plazuela---------------------------:	652
Cambalache-------------------------:	709
San Vincente-----------------------:	1,386
Toa--------------------------------:	200
Guanica----------------------------:	2,688
Total--------------------------:	6,149

Source.--Except where stated otherwise, data in tables are reported from or derived from annual reports of the Land Authority of Puerto Rico.

Table 2.--Total losses, rents due, and net rents paid for proportional-profit sugar farms reporting losses, by project, 1950-62

Project	Losses	Rents due	Net rents paid
	1,000 dollars		
Loiza------------------:	1,567	1,762	195
Fajardo----------------:	5,157	1,967	-3,190
Plazuela---------------:	806	1,110	304
Cambalache-------------:	609	1,669	1,060
San Vincente-----------:	902	1,350	448
Toa--------------------:	2,716	1,187	-1,529
Guanica----------------:	365	3,040	2,675
Total--------------:	12,122	12,085	- 37

6

The decline in the percentage of sugar retrieved seems related to two factors. First, the Caribbean area as a whole experienced secular change in weather patterns during 1950-62. Available moisture at harvest-time is a key factor explaining the yield of sugar from the cane. If the harvest season is abnormally wet, there will be a heavier production of green matter and a decrease in sucrose content of the cane. The heavier rainfalls that occurred in the later years of the study period thus contributed to the decline in sugar retrieval.

A second factor affecting sugar retrieval percentage is the time of cane cutting and the period that elapses between cutting and grinding. The time of cutting and the length of the waiting period between cutting and grinding call for compromises based on the needs of the mill and those of the farm. Cane should be cut when the sucrose content is at a maximum, and should then be ground as soon as possible. Toward the end of the study period, increasing labor shortages were experienced. This upset the desired pattern, resulting in a lower rate of sugar retrieval.

To evaluate the economic performance of the proportional-profit sugar farms, a series of Cobb-Douglas production functions were estimated for each project for the period 1950-62. The final results took the following form:

$$Y = \alpha_0 K^{\alpha 1} L^{\alpha 2} e^{\alpha 3 t}$$

Where

Y = gross income per acre
K = capital expenditures per acre 10/
L = man-days of labor per acre
t = time index (1950-62)

The coefficients for capital, labor, and time are shown in table 3, and marginal-value products of capital and labor are shown in table 4.

Before a discussion of the implications of these results, a word is in order concerning the functions themselves. An examination of the matrix of simple correlation coefficients for each equation did not show evidence of milticollinearity. Presence of multicollinearity--that is, a high level of correlation between the independent variables relative to the overall correlation--leads to indeterminate values for the coefficients (5, pp. 204-206). The Durbin-Watson test indicated no autocorrelation in the errors or residuals. The absence of autocorrelated errors indicates that the model is algebraically satisfactory, that there were no errors of observation, and that no important explanatory variables have been omitted (5, pp. 133).

A variety of other algebraic forms were tested, none of which yielded statistically satisfactory results when compared with the Cobb-Douglas form. Estimates were also made with capital broken down into its various component

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10/ Capital expenditures include variable inputs obtained from the Authority, plus a charge for managerial services. Land payments are treated as a fixed cost.

parts--machinery, fertilizer, and so forth. Resultant coefficients were considered unreliable because of the high degree of multicollinearity present.

Table 3.--Regression coefficients for proportional-profit sugar farms, by project, 1950-62 1/

Project	Capital	Labor	Time	R^2
Loiza.................:	.0211 (.1003)	.3828 (.0837)	.1090 (.0071)	.161
Fajardo..............:	.4859 (.1051)	.3723 (.1083)	-.0015 (.0089)	.436
Plazuela.............:	.2837 (.0943)	.5373 (.1182)	.0096 (.0077)	.460
Cambalache...........:	.4569 (.0798)	.4402 (.0822)	.0000 ----	.676
San Vincente.........:	.4881 (.0945)	.3204 (.0851)	-.0251 (.0073)	.448
Toa..................:	.1739 (.1030)	.3126 (.0849)	.0123 (.0100)	.171
Guanica..............:	.7364 (.0929)	.1680 (.1090)	-.0052 (.0073)	.498

1/ See p. 7 for description of production function. Numbers shown in parentheses are standard errors of the coefficients.

Table 4.--Marginal value products of capital and labor on proportional-profit sugar farms, by project, 1950-62

Project	Capital (Return per dollar of nonland capital)	Labor (dollars per day)
Loiza.................:	.038	3.486
Fajardo..............:	.716	2.749
Plazuela.............:	.517	4.827
Cambalache...........:	.909	4.014
San Vincente.........:	1,004	2.798
Toa..................:	.270	2.355
Guanica..............:	1.620	1.920

Per acre measures of capital, labor, and output were used in the model because of external constraints on the Authority. For reasons that are stated later, the Authority was not completely free to vary its land input. In summary, the functions reported were believed to provide the most reasonable estimates of the manner in which the Authority applied its variable resources--capital and labor--to its fixed factor--land.

The low R^2_s', especially those for the Toa and Loiza projects, strongly suggest that factors external to management are important in determining the performance of the farms. While the R^2_s' are significant at the 1-percent level, they point to a high, unexplained residual. The insignificant Durbin-Watson test results indicate that the unexplained residual is the result of random influences on the production process. Most likely these would be microclimatic conditions peculiar to each project, for which no data were available. For these reasons, the coefficients should be interpreted cautiously.

A comparison of the factor marginal-value products from table 4 with their prices provides insight into the Authority's operations. Table 5 presents the ratio of marginal-value product to price for capital and labor for each project. Interpretation of these findings is based on the nature of the markets within which the Authority sells its product and purchases its inputs. On the product side, the Authority is not able to influence the price at which it sells sugar since sugar prices are determined according to legislation governing the U.S. quota system. There is no evidence that the Authority exercises any significant influence over the prices it pays for its inputs. Any price leverage that exists would occur at the level of the Authority's central management, and not at the project level. Therefore, the projects can be considered to be price takers; that is, they have no influence over the level of factor prices.

Table 5.--Ratios of marginal-value product of capital and labor to price for proportional-profit sugar farms, by projects, average 1950-62 1/

Project	Capital	Labor
Loiza---------------------:	.036	.958
Fajardo-------------------:	.682	.770
Plazuela------------------:	.492	1.375
Cambalache---------------:	.866	1.134
San Vincente-------------:	.956	.797
Toa----------------------:	.257	.667
Guanica------------------:	1.543	.501

1/ The price for capital was $1.05; the price for labor was taken from the average wage figure for each project found in app. table 13.

9

Given this market environment, the competitive model applies to the Authority's operations. Therefore, if during 1950-62 the Authority operated at an efficient level, the variable factors should have been allocated in such a way as to equate their prices with their marginal-value products-- that is, the ratio of price to the marginal-value product of both capital and labor should equal one. The presence or absence of net income would depend on the level of fixed cost as represented by payments to land. We can see from table 5 that there are divergences from an optimum allocation of the variable factors. A ratio of marginal-value product of a factor to its price of less than one indicates that more of the factor was applied than was profitable, taking the 13-year period as a whole. Conversely, a ratio greater than one indicates that less of the factor was used than was profitable.

In table 6, the combined marginal return to cost ratios for capital and labor are compared with the average net income per acre before any profit distribution. The ratios for capital and labor have been combined in the same proportions that capital and labor were used on the project farms. Net income was computed by subtracting average expenditures for capital and labor plus rents per acre from average gross income.

Since sugar is produced and sold in a market having many characteristics of the competition model, and payment to all factors of production is included in the production function, it would be expected that at a marginal value product-to-price ratio of one, the net profits per acre would be zero. The computed correlation coefficient between the ratio of marginal value product to price and net income per acre was 0.763 (significant at the 0.5-percent level). Using this relationship, we estimate a ratio of 0.937 would yield zero net income.

Table 6.--Combined marginal value product-to-price ratio and average net income per acre for proportional-profit sugar farms, by project, 1950-62

Project	:	Ratio of Marginal value product to price [1]	:	Net income per acre [2]
	:			Dollars
Loiza...................:		.442		-27.48
Fajardo................:		.719		-72.00
Plazuela...............:		.863		-11.70
Cambalache.............:		.984		.89
San Vincente...........:		.885		6.90
Toa....................:		.429		-54.71
Guanica................:		1.114		36.56

[1] The MVP/price ratios for capital and labor (from table 5) combined in the same relative shares as capital and labor expenditures were of nonland expenditure (derived from app. tables 9 and 10).

[2] Computed by subtracting average nonland expenditures (app. table 9) and rents (app. table 12) from average gross income (app. table 8).

These results provide the key to the performance of the Land Authority's
sugar program in 1950-62. Part of that performance was due to an industry-
wide pattern of fairly stable income per acre coupled with rising production
costs. In addition, the projects tended to employ more variable resources
(capital and labor) than was economically justified. Thus, the Authority
apparently was pursuing a goal--that of maximizing output on the lands it
controlled--that competed with its original goal of maintaining efficient
production. It should be pointed out that while the Authority retained
marginal and submarginal farms in operation, overall labor efficiency was
reasonably high, measured in terms of cwts. of sugar produced per man-day and
compared with labor productivity for the private sugar industry (table 7).

Table 7.--Labor productivity of Land Authority and private industry, average
1950-61

	:	Land Authority	:	Private industry 1/
	:			
Average labor productivity; cwts. of sugar/man-day......................	:	2.00		1.64
	:			
Average annual percentage change in productivity 2/...................	:	.036		.025
	:			

1/ Source: (20, pp. 34-35). Data adjusted to remove the Land Authority
component.
2/ Both are significant at the 1-percent level.

An explanation for the Authority's retaining unprofitable holdings may
be found in the economic conditions prevailing in Puerto Rico during 1950-62.
While the island's economy showed rapid growth in per capita income, and a
shift in the structure of the labor market away from agriculture, serious
problems remained (6). Prosperity was not evenly distributed throughout the
island, and unemployment remained above 12 percent. Also, the Government
wanted to increase the volume of exports to the continental United States.
It was in response to these broad problems that the Authority adopted the
policies that it did. By continuing some unprofitable operations, it was
able to provide employment opportunities in what might well have been seriously
depressed areas. A further consideration was the need to provide employment
in the rural areas as a means of stemming the migration of workers to the
already strained urban centers of Puerto Rico. This policy also provided
sugar for export to the mainland, providing income to the island and helping
to meet Puerto Rico's sugar quota in the regulated U.S. market. Whether these
goals could have been satisfied through some other means of land utilization
is discussed in the following section which explores the extent to which these
policies did or did not contribute to the overall performance of the island's
economy.

11

PROPORTIONAL-PROFIT SUGAR FARMS AND ECONOMIC GROWTH

To relate the Land Authority's sugar program to Puerto Rico's overall economic picture, a seven-equation model was estimated for the period 1950-62. Annual gross value of output of the proportional-profit sugar farms was included explicitly in the model (all dollar values are deflated). The equations, with the standard deviations of the coefficients and multiple R^2's, are as follows:

$$(1) \quad X_{2t} = 3.277 I_t + .734 L_{2t} \qquad\qquad R^2 = .94$$
$$\phantom{(1) \quad X_{2t} =} (.229) \quad\; (.095)$$

$$(2) \quad L_{2t} = 501.879 - .084 I_t + 195.723\, W(I)_t - 14.832t \qquad R^2 = .76$$
$$\phantom{(2) \quad L_{2t} = 501.879 -} (.055) \quad (95.571) \qquad (5.035)$$

$$(3) \quad I_t = 13.697 + .096 K_{t-1} + .888\, G_t \qquad\qquad R^2 = .98$$
$$ (.030) \qquad (.429)$$

$$(4) \quad E_t = -133.464 + .434\, X_{2t} + X_{1t} \qquad\qquad R^2 = .97$$
$$ (.022)$$

$$(5) \quad \Delta Y = 170.360 - .407 Y_{t-1} + .514 E_t + .730\, I_t \qquad R^2 = .77$$
$$ (.122) \qquad (.308) \quad (.260)$$

$$(6) \quad Y_t = X_{1t} + X_{2t}$$

$$(7) \quad R_t = \frac{\Delta Y_t}{Y_{t-1}}$$

The notation for the variables is:

Y_t = Annual gross output of the economy (millions of dollars)

X_{1t} = Annual gross output of public sugar sector (millions of dollars)

X_{2t} = Annual gross output of the economy less output of the public sugar sector (millions of dollars)

L_{2t} = Annual employment minus the public sugar sector (thousands of man-years)

I_t = Annual investment in fixed plant and equipment (millions of dollars)

E_t = Annual exports (millions of dollars)

G_t = Annual net Government expenditures (millions of dollars)

$W(I)_t$ = Index of nonagricultural wages

K_t = Net accumulated capital stock (millions of dollars) [11]/

t = time index; 1-14, years 1948-1961

$\Delta Y = Y_t - Y_{t-1}$

$R_t = \Delta Y / Y_{t-1}$

Equations (2), (3), (4), and (5) are simple linear estimations, with the exception that X_{1t} was subtracted from E_t prior to estimation because of the assumption that all of X_{1t} was exported. Equation (1) was estimated from an equation relating output per man-year to investment per man-year:

$$\left(\frac{X_{2t}}{L_{2t}} \right) = \alpha_o \left(\frac{I_t}{L_{2t}} \right)^{\alpha_1}$$

which yields the Cobb-Douglas equation:

$$X_{2t} = \alpha_o I_t^{\alpha_1} L_{2t}^{1-\alpha_1}$$

The linear form of equation (1) was derived through the use of Taylor's series of the first order ([21], pp. 171-172). [12]/ All of the equations are overidentified, pointing to full-information maximum likelihood as being the most desirable estimating technique. However, since the matrix of coefficients for the endogenous variables is recursive, we have a special case wherein least squares applied to each individual equation yields results identical to the full-information maximum likelihood estimation ([5], pp. 264-266, p. 293). Therefore, in the interest of simplicity, the least squares estimation technique was employed.

This model was constructed with the view of analyzing the impact of the Land Authority's sugar program on the rate of growth of the Puerto Rican economy. Since the model is recursive, we may derive a reduced form equation with the policy target, R_t, as a function of the exogenous variables Y_{t-1}, K_{t-1}, $W(I)_t$, and t, plus two instrument (policy) variables X_{1t}, and G_t:

$$R_t = R_t \, (Y_{t-1}, K_{t-1}, W(I)_t, \, t, \, G_t, \, X_{1t})$$

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[11]/ K_t was developed from the series I_t, to which the Puerto Rico Planning Board's estimate of depreciation was applied. The base was given by a capital stock estimate for 1946.

[12]/ Investment was used as a weak proxy for capital expenditures, since expenditure data were not available. The nature of investment in Puerto Rico--that is, light industry, with its short gestation period--lends itself to this type of substitution.

Structural equations (2) and (3) are also employed to evaluate the performance of L_{2t} as a secondary target (19, passim). The reduced form equation provides an estimate of an average rate of growth in total product of 6.21 percent per year. This compares with the observed average rate of growth of 6.23 percent as estimated by:

$$\ln Y_t = 6.5840 + .0623t \qquad R^2 = .97$$
$$(.0032)$$

Equations (1), (3), and (4) are straightforward in their interpretation. Equation (3) shows the important role of government expenditures on the Puerto Rican economy during the early years of the period examined. Only after capital stock has accumulated substantially does it have any major impact on the level of investment. As the accumulation process continues, this variable becomes more important than government expenditures. Equation (4) points out the importance of sugar exports to the economy, with over 40 percent of gross output being exported.

The coefficients in equation (2) point up the conflicting forces involved in determining the level of employment. The negative sign on the investment coefficient is representative of a substitution of capital for labor during 1950-62. This substitution took place to some degree in all sectors of the economy. More important, however, was the changing structure of the economy-- from a primarily agricultural economy to an economy of light industry, with a fairly large agricultural sector (17, p. 78; 6, pp. 463-464).

Within sectors, employment grew in the higher paying categories of skilled labor. This growth explains the positive coefficient associated with the non-agricultural wage index.

The negative time coefficient, while reflecting in part the effects of investment, is more than likely representative of the effects of the total population picture. During 1950-62, the natural rate of population growth was roughly 2.5 percent a year. Migration to the mainland was sufficient to reduce this figure to an actual rate of 1.5 percent a year. Out-migrants were primarily males in the productive ages, while in-migrants were largely children and retirees. As a result, the percentage of population in the productive ages declined and produced a declining labor participation rate (employment divided by population) (6, pp. 469-470).

The combined effect of these influences was to produce a fairly stable level of employment. Employment declined to a low mark in 1955, then moved upward erratically after 1955. The rate of unemployment remained high, averaging 13 percent per year for 1950-62. This high rate of unemployment was a significant factor in the relationship of the Land Authority's operations to the overall pattern of economic development since, as previously noted, the Authority continued to operate some unprofitable holdings to provide rural employment opportunities.

Several points should be considered when viewing the Authority's sugar. operations in the context of the total economy during 1950-62: (1) Roughly

14

10 percent of the sugar industry was operated by the Authority; (2) two projects of this operation sustained high losses; (3) the Authority's other projects, except one, tended to employ their variable resources in an intensive manner; and (4) profit distribution, by law, continued to be made at the same time that losses were being incurred. Characteristics of the economy during 1950-62 were: (1) a high rate of growth; (2) structural shifts away from agriculture; (3) heavy unemployment; and (4) an incipient high rate of population growth, held in check by positive net migration.

For examining the relationship between the Land Authority's sugar program and the rate of growth of the economy, the reduced form equation is evaluated under different operating rules. The operating rules deal with two aspects of the operation--the intensity of variable factor use, and profit distribution.

Rule one assumes that, on each project, the variable factors were employed up to the point where their marginal-value products were equal to their prices (that is, the wage rate for labor, and $1.05 for capital). Table 8 shows the observed input levels and associated gross output by project. Table 9 shows the input levels that would satisfy the optimization criterion and the gross output associated with these input levels. Comparing the tables, we see that the gross output for the system drops by one-third, from approximately $9 million to just under $6 million. The amount of adjustment varies widely between project because of the great disparities in the production coefficients. Because of the high unexplained residual (low R^2's) of the functions, the quantities shown in table 9 should be interpreted as representing directions of change rather than as precise estimates. The amount of land was held constant in these computations. However, it is clear, from the figures in table 9, that some land abandonment is implicit.

Table 8.--Observed average annual input and output levels of proportional-profit sugar farms, by project, 1950-62

Project	:	Gross output	:	Capital	:	Labor
	:	-----------------------1,000 dollars-----------				Man-years
	:					
Loiza	:	1,258		695		589
Fajardo	:	1,515		1,028		833
Plazuela	:	869		476		387
Cambalache	:	1,204		605		528
San Vincente	:	1,002		646		532
Toa	:	1,164		566		533
Guanica	:	1,949		886		682
Total...........:		8,961		4,902		4,084

15

Table 9.--Optimum average annual input and output levels of proportional-
profit sugar farms, by project, 1950-62

Project	:	Gross output	:	Capital	:	Labor
	:	------------1,000 dollars-------------				Man-years
Loiza...............:		1,045		21		440
Fajardo............:		127		509		52
Plazuela...........:		570		154		349
Cambalache.........:		612		266		304
San Vincente.......:		508		84		185
Toa................:		454		211		166
Guanica............:		2,651		1,384		465
Total...........:		5,967		2,629		1,961

Under the assumption of rule one, the total net income above variable
cost would have been slightly more than $18 million over the 13-year period
and net rents paid to the Authority $4.6 million, compared with an actual
deficit in net rents received (table 2). Net income available for distribu-
tion would have been $7.8 million, compared with $6.1 million actually avail-
able (table 1). Three projects--Fajardo, Cambalache, and Toa--would have been
unable to cover the amount of rents payable to the Authority.

Rule number two provides for the optimum level of output but does away
with profit distribution. In this case, the total net income ($18.2 million)
above variable cost is available for government expenditure (G_t) at an average
of $1.4 million per year, in contrast to an annual average of $355,000 with
profit distribution.

The final rule is concerned only with the profit-sharing aspect of the
program. Output levels are kept at the observed level, but profit sharing
is dispensed with. Thus, net incomes (table 1) would have been used to
offset losses (table 2). This procedure yields a net rents-paid figure of
slightly more than $6 million, or $473,000 annually, available for government
expenditure (G_t). The aggregate results of applying these three rules to the
Land Authority are shown in table 10. Columns 3, 4, and 5 are a result of the
comparison of the observed levels with those that would prevail under the
figures in columns 1 and 2.

These findings raise two issues concerning the operation of the propor-
tional-profit farms. The first deals with the Authority's apparent decision
to maximize sugar output on its holdings. This decision, to the extent that
it resulted in maintaining uneconomic operations, led to financial losses and
reduced net rents earned from lands owned by the Authority. It did, however,
have the effect of stabilizing employment during a period of substantial un-
employment. As we have seen above, the optimum level of variable factors

Table 10.--Impact of alternative operating rules for the Land
Authority, 1950-62

Rules	Average annual addition to G_t	Rate of growth in total product (per-cent)	Comparison of expected with observed income and employment		
			Change in total income [1]	Average change in total income [1]	Change in employment [2]
	Million dollars	Percent	------Million dollars------		1,000 man-years
I. Optimum level for variable factors	.355	6.13	-147.63	-11.36	-2.150
II. Optimum level of variable factors with no profit distribution	1.402	6.23	+30.93	+2.38	-2.228
III. Observed level of variable factors with no profit distribution	.470	6.26	+77.30	+5.95	-.035

[1] Derived by evaluating the integral $Y_0 = \int_0^{13} e^{rt} dt$, where r comes from the reduced form equation.
[2] Derived from structural equations 2 and 3 and tables 8 and 9.

implied that some land would be diverted from sugar production. Could this land have been put to other uses that would have offset the negative effects of the application of the first operating rule? From the standpoint of the Authority, there is no doubt that much of the land had an opportunity cost that would have made it feasible to transfer the land to alternate uses; for example, livestock or other field crops. While this might have been profitable for the Authority, it would have introduced external diseconomies in the form of unemployment and lowered gross income per acre, and brought about a decline in sugar production. In Puerto Rico, there is no other crop with a ready market that would have the same impact as sugar in terms of employment, value per acre, and a ready export market. 13/ Even if we consider the impact that the production of alternative crops might have had in reducing foodstuff imports, the island's comparative advantage still was with the production of sugar for export.

The second issue concerns the profit-sharing aspects of the program. Private investment capital cannot be considered scarce in Puerto Rico (in contrast to the situation in other less developed areas), because of the ready access to capital. Thus, any capital shortage on the island would be in the public sector. The key to private investment was the ability of the Commonwealth Government to provide the necessary infrastructure to allow the economy to absorb new investment. Limits on the borrowing and taxing powers of the Government, coupled with the wide variety of public needs (12, pp. 86-88; pp. 93-94), placed a decided strain on public resources. In this context, the findings presented in table 10 make profit sharing a strategy of doubtful desirability during an economy's early stages of development. The Land Authority's diversion of profits into consumption very likely had a dampening effect on growth in total income for 1950-62. It should be remembered that these funds were distributed to individuals with low incomes, and therefore with a high marginal propensity to consume. Furthermore, since wages on the proportional-profit farms were the same as in the industry as a whole, these workers would have suffered no relative welfare decline had profit sharing been foregone.

Overall, it appears that the behavior of the Land Authority was consistent with the goal of economic growth for Puerto Rico. Assuming that the institutional setting—that is, the Land Law of 1941—gave the Authority no discretion as regards profit sharing, its use of variable resources was rational. As a public agency, the Authority had to consider the social impact of its activities as well as the profit and loss aspects of its farming operations. Thus, an increase in unemployment would have had to be treated as an internal diseconomy in this framework, and the use of marginal land in the continued production of sugar would have had to be based on the social returns to this activity.

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13/ The Land Authority has experimented with pineapple culture in Puerto Rico with favorable technical results. However, the nature of the marketing structure is such that Puerto Rico has not developed an export market.

In Puerto Rico, the proportional-profit sugar farm system was conceived simultaneously as a reform measure, a structural change, and a policy instrument (19, passim). As a reform measure, the program transferred productive resources from private to public ownership. 14/ Profit sharing as a mechanism of distribution represented a structural change in the manner of compensating the factors of production. Finally, the ability of the Government to intervene in the determination of product level and input mix constituted a policy instrument. This study was concerned primarily with the policy instrument aspect of the program, and to a lesser degree with the structural change aspect of the program.

As stated earlier, by 1948 the Land Authority had acquired 49 percent of the corporate plantation land that in 1940 was held in excess of the 500-acre limit. There is no evidence to suggest that corporate landownership decreased by other means during 1950-62. Thus, the Authority failed to fully achieve this first of its three main goals. Essentially, two factors explain the failure to eliminate corporate latifundia. First, funds for land purchase were limited, and there were urgent competing needs for such funds. In 1948, when the major land acquisitions ceased, the Authority was faced with the problem of acquiring some 95,000 acres of land in the face of rising land prices. Based on a conservative figure of $200 per acre, which represents the average value of the Authority's sugar lands in 1950, the cost of acquiring these additional lands would have exceeded $19 million. At the same time, emphasis was shifting from agricultural to industrial development. There is no evidence to suggest that the transfer of ownership of sugar land resulted in any significant increases in output. 15/ Thus, the funds needed for acquisition of additional lands probably had a greater impact on the economy when channeled into other uses.

By acquiring such lands as it did, however, the Authority effectively eliminated the influence of corporate latifundia in Puerto Rico. By the late 1940's and early 1950's the sugar growers had become only one of a number of interests in the society, and attention shifted to new reform and development programs (9, pp. 145-160).

Emphasis on profit sharing in the Land Law was based on a vision of the future evolution of the proportional-profit farm system. The drafters of the law had looked for the development of worker participation in management and

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14/ In this context, reform does not imply a value connotation, but refers to a change that affects fundamental social relationships within the society.

15/ Packard's study in 1948 (12) did find that the first acquisitions, the Cambalache project, resulted in an improved land use pattern. However, this was the only project for which extensive data were available for the period prior to acquisition.

a decentralized management system. From its very beginnings, however, directors of the program found that this would not work. Attempts at decentralizing management failed, primarily because of a lack of skilled personnel. 16/ At the same time the institution of profit sharing did not generate any appreciable change in workers' attitudes. (18) The program's impact on labor came through the labor unions. Unions included anticipated profits in their wage agreements with the Authority, thus stabilizing worker incomes. 17/

Another of the major goals of the Land Law of 1941 was to retain efficiencies of large-scale, corporate operations. The goal was not achieved. In effect, the Authority found it necessary to take a social point of view in determining operational procedure, which conflicted with operating efficiency. Achievement of optimum efficiency, whether from a social or single firm point of view, was made additionally difficult by the mandatory distribution of profits. While it is reasonable to assert that such profits could have been utilized elsewhere to operate public programs, thus contributing to the achievement of social objectives, there are indications that the program would have been politically unacceptable without the profit-sharing feature. 18/

Is the proportional-profit farms scheme suitable for other developing economies? We cannot make a universal judgment since every economy has unique features. Progress in Puerto Rico, for example, was undoubtably influenced by the close political ties of the island with the mainland United States. It is clear, however, that the institution would seem to be worth considering as a reform mechanism in those areas where the plantation form of agriculture is important and where skilled managers are in short supply. The profit-sharing mechanism may be questioned if the overriding goal is an increased rate of economic growth. However, as in Puerto Rico, a diminution in the rate of growth may be an acceptable price for achieving a distribution of wealth more heavily weighted toward labor.

16/ Acosta-Velarde, Jose. First Director, Land Authority of Puerto Rico. San Juan, P.R., interview. 1963.

17/ Colon-Torres, op. cit.

18/ Acosta-Velarde, op. cit.

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Appendix Table 1.-- Land leased to proportional-profit sugar farm projects,
Land Authority of Puerto Rico, 1950-62

Year	Project							Total
	Loiza	Fajardo	Plazuela	Cambalache	San Vincente	Toa	Guanica	
	Acres							
1950	9,481	11,682	8,208	6,537	9,816	7,786	10,087	63,598
1951	9,410	11,670	8,004	7,217	8,326	7,766	10,078	62,474
1952	7,595	11,363	8,367	6,925	8,576	7,819	10,102	60,746
1953	7,703	11,365	8,309	6,993	8,548	7,763	10,002	60,688
1954	7,643	11,346	8,682	6,993	8,170	7,642	9,997	60,472
1955	6,660	8,834	11,283	6,924	7,711	6,006	9,901	57,320
1956	6,821	11,161	4,780	6,239	8,046	5,341	9,883	52,271
1957	6,814	11,161	4,364	6,176	8,124	5,317	9,849	51,805
1958	6,770	9,333	4,591	5,585	6,574	5,092	9,028	46,973
1959	6,723	8,880	3,717	5,515	6,221	5,090	8,996	45,142
1960	6,587	8,123	3,414	5,515	6,419	5,024	8,943	46,249
1961	6,575	8,103	3,418	5,515	6,303	5,019	8,931	43,864
1962	6,531	8,047	3,344	4,726	6,197	4,909	8,539	42,293

Source: Annual financial reports of the Land Authority of Puerto Rico.

23

Appendix Table 2. -- Area harvested by proportional-profit sugar farm projects, 1950-62

Year	Loíza	Fajardo	Plazuela	Project Cambalache	San Vincente	Toa	Guanica	Total
				Acres				
1950	5,083	6,679	3,864	4,028	4,487	5,011	5,603	34,755
1951	4,751	6,860	3,590	4,094	4,281	4,614	5,207	33,387
1952	4,822	6,768	3,526	4,470	4,310	4,443	5,166	33,505
1953	4,335	6,357	3,209	4,290	4,110	4,503	5,007	31,811
1954	4,403	6,649	3,413	4,123	4,225	4,388	4,476	31,682
1955	4,165	6,538	3,471	3,938	3,671	4,160	4,167	30,160
1956	3,511	6,100	2,187	3,599	3,828	3,170	4,447	26,842
1957	4,124	6,134	2,405	3,734	3,961	3,083	5,111	28,852
1958	3,206	5,092	2,056	3,185	3,622	2,809	4,954	24,924
1959	2,943	5,198	2,111	3,834	3,950	3,018	4,743	25,796
1960	3,730	3,739	2,020	3,573	3,611	3,097	4,631	24,401
1961	3,495	3,959	1,893	3,846	3,401	3,195	4,794	24,582
1962	2,951	3,417	1,849	3,628	2,792	3,304	4,426	22,369
Total	51,524	73,540	35,585	50,342	50,249	48,795	62,732	372,766

Source: Annual financial reports of the Land Authority of Puerto Rico.

24

Appendix Table 3.-- Average yield of sugarcane harvested per acre by proportional-profit sugar farm projects, 1950-62

Year	Project							Average, all projects
	Loiza	Fajardo	Plazuela	Cambalache	San Vincente	Toa	Guanica	
	Tons							
1950	32.57	32.05	31.64	37.39	36.25	28.23	37.79	33.62
1951	33.47	28.17	31.56	32.55	32.26	27.22	37.00	31.59
1952	35.06	33.74	35.42	33.93	37.64	32.86	38.57	35.25
1953	28.29	22.65	32.27	32.56	32.65	26.02	32.88	29.10
1954	31.68	26.53	33.31	36.72	35.38	28.19	38.05	32.34
1955	31.74	26.42	31.63	35.03	35.84	26.23	37.46	31.74
1956	37.51	28.99	40.75	37.64	37.23	29.04	36.52	34.64
1957	29.97	29.60	39.63	26.46	25.93	22.08	31.67	26.22
1958	31.52	24.13	36.25	33.32	30.87	28.33	27.43	29.46
1959	30.94	30.69	42.81	37.63	33.93	33.81	36.30	34.00
1960	29.96	28.68	34.95	37.02	32.32	29.94	35.55	32.10
1961	35.63	34.22	40.49	38.48	35.24	32.65	45.26	36.84
1962	35.76	36.23	40.77	33.42	36.97	30.78	40.16	35.11
1950-62 average	32.55	28.31	34.78	34.77	34.12	28.76	36.45	32.54

Source: Annual financial reports of the Land Authority of Puerto Rico.

25

Appendix Table 4.--Average yield of sugar per acre of cane harvested
by proportional-profit sugar farm projects, 1950-62

Year		Project						Average, all projects
	Loiza	Fajardo	Plazuela	Cambalache	San Vincente	Toa	Guanica	
				Tons				
1950	3.35	3.76	3.55	4.10	4.16	3.23	5.03	3.96
1951	3.85	3.14	3.47	3.36	3.65	3.12	4.77	3.16
1952	3.79	3.47	3.58	3.16	3.80	3.39	4.72	3.71
1953	3.05	2.39	3.51	3.55	3.65	2.82	4.07	3.24
1954	3.39	2.73	3.55	3.82	3.60	2.90	4.73	3.48
1955	3.77	3.18	3.53	3.93	3.99	2.89	4.80	3.68
1956	4.12	3.26	4.22	3.89	3.68	2.82	4.57	3.74
1957	3.45	2.32	3.13	2.78	2.72	2.34	4.10	2.95
1958	3.21	2.44	3.52	3.29	2.88	2.70	3.16	2.98
1959	3.34	2.88	4.09	3.85	3.12	3.29	3.98	3.40
1960	3.34	2.67	3.61	3.59	2.89	2.88	3.80	3.20
1961	3.48	3.24	3.55	3.68	3.02	3.07	5.11	3.56
1962	3.38	3.29	3.36	3.17	3.06	2.76	4.56	3.29
1950-62 average	3.56	3.00	3.58	3.56	3.40	2.96	4.42	3.36

Source: Annual financial reports of the Land Authority of Puerto Rico.

Appendix Table 5.-- Average value per acre of land leased to proportional-profit
sugar farm projects, 1950-62

Year	Project							Total
	Loiza	Fajardo	Plazuela	Cambalache	San Vincente	Toa	Guanica	
				Dollars				
1950	224.94	172.90	159.22	253.58	139.31	169.06	292.26	200.46
1951	225.79	172.89	159.68	257.17	166.77	168.65	292.11	206.79
1952	235.34	162.00	167.11	266.30	161.15	167.33	291.41	205.85
1953	236.19	162.07	167.05	266.16	161.47	167.87	293.03	206.39
1954	223.85	161.71	161.20	266.15	167.47	160.26	292.26	205.00
1955	252.59	205.03	174.83	268.80	177.39	202.01	295.32	223.87
1956	248.15	161.98	1/	1/	170.00	1/	295.62	2/213.16
1957	248.23	161.98	1/	1/	168.34	222.80	294.98	2/225.22
1958	249.21	193.57	1/	1/	1/	230.64	305.10	2/261.16
1959	250.04	197.38	1/	1/	1/	230.62	305.34	2/250.26
1960	251.94	209.40	1/	1/	202.62	299.54	307.02	2/254.56
1961	252.14	209.82	1/	1/	206.29	229.39	306.87	2/255.76
1962	253.34	210.68	1/	1/	208.14	224.88	311.82	2/259.25

Source: Annual financial reports of the Land Authority of Puerto Rico.

1/ Values are not available, as land was transferred to the Canos Tiburones development project.
2/ Includes lands transferred to the Canos Tiburones developmental project.

27

Appendix Table 6.-- Net profits of farms in proportional-profit
sugar farm projects, 1950-62

Year	Project							
	Loiza	Fajardo	Plazuela	Cambalache	San Vincente	Toa	Guanica	Total
	Dollars							
1950-------	56,434	3,853	184,499	129,256	262,052	77,944	236,586	950,627
1951-------	83,577	16,819	144,096	133,756	219,437	92,830	522,905	1,213,403
1952-------	46,961	988	87,214	54,509	216,771	29,020	259,462	694,928
1953-------	1/-	-	28,289	46,034	132,410	-	102,233	308,968
1954-------	13,197	-	56,671	49,786	131,309	-	141,809	392,773
1955-------	64,237	11,776	43,677	114,681	179,366	-	139,013	552,803
1956-------	77,681	9,516	61,946	58,952	106,535	-	304,349	618,981
1957-------	62,020	-	8,529	109	57,361	-	225,313	353,334
1958-------	3,325	-	2,492	6,200	27,899	-	14,302	54,220
1959-------	11,413	-	23,434	94,346	48,693	-	78,120	256,008
1960-------	24,128	-	11,602	4,531	-	-	65,048	105,310
1961-------	27,912	-	-	13,707	4,021	-	356,519	402,161
1962-------	-	-	-	2,873	607	-	242,247	245,729
Total	470,919	42,954	652,455	708,749	1,386,466	199,794	2,687,911	6,149,251

Source: Annual financial reports of the Land Authority of Puerto Rico.

1/ A dash means that no farm in the project earned a profit for the year indicated.

28

Appendix Table 7.--Losses incurred by farms in proportional-profit
sugar farm projects, 1950-62

Year	Project							Total
	Loiza	Fajardo	Plazuela	Cambalache	San Vincente	Toa	Guanica	
	Dollars							
1950	117,807	203,602	1/ –	–	–	26,697	3,174	351,283
1951	80,751	268,896	73,980	3,201	13,316	52,840	–	492,986
1952	87,028	198,808	25,256	17,717	2,749	86,859	–	418,418
1953	335,717	799,511	61,295	41,672	32,853	286,767	31,675	1,589,494
1954	144,968	515,425	74,974	35,570	22,953	179,315	2,491	975,698
1955	5,727	277,558	97,620	6,318	8,480	225,968	17,961	639,635
1956	23,918	160,945	3,075	8,938	38,460	338,481	–	573,819
1957	29,838	425,786	53,771	125,987	89,231	337,439	13,058	1,075,164
1958	135,519	527,771	36,446	132,883	102,996	273,729	111,399	1,320,747
1959	169,191	560,965	46,367	24,231	66,334	260,666	148,013	1,275,771
1960	93,758	491,258	66,762	80,688	195,809	240,874	37,381	1,206,532
1961	124,894	415,306	123,796	59,125	138,153	159,991	–	1,021,266
1962	217,853	310,391	142,795	72,819	191,093	245,958	–	1,180,911
Total	1,567,025	5,156,228	806,141	609,153	902,434	2,715,590	365,157	12,121,730

Source: Annual financial reports of the Land Authority of Puerto Rico.

1/ A dash means that no farm in the project incurred a net loss of income for the year indicated.

29

Appendix Table 8.--Gross income per acre for proportional-profit
sugar farm projects, 1950-62

Year	Loiza	Fajardo	Plazuela	Cambalache	San Vincente	Toa	Guanica	Average, all projects
				Dollars				
1950	310.72	302.06	290.32	303.75	332.36	254.26	401.81	314.88
1951	348.00	292.78	309.03	308.08	318.95	290.54	440.75	328.20
1952	348.64	332.22	334.55	232.19	351.84	308.32	411.95	338.39
1953	286.08	227.23	309.79	315.15	325.58	257.56	391.34	297.86
1954	290.13	239.58	309.73	331.95	309.03	253.13	421.56	304.15
1955	324.67	269.85	324.07	347.25	343.79	251.92	426.92	323.61
1956	353.36	279.51	357.80	326.23	298.64	249.76	411.32	323.46
1957	313.45	217.36	276.73	251.10	253.23	218.46	391.17	273.80
1958	288.33	217.64	296.93	289.53	259.51	245.36	297.25	266.70
1959	300.07	255.40	360.58	340.20	277.57	297.30	363.45	308.33
1960	301.04	251.90	319.76	309.93	259.37	262.31	351.97	293.16
1961	335.39	307.62	334.68	335.43	287.20	296.69	485.98	343.51
1962	319.38	317.86	318.50	294.41	295.56	275.89	458.40	329.10
1950-62 average	317.43	267.77	317.56	311.06	301.17	266.95	403.69	311.63

Source: Annual financial reports of the Land Authority of Puerto Rico.

Appendix Table 9.--Nonland expenditures per acre, proportional-profit
sugar farm projects, 1950-62

Year	Project								Average, all projects
	Loíza	Fajardo	Plazuela	Cambalache	San Vincente	Toa	Guanica		
					Dollars				
1950	278.23	288.88	212.24	231.30	243.82	225.24	305.13		259.28
1951	312.77	297.66	261.61	243.19	245.38	259.16	291.65		275.86
1952	322.98	322.59	314.30	242.40	277.43	295.32	313.48		302.29
1953	326.55	323.95	298.08	283.06	275.27	300.00	324.40		305.94
1954	293.67	294.55	294.57	293.40	256.91	271.63	331.90		291.19
1955	283.71	286.36	327.40	280.96	264.80	279.72	334.99		293.97
1956	305.24	278.89	289.78	278.30	252.30	327.03	294.03		288.67
1957	277.27	266.21	270.53	255.53	234.09	306.85	300.76		271.50
1958	299.92	293.07	273.70	291.79	249.95	311.86	272.46		284.51
1959	319.83	342.06	339.48	297.52	260.72	367.43	333.98		320.59
1960	303.32	353.19	311.44	299.42	287.27	329.53	310.73		312.66
1961	337.19	389.08	368.50	319.82	306.30	316.27	373.00		344.14
1962	368.22	384.41	362.58	282.34	334.83	322.94	365.76		346.94
1950-62 average	310.72	313.03	298.06	276.99	267.40	297.33	318.67		297.45

Source: Annual financial reports of the Land Authority of Puerto Rico.

31

Appendix Table 10.--Capital expenditures per acre, proportional-profit sugar farm projects, 1950-62

Year	Loiza	Fajardo	Plazuela	Project Cambalache	San Vincente	Toa	Guanica	Average, all projects
				Dollars				
1950	141.03	157.26	115.78	119.21	115.12	112.47	150.54	133.99
1951	157.34	160.82	141.47	131.44	126.36	118.30	156.30	143.38
1952	155.42	173.78	175.34	128.93	139.73	141.56	167.48	155.65
1953	172.07	170.29	171.03	154.89	145.80	163.23	180.33	166.73
1954	162.92	164.54	168.10	164.27	140.14	145.57	189.92	162.24
1955	163.46	163.42	209.72	164.37	143.46	162.40	201.80	173.19
1956	189.97	156.91	164.61	157.74	136.35	195.70	165.88	164.89
1957	157.93	153.03	152.92	146.72	125.03	182.08	175.28	155.02
1958	181.71	180.75	160.71	171.87	142.37	205.09	163.11	171.85
1959	200.74	214.19	202.66	161.40	140.03	243.97	198.53	192.56
1960	189.69	236.60	196.98	132.41	171.10	222.91	191.31	198.55
1961	209.24	252.07	233.93	190.85	174.95	202.70	223.84	211.85
1962	249.10	253.24	241.56	179.03	203.84	210.86	224.91	222.45
1950-62 average	175.44	181.63	174.07	156.31	146.50	172.22	183.49	170.23

Source: Annual financial reports of the Land Authority of Puerto Rico.

Appendix Table 11.—Man-days of labor per acre on proportional-profit sugar farm
projects, 1950-62

Year	Project							Average, all projects
	Loiza	Fajardo	Plazuela	Cambalache	San Vincente	Toa	Guanica	
	Number							
1950	45.61	46.37	33.64	40.36	44.57	40.17	52.50	43.85
1951	50.47	44.75	41.41	34.82	36.84	46.67	41.37	42.36
1952	52.73	49.82	42.37	34.39	42.62	48.53	43.22	45.30
1953	44.55	45.10	36.41	36.93	38.44	40.28	41.07	40.73
1954	36.45	36.14	34.12	36.20	32.37	35.54	38.09	35.61
1955	35.09	34.42	38.74	33.92	33.08	40.49	36.52	35.99
1956	36.80	35.49	47.17	37.25	33.29	37.55	35.05	35.95
1957	30.71	26.78	30.53	23.58	28.42	30.15	30.40	29.07
1958	29.88	27.08	28.84	30.93	27.68	25.70	25.37	28.02
1959	30.83	30.84	37.11	37.70	35.07	38.14	32.27	33.08
1960	28.36	28.74	29.69	34.74	33.12	21.64	29.29	29.49
1961	28.14	30.94	34.83	30.72	34.41	23.44	26.27	29.24
1962	25.10	26.36	23.94	26.64	29.26	22.29	26.05	25.93
1950-62 average	37.13	36.83	35.35	34.11	34.49	35.44	35.32	35.76

Source: Annual financial reports of the Land Authority of Puerto Rico.

Appendix Table 12.--Land rent per acre harvested by proportional-profit sugar farm projects, 1950-62

Year	Project (Dollars)							Average, all projects
	Loiza	Fajardo	Plazuela	Cambalache	San Vincente	Toa	Guanica	
1950	30.62	37.16	25.00	38.63	29.60	22.60	59.36	37.00
1951	38.57	30.63	28.50	34.61	25.41	22.10	47.93	32.54
1952	36.82	27.88	27.99	31.66	22.95	25.98	47.08	31.28
1953	37.84	27.97	29.74	31.97	27.65	20.38	49.82	32.13
1954	30.41	23.00	30.17	34.74	25.86	32.79	56.77	31.36
1955	27.86	23.97	29.98	35.51	30.91	22.98	62.21	32.95
1956	35.69	25.67	30.66	33.70	28.12	28.02	50.26	33.99
1957	29.06	29.92	30.57	30.08	25.22	22.08	49.00	29.32
1958	85.11	25.34	38.53	41.41	29.61	30.03	43.53	34.11
1959	39.48	22.72	31.94	27.49	22.75	26.67	48.88	31.39
1960	34.19	31.70	34.64	33.21	26.51	25.08	38.63	30.49
1961	33.25	24.41	36.58	28.80	24.60	27.47	40.25	30.40
1962	35.53	28.62	36.47	29.86	34.08	25.66	35.81	31.58
1950-62 average	34.19	26.74	31.20	33.18	26.87	24.33	48.46	33.29

Source: Annual financial reports of the Land Authority of Puerto Rico.

34

Appendix Table 13.--Wages paid per day, proportional-profit sugar farm projects, 1950-62

Year	Loiza	Fajardo	Plazuela	Project Cambalache	San Vincente	Toa	Guanica	Average, all projects
				Dollars				
1950	2.82	2.84	2.87	2.78	2.39	2.81	2.94	2.86
1951	3.07	3.06	3.22	3.21	3.17	3.02	3.25	3.13
1952	3.18	3.19	3.27	3.30	3.25	3.17	3.38	3.24
1953	3.47	3.28	3.49	3.47	3.37	3.40	3.51	3.42
1954	3.59	3.60	3.71	3.57	3.61	3.55	3.73	3.62
1955	3.43	3.56	3.04	3.44	3.52	2.90	3.65	3.36
1956	3.38	3.44	3.37	3.24	3.47	3.50	3.66	3.44
1957	3.89	4.23	3.92	3.81	3.84	4.14	4.13	4.01
1958	3.96	4.15	3.92	3.88	3.89	4.18	4.15	4.02
1959	3.36	4.15	3.69	3.61	3.35	4.39	4.20	3.87
1960	4.01	4.06	3.36	3.37	3.51	4.47	4.08	3.87
1961	4.55	4.43	4.25	4.20	3.82	4.85	5.68	4.52
1962	4.75	5.00	5.06	4.22	4.31	5.03	5.41	4.80
1950-62 average	3.64	3.57	3.51	3.54	3.51	3.53	3.83	3.56

Source: Annual financial reports of the Land Authority of Puerto Rico.

35