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9. ABSTRACT

Economic factors influencing family food consumption can be analyzed by means of linear programming models, if input data are accurate and complete. This study evaluated methods for analyzing economic factors influencing family food consumption. Two linear programming models were developed: one to analyze urban household food consumption, and the other to analyze the relationships between production and consumption decisions for rural households. The urban model was tested in four countries (Bolivia, Colombia, the Dominican Republic and Guatemala) and the rural model in one country (Guatemala). The urban models were constructed to facilitate comparisons with survey data on average food consumption at various income and food budget levels. Results of the analyses showed that low-income urban families in the four countries attempt to follow a preferred dietary pattern, and that their buying decisions are quite rational. Food prices and the size of food budget are the most important factors influencing these decisions, for they explain almost all of the variation observed in calorie and protein consumption. The results of the farm decision model show that the single most important factor affecting the production and consumption decisions of small farmers is the level of available operating capital. When this supply of capital is ample, farm income is high and derives chiefly from production of cash crops. When the supply of capital is restricted, the amount of land dedicated to cash crops diminishes, the use of hired labor decreases, and production of subsistence crops increases.

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FOOD BEHAVIOR MODELS

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PREFACE

This study was begun in June 1976 under the auspices of the Office of Nutrition, Technical Assistance Bureau, Agency for International Development. Field work to obtain the necessary data was carried out in June and July, and involved travel to three countries: Bolivia, Colombia and Guatemala. The models consituting the basis for the study were constricted and tested during the period from August to October, with writing of the report taking place in November and early December.

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December 1976

A. Introduction

The purpose of this study is to investigate and evaluate methods for analyzing the economic factors which influence family food consumption. For urban workers, and more generally those who do not produce food, these factors are fairly straightforward--household income and food prices. For rural families, especially private small farm operators, the picture is not so clear. These families earn their livelihood by production and sales of foods and other agricultural products. Food consumption and household income are both functions of food prices. But costs and availabilities of factors of production (land, labor and capital), technology and production opportunities are also important in small farmer decision making.

In this study two linear programming models have been developed: one to analyze urban household food consumption; and another to analyze the relationships between production and consumption decisions for rural households. The urban model has been tested in four countries (Bolivia, Colombia, the Dominican Republic, and Guatemala), and the rural model in one country (Guatemala). The urban models were formulated so as to facilitate comparisons with survey data on average food consumption at various income and food budget levels. The comparisons show a high degree of correspondence between the results given by the model and the observed consumption of calories and proteins within various income groups. Less success has been achieved in validating the farm model due to significant gaps in available data, but useful insights were possible, and a program of refinements and further testing is suggested.

The objective of the study is to design more adequate means of predicting the impact of changes in economic variables on the consumption pattern and nutrient intake of representative urban and farm households. The models studied offer the nutrition planner a means of evaluating the probable effects of a wide range of income, price and farm policies on the food intake pattern of target households.

B. Methodology

The two models dealt with in this study have been developed to offer an alternative to statistical models. The linear programming model incorporates pertinent economic variables in an optimization framework in order to make normative rather than positive prediction of household food consumption behavior. In other words, the models presented here use data on decision variables (food prices, food budgets, etc.) to determine the best food consumption pattern to satisfy a given objective or decision criterion; whereas, statistical models can predict the food consumption pattern of households based only on the average past behavior of a group of similar households.

The advantage of the linear programming model is that it is much more flexible and can be more easily adapted to changing economic conditions (for example, inflation). In contrast, adaptation of statistical models to such a changing economic environment requires an expensive and time consuming series of longitudinal sample surveys.

For urban households, food decisions can be attributed to food prices and income (or food budget). The principal behavioral assumption made concerning family food consumption decisions is that the objective of the household is to follow a diet which is as close, in physical quantity terms, to their "ideal"

diet as possible. The ideal diet chosen for the model is not a diet which might be suggested by a nutritionist, but rather the actual average diet shown in food consumption surveys to be eaten by families who are able to purchase a diet adequate in all essential nutrients.

For the farm household, it is not so easy to separate food consumption behavior from other aspects of economic life. Since the household produces food or some other agricultural product to support itself, decisions must be made not only concerning what food will be consumed, but also whether it should be grown on the farm or purchased with the proceeds from the sale of some other product. Inherent in this latter decision are a number of other decision variables such as: the cost of labor and inputs; yields; output prices; etc., for all alternative uses of land. For purposes of this research, it was assumed that the farm household's objective is to maximize profits from farm operations, subject to technical and consumption constraints.

The two formulations represent a significant departure from the traditional linear programming approaches to analyzing food consumption behavior. The oldest and probably most commonly used linear programming model for studying food consumption is the "least cost diet model".[1/] This model determines the combination of food quantities which provides stated quantities of

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1/ Stigler, G.J., "The Cost of Subsistence" Journal of Farm Economics 25, p 303, 1945; or Smith, V.E., "Electronic Computation of Human Diets." East Lansing: Bureau of Business and Economic Research, Michigan State University, 1963.

given nutrients for the lowest cost. Although the model does incorporate food prices, the system of nutritional constraints and the objective function utilized (selection of the least costly foods that satisfy nutrient requirements) cannot logically be assumed to represent actual household behavior. Therefore the analytical uses of the method have been few and most applications have been used for studying animal nutrition problems, specifically those encountered in the preparation of least cost animal feed mixes.

With respect to farm households, there have been several attempts to analyze farm food consumption together with farm production using simultaneous equation statistical models,[1/] but programming models have seldom been used. Even when programming models are used the tendency has been to account for consumption needs through the use of production "flexibility constraints". [2/] This precludes examination of the relationships between decisions concerning production versus those concerning purchase of foods. Of all recent small farm studies reviewed, only two account for the "produce or purchase" decision. In the first such study, Schulter and Mount[3/] require that certain amounts of staple goods be provided by production or purchase;

[1/] See for example Tendulkar, S.D., "Econometric Study of Monthly Consumption Expenditure in Rural Ultar Pradish," American Journal of Agricultural Economics 51:1, 1969, or Desai, B.M., "Relationship of Consumption and Production in Changing Agriculture" Ithaca, New York: Department of Agricultural Economics, Cornell University, 1975.

[2/] Singh, I.J., "Recursive Programming Models of Agricultural Development." In American Journal of Agricultural Economics 53:2 1971.

[3/] Schulter, M.G. and Mount, T.D., "Management Objectives of the Peasant Farmer," Ithica, New York: Department of Agricultural Economics, Cornell University, 1974.

however, these staple goods are not meant to represent a full diet. The other study is an application of essentially the same linear programming methodology explored in this report, to data gathered in the Dominican Republic.[1/] Despite significant data problems, the latter study was able to show that an analysis which included endogenous treatment of both consumption and production was a better predictor of farm behavior than an analysis which considered production variables alone.

In the remainder of this section the mathematical formulations of both urban and rural (farm) models will be presented.

The Urban Model

The following assumptions are embodied in the model:

1. The household attempts to satisfy its desire to consume an "ideal" diet, interpreted in terms of quantities b_1, b_2, ...b_n of n foods.

2. The diet actually consumed will differ as little as possible, in physical quantity terms, from the ideal diet.

The mathematical formulation of the model is as follows:

$$\text{Minimize} \quad \sum_{i=1}^{n} \left| X_i - b_i \right| \quad \text{, subject to}$$

$$\sum_{i=1}^{n} P_i X_i \leq B$$

b_i = amount of food i in ideal diet;

X_i = amount of food i in diet actually selected;

P_i = price per unit quantity of food i;

B = household food budget.

1/ Andrews, M.S. "An Analysis of Small Holder Objectives in the Dominican Republic," Journal of Northeastern Agricultural Economics Council 4:2, 1975.

This mathematical programming problem can be transformed into a linear program[1/], which can be solved using standard computational techniques. A schematic diagram of the matrix for a transformed urban model is shown in Figure B.1.

The transformed model is solved at different budget levels by parametric programming techniques, resulting in one solution for each budget level.

The Farm Model

The farm model is subject to the following assumptions.

1. The farm household faces a set of n land use possibilities (L_i, i = 1 2, ..., n). The output of staple food crop Q_i can be distributed on a monthly basis among sales V_i, storage D_i, and home consumption E_i. The output of cash crops can be sold in the month of harvest.

2. The farm household possesses a fixed amount of land L, family labor FL, cash assets A_o, and stored food S_i at the beginning of the period. Available credit from insitutional sources (BB) is limited and an annual interest rate (r_1) is charged. Available informal credit from family or friends (BF) is limited on a monthly basis and a monthly interest rate (r_2) is charged. Assets accumulate on a monthly basis and monthly interest (r_3) is earned. Output (S_i) suffers losses at a rate of two percent per month, and must be replenished at the end of the twelve month period. Hired labor (HL) is available in indefinite amounts at a set daily wage.

1/ Shanno, David F. and Roman L. Weil, "Linear Programming Models with Absolute Value Functionals, Operations Research 19:1, 1971, pp. 120-124.

3. The farm household will best serve its goals by first consuming an adequate diet, and then maximizing expected returns from farming operations. This is expressed mathematically as follows:

$$\text{Maximize } X = \sum_{i=1}^{n} \left(\sum_{t=1}^{m} P_i V_{it} - C_i L_i - r_i b - r_2 bf_t + r_3 a_t \right) - \sum_{t=1}^{m} \sum_{j=1}^{w} g_{jkjt}$$

$$\text{Subject to } \sum_{i=1}^{n} \left(u_{ik} E_{it} + \sum_{j=1}^{w} q_{jk} h_{jt} \right) \leq N_{kt}$$

where Pi = price of crop i;

V_{it} = quantity of crop i sold in month t;

C_i = costs per hectare for land use i;

L_i = amount of land dedicated to crop i;

r_1 = rate of interest on institutional borrowing;

b = annual capital borrowed from institutions;

r_2 = rate of interest on informal borrowing;

bf_t = capital borrowed informally in month t;

r_3 = rate of interest which can be earned by saving institutionally or lending assets informally;

D_{it} = amount of food i stored in month t;

a_t = available cash assets in month t;

G_j = price of purchased food j;

u_{ik} = content of nutrient k in consumed food i,

E_{it} = quantity of crop i eaten by household in month t;

q_{jk} = content of nutrient K in purchased food j;

h_{jt} = quantity of food j purchased for consumption in month t;

N_{kt} = requirement of nutrient k needed by entire household in month t.

FIGURE B 1 SCHEMATIC OF MATRIX - URBAN MODEL

DOMINICAN REPUBLIC

		XRICE	XPASTA	XBEANS	XYUCA	XBEEF	XCHIC	XPORK	XSAUG	XEGGS	XMILK	XSUGR	XOIL	XPLN	XBRD	YRICE	YPASTA	YBEANS	YYUCA	YBEEF	YCHIC	YPORK	YSAUG	YEGGS	YMILK	YSUGR	YOIL	YPLN	YBRD	ZRICE	ZPASTA	ZBEANS	ZYUCA	ZBEEF	ZCHIC	ZPORK	ZSAUG	ZEGGS	ZMILK	ZSUGR	ZOIL	ZPLN	ZBRD	RHDIS	DHDIS
CALO	N	D	D	D	D	D	D	D	D	D	C	D	D	C	D	D	D	D	D	D	D	D	D	D	C	D	D	C	D	D	D	D	D	D	D	D	D	D	C	D	D	C	D		
PRUT	N	B	C	C	A	C	C	C	C	B	B			A	B	B	C	C	A	C	C	C	C	B	B			A	B	B	C	C	A	C	C	C	C	B	B			A	B		
CALC	N	B	C	C	C	B	B	B	C	C	D		B	A	C	B	C	C	C	B	B	B	C	C	D		B	A	C	B	C	C	C	B	B	B	C	C	D		B	A	C		
IRON	N	B	B	B	A	B	B	B	B	B	A		1	A	B	B	B	B	A	B	B	B	B	B	A		1	A	B	B	B	B	A	B	B	B	B	B	A		1	A	B		
VITA	N			B	B				C	D	C			D				B	B				C	D	C			D				B	B				C	D	C			D			
TIAM	N	T	A	A	T	T	T	A	A	A	T			T	1	T	A	A	T	T	T	A	A	A	T			T	1	T	A	A	T	T	T	A	A	A	T			T	1		
RIBO	N	T	T	A	T	A	A	A	A	A	A			T	T	T	T	A	T	A	A	A	A	A	A			T	T	T	A	T	A	A	A	A	A	A	A			T	T		
NIAC	N	B	B	B	A	B	B	B	B	1	1			T	B	B	B	B	A	B	B	B	B	1	1			T	B	B	B	B	A	B	B	B	B	1	1			T	B		
VITC	N			B	C						A			C				B	C						A			C																	
RICET	E	1																																											A
PASTAT	E		1																																										U
BEANST	E			1																																									T
YUCAT	E				1																																								T
BEEFT	E					1																																							T
CHICT	E						1																																						T
PORKT	E							1																																					T
SAUGT	E								1																																				T
EGGST	E									1																																			T
MILKT	E										1																																		T
SUGRT	E											1																																	A
OILT	E												1																																T
PLNT	E													1																															A
BRDT	E														1																														T
RICE	G	1														1														-1															
PASTA	G		1														1														-1														
BEANS	G			1														1														-1													
YUCA	G				1														1														-1												
BEEF	G					1														1														-1											
CHIC	G						1														1														-1										
PORK	G							1														1														-1									
SAUG	G								1														1														-1								
EGGS	G									1														1														-1							
MILK	G										1														1														-1						
SUGR	G											1														1														-1					
OIL	G												1														1														-1				
PLN	G													1														1														-1			
BRD	G														1														1														-1		
BUDGET	L	T	T	T	U	T	T	T	T	A	T	U	T	T	T	T	T	T	U	T	T	T	T	A	T	U	T	T	T	-T	-T	-T	-U	-T	-T	-T	-T	-A	-T	-U	-T	-T	-T	A	-T
OBJF	N															1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		

FIGURE B.1.

CODE

CALO	-	Calories
PRO	-	Protein
CALC	-	Calcium
IRON	-	Iron
VITA	-	Vitamin A
TIAM	-	Thiamin
RIBO	-	Riboflavin
NIAC	-	Niacin
VITC	-	Vitamin C
RICE	-	Rice
PASTA	-	Pasta
BEANS	-	Beans
YUCA	-	Cassava
BEEF	-	Beef
CHIC	-	Chicken
PORK	-	Pork
SAUG	-	Sausage
EGGS	-	Eggs
MILK	-	Milk
SUGR	-	Sugar
OIL	-	OIL
PLN	-	Plantain
BRD	-	Bread
BUDGET	-	Budget
OBJF	-	Objective Function

C. Data

In this section the general data requirements for both models will be reviewed and the specific data sources used discussed. Mention will be made of operations which had to be performed on the data to make it appropriate for the model's format. It is beyond the scope of this study, however, to judge the statistical validity of the data. The two types of models will be presented sequentially.

The Urban Model

The data needed to formulate the urban model can be grouped into three categories: food prices; nutrient content; and average food consumption patterns of different income groups. In most countries retail food prices are collected periodically in urban areas by the government agency responsible for preparing cost of living indexes or by a food marketing agency. Detailed, disaggregate data may not be regularly published, but usually exists in government files. Nutrient content data is often prepared for local foods by national research institutions. If it is not available, estimates from a regional institute such as INCAP [1]; the U.N. Food and Agriculture Organization (FAO) [2]; or the U.S. Department of Agriculture (USDA) [3] can be used. Perhaps the most difficult data to locate is average food consumption by income groups. Although any country which publishes a cost of living index has at some time (usually the base year of the index) undertaken an income and expenditure survey, the food expenditure results are seldom published in detail and even more rarely are the quantities consumed published. In addition to

these surveys, food consumption and income data are frequently collected in connection with regional marketing or income distribution studies. In any case, surveys to collect food expenditure data are complicated and results are subject to controversy.

In the following paragraphs the three types of data inputs needed to formulate the urban models will be discussed by country.

Bolivia. In Bolivia a series of income and expenditure surveys have been carried out during the last decade in regional cities and rural areas as well as in the capital city, La Paz. However, the only urban setting in which all three types of data were available was La Paz. The survey data used was collected in 1967 by the Ministry of Finance with technical support from Michigan State University [4]. The survey consisted of two rounds of 650 and 92 households, the second round concentrating on high income families. The data from the survey were published in their most detailed form in a recent report by Le Baron which contains tabulations of food expenditures for twelve income groups and over thirty foods or food groups [5].

Food price data for La Paz is collected regularly by the National Statistics Institute (INE); however, prices for 1967, the year of the survey, were not available in published form. Unpublished figures were obtained from the Institute files. These price data were supplemented by data from the Division of Nutrition [6]. From these sources prices for fifteen products were still unavailable. Spot checks of La Paz markets

were made with the assistance of USAID personnel in order to determine the current relative prices of the reamining products, and 1967 prices were estimated on that basis.

Detailed nutrient content data for native Bolivian foods has been published by the Division of Nutrition [7]. The INCAP food composition tables [8] were consulted for foods not contained in the Bolivian tables.

In order to formulate the models significant transformations of the data were necessary. First of all, the expenditure data had to be transformed to give quantities consumed. Since the expenditure data were grouped it was necessary to develop a weighting scheme through which to compute weighted average prices of food groups and weighted nutrient contents. Table C.1 illustrates the final scheme. The weights were based on the observed consumption of food products in two dietary surveys in the La Paz area: the Bolivia Nutrition Survey of 1962 [9] and a Division of Nutrition survey of two low-income neighborhoods in 1966 [10]. Once weighted prices were obtained, the quantity data of Table C.2 were estimated from the expenditure data tabulated by Le Baron.

Nutrient content of the foods and food groups in Table C.3 were calculated by adjusting published coefficients (for 100 grams of edible weight) to account for inedible portions of purchased foods (e.g. shells, bones, peels, etc.). The adjusted coefficients were weighted using the scheme of Table C.1.

Finally, the average calorie and protein consumption of each income group, Table C.4, were estimated by multiplying

quantities in Table C.2 by calorie and protein coefficients of Table C.3. The calculated per capita daily intakes of calories and proteins were higher than expected. Le Baron has noted as well that the expenditure estimates do not seem totally plausible when compared to other Bolivian data [5].

The diet of the group whose income was in the range B$23,000-28,500 was chosen as the target diet for the Bolivian urban model (Table C.5) and its cost computed.

Colombia. Food consumption data by income groups for the capital, Bogota, and several regional cities were available. Cali, the urban center for the Cauca Valley, was chosen for the study and two sources of data were found. In February 1969 two rounds of an income and expenditure survey were carried out as part of a Colombian marketing project with the participation of Michigan State University [11]. Near the end of the following year the Colombian National Administrative Statistical Department (DANE) conducted a similar survey to modify the regional cost of living index in several regional cities including Cali [12]. Both surveys were tabulated only by food expenditures. Though the 1969 data [11] had been carefully edited in conjunction with a CIAT (International Center for Tropical Agriculture) research project [13], it was found to be less desirable for this study since it was tabulated in an aggregate form, with only twenty food groups and five income groups available. On the other hand, unpublished tabulations from the DANE Study were available for all foods surveyed and for 22 income groups. Data from the DANE Survey were thus summarized for fifty-seven foods and seven income groups for use here.

Since the DANE data was tabulated by individual foods and not by food groups, no weighting scheme was needed. Though price data for Cali is collected by DANE, not all fifty-seven products are covered. The missing prices were estimated by wholesale prices obtained from the Universidad del Valle. The resulting quantities are illustrated in Table C.6.

Nutrient content coefficients were adjusted to take account of inedible portions* and were taken almost entirely from the National Nutrition Institute's food composition tables [14]. The resulting figures are given in Table C.7.

The estimations of calorie and protein intake in Table C.8 came directly from the two former tables. The target diet was taken to be the diet eaten by the 10,000-14,000 peso per year income group and is presented in Table C.9.

Guatemala. Data on income and food consumption were scarcest in Guatemala. Though there was a fairly extensive survey done in Guatemala City and regional urban centers [15], the data were poorly tabulated. The survey in 1969 was stratified by municipal zone, district and section, and 2100 families in the capital were surveyed.

All data published on food expenditures were aggregated into one of fifteen food groups, and tabulated for ten income groups. Only eleven food groups could be used in the study due to the absence of complementary price and/or nutrient content data. A full weighting scheme was developed on the basis of cost of living weights [16] and is presented in Table C.10.

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*Coefficients for rice, oats, corn, pasta, dried peas, beans, lentils, coffee, and chocolate are referred to in their prepared weights.

Price data came from unpublished figures on file at the Directorate General of Statistics (DGE) and unpublished data collected by SIECA (Secretariat for the Economic Integration of Central America) [17]. Prices for forty-three foods were weighted to obtain averages for the eleven categories. The quantities estimated are given in Table C.11. Nutrient content of the forty-three foods were weighted according to the same scheme and adjusted for inedible portions to produce the data of Table C.12.

Calorie and protein averages by income group were computed as shown in Table C.13 and the target diet was taken to be that diet eaten by the income group earning between Q$6,000 and Q$8,000, as illustrated in Table C.14.

Dominican Republic. This is the only country for which data on average quantity of food consumed by income group is available. The survey providing this data was carried out by the Central Bank of the Dominican Republic in 1969, to update the cost of living index. The original data records were obtained and a subsample of the data summarized and tabulated. The data was tabulated for five non-contiguous income groups and fourteen individual foods.

Prices for all fourteen foods were available from the Central Bank for the year 1969 and were used to estimate the quantities consumed as shown in Table C.15.

Nutrient content was taken from the INCAP food composition tables, adjusted for inedible portions (Table C.16) and used to estimate average calories and proteins consumed by income

groups (Table C.17). And finally, the target diet was taken to be that eaten by the $50-99 peso per month income group as shown in Table C.18.

The Farm Model

In comparison with the urban models, data for the farm models are significantly more difficult to obtain. In general the types of data needed include: average costs of production and labor requirements for all land use possiblities by month; cropping calendar and crop rotations; producer prices for farm products; retail prices of foods; nutrient content of home produced foods; average family size and composition; and hired labor wage rates. Also useful are descriptive data on regional geography; average size of land holdings; patterns of family labor input; implements; machinery and draft animals at disposal of average farmer; availability and use of irrigation; average use and sources of credit; patterns of storage and food consumption.

The source used for this application was the Guatemala Small Farm Survey carried out in 1974 with cooperation from AID (Latin America Bureau, Sector Analysis Division) [19]. The sample was designed to include 800 farms using government credit paired with 800 farms which did not use the loans. The paired farms were sampled by sub-region and comprehensive interviews were carried out to determine socio-economic data, costs of production, financial and other data.

For this application data collected from the western altiplano were used. Since small farmers are the group facing the greatest nutritional risk, the sample was further limited to those households cultivating less than three hectares of land.

These restrictions limited the sample to 209 farms (101 credit users and 108 non-credit users). Special tabulations of socio-economic data (see Table C.19) were made for the sub-sample.

In order to calculate costs of production the 209 questionaires were tabulated by crop (specifically wheat, corn, beans, garlic and potatoes), by improved and traditional technologies. This data included estimates of average input costs, machinery costs, animal days and costs, paid and unpaid labor days, wages, marketing and transport costs, credit, yields, revenues, and uses of production. The estimates were then adapted to a format appropriate for inclusion in the farm model as illustrated in Tables C.20 through C.25. Costs of production were not tabulated by improved or traditional technologies since the original survey data showed that dual technologies were not common except for corn and beans. Other sources on Guatemalan agriculture indicate that under traditional cultivation of corn and beans, the two crops are interplanted [20]. Therefore, the improved technology patterns for the two crops were tabulated separately (Tables C.20 and C.21) from the traditional technologies as represented by interplanting (Table C.25). For the other three crops, the predominate technology for wheat and garlic was traditional; for potatoes, improved. The uses of production for the five crops are presented in Table C.26.

Two other tabulations of the survey data were made to estimate a cropping calendar and credit limits. To estimate the cropping calendar, frequency counts of the month in which preparation for weeding, seeding, fertilization, cultivation and harvesting occurred were made for each crop. The resulting

figures were summarized as shown in Table C.27. To estimate credit limits survey data on loans from four sources were tabulated as shown in Table C.28.

Finally, the data on retail food prices were taken from unpublished information on file with the Directorate General of Statistics (DGE) for the year 1974. These data were weighted using the weights observed in the cost of living index for the western altiplano [16]. Nutrient content data came from the INCAP tables for Central America and Panama [22]. Table C.29 presents this data.

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TABLE C.1

BOLIVIA

WEIGHTINGS USED TO COMPUTE PRICE AND NUTRIENT CONTENT COEFFICIENTS

Food Item	Weighting	Food Item	Weighting
Wheat Products	1.00	Fresh Vegetables	1.00
Bread	.60	Cabbage	.04
Wheat (grains)	.05	Carrots	.18
(flour)	.01	Lettuce	.03
Pasta	.34	Onions	.18
		Oca	.39
Corn Products	1.00	Peppers (fresh)	.005
Dried Corn (white)	.22	Sweet Potatoes	.005
(yellow)	.44	Tomato	.06
Cornmeal	.34	Turnip	.03
		Zapallo	.02
Other Cereals	1.00	Beans (green)	.01
Barley	1.00	Peas	.05
Beef	1.00	Potatoes and Derivatives	1.00
Beef (with bone)	.13	Potatoes	.85
(without bone)	.84	Chuño	.13
(dried)	.03	Papaliza	.02
Lamb	1.00	Legumes	1.00
Lamb (leg)	.85	Fava Beans	.98
(heart)	.01	Lentils	.01
(head)	.14	Peanuts	.01
Other Red Meats	1.00	Other Fresh Fruits	1.00
Goat	.91	Peach	.28
Llama	.09	Tuna	.12
		Grapes	.32
Canned Fish	1.00	Avocado	.12
Sardines	.70	Fig	.04
Salmon	.30	Apple	.12
Vegetable Fats	1.00	Citrus Fruits	1.00
Edible Oil	1.00	Lima	.02
		Lemon	.05
Animal Fats	1.00	Orange	.56
Butter	.03	Tangerine	.37
Lard	.97		
		Canned Fruits	1.00
Milk and Cheese	1.00	Peaches with juice	1.00
Cheese	.32		
Milk (whole)	.57	Dried Fruits	1.00
(dry)	.07	Dried Peaches	1.00
(evaporated)	.04		
		Canned Vegetables	1.00
		Tomato Sauce	1.00

TABLE C.2

PRICE OF COMMON FOODS AND AVERAGE DAILY HOUSEHOLD CONSUMPTION BY INCOME GROUPS, LA PAZ, 1967

od Item	Estimated Price Per Kilo **	INCOME GROUPS* $6000 (g)	$6001-$8000 (g)	$8001-$10000 (g)	$10001-$12000 (g)	$12001-$14000 (g)	$14001-$16000 (g)	$16001-$18000 (g)	$18001-$20000 (g)	$20001-$23000 (g)	$23001-$28500 (g)	$28501-$36000 (g)	$36000 (g)
reals													
Wheat Products	2.32	886.4	1091.6	1441.6	1562.7	1490.2	1578.1	1822.1	1811.6	1820.3	1738.4	2034.9	2430.1
Rice	.90	371.3	450.7	538.0	616.0	658.7	727.0	757.0	668.8	755.7	598.3	801.7	922.3
Corn Products	.33	141.6	184.7	175.9	177.4	309.6	373.0	442.3	621.9	296.4	296.4	725.5	1154.0
Oats	.59	50.4	22.4	20.1	24.8	28.9	30.3	40.8	54.4	25.9	36.7	49.7	78.2
Quinoa	.35	92.9	222.7	194.3	182.3	174.5	194.3	202.8	202.8	186.5	247.5	182.3	219.1
her Cereals	.59	--	14.9	24.1	2.1	9.9	12.1	35.4	43.3	31.2	17.0	7.1	45.4
ts													
Beef	8.70	263.4	347.9	428.9	510.0	548.6	621.3	602.8	678.5	680.5	662.9	818.9	1004.8
Mutton and Lamb	9.66	20.7	37.0	36.8	55.0	75.1	107.2	108.0	77.6	132.5	125.6	156.8	212.7
Pork	10.32	--	--	4.4	9.9	8.7	22.3	17.7	11.4	30.4	16.3	44.8	103.8
Other Red Meats	6.88	--	.2	--	--	.4	--	2.1	--	--	.8	--	35.5
Poultry	12.38	11.2	13.3	10.6	21.6	36.5	27.2	56.7	35.7	37.8	91.6	157.0	307.3
Processed Meats	10.66	4.4	8.3	6.2	12.6	11.7	19.6	37.8	48.5	44.0	60.0	90.3	221.0
Fresh Fish	6.23	12.6	25.5	32.3	26.3	36.9	41.5	66.0	23.2	67.4	61.2	78.0	114.4
Canned Fish	11.32	.6	.8	1.5	3.5	3.3	6.9	18.8	11.2	7.7	11.4	25.6	106.5
s and Oils													
Vegetable Fats	7.00	41.2	54.1	72.4	85.7	94.5	104.9	123.1	130.8	133.3	145.5	166.5	199.8
Animal Fats	6.45	39.0	59.4	57.1	63.3	86.4	104.3	96.6	109.4	111.6	115.2	182.1	200.7
k and Eggs													
Eggs	13.00	4.3	11.3	14.7	23.4	32.0	40.1	39.0	51.5	54.5	57.5	105.3	150.2
Milk and Cheese	4.12	81.1	115.8	173.7	218.4	295.4	358.5	422.3	487.2	541.6	606.4	10005.2	1545.4
uits and Vegetables													
Fresh Vegetables	3.26	284.4	420.7	522.8	585.9	679.2	706.8	781.3	812.0	844.4	1029.4	1163.5	1503.5
Legumes	.98	39.4	62.6	56.9	141.1	96.0	180.5	131.0	203.7	205.2	228.4	377.0	575.0
Citrus Fruits	3.55	22.9	44.3	51.5	53.1	68.8	118.3	116.7	179.5	144.5	174.6	308.2	509.1
Bananas	2.00	66.4	84.3	124.3	159.3	210.7	205.7	200.0	201.4	206.4	240.0	277.1	358.6
Other Fresh Fruits	6.16	52.4	71.7	109.0	135.7	166.5	200.8	217.3	238.2	291.0	343.9	535.3	784.6
Dried Fruits	10.80	2.0	.8	.1	1.2	.3	1.5	.9	6.2	4.9	11.0	8.3	25.5
Canned Fruits	12.00	--	--	.8	--	1.7	1.4	.1	4.4	.8	6.5	16.2	31.1
Canned Vegetables	24.54	.1	.3	.3	.3	.3	2.3	1.8	.9	2.0	3.4	11.8	27.9
ers													
Potatoes and Derivatives	2.88	397.3	541.7	638.4	721.2	730.2	764.9	730.2	758.9	881.0	816.0	979.2	1189.5

TABLE C.2 - BOLIVIA (Continued)

'ood Item	Estimated Price Per Kilo	INCOME GROUPS* $6000 (g)	$6001-$8000 (g)	$8001-$10000 (g)	$10001-$12000 (g)	$12001-$14000 (g)	$14001-$16000 (g)	$16001-$18000 (g)	$18001-$20000 (g)	$20001-$23000 (g)	$23001-$28500 (g)	$28501-$36000 (g)	$36000 (g)
ugar													
Sugar	2.10	289.1	341.5	423.1	427.2	436.7	485.0	476.2	456.5	479.6	426.5	601.4	610.9
ther Foods													
Coffee	.06	5743.6	6461.5	7730.8	8487.2	9128.2	9692.3	10435.9	9102.6	10384.6	10717.9	11935.9	14256.4
Tea	.08	1308.8	1955.9	5308.8	3000.0	3617.6	3205.9	4367.6	5661.8	5029.4	5617.6	7514.7	8147.1
Soft Drinks	2.88	27.3	57.5	76.4	106.2	112.6	187.5	178.1	177.6	206.3	293.2	332.8	611.6
ercentage of Sample	NA	5.6	9.7	12.9	10.6	10.5	7.9	7.2	5.0	8.7	8.2	8.5	8.3

ource: Unpublished data from 1967 Income and Expenditure Survey (Allen LeBaron, "Bolivian Basic Foods Production and Marketing," preliminary report for contract No. AID-511-95t, June 1976, Table III.4) and prices from the National Nutrition Division and the National Statistical Institute (INE).

Bolivian pesos per year (11.88 pesos = $1 U.S., 1967)

*Price per Kilo of prepared weight (for rice, corn products, oats, quinoa, legumes, coffee and tea)

TABLE C.3

BOLIVIA

NUTRIENT CONTENT PER GRAM OF COMMON FOODS
(Adjusted for Inedible Portions)

Food Item	Calories	Protein (g)	Calcium (mg)	Iron (mg)	Vitamin A (IU)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Vitamin C (mg)
Cereals									
Wheat products	2.58	.082	.250	.016	--	.0010	.0027	.0005	--
Rice	1.09	.018	.027	.016	--	.0005	.0002	.0079	--
Corn Products	.49	.012	.011	.011	--	.0003	.0003	.0030	.002
Oats	.53	.016	.140	.009	--	.0006	.0002	.0038	.013
Quinoa	.52	.016	.083	.015	--	.0003	.0003	.0017	.002
Other Cereals	.50	.014	.087	.009	--	.0004	.0002	.0100	--
Meats									
Beef	2.81	.166	.100	.027	--	.0006	.0015	.1460	--
Mutton and Lamb	1.06	.081	.145	.010	--	.0003	.0008	.0789	--
Pork	1.70	.122	.040	.013	--	.0066	.0017	.0348	--
Other Red Meats	.62	.105	.061	.012	--	.0010	.0018	.0314	--
Poultry	1.09	.116	.090	.010	--	.0051	.0010	.0576	--
Processed Meats	1.73	.109	.372	.044	.140	.0014	.0014	.0260	--
Canned Fish	2.68	.206	.312	.028	.505	.0002	.0016	.2528	--
Fresh Fish	.75	.132	.20	.006	--	.0003	.0006	.022	--
Fats and Oils									
Vegetable Oil	8.84	--	--	--	--	--	--	--	--
Animal Fats	8.92	--	.001	--	.252	--	--	--	--
Milk and Eggs									
Eggs	1.30	.099	.475	.022	1.100	.0012	.0033	.0009	--
Milk and Cheese	1.20	.087	1.677	.003	.408	.0006	.0026	.0013	.011
Fruits and Vegetables									
Fresh Vegetables	.42	.011	.171	.202	2.706	.0004	.0007	.0039	.1875
Legumes	1.18	.085	.214	.021	--	.0012	.0009	.0085	.003
Citrus Fruits	.410	.0053	.196	.005	.963	.0004	.0004	.0048	.339
Bananas	.809	.0100	.087	.001	.663	.0004	.0009	.0066	.030
Other Fresh Fruits	.500	.005	.128	.007	.019	.0003	.0004	.0034	.091
Dried Fruits	3.29	.038	.360	.027	1.094	.0004	.0003	.0052	.031
Canned Fruits	.48	.002	.040	--	1.303	.0001	.0002	.0040	--
Canned Vegetables	1.06	.020	.220	.008	4.242	.0009	.0007	.0160	.150

BOLIVIA TABLE C.3 (Continued)

Food Item	Calories	Protein (g)	Calcium (mg)	Iron (mg)	Vitamin A (IU)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Vitamin C (mg)
Tubers									
Potatoes and Derivatives	1.03	.025	.197	.020	.041	.0006	.0005	.0092	.087
Sugar									
Sugar	3.84	--	--	--	--	--	--	--	--
Other Foods									
Coffee	.01	--	.01	--	--	--	--	--	--
Tea	.02	--	--	--	--	--	.0001	.0001	--
Spices, etc.	3.28	.095	1.40	.164	14.83	.0024	.0084	.219	.550
Soft Drinks	.46	--	--	--	--	--	--	--	--

Source: Nutrition Division, Ministry of Public Health, Bolivian Food Composition Tables, 1973 and INCAP - ICNNID, Food Composition Tables for Use in Latin America, 1961.

TABLE C.4

BOLIVIA

AVERAGE DAILY HOUSEHOLD CONSUMPTION OF CALORIES AND PROTEINS BY INCOME GROUP, LA PAZ, 1967

Food Item	INCOME GROUPS* 6000		6001-8000		8001-10,000		10,001-12,000		12,001-14,000		14,001-16,000	
	Calories	Proteins	Calories	Proteins	Calories	Proteins	Calories	Proteins	Calories	Proteins	Calories	Proteins
Cereals												
Wheat Products	2291.9	72.3	2822.4	89.0	3727.2	117.6	4040.4	127.5	3852.6	121.5	4080.0	128.7
Rice	403.3	6.8	489.4	8.2	584.3	9.8	669.0	11.3	715.3	12.1	789.5	13.3
Corn Products	69.6	1.8	90.8	2.3	86.5	2.2	147.9	3.7	149.7	3.8	183.4	4.7
Oats	26.6	.8	84.0	2.5	75.4	2.2	93.0	2.8	108.4	3.2	113.6	3.4
Quinoa	48.6	1.5	116.5	3.5	101.7	3.1	95.3	2.9	91.3	2.8	101.7	3.1
Other Cereals	--	--	18.2	.5	12.1	.3	1.1	.0	5.0	.1	6.1	.2
Total Cereals	2840.0	83.2	3621.3	106.0	4587.2	135.2	5046.7	148.2	4922.3	143.5	5274.3	153.4
Meats												
Beef	740.2	43.7	977.6	57.6	1205.2	71.2	1433.1	84.7	1541.6	91.1	1745.9	103.1
Mutton and Lamb	21.9	1.7	39.2	3.0	39.0	3.0	58.3	4.5	79.6	6.1	113.6	8.7
Pork	--	--	--	--	7.5	.5	16.8	1.2	14.8	1.1	37.9	2.7
Other Red Meats	--	--	.1		.0	--	--	--	.2	.0	1.3	.2
Poultry	12.2	1.3	14.5	1.5	11.5	1.2	23.5	2.5	39.8	4.2	29.6	3.2
Processed Meats	7.6	.5	14.4	.9	10.7	.7	21.8	1.4	20.2	1.3	33.9	2.1
Fresh Fish	9.5	1.7	19.1	3.4	24.2	4.3	19.7	3.5	27.7	4.9	31.1	5.5
Canned Fish	1.6	.1	2.1	.1	4.0	.3	9.4	.7	8.8	.7	18.5	1.4
Total Meats	793.0	49.0	1067.0	66.5	1302.1	81.2	1582.6	98.5	1732.7	109.4	2011.8	126.9
Fats and Oils												
Vegetable Fats	364.2	--	478.2	--	640.0	--	757.6	--	835.4	--	927.3	--
Animal Fats	347.9	--	529.8	--	509.3	--	564.6	--	770.7	--	930.4	--
Total Fats and Oils	712.1	--	1008.0	--	1149.3	--	1322.2	--	1606.1	--	1857.7	--
Milk and Eggs												
Eggs	5.6	.4	14.7	1.1	19.1	1.5	30.4	2.3	41.6	3.1	52.1	4.0
Milk and Cheese	97.3	7.1	139.0	10.1	208.4	15.1	262.1	19.0	354.5	25.7	430.2	31.2
Total Milk and Eggs	102.9	7.5	153.7	11.2	227.5	16.6	292.5	21.3	396.1	28.8	482.3	35.2

TABLE C.4 - BOLIVIA (Continued)

od Item	INCOME GROUPS* 6000 Cal-ories	6000 Pro-teins	6001-8000 Cal-ories	6001-8000 Pro-teins	8001-10,000 Cal-ories	8001-10,000 Pro-teins	10,001-12,000 Cal-ories	10,001-12,000 Pro-teins	12,001-14,000 Cal-ories	12,001-14,000 Pro-teins	14,001-16,000 Cal-ories	14,001-16,000 Pro-teins
uits and Vegetables												
Fresh Fruits	119.4	3.1	176.7	4.6	219.6	5.8	246.1	6.4	285.3	7.5	296.9	7.8
Legumes	46.4	3.3	73.9	5.3	67.1	4.8	166.4	12.0	113.2	8.1	212.9	15.3
Citrus Fruits	9.4	.1	18.2	.2	21.1	.3	21.8	.3	28.2	.4	48.5	.6
Bananas	53.7	.7	68.2	.8	100.6	1.2	128.9	1.6	170.5	2.1	166.4	2.1
Other Fresh Fruits	26.2	.3	35.9	.4	54.5	.5	67.9	.7	83.3	.8	100.4	1.0
Dried Fruits	6.6	.1	2.6	.0	.3	.0	3.9	.0	1.0	.0	4.9	.1
Canned Fruits	--	--	--	--	.4	.0	--	--	.8	.0	.7	.0
Canned Vegetables	.1	.0	.3	.0	.3	.0	.3	.0	.3	.0	2.4	.0
Total Fruits and Vegetables	261.8	7.6	375.8	11.3	463.9	12.6	635.3	21.0	682.6	18.9	833.1	26.9
bers												
Potatoes and Derivatives	409.2	9.9	558.0	13.5	657.6	16.0	742.8	18.0	752.1	18.3	787.8	19.1
gar												
Sugar	1110.1	--	1311.4	--	1624.7	--	1640.4	--	1676.9	--	1862.4	--
her Foods												
Coffee	57.8	--	65.0	--	77.8	--	85.4	--	91.8	--	97.5	--
Tea	26.2	--	39.1	--	106.1	--	60.0	--	72.3	--	64.1	--
Soft Drinks	12.6	--	26.5	--	35.1	--	48.9	--	51.9	--	86.3	--
Total Other Foods	96.6	--	130.6	--	219.0	--	194.3	--	215.9	--	247.9	--
and Total (Household)	6325.7	157.2	8225.8	208.5	10231.3	261.6	11402.8	289.0	11984.7	318.9	13357.3	362.3
r Capita Total	1700.5	42.3	1861.0	47.1	1779.4	45.5	2096.1	53.1	2248.5	59.8	2331.1	63.2
rcentage of Sample	5.6		9.7		12.9		10.6		10.5		7.9	

TABLE C.4 - BOLIVIA (Continued)

Food Item	INCOME GROUPS* 16,001-18,000 Cal-ories	Pro-teins	18,001-20,000 Cal-ories	Pro-teins	20.001-23,000 Cal-ories	Pro-teins	23,001-28,500 Cal-ories	Pro-teins	28,501-36,000 Cal-ories	Pro-teins	36,000 Cal-ories	Pro-teins
Cereals												
Wheat Products	4711.1	148.6	4683.8	147.8	4706.4	148.5	4494.7	141.8	5261.1	166.0	6282.9	198.2
Rice	822.1	13.9	725.8	12.2	820.7	13.8	649.8	10.9	870.6	14.7	1001.7	16.9
Corn Products	21.8	5.5	305.9	7.8	145.8	3.7	145.8	3.7	356.8	9.0	567.6	14.4
Oats	153.0	4.5	204.0	6.0	97.1	2.9	137.6	4.1	186.4	5.5	293.3	8.7
Quinoa	106.1	3.2	106.1	3.2	97.6	2.9	129.5	3.9	95.3	2.9	114.6	3.5
Other Cereals	2.5	.1	21.8	.6	15.7	.4	8.6	.2	3.6	.1	22.9	.6
Total Cereals	5816.6	175.8	6047.4	177.6	5883.3	172.2	5566.0	164.6	6773.8	198.2	8283.0	242.3
Meats												
Beef	1693.9	100.1	1906.6	112.6	1912.2	113.0	1862.7	110.0	2301.1	135.9	2823.5	166.8
Mutton and Lamb	114.5	8.7	82.3	6.3	140.5	10.7	133.1	10.2	167.3	12.8	225.5	17.2
Pork	30.1	2.2	19.4	1.4	55.1	4.0	27.7	2.0	76.2	5.5	176.5	12.7
Other Red Meat	1.3	.2	--	--	--	--	.5	.1	--	--	22.00	3.7
Poultry	61.8	6.6	38.9	4.1	41.2	4.4	99.8	10.6	171.1	18.2	335.0	35.6
Processed Meats	65.4	4.1	83.9	5.3	76.1	4.8	103.8	6.5	156.2	9.8	36.3	24.1
Fresh Fish	49.5	8.7	17.4	3.1	50.6	8.9	45.9	8.1	58.5	10.3	85.8	15.1
Canned Fish	50.4	3.9	30.0	2.3	20.6	1.6	30.6	2.3	68.6	5.3	285.4	21.9
Total Meats	2066.9	134.5	2178.5	135.1	2296.3	147.4	2304.1	149.8	2999.0	197.8	3990.0	297.1
Fats and Oils												
Vegetable Fats	1088.2	--	1156.3	--	1152.1	--	1286.2	--	1471.9	--	1766.2	--
Animal Fats	861.7	--	975.8	--	995.5	--	1027.6	--	1624.3	--	1790.2	--
Total Fats and Oils	1949.9	--	2132.1	--	2147.6	--	2313.8	--	3096.2	--	3556.4	--
Milk and Eggs												
Eggs	50.7	3.9	67.0	5.1	70.9	5.4	74.8	5.7	136.9	10.4	195.3	14.9
Milk and Cheese	506.8	36.7	584.6	42.4	649.9	47.1	727.7	52.6	1206.2	87.5	1854.5	134.5
Total Milk and Eggs	557.5	40.6	651.6	47.5	720.8	52.5	802.5	58.3	1343.1	97.9	2049.8	149.4

TAB[illegible].4 [illegible] LIV[illegible] ont[illegible]

od Item	INCOME GROUPS* 16,001-18,000 Cal-ories	Pro-teins	18,001-20,000 Cal-ories	Pro-teins	20,001-23,000 Cal-ories	Pro-teins	23,001-28,500 Cal-ories	Pro-teins	28,501-36,000 Cal-ories	Pro-teins	36,000 Cal-ories	Pro-teins
uits and Vegetables												
Fresh Fruits	328.1	8.6	341.0	8.9	354.6	9.3	432.3	11.3	488.7	12.8	631.5	16.5
Legumes	154.6	11.1	240.4	17.3	242.0	17.4	269.5	19.4	444.8	32.0	678.3	48.8
Citrus Fruits	47.8	.6	73.6	1.0	59.2	.8	71.6	.9	126.4	1.6	208.7	2.7
Bananas	161.8	2.0	162.9	2.0	167.0	2.1	194.2	2.4	224.2	2.8	290.1	3.6
Other Fresh Fruits	108.7	1.1	119.1	1.2	145.5	1.5	172.0	1.7	267.7	2.7	392.3	3.9
Dried Fruits	3.0	.0	20.4	.2	16.1	.2	36.2	.4	27.3	.3	83.9	1.0
Canned Fruits	.0	.0	2.1	.0	.4	.0	3.1	.0	7.8	.0	14.9	.1
Canned Vegetables	1.9	.0	.9	.0	2.1	.0	3.6	.1	12.5	.2	29.6	.6
Total Fruits and Vegetables	805.9	23.4	960.4	30.6	986.9	31.3	1182.5	36.2	1599.4	52.4	2329.3	77.2
ibers												
Potatoes and Derivatives	752.1	18.3	781.7	19.0	835.3	20.3	840.5	20.4	1008.6	24.5	1225.2	29.7
ugar												
Sugar	1828.6	--	1753.0	--	1841.7	--	1637.8	--	2309.4	--	2345.9	--
ther Foods												
Coffee	105.0	--	91.6	--	104.5	--	107.1	--	120.1	--	143.4	--
Tea	87.3	--	113.2	--	100.5	--	112.3	--	150.2	--	162.9	--
Soft Drinks	81.9	--	81.7	--	94.9	--	134.9	--	153.1	--	281.3	--
Total Other Foods	274.2	--	286.5	--	299.9	--	354.3	--	423.4	--	587.6	--
rand Total (Household)	14051.7	392.6	14791.2	409.8	15011.8	423.7	15001.5	429.3	19552.9	570.8	24407.2	795.7
er Capita Totals	2349.8	65.7	2684.4	74.4	2523.0	71.2	2664.6	76.3	3079.2	89.9	3557.9	116.0
ercent of Sample	7.2		5.0		8.7		8.2		8.5		8.3	

ource: Calculated from unpublished data from the Income and Expenditure Survey, 1967; food prices from INE and the Bolivian Ministry of Public Health Nutrition Division; and nutrient content data from the Nutrition Division.

Bolivian pesos per year (11.88 pesos = $1 U.S., 1967)

TABLE C.5

BOLIVIA

QUANTITY AND COST OF DAILY TARGET DIET
FOR 5.6 MEMBER HOUSEHOLD

Food Item	Cost	Quantity Kg
Wheat Products	4.03	1.7384
Rice	.54	.5983
Corn Products	.10	.2964
Oats	.02	.0367
Quinoa	.09	.2475
Other Cereals	.01	.0170
Beef	5.77	.6629
Mutton and Lamb	1.21	.1256
Pork	.17	.0163
Other Red Meats	.01	.0008
Poultry	1.13	.0916
Processed Meats	.64	.0600
Fresh Fish	.38	.0612
Canned Fish	.13	.0114
Vegetable Fats	1.02	.1455
Animal Fats	.74	.1152
Eggs	.75	.0575
Milk and Cheese	2.50	.6064
Fresh Vegetables	3.36	1.0294
Potatoes and Derivatives	2.35	.8160
Legumes	.22	.2284
Other Fresh Fruits	2.12	.3439
Citrus	.62	.1746
Bananas	.48	.2400
Dried Fruits	.12	.0110
Canned Fruits	.08	.0065
Canned Vegetables	.08	.0034
Sugar	.90	.4265
Coffee	.64	10.7179
Tea and Others	.45	5.6176
Soft Drinks	.84	.2932
	31.50	

(*Bolivian pesos, 11.88 pesos = $1 U.S., 1967)

TABLE 3.6

COLOMBIA

PRICE OF COMMON FOODS AND AVERAGE DAILY HOUSEHOLD CONSUMPTION BY INCOME GROUPS, CALI, 1971

Food Item	Estimated Price per Kilo	INCOME GROUPS* $4000	$4001-$6000 (g.)	$6001-$8000 (g.)	$8001-$10000 (g.)	$10001-$14000 (g.)	$14001-$24000 (g.)	$24000 (g.)
Bread + Cereals								
Rice	1.60	847.0	1179.0	1452.7	1893.3	1687.3	1953.3	2680.0
Oats	2.51	19.1	40.4	11.9	84.4	14.9	105.7	163.1
Arepa (corn meal cake)	11.86	5.4	7.3	13.9	19.1	15.0	22.9	15.6
Areparina	11.86	3.5	2.0	2.0	7.5	10.1	15.3	40.2
Wheat flour	7.54	16.7	17.5	23.7	26.2	20.3	28.1	33.4
Corn	.41	545.3	757.7	1091.2	805.1	797.8	1129.2	1485.4
Pasta	3.69	64.0	81.1	78.3	148.4	121.1	116.8	164.6
Bread plain	11.87	52.1	86.2	97.8	129.6	151.3	178.5	198.8
Bread sweet								
Meat								
Beef (without bone)	18.28	92.1	225.2	281.1	290.1	323.0	456.2	634.5
(with bone)	12.46	65.8	47.7	78.1	102.7	154.5	92.9	65.7
Loin	20.77	0.0	0.0	3.7	2.0	16.8	22.1	116.3
Pork (without bone)	20.77	0.0	.4	1.2	2.1	13.4	17.8	40.3
Bacon	18.70	0.0	6.1	2.5	6.5	19.8	22.5	38.0
Chicken	22.25	0.0	1.6	4.3	7.1	19.1	17.1	100.0
Beef (bone)	10.60	7.9	29.6	22.7	28.5	57.3	64.3	58.2
Fresh fish	23.20	1.9	1.8	4.2	5.3	4.9	7.9	30.1
Milk, Cheese, Eggs								
Eggs	15.80	16.6	35.9	63.5	84.1	95.6	124.9	198.0
Milk (natural)	4.48	107.0	192.3	331.0	202.6	332.6	594.1	926.0
(pasteurized)	7.17	5.8	51.8	59.7	95.3	118.6	225.3	282.8
(powdered)	9.48	12.4	20.2	37.2	102.3	50.4	29.5	36.4
Cheese	44.80	0.0	0.0	.4	0.0	2.3	11.7	28.3
Oil, Land + Grease								
Lard (pork)	15.57	3.6	8.8	8.7	6.2	10.8	5.3	14.6
(vegetable)	10.70	47.5	76.1	79.1	89.4	85.6	68.6	79.4
Butter	33.00	.2	1.5	3.2	6.9	10.6	24.8	45.0
Oil	13.55	14.1	24.7	35.4	92.2	88.0	164.6	236.5

TABLE C.6 (Continued)

Food Item	Estimated Price per Kilo	INCOME GROUPS* $4000	$4001-$6000 (g.)	$6001-$8000 (g.)	$8001-$10000 (g.)	$10001-$14000 (g.)	$14001-$24000 (g.)	$24000 (g.)
Fruits + Vegetables								
Dried peas	2.66	0.0	24.7	59.5	56.9	47.7	66.4	147.4
Dried beans	2.17	266.7	338.5	350.0	428.4	362.4	450.3	391.4
Lentils	3.71	42.0	88.1	106.4	113.1	167.6	232.1	144.2
Onions (with leaves)	2.74	47.2	75.1	80.5	95.3	119.2	114.2	145.8
Onions (heads)	6.41	14.1	22.5	31.3	31.4	52.3	61.6	99.1
Beets	3.16	9.8	26.4	46.1	45.7	40.1	81.3	129.6
Cabbage	2.24	16.4	40.3	49.9	57.6	77.8	85.9	154.5
Tomatoes	6.30	35.8	64.7	85.9	98.8	127.7	140.9	193.2
Carrots	2.26	5.2	5.8	9.4	10.6	12.8	15.3	23.7
Peas (fresh)	9.16	5.2	11.0	16.0	17.3	29.9	50.1	67.3
Bananas	1.74	33.3	127.1	252.4	205.1	392.1	385.6	466.0
Lemons	2.89	12.0	25.2	52.1	66.3	87.3	105.7	140.9
Oranges	1.58	11.6	101.4	104.4	138.3	274.8	385.6	679.6
Pineapples	1.46	4.0	16.9	24.2	73.0	127.7	166.0	322.4
Lulos	4.62	2.5	11.4	26.2	45.9	72.3	112.1	149.8
Blackberries	9.24	0.0	2.5	3.4	6.5	12.1	27.6	74.9
Potatoes, Plantains + Tubers								
Potatoes	1.64	428.2	560.9	674.9	854.4	683.6	844.6	1198.8
Cassava	3.30	77.3	142.8	157.4	144.3	183.2	159.1	195.5
Arracacha	2.32	42.6	41.4	66.2	64.9	82.5	98.9	99.8
Plantains (mature)	1.80	393.0	519.4	633.5	775.5	872.1	1150.3	1269.7
(green)								
Sugar + Panela								
Sugar	2.03	286.2	384.4	517.3	590.9	564.7	631.5	960.9
Panela	2.94	202.9	257.6	375.9	393.8	392.7	363.5	446.8
Other Foods								
Coffee	.04	8538.5	15641.0	20076.9	22192.3	17743.5	25179.5	38756.4
Chocolate + cocoa	.11	1882.4	2941.2	4647.6	5911.8	7970.6	7529.4	
Spices, etc.	11.55	33.3	39.6	49.6	78.4	96.3	139.0	658.2
Percentage of sample	NA	13.2	16.5	16.5	12.3	16.7	15.7	9.4

TABLE C.6 (Continued)

Estimated Price per Kilo	$4000	$4001-$6000 (g.)	$6001-$8000 (g.)	$8001-$10000 (g.)	$10001-$14000 (g.)	$14001-$24000 (g.)	$24000 (g.)

Source: Unpublished tabulations from the Encuesta Nacional de Hogares, Departamento Administrativo de Estadistica, 1971 and 1971 price date from DANE and INDECA.

* Colombian pesos per year (21 pesos = $1.00 U.S., 1971)

TABLE C.7

COLOMBIA

NUTRIENT CONTENT PER GRAM OF COMMON FOODS
(Adjusted for Inedible Portions)

Food Item	% Edible	Calories	Protein (g)	Calcium (mg)	Iron (mg)	Vitamin A (IU)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Vitamin C (mg)
Bread + Cereals										
Rice	100	1.08	.023	.03	.002	--	.0002	.0001	.004	--
Oats	100	.49	.016	.08	.011	--	.0006	.0002	.002	--
Arepa (corn meal cake)	100	1.73	.041	.03	.008	--	.0003	.0001	.001	--
Areparina	100	1.73	.041	.03	.008	--	.0003	.0001	.001	--
Wheat flour	100	3.36	.137	.50	.043	--	.0098	.0021	.003	--
Corn	100	.44	.010	.01	.004	.08	.0004	.0001	.023	--
Pasta	100	1.13	.034	.08	.012	--	.0004	.0001	.002	--
Bread	100	3.37	.090	.30	.024	--	.0013	.0007	.013	--
Meat										
Beef (without bone)	100	2.32	.187	.06	.031	--	.0006	.0017	.043	--
(with bone)	50	1.16	.094	.03	.016	--	.0003	.0009	.022	--
(lomo)	100	1.50	.215	.06	.027	--	.0008	.0023	.051	--
Pork (without bone)	100	2.48	.165	.05	.020	--	.0076	.0022	.024	--
Bacon	100	6.31	.091	.13	.008	--	.0038	.0012	.019	--
Chicken	60	1.45	.115	.08	.009	--	.0005	.0010	.050	--
Beef (bone)	10	.26	.042	.01	.004	--	.0001	.0002	.005	--
Fresh fish	50	.50	.115	.11	.003	--	.0002	.0005	.014	--
Milk, Cheese, eggs										
Eggs	90	1.47	.115	.49	.024	9.90	.0009	.0026	.0009	--
Milk (natural)	100	.60	.034	1.20	.002	1.50	.0004	.0018	.001	.02
(pasteurized)	100	.50	.034	1.20	.003	1.20	.0004	.0018	.001	.01
(powdered)	100	.46	.046	1.55	.001	.04	.0004	.0025	.001	.01
Cheese	100	2.80	.217	6.90	.007	14.00	.0002	.0040	.001	--
Oil, Lard + Grease										
Lard (pork)	100	8.92	--	--	--	--	--	--	--	--
(vegetable)	100	7.19	.006	.02	.002	--	--	--	--	--
Butter	100	7.32	.012	.22	.002	48.60	--	.0001	.001	--
Oil	100	8.84	--	--	--	--	--	--	--	--

TABLE C.7 (Continued)

Food Item	% Edible	Calories	Protein (g)	Calcium (mg)	Iron (mg)	Vitamin A (IU)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Vitamin C (mg)
Fruits + Vegetables										
Dried peas	100	1.02	.083	.21	.016	.77	.0027	.0006	.011	.01
Dried beans	100	1.05	.071	.35	.025	--	.0015	.0004	.006	.01
Lentils	100	.98	.073	.22	.030	--	.0016	.0006	.006	--
Onions (with leaves)	70	.21	.009	.22	.003	--	.0003	.0002	.002	.09
Onions (heads)	95	.31	.013	.33	.005	--	.0004	.0004	.004	.14
Beets	80	.34	.011	.14	.008	--	.0002	.0006	.002	.05
Cabbage	85	.20	.019	2.92	.012	25.6	.0005	.0014	.010	.85
Tomatoes	80	.14	.007	.06	.006	8.8	.0004	.0002	.005	.16
Carrots	85	.31	.006	.28	.005	59.5	.0003	.0003	.003	.02
Peas (fresh)	40	.46	.033	.14	.010	.88	.0014	.0005	.0088	.08
Bananas	70	.59	.008	.04	.004	1.54	.0003	.0002	.0049	.07
Lemons	50	.13	.002	.07	.002	--	.0001	.0001	.0005	.13
Oranges	60	.21	.004	.11	.002	--	.0004	.0002	.0018	.36
Pineapples	55	.26	.002	.12	.002	--	.0005	.0017	.0011	.07
Lulos	60	.14	.004	.45	.004	3.60	.0002	.0002	.0090	.15
Blackberries	90	.21	.005	.16	.011	--	.0002	.0004	.0036	.14
Potatoes, Plantains + Tubers										
Potatoes	80	.73	.015	.02	.008	--	.0006	.0006	.0072	.13
Cassava	80	1.17	.006	.22	.003	.08	.0003	.0002	.0040	.24
Arracacha	85	.81	.008	.20	.009	.09	.0004	.0005	.0213	.13
Plantains	60	.68	.010	.02	.002	.96	.0002	.0001	.0024	.09
Sugar + Panela										
Sugar	100	3.84	--	--	.001	--	--	--	--	--
Panela	100	3.12	.005	.80	.024	--	.0002	.0007	.0030	.03
Other Foods										
Coffee	100	.02	.001	.01	--	--	--	--	.001	--
Chocolate + cocoa	100	.04	.001	.01	--	--	--	--	--	--

Source: Instituto Nacional de Nutrición. Table de Composición de Alimentos Colombianos Tercera Edición. Bogota, Colombia, 1967.

Table C.8

COLOMBIA

AVERAGE DAILY HOUSEHOLD CONSUMPTION OF CALORIES AND PROTEINS BY INCOME GROUP, CALI, 1971

Food Item	INCOME GROUPS* ($4000) Cal.	Prot. (g)	($4001-6000) Cal.	Prot. (g)	($6001-8000) Cal.	Prot. (g)	($8001-10000) Cal.	Prot. (g)	($10001-14000) Cal.	Prot. (g)	($14001-24000) Cal.	Prot. (g)	($24000) Cal.	Prot. (g)
Breads + Cereals														
Rice	912.2	19.8	1269.8	27.6	1564.5	34.0	2039.1	44.3	1817.3	39.5	2103.7	45.7	2886.4	62.7
Oats	9.4	.3	19.8	.6	48.4	1.5	66.5	2.1	52.2	1.6	82.1	2.6	80.0	2.5
Arepa (corn meal cake)	9.3	.2	12.6	.3	24.0	.6	33.0	.8	26.0	.6	39.6	.9	27.0	.6
Areparina	6.1	.1	3.5	.1	3.5	.1	13.0	.3	17.5	.4	26.5	.6	69.5	1.6
Wheat flour	56.1	2.3	58.8	2.4	79.6	3.2	88.0	3.6	68.2	2.8	94.4	3.8	112.2	4.6
Corn	242.0	5.6	336.3	14.2	484.4	11.2	357.4	8.3	336.6	7.8	501.2	11.6	659.3	15.3
Pasta	72.1	2.2	91.4	2.8	88.2	2.7	167.3	5.1	136.5	4.2	131.6	4.0	185.5	5.7
Bread	175.6	4.7	290.5	7.8	329.6	8.8	436.8	11.7	509.9	13.6	601.5	16.1	670.0	17.9
Total	1482.8	35.2	2082.7	55.8	2622.2	62.1	3201.1	76.2	2964.2	70.5	3580.6	85.3	4689.9	110.9
Meat														
Beef (w/out bone)	213.7	17.2	523.2	42.1	652.2	52.6	673.0	54.2	749.4	60.4	1058.4	85.3	1472.0	118.7
(with bone)	76.3	6.2	55.3	4.5	90.6	7.3	119.1	9.7	179.7	14.6	107.8	8.7	76.2	6.2
(loin)	--	--	--	--	5.6	.8	3.0	.4	25.2	3.6	33.2	4.8	174.5	25.0
Pork (w/out bone)	--	--	1.0	.1	3.0	.2	5.2	.3	33.2	2.2	44.1	2.9	100.0	6.6
Bacon	--	--	38.5	.6	15.8	.2	41.0	.6	124.9	1.8	142.0	2.0	239.8	3.5
Chicken	--	--	2.3	.2	6.2	.5	10.3	.8	27.7	2.2	24.8	2.0	145.0	11.5
Beef (bone)	2.0	.3	7.7	1.2	5.9	1.0	7.4	1.2	14.9	2.4	16.7	2.7	15.1	2.4
Fresh fish	1.0	.2	.9	.2	2.1	.5	2.7	.6	2.5	.6	4.0	.6	15.1	3.5
Total	293.0	23.9	628.9	48.9	781.4	63.1	861.7	67.8	1157.5	87.8	1431.0	109.0	2237.7	177.4
Milk, Cheese, Eggs														
Eggs	24.4	1.9	52.8	4.1	93.3	7.3	123.6	9.7	140.5	11.0	183.6	14.4	291.1	22.8
Milk (natural)	64.2	3.6	115.4	6.5	198.6	11.3	121.6	6.9	199.6	11.3	356.5	20.2	555.6	31.5
(pasteurized)	2.9	.2	25.9	1.8	29.9	2.0	47.7	3.2	59.3	4.0	112.7	7.7	141.4	9.6
(powdered)	5.7	.6	9.3	.9	17.1	1.7	47.0	4.8	23.1	2.3	41.7	4.2	100.7	10.2
Cheese	--	--	--	--	1.1	.1	--	--	6.4	.5	32.8	2.5	79.2	6.1
Total	97.2	6.3	203.4	13.3	340.0	22.4	339.9	24.6	428.9	29.1	727.3	49.0	1168.0	80.2
Oil, lard + Grease														
Lard (pork)	32.1	--	78.5	--	77.6	--	55.3	--	96.3	--	47.3	--	130.2	--
(vegetable)	341.5	.3	547.2	.3	568.7	.5	642.8	.5	615.4	.5	493.2	.4	570.9	.5
Butter	1.5	--	11.0	--	23.4	--	50.5	.1	77.6	.1	181.5	.3	329.4	.5
Oil	124.6	--	218.3	--	312.9	--	815.0	--	777.9	--	1455.1	--	2090.7	--
Total	499.7	.3	855.0	.3	982.6	.5	1563.6	.6	1567.2	.6	2177.1	.7	3121.2	1.0

TABLE C.8 (continued)

Food Item	INCOME GROUPS* ($4000) Cal.	Prot. (g)	($4001-6000) Cal.	Prot. (g)	($6001-8000) Cal.	Prot. (g)	($8001-10000) Cal.	Prot. (g)	($10001-14000) Cal.	Prot. (g)	($14001-24000) Cal.	Prot. (g)	($24000) Cal.	Prot. (g)
Fruits + Vegetables														
Dried peas	--	--	26.5	2.1	63.8	4.9	61.0	4.7	51.1	4.0	23.1	5.5	158.0	12.3
Dried beans	280.3	18.9	355.8	24.0	372.1	25.1	450.3	30.4	380.8	25.7	473.2	32.0	411.3	27.8
Lentils	41.3	3.1	86.6	6.5	104.6	7.8	111.2	8.3	164.7	12.3	228.1	17.0	141.8	10.6
Onions (w/leaves)	9.9	.4	15.8	.7	16.9	.7	20.0	.9	25.0	1.1	24.0	1.0	30.6	1.3
Onion (heads)	4.4	.2	7.0	.3	9.7	.4	9.7	.4	16.2	.7	19.1	.8	30.7	1.3
Beets	3.3	.1	9.0	.3	15.7	.5	15.5	.5	13.6	.4	27.6	.9	44.1	1.4
Cabbage	3.3	.3	8.1	.8	10.0	.9	11.5	1.1	15.6	1.5	17.2	1.6	30.9	2.9
Tomatoes	6.0	.3	9.1	.5	12.0	.6	13.8	.7	17.9	.9	19.7	1.0	27.0	1.4
Carrots	1.6	--	1.8	--	2.9	.1	3.3	.1	4.0	.1	4.7	.1	7.3	.1
Peas	2.4	.9	5.1	.4	7.4	.5	8.0	.6	13.9	1.0	23.2	1.7	31.2	2.2
Bananas	19.6	.3	75.0	1.0	148.9	2.0	121.0	1.6	231.3	3.1	227.5	3.1	274.9	3.7
Lemons	1.6	--	3.3	.1	6.7	.1	8.6	.1	11.3	.2	13.7	.2	88.3	1.4
Oranges	2.4	--	21.3	.4	21.9	.4	29.0	.6	57.7	1.1	81.0	1.5	142.7	2.7
Pineapples	1.0	--	4.4	--	6.3	--	19.0	.1	33.2	.3	43.1	.3	83.8	.6
Lulos	.4	--	1.6	--	3.7	.1	6.4	.1	10.1	.1	15.7	.2	21.0	.3
Blackberries	--	--	.5	--	.7	--	1.4	--	2.5	.1	5.8	.1	15.7	.4
Total	376.5	24.5	630.9	37.1	803.3	44.1	889.7	50.2	1048.9	53.1	1246.7	67.0	1539.3	70.4
Potatoes, Plantains, + Tubers														
Potatoes	312.6	6.4	409.5	8.4	492.7	10.1	623.7	12.8	499.0	10.2	616.6	12.7	875.1	18.0
Cassava	90.4	.5	167.1	.9	184.2	.9	168.8	.9	214.3	1.1	186.1	1.0	228.7	1.2
Arracacha	34.5	.3	33.3	.3	53.6	.5	52.6	.5	66.8	.7	80.1	.8	80.8	.8
Plantains	267.2	3.9	353.2	5.2	430.8	6.3	527.3	7.8	593.3	8.7	782.2	11.5	863.4	12.7
Total	704.7	11.1	963.1	14.8	1161.3	17.8	1372.4	22.0	1373.4	20.7	1665.0	26.0	2048.0	32.7
Sugar + Panela														
Sugar	1099.0	--	1476.1	--	1986.4	--	2269.1	--	2168.4	--	2425.0	--	3690.0	--
Panela	633.0	1.0	803.7	1.3	1172.8	1.9	1228.7	2.0	1225.2	2.0	1134.1	1.8	1394.0	2.2
Total	1732.0	1.0	2279.8	1.3	3159.2	1.9	3497.8	2.0	3393.6	2.0	3559.1	1.8	5084.0	2.2
Other foods														
Coffee	150.0	8.4	275.7	15.4	353.9	19.7	391.2	21.8	312.8	17.4	443.9	24.7	683.2	38.0
Chocolate + cocoa	58.4	1.5	91.2	2.4	144.1	3.8	183.3	4.8	247.2	6.5	233.5	6.1	394.4	10.4
Spices, etc.														
Total	208.9	9.9	366.9	17.8	498.0	23.5	574.5	26.6	560.0	23.9	677.4	30.8	1077.6	48.4

TABLE C.8 (continued)

Food Item	INCOME GROUPS* ($4000) Cal.	Prot. (g)	($4001-6000) Cal.	Prot. (g)	($6001-8000) Cal.	Prot. (g)	($8001-10000) Cal.	Prot. (g)	($10001-14000) Cal.	Prot. (g)	($14001-24000) Cal.	Prot. (g)	($24000) Cal.	Prot. (g)
Grand Total (Household)	5394.8	112.2	8011.6	189.3	9848.0	235.4	12273.7	270.0	12493.7	287.7	15064.2	369.6	20965.7	523.2
Per Capita**	850.9	17.7	1263.7	29.9	1553.3	37.1	1935.8	42.6	1970.6	45.4	2376.1	58.3	3306.9	82.5
Percent of Sample	13.2		16.5		16.5		12.3		16.7		15.7		9.4	

Source: Calculated from unpublished tabulations of Encuesta Nacional de Hogares, Departamento Administrativo de Estadistica, 1971 and 1971 food price data from DANE and INDECA and nutrient content data from the Instituto Nacional de Nutricion.

* Colombian pesos per year (21 pesos = $1.00 US, 1971)
** Average of 6.34 persons per household

Table C.9

COLOMBIA

QUANTITY AND COST OF DAILY TARGET DIET
FOR 6.3 MEMBER HOUSEHOLD

Food Item	Cost/ day	Quantity Kg
Rice	3.13	1.6873
Oats	.42	.1057
Arepa (corn meal cake)	.45	.0382
Wheat flour	.21	.0281
Corn	.46	1.1292
Pasta	.43	.1168
Bread	2.12	.1785
Beef (without bone)	8.34	.4562
(with bone)	1.16	.0929
(loin)	.46	.0221
Pork (without bone)	.37	.0178
Bacon	.42	.0225
Chicken	.38	.0171
Soup bone (beef)	.68	.0643
Fresh fish	.18	.0079
Eggs	1.97	.1249
Milk (natural)	2.66	.5941
(pasteurized)	1.62	.2253
(powdered)	.28	.0295
Cheese	.52	.0117
Lard (pork)	.08	.0053
(vegetable)	.73	.686
Butter	.82	.0248
Oil	2.23	.1646
Dried peas	.18	.0664
Dried beans	.98	.4502
Lentils	.86	.2321
Onions (with stalks)	.31	.1142
Onions	.39	.616
Beets	.26	.0813
Cabbage	.19	.0859
Tomatoes	.97	.1409
Carrots	.03	.0153
Peas (fresh)	.46	.0501
Bananas	.68	.3921
Lemons	.25	.0873
Oranges	.43	.2748
Pineapples	.19	.1277
Lulos	.33	.0723
Blackberries	.11	.0121
Potatoes	1.39	.8446
Cassava	.52	.1591
Arracacha	.23	.0989
Plantains	2.07	1.1503
Sugar	1.28	.6315
Panela (brown sugar loaf)	1.07	.3635
Coffee	1.01	25.1795
Chocolate + cocoa	.83	7.5294
Spices, etc.	1.61	.1390
	46.75	43.5335

Table C.10

GUATEMALA

WEIGHTINGS USED TO COMPUTE PRICE AND NUTRIENT CONTENT COEFFICIENTS

Food Item	Weighting	Food Item	Weighting
Meat	1.00	Coffee	1.00
Beef (roast)	.27	Coffee (instant)	.07
(steving)	.44	(beans)	.93
Chicken	.17		
Pork	.05	Non-alcoholic beverages	1.00
Sausage	.07	Sodas	.81
		Fruit juices	.19
Cereals	1.00		
Tortillas	.34	Fats and oils	1.00
Rice	.09	Edible oils	.63
Bread (French)	.37	Margarine	.14
Pasta	.03	Lard (vegetable)	.11
Corn	.13	(pork)	.11
Oats	.02		
Corn flakes	.02	Other foods	1.00
		Jellies and preserves	.37
Eggs and milk	1.00	Sweets and candy	.63
Eggs	.13		
Milk (fresh)	.80		
(powdered)	.01		
Cream	.04		
Cheese	.01		
Vegetables	1.00		
Tomato	.22		
Onion	.26		
Guisquil	.29		
Carrot	.11		
Guicoy	.01		
Cabbage	.10		
Fruits	1.00		
Bananas	.20		
Plantains	.15		
Oranges	.28		
Avocado	.08		
Lemon	.21		
Pineapple	.04		
Melon	.02		
Sugar, salt and spices	1.00		
Sugar	.83		
Salt	.14		
Vinegar	.03		

Source: Computed from weightings used to calculate the cost of living index (Instituto de Investigaciones Economicos, Costo de la Vida, estudios monográficos No. 2, 1974) and prices from the General Statistics Office and SIECA.

TABLE C.11

GUATEMALA

NUTRIENT CONTENT PER GRAM OF COMMON FOODS
(Adjusted For Inedible Portions)

Food Item	Calories	Proteins (g)	Calcium (mg)	Iron (mg)	Vitamin A (IU)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Vitamin C (mg)
Meat	1.49	.160	.154	.029	.02	.0013	.0014	.031	--
Fish	.77	.160	.133	--	--	.0027	.0007	.007	--
Cereals	2.79	.079	.856	.039	.02	.0015	.0006	.010	--
Milk and Eggs	.83	.046	1.487	.003	.45	.0005	.0023	.001	.01
Vegetables	.36	.007	.153	.006	1.07	.0004	.0003	.005	.12
Potatoes	.63	.016	.059	.006	--	.0008	.0002	.012	.14
Dried Beans	3.36	.220	.867	.077	.03	.0053	.0020	.020	.03
Fresh Fruits	.45	.006	.088	.003	.19	.0004	.0002	.002	.20
Fats and Oils	8.62	--	.022	--	1.35	--	--	--	--
Sugar, Salt and Spices	3.19	--	.044	--	--	--	--	--	--
Coffee	2.34	.127	1.605	.027	--	.0007	.0007	.183	--
Other Foods	2.53	.003	.133	.003	--	.0003	.0003	.003	.03
Other Non-Alcoholic Drinks	1.48	.001	.042	.001	.15	--	.0001	.002	.01

Source: INCAP, Nutritive Value of Foods for Central America and Panama, 1971

TABLE C.12
GUATEMALA

PRICE OF COMMON FOODS AND AVERAGE DAILY HOUSEHOLD CONSUMPTION BY INCOME GROUPS, GUATEMALA, 1969

	Estimated Price Per Kilo	INCOME GROUPS* $500	$501-$1000	$1001-$1500	$1501-$2000	$2001-$3000	$3001-$4000	$4001-$6000	$6001-$8000	$8001-$10000	>$10001
Meat	.96	90.0	161.7	291.2	412.4	532.7	659.7	858.5	1001.6	1352.0	1578.0
Fish	1.24	--	1.0	10.5	13.6	24.1	33.1	51.8	61.1	67.8	82.7
Cereals	.29	922.1	1400.8	1728.5	1896.6	2072.2	3114.2	2489.2	2633.0	2522.9	3159.6
Fats and Oils	.59	48.3	86.1	108.1	136.0	154.2	194.1	230.5	231.3	261.5	349.7
Milk, Eggs and Milk Produce	.37	73.9	363.3	656.6	815.9	1145.6	1596.2	2002.1	2265.2	2728.8	3253.1
Vegetables	.19	594.2	804.2	977.2	1155.2	1252.5	1366.9	1680.3	1728.8	1982.8	2456.8
Potatoes	.18	43.1	87.2	131.1	139.4	171.1	150.7	225.1	211.0	239.9	441.4
Beans	.27	--	1.0	2.4	4.5	4.1	11.3	29.5	6.9	3.8	32.4
Fruits	.21	108.2	233.1	308.3	501.2	680.4	840.8	1167.5	1252.7	1612.3	2077.0
Sugar, Salt and Spices	.18	271.5	403.5	472.6	508.1	568.5	641.4	665.0	1784.5	1850.7	764.3
Coffee, Tea	1.85	20.8	28.5	32.2	38.6	45.1	48.6	55.5	62.4	63.8	72.4
Other Foods	.43	1.0	11.0	24.0	27.4	47.3	172.9	75.9	95.4	103.7	158.1
Non-Alcoholic Drinks	.29	--	44.4	72.1	114.1	145.0	202.4	202.4	289.2	262.0	441.6

Source: Calculated from Ingresos y Gastos de Familias Urbanas de Guatemala. Orellana, René Arturo y de León, Adolfo E/ Instituto de Investigaciones Económicos y Sociales, Universidad de San Carlos de Guatemala. Guatemala, Guatemala, C.A., 1972 using weighted prices from the Dirección General de Estadística prices.

*Guatemalan Quetzales per year (1 Quetzal = $1 U.S., 1969)

TABLE C.19

GUATEMALA

AVERAGE DAILY HOUSEHOLD CONSUMPTION OF CALORIES AND PROTEINS BY INCOME GROUP, GUATEMALA, 1969

	INCOME GROUPS*																			
	$500		$500-1000		$1001-1500		$1501-2000		$2001-3000		$3001-4000		$4001-6000		$6001-8000		$8001-10,000		$10,000	
	Calories	Proteins	Calories	Proteins	Calories	Proteins	Calories	Proteins	Calories	Proteins	Calories	Proteins	Calories	Proteins	Calories	Proteins	Calories	Proteins	Calories	Proteins
Meat	134.1	14.4	241.0	25.9	435.4	46.8	614.5	66.0	793.7	85.2	982.9	105.6	1279.2	137.4	1492.3	160.3	2014.5	216.3	2351.2	252.5
Fish	—	—	.8	.2	8.1	1.7	10.5	2.2	18.6	3.9	25.5	1.8	39.9	8.3	47.0	9.8	52.2	10.8	63.7	13.2
Cereals	2572.7	72.8	3908.3	110.7	4822.5	136.6	5291.5	149.8	5781.4	163.7	8688.6	246.0	6944.9	196.6	7346.1	208.0	7038.9	199.3	8815.3	249.6
Milk and Eggs	61.3	3.4	301.5	16.7	545.0	30.2	677.2	37.5	950.8	52.7	1324.8	73.4	1661.7	92.1	1880.1	104.2	2264.9	125.5	2700.0	149.6
Vegetables	213.9	4.2	209.5	5.6	351.8	6.8	415.9	8.1	450.9	8.8	492.1	9.6	604.9	11.8	622.4	12.1	713.8	13.8	884.4	17.2
Potatoes	27.2	.7	54.9	1.4	82.6	2.1	87.8	2.2	107.8	2.7	94.9	2.4	141.8	3.6	132.9	3.4	151.1	3.8	278.1	7.1
Dried Beans	—	—	3.7	.2	8.1	.5	15.1	1.0	13.8	.9	38.0	2.5	99.1	6.5	23.2	1.5	12.8	.8	108.9	7.1
Fresh Fruit	48.7	.7	104.9	1.4	212.7	2.8	225.5	3.0	306.2	4.0	378.4	5.0	525.4	7.0	563.7	7.5	725.5	9.7	934.7	12.5
Fats and Oils	416.3	—	742.2	—	931.8	—	1172.3	—	1329.2	—	1673.6	—	1906.9	—	1993.8	—	2254.1	—	3014.4	—
Sugar, Salt and Spices	866.1	—	1287.2	—	1507.6	—	1620.8	—	1813.5	—	2046.1	—	2121.4	—	2502.6	—	2713.7	—	2436.1	—
Coffee	48.7	2.6	66.7	3.6	75.3	4.1	90.3	4.9	105.5	5.7	113.7	6.2	129.9	7.0	146.0	7.9	149.3	8.1	169.4	9.2
Other Foods	2.5	—	27.8	—	60.7	.1	69.3	.1	119.7	.1	192.0	.2	241.4	.3	262.4	.3	400.0	.5	437.4	.5
Other Non-Alcoholic Drinks	—	—	65.7	—	106.7	.1	168.9	.1	214.6	.1	255.9	.2	299.6	.2	428.0	.3	387.8	.3	653.6	.4
Grand Total	4391.5	98.8	7094.2	169.7	9148.3	231.8	10459.6	274.9	12005.7	327.8	16306.5	452.9	16076.1	470.8	17440.5	515.7	18878.6	588.9	22849.2	718.9
Total per Capita	1171.1	26.3	1413.2	33.0	1779.8	45.1	1905.2	50.1	2136.2	58.3	2831.0	78.6	2580.4	75.6	2742.2	81.1	3183.6	99.3	3420.5	107.6
Percent of Sample	.99%		12.0%		17.2%		15.2%		18.3%		4.4%		13.5%		3.2%		3.9%		11.4%	

Source: Calculated from published tabulations the Income and Expenditure Survey, 1969 (Instituto de Investigaciónes Economicas y Sociales, Ingresos y Gastos de Familias Urbanos de Guatemala, 1973); food price data from the General Statistical Office; and nutrient content data from INCAP

*Guatemalan Quetzales per year (1 quetzal = $1 U.S., 1969)

Table C.14

GUATEMALA

QUANTITY AND COST OF DAILY TARGET DIET
FOR 6.4 MEMBER HOUSEHOLD

Food Item	Cost	Quantity
Meat	.962	1.0016
Fish	.076	.0611
Cereals	.764	2.6330
Milk and Eggs	.838	2.2652
Vegetables	.328	1.7288
Potatoes	.038	.2110
Dried Beans	.002	.0069
Fresh Fruit	.263	1.2527
Fats and Oils	.136	.2313
Sugar, Salt and Spices	.141	.7845
Coffee	.115	.0624
Other Foods	.410	.9540
Other Non-alcoholic Beverages	.084	.2892
	4.157	11.4817

TABLE C.15

DOMINICAN REPUBLIC

PRICE OF COMMON FOODS AND AVERAGE DAILY HOUSEHOLD CONSUMPTION BY INCOME GROUPS, SANTO DOMINGO, 1969

	Estimated Price Per Kilo	Income Groups* 0-$4.99 g	$10-14.99 g	$20-24.99 g	$25-29.99 g	$50-99.99 g
Rice	.149	78.9	739.7	1117.2	1160.0	902.4
Pasta	.221	63.1	51.2	66.9	55.5	67.7
Beans	.188	228.8	182.1	220.8	246.8	211.5
Cassava	.064	165.7	113.8	247.5	296.2	203.0
Beef	.494	78.9	91.0	260.9	302.3	287.6
Chicken	.455	31.6	28.5	160.6	135.7	344.0
Pork	.444	23.7	39.8	66.9	98.7	90.2
Sausage	.482	7.9	17.1	60.2	55.5	84.6
Eggs	1.056	--	8.5	16.7	43.2	101.5
Milk	.150	15.8	34.1	60.2	92.6	107.2
Sugar	.098	205.1	324.3	555.3	617.0	868.6
Oil	.562	118.4	156.5	240.8	277.7	344.0
Plantain	.116	737.7	1263.2	1906.7	--	2529.0
Bread	.164	173.6	187.8	294.4	391.8	358.1
Percentage of Sample	NA	4.4	12.9	7.9	5.9	19.3

Source: Unpublished data from Income and Expenditure Survey, Banco Central, 1969 and Banco Central prices.

*Dominican pesos per month (1 peso = $1 U.S., 1969)

Table C.16

DOMINICAN REPUBLIC

NUTRIENT CONTENT PER GRAM OF COMMON FOODS
(Adjusted for Inedible Portions)

	%* Edible	Calories	Proteins (g)	Calcium (mg)	Iron (mg)	Vitamin A (IU)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Vitamin C (mg)
Rice	100	3.64	.072	.09	.013	--	.0008	.0002	.016	--
Pasta	100	3.43	.103	.26	.021	--	.0012	.0008	011	--
Beans	100	3.37	.220	.86	.076	.05	.0054	.0019	.021	.03
Yuca	68	1.01	.005	.24	.007	.03	.0004	.0003	.005	.27
Beef	81	1.98	.151	.03	.026	--	.0005	.0014	.035	--
Chicken	69	1.17	.126	.10	.010	--	.0006	.0011	.062	--
Pork	86	1.86	.133	.04	.014	--	.0071	.0017	.038	--
Sausage	93	3.79	.113	.39	.032	.51	.0023	.0018	.027	--
Eggs	88	1.30	.099	.48	.022	1.10	.0012	.0033	.001	--
Milk	100	.65	.033	1.52	.003	.35	.0004	.0020	.001	.01
Sugar	100	3.84	--	--	--	--	--	--	--	--
Oil	100	8.84	--	.05	.001	--	--	--	--	--
Plantain	69	.91	.008	.01	.006	2.62	.0005	.0003	.0003	.19
Bread	100	3.07	.093	.32	.017	--	.0010	.0006	.0110	--

Source: INCAP - ICNND, Food Composition Table for Use in Latin America, 1961

*Those figures not available in INCAP composition tables taken from the official Food Balance Sheet for Dominican Republic; Oficina Nacional de Estadistica, Hoja de Balance de Alimentos para la Republica Dominicana, 1971.

TABLE C.17

DOMINICAN REPUBLIC

AVERAGE DAILY HOUSEHOLD CONSUMPTION OF CALORIES AND PROTEINS BY INCOME GROUPS, SANTO DOMINGO, 1969

Food Item	INCOME GROUPS* (RD $0-$4.99) Calories	Proteins	(RD $10-$14.99) Calories	Proteins	(RD $20-$24.99) Calories	Proteins	(RD $25-$29.99) Calories	Proteins	(RD$50-$99.99) Calories	Proteins
Rice	287.2	56.8	2692.5	54.5	4066.7	80.4	4222.3	83.5	3284.7	65.0
Pasta	216.5	6.5	175.7	5.3	229.5	6.9	190.5	5.7	232.2	7.0
Beans	771.1	50.3	613.6	40.1	744.0	48.6	831.7	54.3	712.8	46.5
Cassava	167.3	.9	114.9	.6	250.0	1.3	299.1	1.5	205.0	1.0
Beef	156.2	11.9	180.3	13.8	516.6	39.4	598.6	45.7	569.4	43.4
Chicken	36.9	3.9	33.3	3.6	187.9	20.2	158.8	17.1	402.5	43.4
Pork	44.0	3.2	74.1	5.3	124.4	8.9	183.6	13.1	167.8	12.0
Sausage	29.9	.9	64.7	1.9	228.2	6.8	210.5	6.3	320.6	9.6
Eggs	--	--	11.1	.9	21.7	1.7	56.1	4.3	132.0	10.0
Milk	10.3	.6	22.2	1.1	39.1	2.0	60.2	3.1	69.7	3.6
Sugar	787.7	--	1245.0	--	2132.2	--	2369.3	--	3335.4	--
Oil	1046.2	--	1382.7	--	2129.0	--	2454.4	--	3041.0	--
Plantains	671.4	5.9	1149.5	10.1	1735.1	15.3	--	--	2301.4	20.2
Bread	532.9	16.2	576.5	17.5	903.7	27.4	1202.8	36.5	1099.4	33.3
Grand Total (Household)	4757.6	157.1	8336.1	154.7	13308.1	258.9	12837.9	271.1	15873.9	295.0
Total Per Capita	603.00	19.91	1465.04	27.18	1989.25	38.70	2080.70	43.94	2783.9	52.31
Percent of Sample	4.4		12.9		7.9		5.9		19.3	

Source: Calculated from unpublished data from the Income and Expenditure Survey 1969; food prices from the Central Bank; and nutrient content data from INCAP/

*Dominican pesos per month (1 peso = $1 U.S., 1969)

TABLE C.18

DOMINICAN REPUBLIC

QUANTITY AND COST OF DAILY TARGET DIET FOR 6.8 MEMBER HOUSEHOLD

Food Item	Cost ($RD)	Quantity (Kg)
Rice	.1345	.9024
Pasta	.0150	.0677
Beans	.0398	.2115
Cassava	.0130	.2030
Beef	.1421	.2876
Chicken	.1565	.3440
Pork	.0400	.0902
Sausage	.0408	.0846
Eggs	.072	.1015
Milk	.0161	.1072
Sugar	.0851	.8686
Oil	.1933	.3440
Plantain	.2934	2.5290
Bread	.0587	.3581
	1.3355	

TABLE C.19

Socio Economic Data Tabulated for Sub Sample of Western Altiplano Farm Households Using Less than Three Hectares

	All Farms	Loan Users	Non-Loan Users
Number of family members	6.4	6.5	6.3
Over 64	.3	.2	.5
12-64 (men)	2.2	2.2	2.2
12-64 (women)	1.9	1.9	2.0
Under 12	1.9	2.2	1.7
Total income in 1973	539.3	723.2	367.4
Crop Sales	318.1	482.1	164.9
Livestock sales	12.4	18.2	6.9
Other	208.9	223.0	195.7
Total Consumption in 1973	387.8	505.0	278.2
Food	60.8	74.6	47.8
Clothing	12.4	13.0	11.9
Personal articles	18.0	15.3	20.6
Household articles	5.8	8.5	3.3
Other	58.9	87.2	32.4
Land Tenancy (Total)	1.54	1.76	1.34
Hectares of land owned	1.39	1.53	1.26
Rented	.13	.19	.07
Share cropped	.01	.01	--
Other	.02	.03	.01
Land Use (Total)	1.55	1.76	1.34
Hectares in seasonal crops	1.30	1.57	1.05
Permanent crops	.01	.02	--
Pastures	.03	.02	.05
Other	.20	.15	.25

TABLE C.20

CORN

COSTS OF PRODUCTION PER HECTARE

	Month of Operation	Purchased Inputs	Costs		Labor Days	
			Machinery	Animal Power	Family	Hired
Prepare Land	May		4.35	.08	10.5	12.7
Planting	June	10.86	.84		6.9	7.4
Apply fertilizers and chemicals	July	24.25				1.5
Cultivate	August		3.28	.11	5.6	5.5
Apply fertilizers and chemicals	August	24.25			2.0	1.5
Harvest	December		2.75	.08	13.8	18.7
Total		59.36	11.22	.27	40.8	47.3

Yield = 2269 Kilos

Farm Gate Price = .1240/Kilo

Source: Guatemala Sector Analysis Survey, 1974

TABLE C.21

BEANS

COST OF PRODUCTION PER HECTARE

	Month of Operation	Purchased Inputs	Costs		Labor Days	
			Machinery	Animal Power	Family	Hired
Prepare Land	July		1.35	.55	12.1	11.9
Planting	July	.41	.03		7.1	7.5
Apply fertilizers, chemicals and/or irrigation	August	15.86	--		2.2	2.3
Cultivate	September		.05		9.5	11.7
Apply fertilizers and/or chemicals	September	15.86			2.2	2.3
Harvest	January	4.39	.03		10.6	11.1
Total		77.11	1.46	.55	43.7	46.8

Yield = 769

Farm Gate Price = .294/Kilo

Source: Guatemala Sector Analysis Survey, 1974

TABLE C.22

WHEAT

COST OF PRODUCTION PER HECTARE

	Month of Operation	Purchased Inputs	Costs		Labor Days	
			Machinery	Animal Power	Family	Hired
Prepare Land	March	1.13		.09	2.3	1.4
Planting	May			.01	1.0	.8
Apply fertilizers, chemicals and/or irrigation	May	1.84		.02	.2	.2
Cultivate	July				1.7	1.3
Apply fertilizers and/or chemicals	August	1.84			.2	.2
Harvest and Market	October	.39	—	.02	1.4	.9
Total		5.19		.14	6.8	4.8

Yield = 382

Farm Gate Price = .1170

Source: Guatemala Sector Analysis Survey

TABLE C.23

POTATO

COST OF PRODUCTION PER HECTARE

	Month of Operation	Purchased Inputs	Costs		Labor Days	
			Machinery	Animal Power	Family	Hired
Prepare Land	April		2.59	.40	24.3	18.6
Planting	May				36.2	18.3
Apply fertilizers, chemicals and/or irrigation	April	71.37			7.3	2.4
Cultivate	June				23.9	9.3
Apply fertilizers, chemicals and/or irrigation	July	70.95			7.3	2.3
Harvest and Market	August	53.34			50.2	21.9
		195.66	2.59	.40	149.2	72.8

Yield = 8317

Farm Gate Price = .1145/Kilo

Source: Guatemala Sector Analysis Survey 1974

TABLE C.24

GARLIC

COST OF PRODUCTION PER HECTARE

	Month of Operation	Costs: Purchased Inputs	Costs: Machinery	Costs: Animal Power	Labor Days: Family	Labor Days: Hired
Prepare Land	September			26.55	7.8	16.8
Apply fertilizers, chemicals and/or irrigation	October	273.16			9.5	7.8
Planting	November	6.91			3.8	113.3
Cultivate	December				9.1	75.3
Harvest	February	62.45			7.5	47.7
		342.52	0.00	26.55	37.7	260.9

Yield = 5424

Farm Gate Price = .4140/Kilo

Source: Guatemala Sector Analysis Survey, 1974

TABLE C.25

CORN AND BEANS INTERPLANTED

COSTS OF PRODUCTION PER HECTARE

	Month of Operation	Costs: Purchased Inputs	Costs: Machinery	Costs: Animal Power	Labor Days
Prepare Land	May			3.09	17.4
Apply fertilizer, pesticides	June	31.72			2.8
Plant Corn	June	.19			16.4
Cultivate	July			.11	13.4
Plant Beans	July	.31			12.0
Cultivate	October				17.5
Harvest	January	1.61		.98	17.8
Total		33.83	--	3.20	97.30

Corn Yield = 1680 Kg/ha

Bean Yield = 282 Kg/ha

Source: Guatemala Sector Analysis Survey 1974

TABLE C.26

AVERAGE USE OF PRODUCTION OF FIVE CROPS
BY SMALL FARMERS IN THE
WESTERN HIGHLANDS, GUATEMALA
(Kg.)

Crop	Total Production	Sales	Consumption	Seeds	Lost	Other
Corn, improved	1,292	1,148	40	82	18	6
Corn, traditional	1,223	749	324	147	4	0
Beans, improved	1,298	411	782	90	15	0
Beans, traditional	1,443	480	850	93	10	9
Wheat	364	143	203	15	3	2
Potato	2,503	1,881	84	493	0	45
Garlic	3,753	3,311	1	441	0	0

TABLE C.27

CROPPING CALENDAR USED IN FARM MODEL

	Crop					
Month	Corn	Beans	Wheat	Potato	Garlic	Corn and Beans Interplanted
March			▮	▮		
April	▮		▮	▮		▮
May	▮		▮	▮		▮
June	▮	▮	▮	▮		▮
July	▮	▮	▮			▮
August	▮	▮				▮
September	▮	▮			▮	▮
October	▮	▮			▮	▮
November	▮	▮			▮	▮
December	▮	▮			▮	▮
January		▮			▮	
February					▮	

TABLE C.28

CHARACTERISTICS OF CREDIT USED BY SMALL FARMERS IN THE WESTERN ALTIPLANO, GUATEMALA

Credit Sources	Number of Loans	Interest %	Average Size Q$	Term Months
Bandesa (government)	120	8.0	228	11.8
Coops	13	4.4	70	11.1
Other	8	4.6	272.8	11.3

TABLE C.29

COST AND NUTRIENT CONTENT OF COMMON FOODS EATEN IN GUATEMALA, WESTERN ALTIPLANO
(Adjusted for Inedible Portions)

Food Item or Crop	Expenditure Weighting	Price/ Kilo	Calories	Proteins	Iron	Vitamin A
Corn	1.000	14.23	3.60	.093	.027	.03
Beans	1.000	36.11	3.36	.220	.077	.03
Potatoes	1.000	17.63	.63	.016	.006	--
Garlic						
Meat	1.000	95.41				
Beef without bones	--	--	1.10	.129	.020	.010
with bones	.545	84.68				
Chicken	.217	101.93				
Pork	.174	98.79				
Fish	.041	142.70				
Sausage	.023	178.31				
Rice	1.000	40.48	3.64	.072	.013	--
Bread	1.000	95.87	2.90	.103	.022	.03
Milk and Eggs	1.000	77.29	1.38	.109	.016	.932
Eggs	.565	85.91				
Fresh Milk	.219	18.68				
Powdered Milk	.034	198.13				
Cream	.025	181.70				
Fresh Cheese	.156	86.50				
Vegetables		24.91	.35	.004	.007	.459
Tomato	.349	33.02				
Onion	.298	31.45				
Guisquil (Squash)	.262	12.38				
Carrots	.031	5.08				
Cabbage	.054	11.43				
Fresh Fruit		12.94	.48	.006	.006	.172
Bananas	.274	9.43	.67			
Plantains	.140	15.85				
Oranges	.326	9.43				
Avocado	.072	45.35				
Lemons	.164	8.50				
Pineapples	.025	16.24				
Melons	--	--				
Sugar, Salt and Condiments		12.14	3.08	.001	.016	--
Sugar	.448	9.38				
Panela	.381	17.38				
Salt	.135	9.77				
Cinnamon						
Fats and Oils		84.00	7.82	--	--	--
Edible Oil	.155	44.11				
Lard (Vegetable)	.058	58.19				
(Pork)	.788	84.96				

D. Results

The solution results for the urban and farm models are presented below. Results are not directly comparable due to differences in formulation for the two types of households. These differences will be discussed in the individual treatments, however.

The Urban Model

With respect to the urban models the results for the four countries are presented in Tables D.1 through D.4. In general, it should be evident that for lower food budgets, the optimum food pattern is determined by eliminating those foods with the highest cost per unit of weight. For example, in the table for Bolivia as the budget varies from 32.5 to 28.5 pesos, some fish, cheese and canned goods are eliminated. With a further reduction, meat, fats and oils are removed. The only foods which remain at the lowest budget level are cereals, fruits and vegetables, potatoes and sugar.

Since individual items are grouped into categories for the Bolivia and Colombia tables the sequential pattern is not as evident as it is, for example, in the table for the Dominican Republic (D.3). In this case it is possible to observe the elimination process, product by product, as the budget is successively lowered.

Although the results may indicate at this point that the methodology is somewhat simplistic, the reader should reserve judgment until the following chapter where the model results will be evaluated against observed survey data. In fact, the simplicity of the decision criteria used in the model may allow insights into behavioral aspects of food consumption.

The Farm Model

The results of the application of the farm model to data from the Western Altiplano, Guatemala is shown in Table D.5. As can be seen in the table, the optimum farm organization plan for purposes of maximizing profits would be to plant, sequentially, cash crops of garlic and potatoes on 94 per cent of the farmland, with enough corn, beans, and wheat planted to maintain stored stocks, and to purchase all food for household consumption. The expected return from such a farm operation is very high ($2,203), about four times as high as the average income recorded for small farmers in the western altiplano in 1973. Possible reasons for this discrepancy include the failure to account for some costs, failure to consider risk, and lack of restrictions on diet composition.[1/] In any case, this result was only possible as long as adequate operating capital (above $392) was available.

1/ Since the only constraints on the diet were its calorie, protein, iron and vitamin A content, the optimum diet was composed of only two food groups--dried corn and vegetables.

The effect of the availability of credit on farm income possibilities is dramatically illustrated in Figure D.1. The minimum amount of operating capital needed to produce a positive return is slightly less than 210 quetzales. Any amount above the minimum produces striking marginal returns which gradually level off as informal credit resources are exhausted and institutional sources tapped.

The availability of credit has noticeable effects on other variables as well. As can be seen in Table D.5, the cropping pattern consistently changes as credit availability declines. Less land is dedicated to cash crops (garlic and potatoes) and consistently more land to the lower cost crops--wheat, corn and beans. The use of hired labor quickly drops off as credit becomes short, and family labor input declines more gradually. As for the household diet, a scarcity of credit results in a greater reliance on home produced foods.

Similar variations were made for the availability of land, but are not reported here since results were not nearly as revealing. As land available for seasonal crops was varied from 1.3 to .3 hectares, the cropping pattern, labor usage and household diet did not change in composition, only in scale.

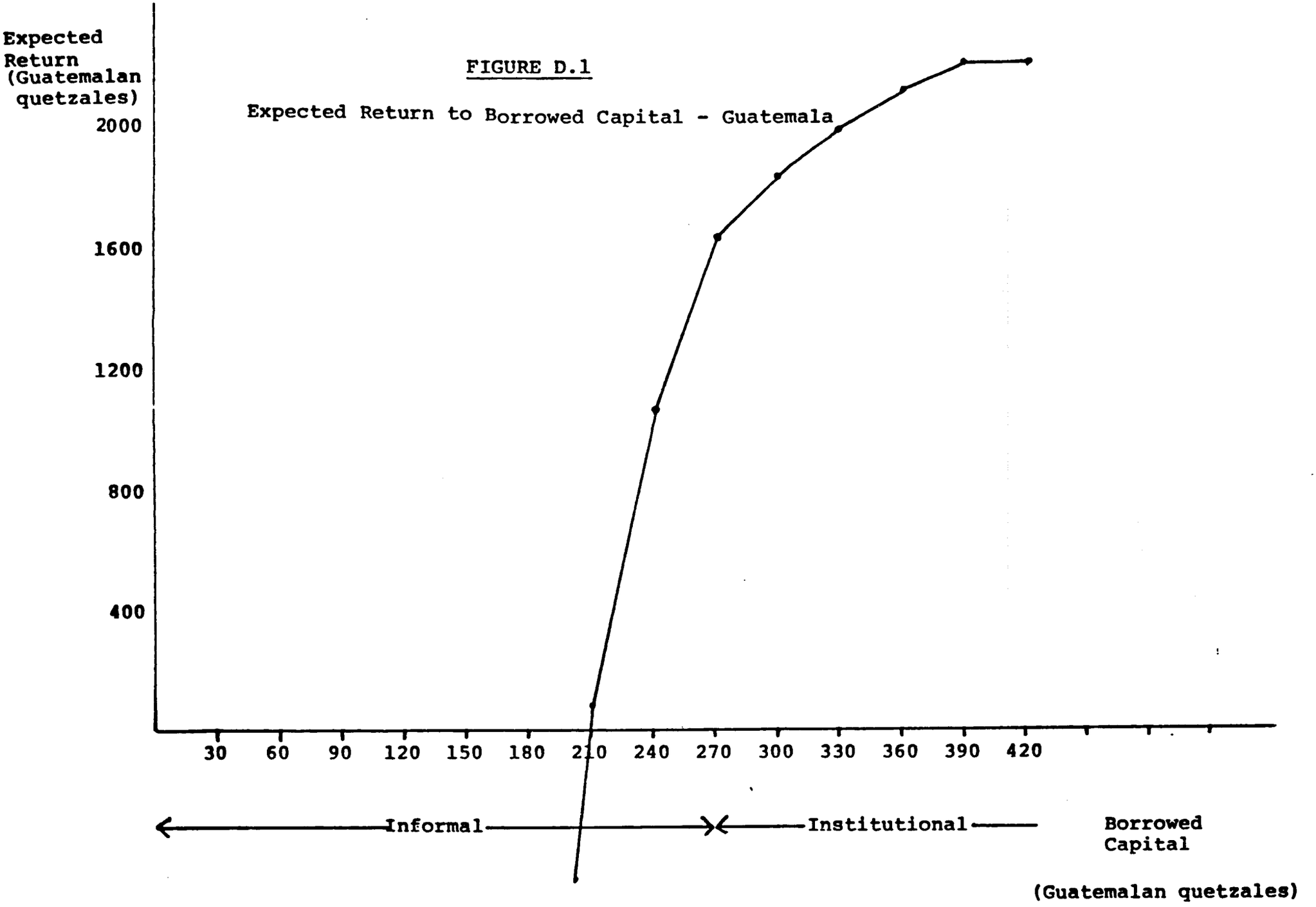


FIGURE D.1

Expected Return to Borrowed Capital - Guatemala

TABLE D.1

BOLIVIA

RESULTS OF DIET MODEL APPLICATION BY DAILY HOUSEHOLD FOOD BUDGET LEVELS

Food Item	Budget Levels*							
	32.5	28.5	24.5	20.5	16.5	12.5	8.5	4.5
	Grams/Household/Day**							
Cereals	2934.3	2934.3	2934.3	2934.3	2934.3	2934.3	2934.3	1650.0
Meat	167.9	789.3	789.3	.8	0.0	0.0	0.0	0.0
Fish	72.6	61.2	61.2	61.2	0.0	0.0	0.0	0.0
Fats and Oils	260.7	260.7	206.7	126.7	0.0	0.0	0.0	0.0
Milk and Eggs	663.9	606.4	606.4	606.4	443.5	0.0	0.0	0.0
Fresh Fruits and Vegetables	2016.3	2016.3	2016.3	2016.3	1672.4	1028.5	468.4	468.4
Canned Fruits and Vegetables	20.9	6.5	6.5	6.5	6.5	0.0	0.0	0.0
Potatoes and Derivatives	816.0	816.0	816.0	816.0	816.0	816.0	61.1	0.0
Tea and Coffee	16335.5	16335.5	16355.5	16355.5	16355.5	16355.5	16355.5	16355.5
Other Non-alcoholic Beverages	293.2	293.2	293.2	293.2	293.2	293.2	293.2	0.0
Sugar	426.5	426.5	426.5	426.5	426.5	426.5	426.5	426.5
Calories per day (household)	14874.6	14511.6	13419.3	11317.7	9774.6	8970.6	7957.9	4446.5
Calories per day (per capita)	2656.2	2591.4	2409.2	2021.0	1745.5	1601.9	1421.1	794.0
Proteins Grams/Day (household)	426.7	400.0	337.2	278.8	254.7	210.3	185.0	78.2
Proteins Grams/Day (per capita)	76.2	71.4	60.2	49.8	45.5	37.6	33.0	14.0

* Bolivian pesos per day (11.88 pesos = $1 U.S., 1967)

**Prepared quantities used for some cereals, dried legumes, tea and coffee.

TABLE D.2

COLOMBIA

RESULTS OF DIET MODEL APPLICATION BY DAILY HOUSEHOLD FOOD BUDGET LEVELS

Food Item	Budget Levels* 46.1	41.0	35.0	29.0	23.0	17.0	11.0
	Grams/Household/Day**						
Bread and Cereals	3283.8	3283.8	3283.8	3265.9	3067.1	3039.0	2816.5
Meat	700.8	501.1	178.4	64.3	0.0	0.0	0.0
Milk, Cheese and Eggs	985.5	973.8	973.8	848.9	819.4	84.7	0.0
Oil, Lard and Grease	263.3	238.5	238.5	68.6	0.0	0.0	0.0
Fruits and Vegetables	2264.3	2264.3	2264.3	2264.3	2232.0	1927.3	794.6
Potatoes, Plantains and tubers	2252.9	2252.9	2252.9	2252.9	2252.9	2252.9	1994.9
Sugar and Panela	995.0	995.0	995.0	995.0	995.0	995.0	995.0
Other Foods **	32847.9	32847.9	32847.9	32847.9	32708.9	32708.9	32708.9
Calories/Day (Household)	14899.1	14067.2	13327.3	11253.8	10250.8	9670.5	5705.9
Per day (per capita)	2350.0	2218.8	2102.1	1775.0	1616.8	1539.5	900.0
Proteins (household)	365.0	319.7	260.2	232.7	212.1	177.6	108.1
Grams/Day (per capita)	57.6	50.4	41.0	36.7	33.5	28.0	17.1

* Colombian pesos per day (21 peso = $1 U.S., 1971).

** Prepared quantities used for some cereals, dried legumes, tea and coffee.

TABLE D.3

DOMINICAN REPUBLIC

RESULTS OF DIET MODEL APPLICATION BY DAILY HOUSEHOLD FOOD BUDGET LEVELS

Food Item	Budget Levels*						
	$1.35	$1.22	$1.02	$ .82	$ .62	$ .42	$ .22
	Grams/Household/Day						
Rice	902.4	902.4	902.4	902.4	902.4	191.4	0.0
Pasta	67.7	67.7	67.7	67.7	0.0	0.0	0.0
Beans	211.5	211.5	211.5	211.5	102.4	0.0	0.0
Cassava	203.0	203.0	203.0	203.0	203.0	203.0	203.0
Beef	287.6	287.6	257.5	0.0	0.0	0.0	0.0
Chicken	344.0	344.0	344.0	273.6	0.0	0.0	0.0
Pork	90.2	90.2	90.2	90.2	0.0	0.0	0.0
Sausage	84.6	84.6	84.6	0.0	0.0	0.0	0.0
Eggs	101.5	0.0	0.0	0.0	0.0	0.0	0.0
Milk	107.2	107.2	107.2	107.2	107.2	0.0	0.0
Sugar	868.6	868.6	868.6	868.6	868.6	868.6	868.6
Oil	344.0	329.4	0.0	0.0	0.0	0.0	0.0
Plantain	2529.0	2529.0	2529.0	2529.0	2529.0	2529.0	1050.7
Bread	358.1	358.1	358.1	358.1	358.1	0.0	0.0
Calories per Day (household)	15873.8	15612.6	12641.3	11728.5	10640.8	6538.6	4496.6
Calories per Day (per capita)	2784.9	2739.0	2217.8	2057.6	1866.8	1147.1	788.9
Proteins Grams/Day (household)	294.9	284.9	280.3	223.0	145.6	35.0	9.4
Proteins Grams/Day (per capita)	52.3	50.5	49.7	39.5	25.8	6.2	1.6

TABLE D.4

GUATEMALA

RESULTS OF DIET MODEL APPLICATION BY DAILY HOUSEHOLD FOOD BUDGET LEVELS

Food Item	Budget Levels* $3.70	$3.20	$2.70	$2.20	$1.70	$1.20	$ .70
	Grams/Household/Day						
Meat	1001.6	587.9	67.0	0.0	0.0	0.0	0.0
Fish	611.0	0.0	0.0	0.0	0.0	0.0	0.0
Cereals	2633.0	2633.0	2633.0	2633.0	2633.0	1473.8	0.0
Milk and Eggs	2265.2	2265.2	2265.2	1567.5	216.1	0.0	0.0
Vegetables	1728.8	1728.8	1728.8	1728.8	1728.8	1728.8	1728.8
Potatoes	211.0	211.0	211.0	211.0	211.0	211.0	211.0
Beans	6.9	6.9	6.9	6.9	6.9	6.9	0.0
Fruit	1252.7	1252.7	1252.7	1252.7	1252.7	1252.7	915.9
Fats and Oils	231.3	231.3	231.3	0.0	0.0	0.0	0.0
Sugar	784.5	784.5	784.5	784.5	784.5	784.5	784.5
Coffee	14.6	0.0	0.0	0.0	0.0	0.0	0.0
Non-Alcoholic Berages	289.2	289.2	289.2	289.2	289.2	0.0	0.0
Other Foods	95.4	95.4	95.4	0.0	0.0	0.0	0.0
Calories (household)	17307.8	16610.1	15834.0	12919.9	11798.2	7956.7	3670.0
per Day (per capita)	2704.3	2595.3	2474.1	2018.7	1843.5	1243.2	573.4
Proteins (household)	509.2	431.4	348.0	304.9	242.8	140.9	21.0
Grams/Day (per capita)	79.6	67.4	54.4	47.6	37.9	22.0	3.3

* Guatemala quetzales per day (1 quetzal = $1 U.S., 1969)

TABLE D.5

GUATEMALA FARM MODEL: RESULTS OF PARAMETRIC VARIATION OF AVAILABLE CREDIT

Available Credit	Expected Return (Quetzales)*	Sales	Assets at Month 12 Quetzales*	Cropping Pattern (hectares) Corn	Beans	Wheat	Garlic	Potatoes	Corn & Beans	Food Purchased %	Home Grown %	Labor Family Days	Hired
$ 0.00													
182.00													
192.00													
202.00	489.3	622.3	0.0	.048	.501	.157	.049	.429	.168	89	16	178.1	0.0
212.00	79.9	1118.5	230.6	.000	.495	.128	.237	.511	.168	89	11	247.3	0.0
222.00	440.5	1551.1	589.8	.000	.426	.128	.406	.580	.168	89	11	306.8	0.0
232.00	782.5	1964.7	930.5	.000	.356	.128	.507	.650	.168	87	13	297.6	3.4
242.00	1058.5	2310.7	1205.5	.000	.287	.128	.697	.719	.168	91	9	350.9	18.7
272.00	1631.5	3053.3	1776.4	.000	.105	.057	.972	.890	.168	87	13	442.9	71.8
302.00	1847.3	3340.8	1991.3	.000	.021	.027	1.086	.948	.168	93	7	454.9	98.3
332.00	1995.2	3547.6	2138.7	.000	.000	.027	1.112	1.103	.162	94	7	478.5	114.7
362.00	2109.7	3733.7	2252.8	.000	.000	.027	1.177	1.146	.098	97	3	481.7	134.0
392.00	2203.2	3887.3	2345.9	.000	.022	.027	1.216	1.216	.036	100	0	486.1	152.8
422.00	2203.2	3887.3	2345.9	.000	.022	.027	1.216	1.216	.036	100	0	486.1	152.8

* (1 quetzal = $ 1 U.S., 1974)

E. Analysis

In order for the models under consideration here to qualify as useful planning tools, they must allow relatively accurate prediction of household behavior. The purpose of this chapter is to compare model results with empirical data, for the urban model. For various reasons a rigorous analysis of the farm model is not possible. These reasons will be discussed below.

The Urban Model

Our approach here is to define a representative household based on survey data and to compare per capita calorie and protein consumption for survey households with the model's predictions for calorie and protein consumption of the representative household at different budget levels.

The analysis was begun by computing per capita calorie and protein consumption and total food expenditures for the average household of each income group from the survey data and for the model results at different food budget levels. The two data sets for the four countries studied are graphed in Figures E.1-E.8. In general, a high degree of correspondence is indicated. (The correlations are higher for Bolivia and Colombia, the two countries in which the survey data were more detailed with respect to the number of food commodities.)

As a further test of the predictive power of the two models, statistical tests were performed to test whether the calorie and protein consumption pattern predicted by the urban model and the pattern observed for the average survey households are significantly different. This was accomplished by estimating three

regression equations (for each of the Figures E.1 through E.8)--one regression using the survey data; one using the model results; and one using the two data sets combined. The resulting regressions are presented in Table E.1.[1/]

The statistical tests which were performed are explained more fully in the Appendix to this chapter. Essentially, the tests allowed determination of whether it was possible to conclude that the two data sets are the same (for a 95 per cent confidence level); (i.e. that the model predictions of calorie and protein consumption at different food expenditure levels are the same as those observed in surveys). For all cases except protein consumption in Guatemala, the tests found the two data sets to be the same. These computations are also presented in the Appendix.

Farm Model

The major difficulty in evaluating the validity of the farm model is the lack of detailed data on food consumption and farm management variables disaggregated by income levels and/or farm size. However, the annual earnings predicted by the farm model in this application and the average earnings of Guatemalan small farmers surveyed in 1974 were sufficiently different to indicate that further refinements in the formulation of the farm model are necessary before it can be used as a predictive planning tool.

[1/] It is interesting to note that the fit of the regressions to survey data was very good. In no case was less than 90 per cent of the variance in calorie and protein consumption among income groups explained by the amount of money spent on food, as indi- by the r^2 coefficient.

TABLE E.1

SUMMARY TABLE OF REGRESSION RESULTS

	Survey					Model					Combined Data				
	Intercept	Slope *	R^2	D.F.	Sum of Squares	Intercept	Slope *	R^2	D.F.	Sum of Squares	Intercept	Slope *	R^2	D.F.	Sum of Squares
Calories															
Bolivia	1102.6	48.3	.917	8	95299.8	696.4	65.8	.966	6	98851.6	834.6	59.2	.938	16	280091.3
Colombia	368.4	43.4	.980	4	30095.4	702.3	37.5	.930	5	103546.5	559.5	39.9	.923	11	233735.8
Dominican Republic	79.8	2083.9	.942	3	151363.0	457.8	1819.7	.959	5	148064.3	316.2	190.9	.936	10	402216.9
Guatemala	998.8	483.3	.935	8	331871.3	393.2	694.8	.922	5	285707.3	784.3	545.8	.904	15	900353.0
Proteins															
Bolivia	20.6	1.7	.935	8	89.6	9.4	2.1	.976	6	72.7	13.0	2.0	.954	16	228.0
Colombia	5.7	1.1	.989	4	10.7	7.4	1.0	.974	5	29.2	6.7	1.1	.980	11	41.2
Dominican Republic	9.3	33.1	.930	3	46.9	-7.9	49.5	.927	5	200.5	-1.6	43.8	.888	10	389.3
Guatemala	17.0	17.8	.963	8	252.3	-8.2	24.0	.982	5	74.4	6.2	20.2	.922	15	980.3

Calories (or grams of protein) per unit of local currency

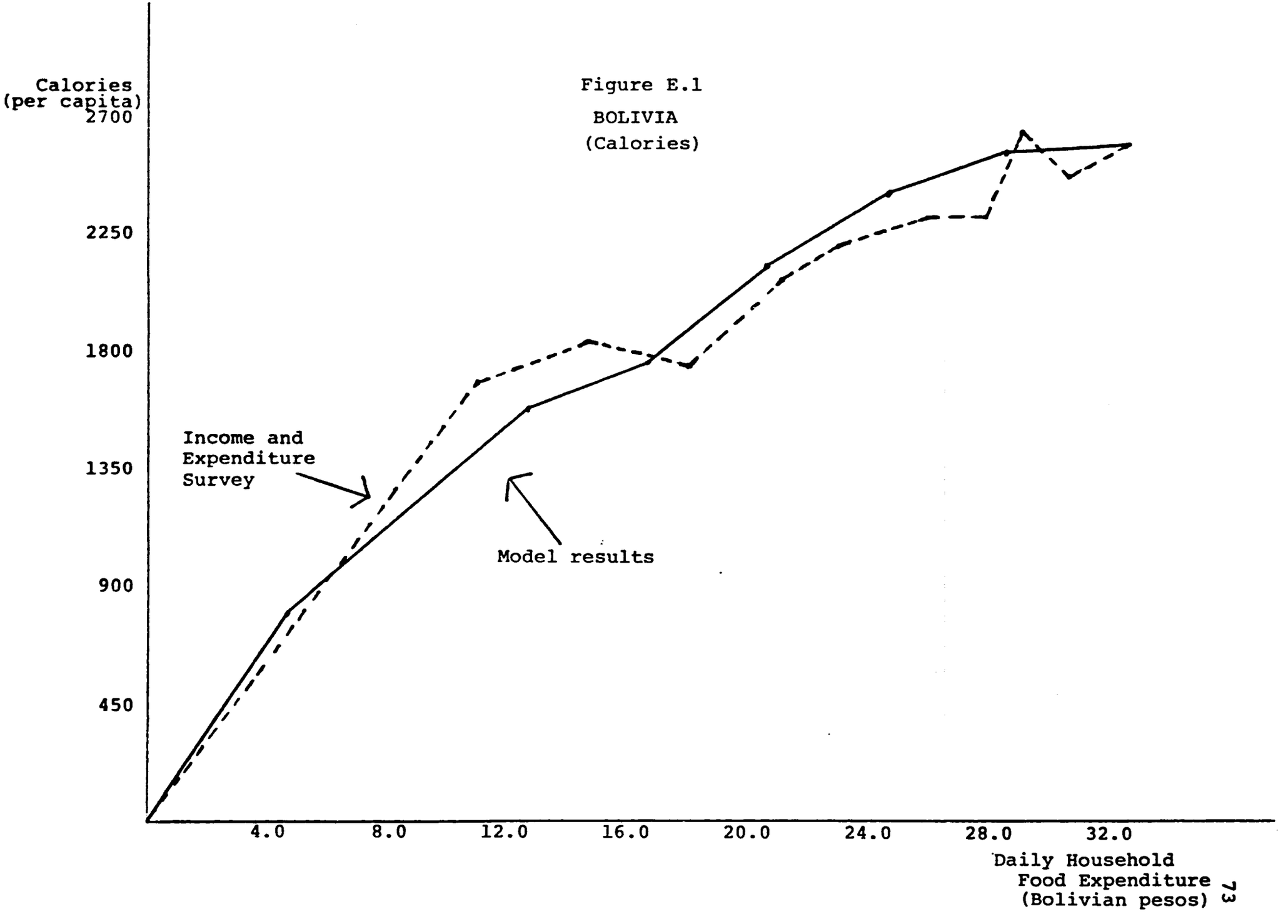


Figure E.1
BOLIVIA
(Calories)
Calories
(per capita)
2700
2250
1800
1350
900
450
Income and
Expenditure
Survey
Model results
4.0
8.0
12.0
16.0
20.0
24.0
28.0
32.0
Daily Household
Food Expenditure
(Bolivian pesos)

Figure E.2

BOLIVIA

(Proteins)

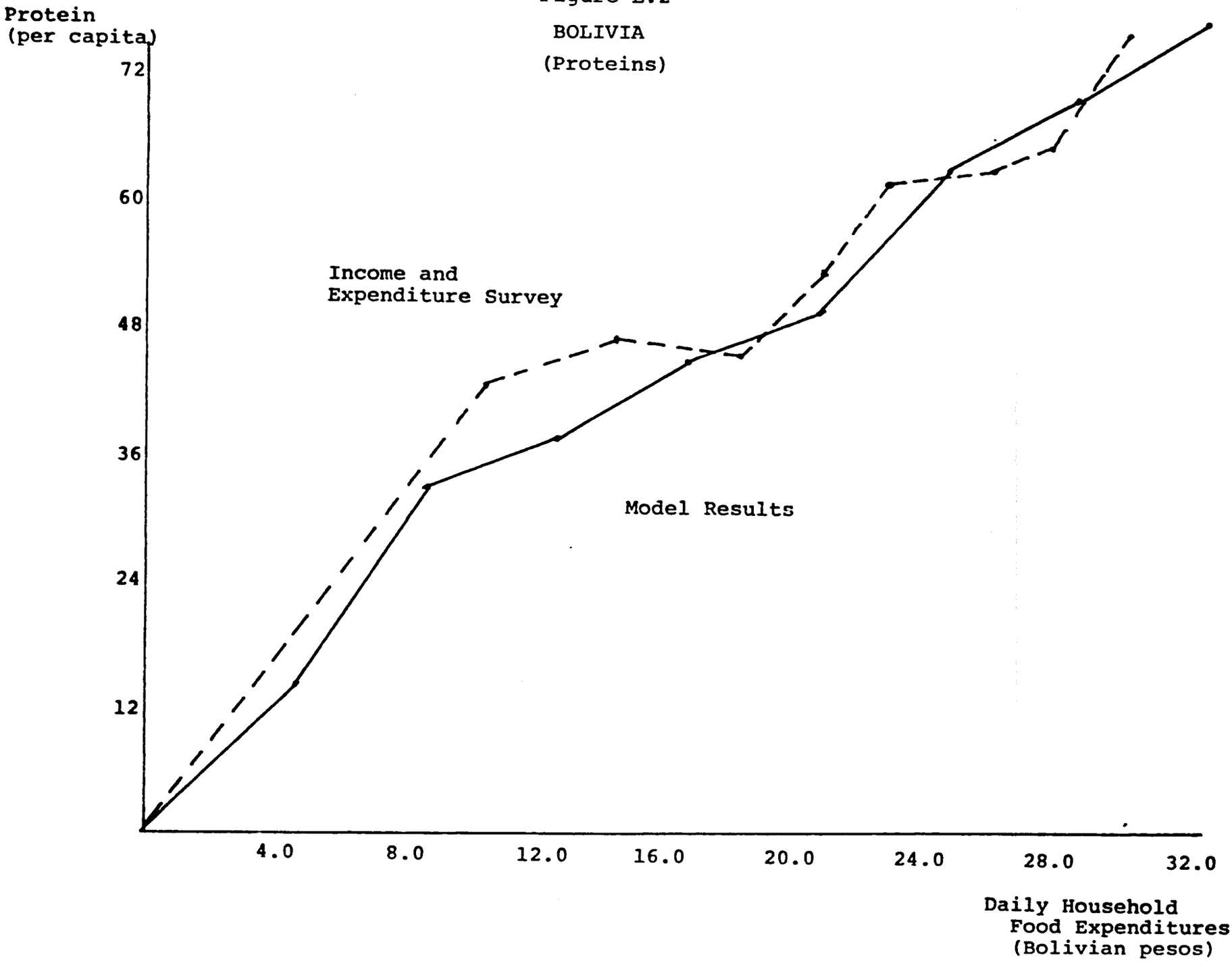
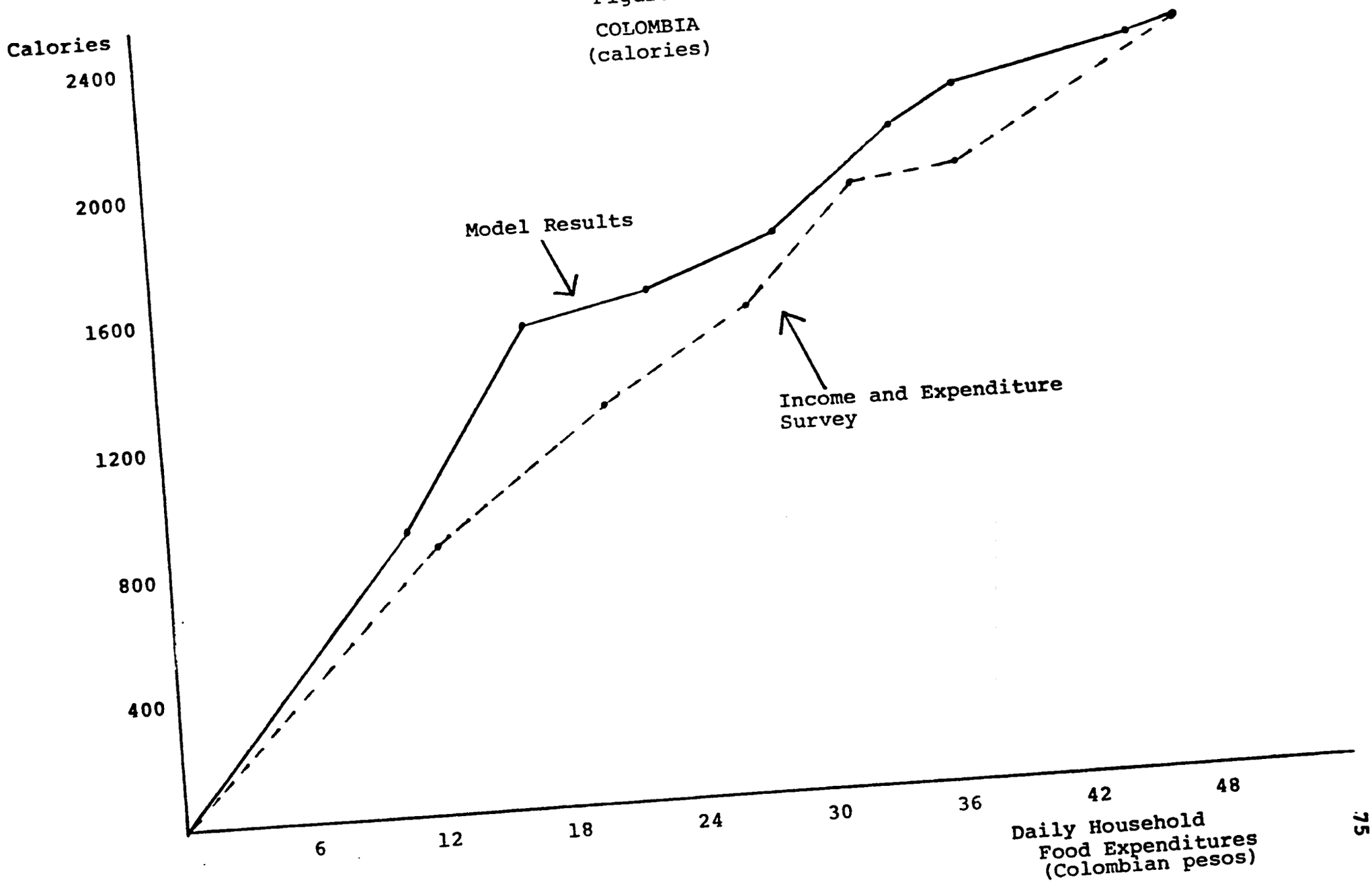


Figure E.3

COLOMBIA
(calories)



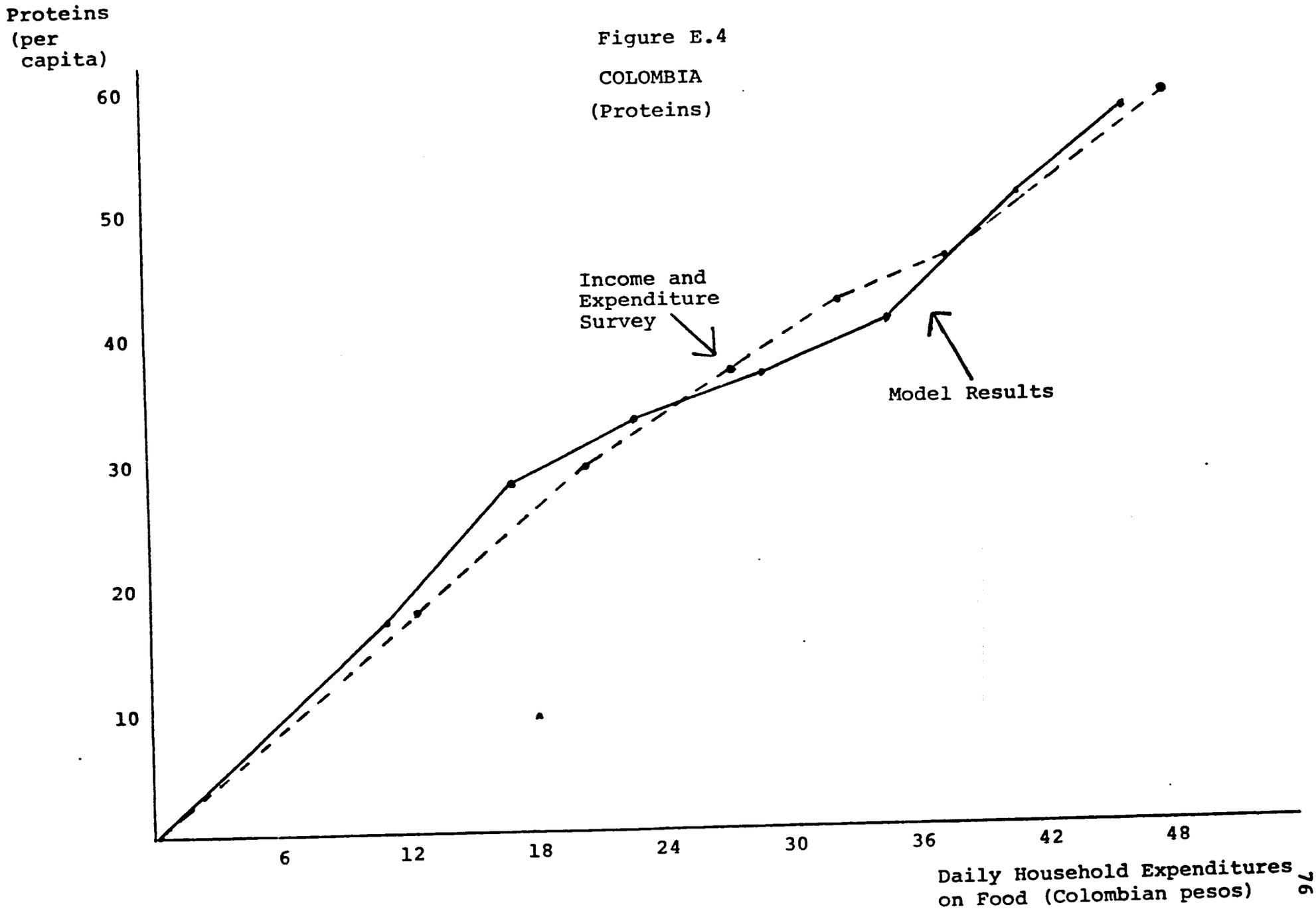


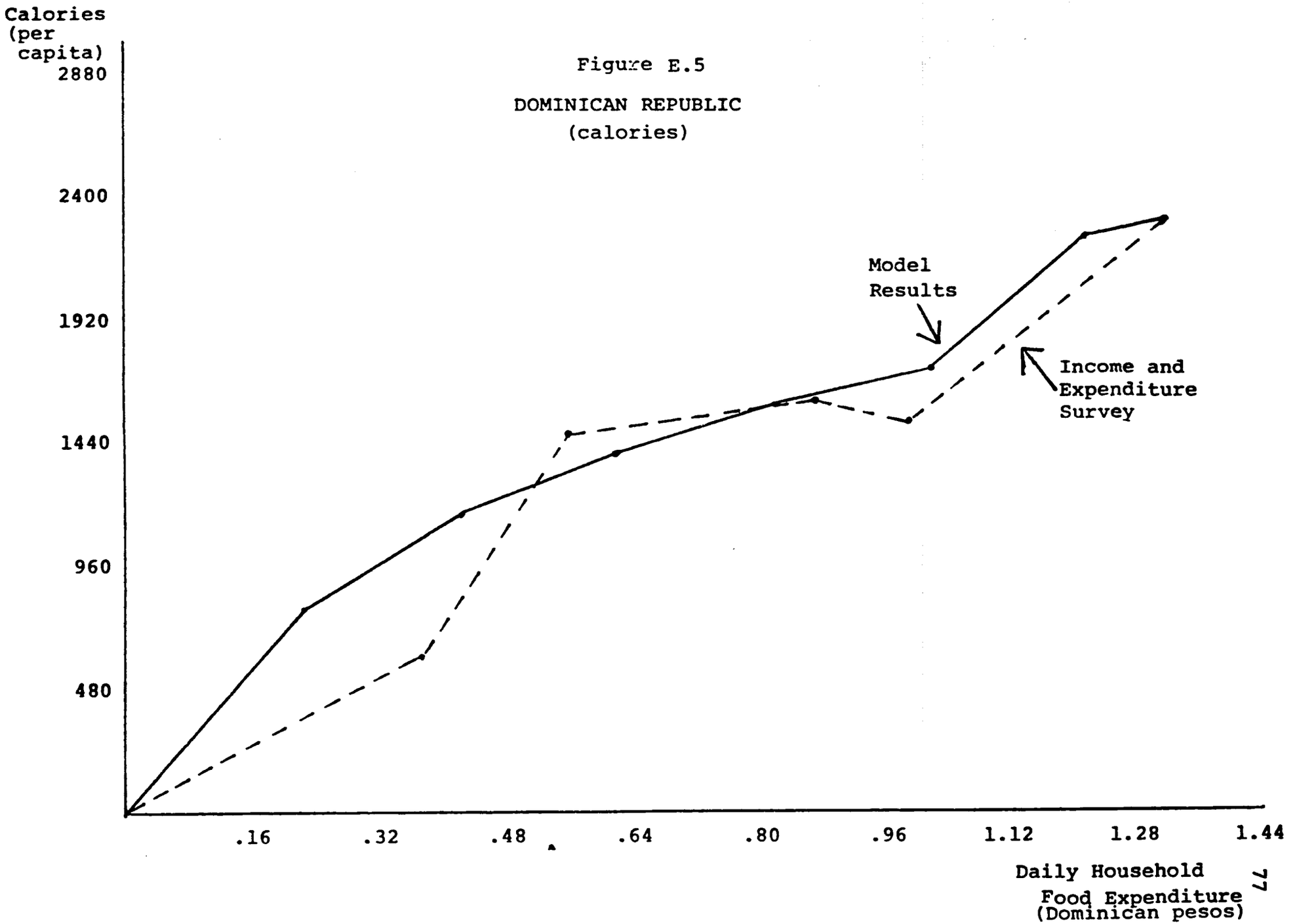
Figure E.4

COLOMBIA

(Proteins)

Figure E.5

DOMINICAN REPUBLIC
(calories)



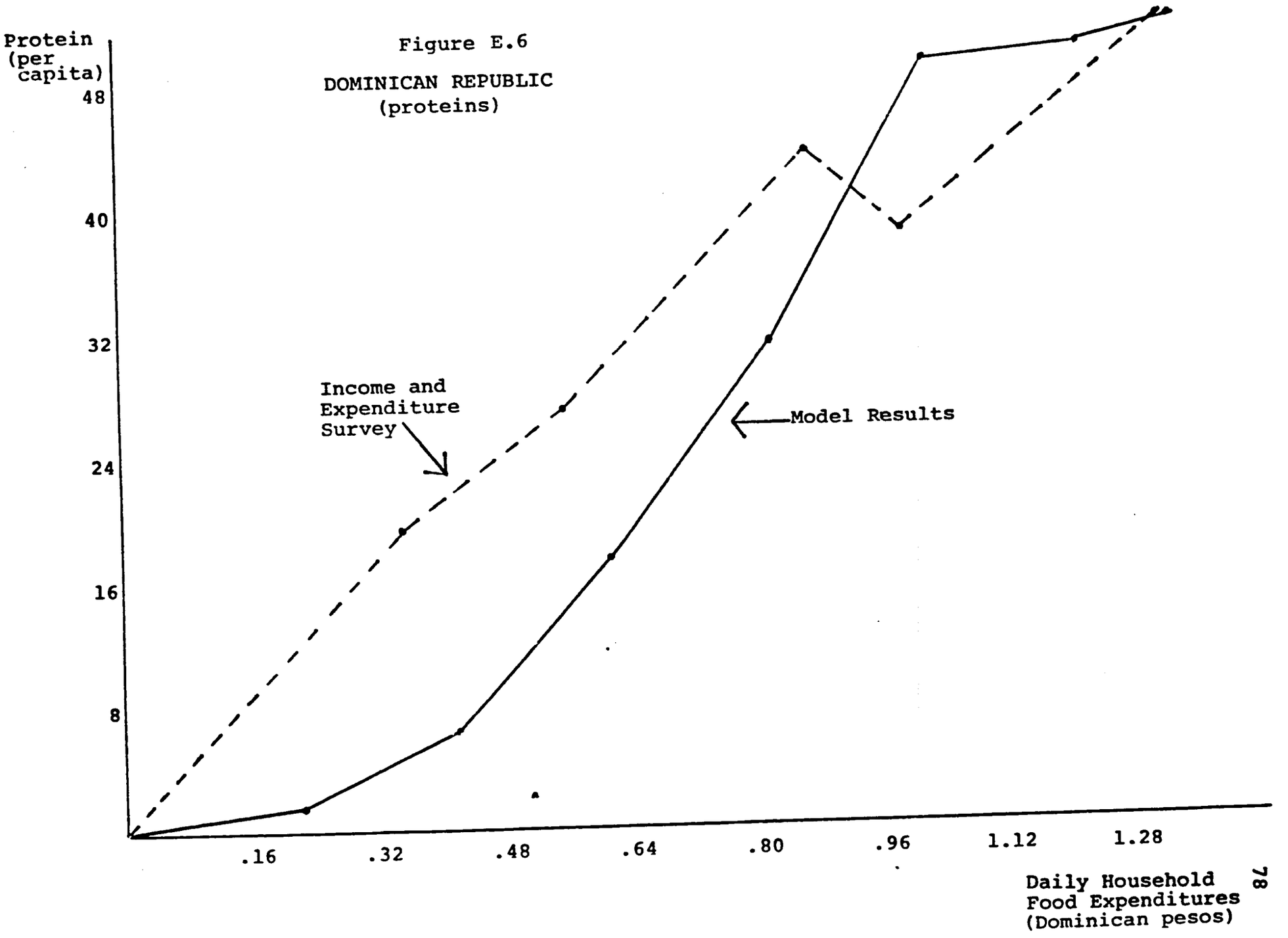


Figure E.6

DOMINICAN REPUBLIC
(proteins)

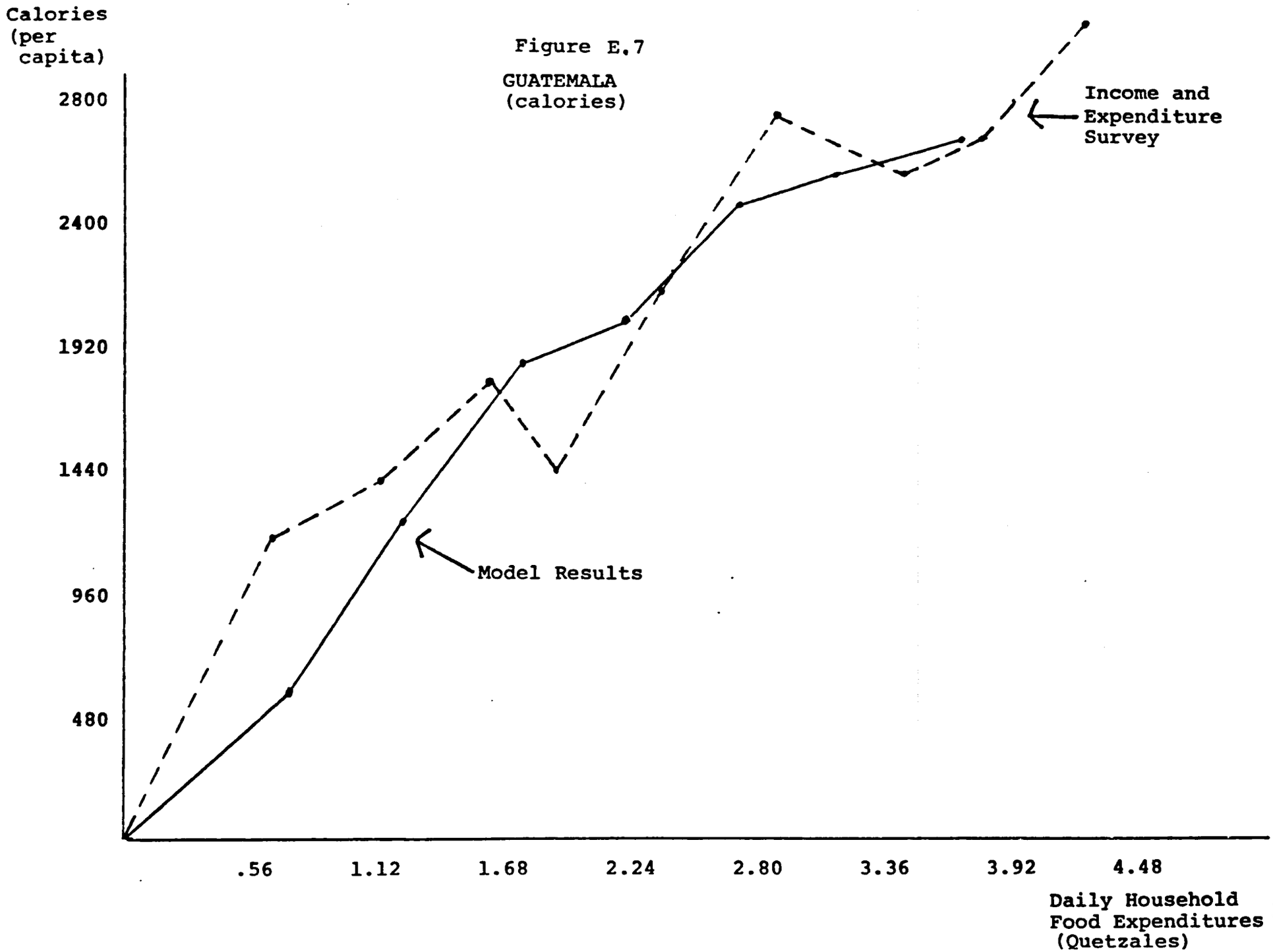

Calories
(per
capita)
2800
2400
1920
1440
960
480
GUATEMALA
(calories)
Income and
Expenditure
Survey
Model Results
.56
1.12
1.68
2.24
2.80
3.36
3.92
4.48
Daily Household
Food Expenditures
(Quetzales)

Figure E.7

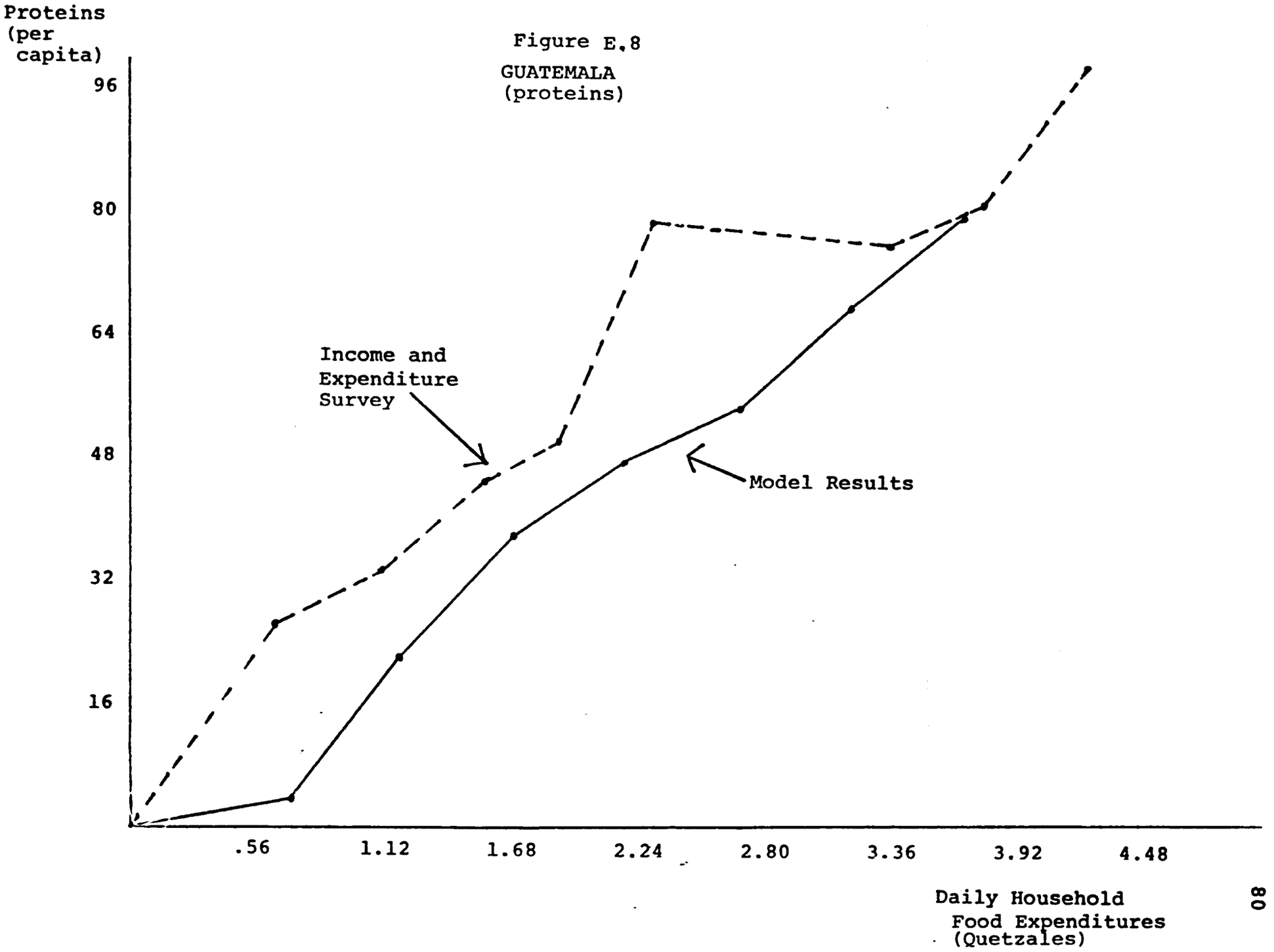


Figure E.8
GUATEMALA
(proteins)

F. Conclusions

It appears from the foregoing analysis that low income urban families in the four countries studied do indeed attempt to follow a preferred dietary pattern, and that their buying decisions related to the acquisition of that diet are very rational. It further appears that food prices and size of food budget are by far the most important factors influencing these decisions, since in every case they explain almost all of the variation observed in calorie and protein consumption.

The results of the farm decision model component of the study show that the single most important factor affecting the production and consumption decisions facing the small farmer is the level of available operating capital. When this capital supply is ample, farm income is high, even on small holdings, and derives chiefly from the production of cash crops. When the supply is restricted, the amount of land dedicated to cash crops diminishes, the use of hired labor decreases, and the production of subsistence crops increases.

The urban food behavior model included here can be used at present for the following kinds of analysis:

(1) to determine the impact on calorie and protein intakes of changes in food prices;

(2) to determine the change in transfer payment needed to offset given price changes, in order to assure a minimum diet;

(3) to predict the probable changes in calorie and protein

consumption levels arising from food price policy enactments.

The farm model presented in this study can be used for the kinds of analysis given below:

(1) to define potential production-consumption patterns and resulting income levels, on small farms;

(2) to examine the effects of various policy options (for example, level of credit) upon production-consumption patterns and level of income;

(3) to determine credit needs for obtaining desired levels of production and consumption.

The quality of results concerning the above kinds of analysis will depend in great degree upon the quality of the data that go into the models themselves. The best kind of environment for the further use of models of these kinds is in the field, where data needs can be assured by constant attention to design and collection.

TABLE F.1

RECOMMENDED PER CAPITA DAILY INTAKES FOR MAJOR NUTRIENTS
(Weighted by Demographic Distributions)

	Calories	Proteins	Calcium (mg)	Phosphorus (mg)	Iron (mg)	Vitamin A (mcg)	Thiamin	Riboflavin	Niacin	Vitamin C
1. Guatemala	2203	56.6	499		11	559	.94	1.18	15	47
2. Colombia	2052	54.9	543		13	797	.80	1.11	13	36
3. Bolivia	2259	54.4	500		10	1150	.86	1.45	15	48
4. Dominican Republic	2235	28.9	494		17	607	1.00	1.30	16	27

Source: 1. Calculated from INCAP Recommended Nutrient Intakes (Evaluacion Nutricional de la Población de Centro America y Panama: Guatemala, 1969) and demographic data from same source (Table 4);

2. Calculated from Instituto Colombiano de Bienestar Familiar, "Recommendación Diaria de Calorias y Nutrientes para la Población Colombiano," Bogota, Sept. 1975 and demographic data from DANE, Encuesta de Hogares, 1970.

3. Calculated from Division Nacional de Nutricion, "Cantodades Minimas de Nutrimentos Recomendadas por Persona y por Dia, La Paz, 1975 and demographic data from Consejo Nacional de Economiá y Planificación.

4. Calculated from FAO Recommendations, 1972, 1970, 1965, 1961 and demographic data from Banco Central, Income and Expenditure Survey, 1969.

G. Recommendations for Further Work

The level of effort in the present contract was insufficient to allow a number of desirable study outputs to be produced. Among these were the following:

1. Standardization of Tables C.4, C.8,C.13 and C.17 to allow better comparison among countries;

2. Estimation of the extent of malnutrition from the above tables and Tables D.1 - D.4;

3. Comparison of the farm model results with other estimates of income, crop mix, and auto-consumption.

In addition to the above elements, which can be done with the existing model formulations, there are several additional methodological avenues which deserve exploration, including:

1. Investigation of the use of objective function weightings in the urban models (one such set of weights would consist of the income elasticities of demand for various foods);

2. Examination of the results of including constraints in the urban models which would allow different substitution effects to be analyzed;

3. Calculation of a money flexibility parameter;

4. Estimation of price and income elasticity matrices and comparison of these with those obtained from food consumption surveys;

5. Improvement in the formulation of the farm decision model by incorporating the preferred diet of the urban model in the objective function, to allow analysis of the relationships of land and operating capital levels to dietary level;

6. Obtention of time series production and consumption

data with which to validate the farm model in a recursive programming framework.

H. Appendix

F-Test Formula and Calculations

Hypotheses

C_1: Slope and intercept from regressions on (s) survey data and (M) model results are the same

C_2: Either slope, intercept and/or both are not the same

Formula

$$F^* = \frac{SSE(S+M) - SSE(F)}{2} \div \frac{SSE(F)}{df_s + df_m}$$

where SSE = Sum of squares (residual)

S = Regression on survey data

M = Regression on model results

F = Regression on combined data

df = Degrees of freedom

Decision Rule

If $F^* \leq F(1-\alpha;\ 2,\ df_s + df_m)$, conclude C_1

$F^* > F(1-\alpha;\ 2,\ df_s + df_m)$, conclude C_2

where α = confidence level

2 = numerator degrees of freedom

Source: Neter, John and Wasserman, William, Applied Linear Statistical Models. Richard D. Irwin, Inc., Homewood, Illinois: (1974), pp. 8, 160-165, 807-813.

I. Calories

Bolivia

$$F^* = \frac{194151.4 - 280091.3}{2} \div \frac{280091.3}{16}$$

$F^* = 2.45$

$F\ (1-.05;\ 2,\ 16) = 3.68$

$F^* < F \therefore$ conclude C_1

Colombia

$$F^* = \frac{133641.9 - 233735.8}{2} \div \frac{233735.8}{11}$$

$F^* = 2.36$

$F\ (1-.05;\ 2,\ 11) = 3.89$

$F^* < F \therefore$ conclude C_1

Dominican Republic

$$F^* = \frac{299427.3 - 402216.9}{2} \div \frac{402216.9}{10}$$

$F^* = 1.28$

$F\ (1-.05,\ 2,\ 15) = 3.68$

$F^* < F \therefore$ conclude C_1

I. Calories - continued

Guatemala

$$F^* = \frac{617678.5 - 900353.0}{2} \div \frac{900353.0}{15}$$

$$F^* = 2.36$$

$$F(1-.05,\ 2,\ 15) = 3.68$$

$F^* < F \therefore$ conclude C_1

II. Proteins

Bolivia

$$F^* = \frac{162.3 - 228.0}{2} \div \frac{228}{16}$$

$F^* = 2.3$

$F\ (1-.05;\ 2,\ 16) = 3.68$

$F^* < F \therefore$ conclude C_1

Colombia

$$F^* = \frac{39.9 - 41.2}{2} \div \frac{41.2}{11}$$

$F^* = .17$

$F\ (1-.05;\ 2,\ 11) = 3.89$

$F^* < F \therefore$ conclude C_1

Dominican Republic

$$F^* = \frac{247.4 - 398.3}{2} \div \frac{398.3}{10}$$

$F^* = 1.89$

$F\ (1-.05;\ 2,\ 10) = 4.10$

$F^* < F \therefore$ conclude C_1

II, Proteins - continued

Guatemala

$$F^* = \frac{326.7 - 980.3}{2} \div \frac{980.3}{15}$$

$$F^* = 5.0$$

$$F\ (1-.05;\ 2,\ 15) = 3.68$$

$F^* > F \therefore$ conclude C_2