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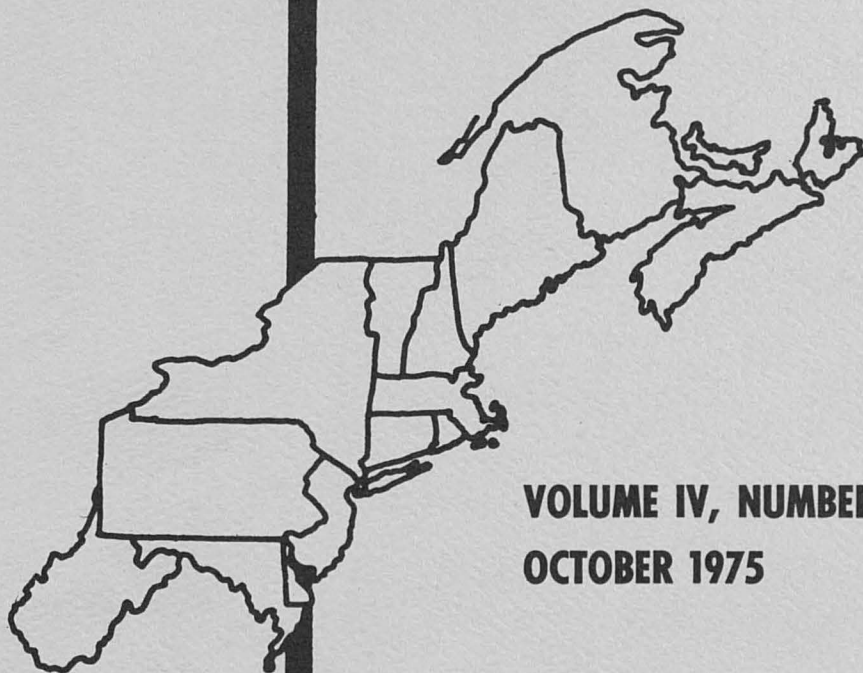
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AN ANALYSIS OF SMALL HOLDER OBJECTIVES IN  
THE DOMINICAN REPUBLIC<sup>1/</sup>

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The question of the operational objectives of small holder, "peasant" farmers has received considerable attention in the literature of agricultural development and production economics. Justification could not be made for rehashing this old issue, were it not for almost universal incomplete specification by most writers on the subject. No writer denies the dual nature of the peasant household, but few have made a serious attempt theoretically, and even less empirically, to integrate consumption activities into an analytical framework of the small farm.

The Dominican Republic presents a particularly interesting case. Progressive subdivision of farms and a population growth rate estimated at over three percent have provoked pressure on land resources. More than one half of all operators have farms of less than 20 tareas (3.2 acres). The term subsistence as it is usually defined does not apply, however. Major cropping and harvest decisions at all levels hinge around the marketability of the crop. Of all major food crops only bananas and root crops had home consumption rates of over 50 percent in a 1973 survey. At the same time clinical data and nutritional surveys repeatedly indicate widespread malnutrition in rural areas. It is something of a paradox, then, that Dominican small farmers are disregarding family welfare to market such a high percentage of production.

The traditional argument "a la Schultz" [10] is that peasants allocate productive resources in the most efficient manner given factor costs and availabilities. This hypothesis has been extensively tested [1, 4, 14] by fitting homogeneous production functions with constant returns to scale to cross section data. If the marginal value products of the fitted functions compared favorably with observed factor costs and if their sum approximated the price of the output then the assumption of a profit maximizing objective has been considered valid.

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The inadequacy of using such an aggregate function to estimate efficiencies at the farm level has luckily been recognized. In their reappraisal of the evidence Dillon and Anderson [2] use an economic decision theory criterion which casts doubt on the profit maximizing hypothesis. They suggest instead a non-linear utility function allowing for subjective considerations of risk as more appropriate. Since utility is a concept of demand theory, it should be emphasized that the recent controversy of utility vs. profit maximization is equivalent to discussion of whether production or consumption considerations are dominant in the dual farm household. Of recent writers on the subject only Lin, Dean and Moore [6] mention consumption activities at all in their discussions.

For peasant households, the controversy is complicated by the fact that factor markets in less developed countries are imperfect, thus tending to amplify the divergence between profit maximizing and utility maximizing factor allocations. This has led development economists (e.g. Lipton [7] ) to postulate survival algorithms rather than maximizing ones.

The most rigorous theoretical work relating production and consumption to date has been outlined by Higgins [3] . Using a "Cho" diagram (i.e. a locus of equilibrium points between wage rates and hours of labor) he illustrated equilibrium production levels for peasant proprietors, and concluded output maximization as their objective function.

Considering the wide range of hypotheses espoused, the purpose of this paper is to develop a simple farm model of a small holder household in the Dominican Republic and to investigate the sensitivity of the linear programming solution to inclusion of consumption needs and to specification of various objective functions.

### Methodology

The linear programming model employed in this study was constructed on a four month basis. Sixteen production activities for seven crops were included (rice, beans, onions, tomatoes, corn, cassava, and plantains). Each crop was included at a subsistence and mid-level (in terms of fertilizer and pesticides use, and mechanical land preparation) technology. Intercropping of cassava and beans and cassava and corn was allowed. Only family labor activities were included to meet labor demands.

A set of distributional activities allocated stored surplus and harvested production monthly between sales, storage and home consumption. Finally a set of buy food activities allowed market purchases of rice, beans, starchy roots, meat, milk and eggs, bread, fruits and vegetables, oil and sugar.

The only effective production constraints were limits on family labor (based on 255 days per year for 2 workers), land (20 tareas) and non-negativity of cash flow. Consumption constraints included monthly minimum limits for calorie, protein and vitamin C for the family. Calorie limits were increased marginally according to average number of hours of labor worked per day by family members. Dietary habits were accounted for by constraints which limited the proportion of beans to rice, the proportion of oil to starchy foods, and sugar and peanut consumption to maximum limits. Animal protein was required to make up at least one fifth of the protein consumed.

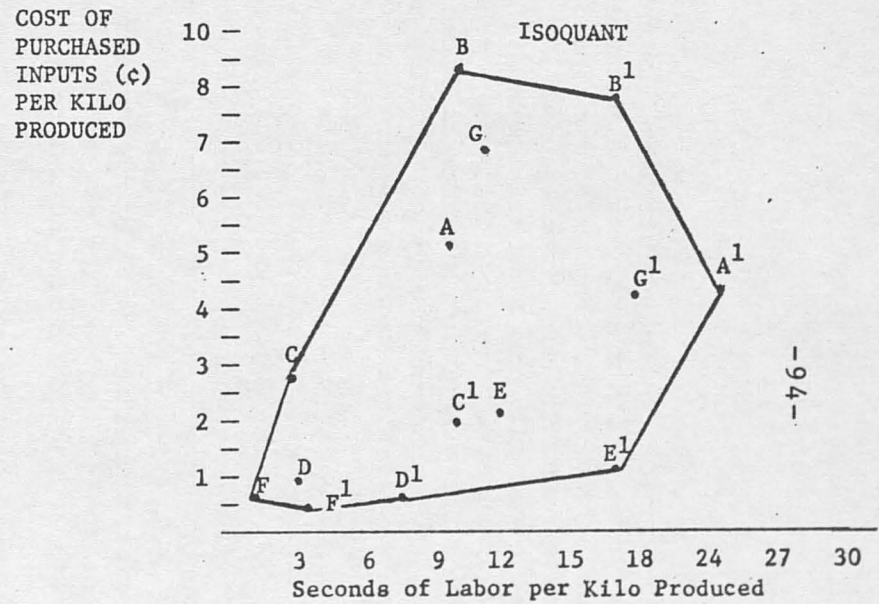
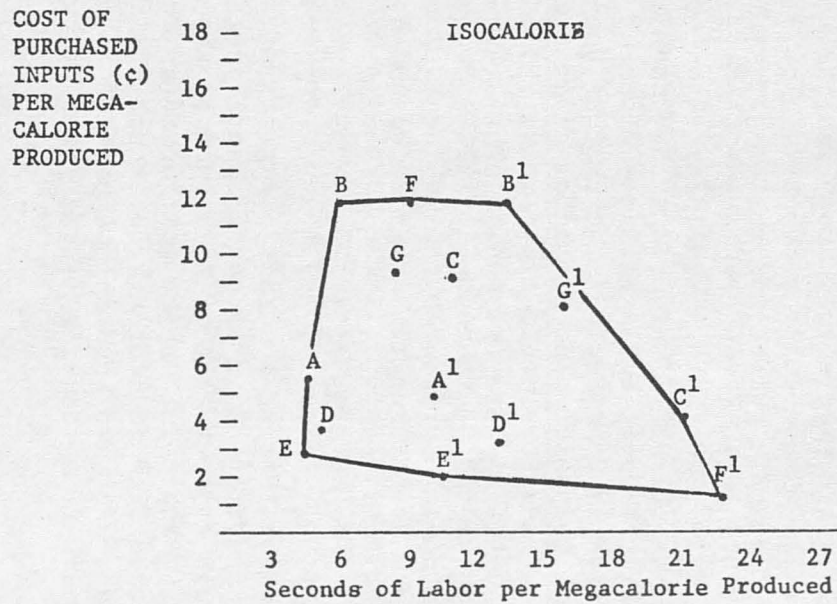
Unlike the work of Singh [11, 12], the described model is unique in the sense that the food consumption pattern of the household is endogenous. Instead of specifying lower bounds on the amount of farm output and cash required for household consumption, the make-up of family food consumption is determined according to the normative criteria of the objective function subject to the minimum nutrition constraints. This cannot be straightforwardly equated to least-cost diet formulation, however, due to the interfacing of production and financial factors.

As is the case in analytical study of any developing economy, the lack of reliable statistical data was the most serious problem in developing the model. In the Dominican Republic, the National Statistic Office publishes monthly indexes of retail food costs and other living costs for the Santo Domingo metropolitan area, but not for other areas of the country. These data for May 1974 were used for computing technical coefficients for food costs since cursory surveys indicate that prices for major products are similar throughout the country. The Hydraulic Institute collects monthly farm gate prices for most major agricultural districts in the country, but there is no consistent gathering of farm management data. The data used in this model for seven crops were prepared in consultation with U. S. AID officials, Secretariat of Agriculture crop specialists and experts at the Dominican Development Foundation. The caloric, protein and vitamin C content of the various foods were taken from the INCAP Tabla de Composición de Alimentos en America Latina, with appropriate conversions made for inedible portions. No attempt was made, however, to allow for nutrient loss in cooking or for food wastage. The coefficients for aggregate food purchasing activities were computed by averages weighted according to preponderance in the National Statistic Office 1969 Food Balance Sheet and various food consumption surveys.

### Results

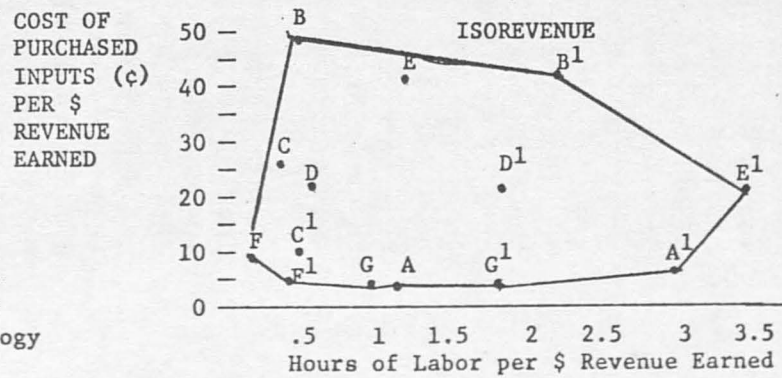
The complexity of considering the multiple goals of the small farm firm is reflected in Figure 1. Unit isoquant, isorevenue and isocalorie outlines have been drawn to compare the efficiency of the seven crops included in the model. Each point may be considered as that point on the corresponding process line indicating the amount of labor and cash for purchased inputs necessary to produce one unit of output (kilo), revenue (dollar) or energy (megacalorie) for a given crop. Each crop

Figure 1



- SYMBOLS**
- A - Peanuts
  - B - Beans
  - C - Onions
  - D - Cassava
  - E - Corn
  - F - Tomatoes
  - G - Rice

NOTE: A = Peanuts at mid-level technology  
 A<sup>1</sup> = Peanuts at subsistence technology



is depicted at both technology levels.<sup>2/</sup> It should be clear that the most efficient crop in terms of producing calories per tarea of land (corn) was the least efficient in terms of producing revenue. Likewise, tomatoes, the most efficient in terms of output and revenue were very poor in terms of calories per unit input.

The model described above was run alternatively under profit maximizing, cost minimizing, and output maximizing objectives. Principal results are summarized in Table 1. (Note: Those crops grown under the traditional technology and those home produced foods in the diet are indicated by asterisks.) Generally a family of 7.1 members with no assets or stored surplus can support itself for four months and earn a surplus of about \$1100 by planting beans and tomatoes, (using the mid-level technology), marketing their entire produce (even though beans could have been consumed in the fourth month), and buying all food for consumption on credit. The imputed cost to land under profit maximization is \$103 per tarea and that of an extra dollar of cash assets is \$17. There is no shadow price for labor except during the harvest period when it is 40¢ per day.

When output maximization was the objective only beans were produced and all food was purchased. Only under the cost minimization objective did home-produced foods (plantains) enter the solution. Still over 60% of the land was used for planting beans for marketing, and even in this solution, beans harvested the fourth month were allocated for market sales instead of for home consumption. Diets in all except the output maximization case were reasonably similar to those reported by consumption surveys in rural areas of the Dominican Republic.

When nutrition constraints were dropped from the model highly labor intensive cultivation of a cash crop predominated in the solution. The optimal cropping pattern included 12.9 tareas of tomatoes planted at the traditional technology level and 7.1 tareas of beans at the intermediate technology. Optimal cash surplus more than doubled.

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<sup>2/</sup> The fact that differing technology levels were allowed and several crops included in the same production function may seem counter to the neoclassical definition. Output of the seven crops was considered to be homogeneous for all purposes here. Concerning technology levels Higgins [3] argues that since technical coefficients are probably fixed in LDC's the production function can only be meaningful if choices among known techniques are allowed. Even with this definition he predicts the isoquants to be well behaved only in a short range, becoming vertical or horizontal and then turning back away from the axes as is the case in Figure 1.

Table 1

Comparison of Primal Solutions Under  
Differing Objective Functions

	PROFIT MAXIMIZATION	OUTPUT MAXIMIZATION (Value of Output)	COST MINIMIZATION	PROFIT MAXIMIZATION (No Consumption Restrains)
CROPPING PATTERN (Land - 20 tareas)	Beans--17.6 tareas Tomatoes--2.4 tareas	Beans--20 tareas	Beans--12.4 tareas Plantains--7.6 tareas	Beans--7.04 tareas *Tomatoes--12.96 tareas*
Profit	\$ 1106.17	\$ 964.40	\$ 0.00	\$ 2125.75
CASH FLOW				
Production Costs	380.77	366.80	246.20	259.75
Food Costs	282.14	388.80	247.29	0.00
Sales	1769.08	1820.00	530.48	2385.50
DIET (Grams/Person/Day)	Beans - 84g Rice - 243g Cassava - 86g Fruits & Vegetables - 103g Milk & Eggs - 244g Sugar - 50g Oil - 32g	Beans - 42g Rice - 125g Cassava - 150g Milk & Eggs - 250g Bread - 300g Sugar - 40g Oil - 23g	Beans - 84g Rice - 243g Plantains - 230g** Milk & Eggs - 244g Sugar - 50g Oil - 47g	

\* Subsistence technology

\*\* Home produced food



### Conclusions

Results of this linear programming exercise indicate that when consumption requirements are considered, optimal solutions to the small farm problem are relatively insensitive to specification of the objective function (beans predominated in the cropping pattern under all three objectives). When these constraints are dropped, unrealistic profit levels and high-risk activities dominate the optimal plan. The deletion of these constraints also biases the true factor costs of family labor downward and the failure to include food costs periodically in cash flow unrealistically relaxes the financial pressure on the small farm unit.

Two concluding suggestions can be made from these comments. First, specification and analysis of the consumption activities of farm firms should be made an integral part of all attempts to study the operation of small farms. Similarly, despite the dearth of meaningful data, the small "subsistence" farm is probably more complex in its objectives and operations than the pure "commercial" firm. For this reason techniques should be developed to specifically document and analyze issues pertinent to the small farm situation.

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