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DEMAND ELASTICITIES FOR A DEVELOPING ECONOMY: AN INTERNATIONAL COMPARISON OF CONSUMPTION PATTERNS

by

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DEMAND ELASTICITIES FOR A DEVELOPING ECONOMY: AN INTERNATIONAL COMPARISON OF CONSUMPTION PATTERNS

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This paper is an attempt to explore the relationship between consumption expenditure and relative prices for a developing economy. While relative prices are central to the theory of household behavior, the aggregation of budget information leads to a macroeconomic relationship which states that the pattern of consumption expenditure is simply a function of per capita income. Although some attempts have been made to account for price effects in predictions of consumption in industrial economies, as in Houthakker and Taylor (29) and Almon (2), the omission of price elasticities of demand for consumption is carried farther with less apology, and perhaps less empirical justification, in studies of developing economies.

The philosophy which underlies the suppression of the price

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variable maintains that at low income levels, there is little possibility for substitution between broad groups of commodities, especially in the short run. This view is built into planning models by fixing the average and/or incremental proportions of consumption among sectors and by basing the incremental shares on demand elasticities which are derived from budget studies or borrowed from other countries.[1/] Some flexibility may be intro-

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1/ See Eckaus and Parikh, 1968 (17), p. 1-12; Tables 3-24, 5-12, and T. E. Weisskopf, 1967 (51) on India; A. R. Khan, 1967 (32), p. 57, and MacEwan, 1968 (34), p. 62-4, on Pakistan; L. Westphal, 1968 (52), p. 83, on Korea; Bruno, 1962 (6), p. 153, on Israel; Nugent, 1966 (35), p. 70-72, on Greece; P. R. Clark, 1967 (13), p. 76-85, on Nigeria.

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duced by allowing variation around these proportions.[2/] Since

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2/ Sandee, 1960 (41), p. 35-37, allows for ± 13% variation; Bruno, 1966 (7), p. 330-332, introduces ± 10% variation around the Engel's curves.

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empirical research has found that constant elasticities are a more accurate description of expenditure, it has been suggested that planning models distribute private consumption as a logarithmic rather than linear function of the income level.[3/] The

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3/ Houthakker, 1957 (25) summarizes the empirical evidence. See Chenery, 1960 (10), p. 627 for the general statement of non-linear demand, and Carter, 1967 (8) and (9).

direct impact of price changes on consumption, however, is still ignored.

The "structuralist" arguments of growth are similar to the planning models in postulating rigidity of consumption demand.

"Structuralism" is built on the assumptions of high income and low price elasticity of demand for basic consumer goods in the face of rigidity on the supply side. Food prices, for example, rise when the growth of per capita income implies a demand which exceeds the per capita growth rate of supply. A per capita income growth of 2% and income elasticity of .6 for food are generally cited.[4/] It is also implied that no change in relative

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4/ See David Felix, "An Alternative View of the 'Monetarist Structuralist' Controversy," p. 87, and Joseph Grunwald, "The 'Structuralist' School on Price Stability and Development: The Chilean Case," both in Hirschman, 1961 (21). See also Hirschman's remarks on 'structuralism' in Baer and Kerstenetsky, 1964 (3), p. 455.

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prices will eliminate the pressure for further price increases, particularly for the sectors of food, transport, and electricity. A low price elasticity is further invoked to demonstrate the effect of inflation in causing loss of real income to the urban worker who typically spends a large share of his budget on food.

The "structuralist" emphasis on excess consumer demand contrasts with the Marxist view of weak effective demand. This insufficient "actual market demand," which is primarily determined by the unequal distribution of income, differs substantially from the "actual social needs" of the working class which Marx

in fact believed to be elastic with respect to both income and price.[5/] Weak consumer demand is held to be widespread, and

5/ "The quantity demanded by these wants [social wants] is very elastic and changing." "Actual social need" is defined as "...that quantity which would be demanded if the money prices of the commodities, or other conditions concerning the money or living of the buyers, were different." Marx, Capital, III, p. 233-4, quoted in P. Sweezy, The Theory of Capitalist Development (New York: Monthly Review, 1956), p. 50; see also p. 183-4.

this aggregate "disproportionality" between the low growth of demand for consumption goods and the high growth of capacity to produce consumption goods forms the basis of the Marxist theory of crises and stagnation.

Growth models in the classical, non-Marxian tradition stress the high elasticity of effective market demand, specifically with respect to price. It is the prompt response to changing prices which explains the flexibility in the classical version. All markets are cleared regardless of fall in price, which may be due, for example, to technical progress.[6/] An

6/ "Diminish the cost of production of hats, and their price will ultimately fall to their new natural price, although the demand should be doubled, trebled, or quadrupled," Chapter XXX, "On the Influence of Demand and Supply on Prices," in Ricardo (38), p. 260.

increase in agricultural exports, causing the temporary decline in domestic consumption of food, leads also to the expansion of the home food supply[7/] in response to a rising domestic price.

7/ "...but till it [increased food supply] be obtained, the high price is absolutely necessary to proportion the consumption to the supply...[The higher price] is the means by which the demand of the home purchasers is diminished," Ricardo (38), p. 203. Note that this is the converse of the "structuralist" chain.

Finally, the classical model speculates on the changing proportions of consumption with higher levels of disposable income and specifies a low, short-run elasticity of demand for food which itself is held to be a function of family size.[8/]

8/ "The increased wages are not always expended on food, but are first made to contribute to other enjoyments of the labourer," Ricardo (38), p. 103. See also Stigler, 1954 (43).

There are a few examples in the current growth literature on empirical models which capture the flexibility of the classical spirit. Chenery and Uzawa, 1958 (12), explore a four-sector programming model which includes prices as an explicit variable in determining consumption. Johansen's model of Norwegian growth (31) employs an extensive set of price and expenditure elasticities based on Frisch's scheme for deriving demand coefficients (20). Other, less ambitious models make some attempt to include price effects on demand.[9/]

9/ See Fox, 1953 (19), and his comments in Adelman and Thorbeck (1), p. 319-321; Harberger, "Some Notes on Inflation," in Baer and Kerstenetsky, 1964 (3), p. 342; Tinbergen, 1957 (45); and Bos and Koyck, 1961 (4).

We would expect simulation models of growth to be free from the linearity imposed by the optimizing framework and also to more readily incorporate price adjustments. Holland and Gillespie, 1963 (22), p. 55, briefly explore the sensitivity of the balance of payments and the general price level to different expenditure and price elasticities in a simulation of the Venezuelan economy. The simulation project of Colombia by Roberts and Kresge, 1968 (39), p. 40, omits price elasticities, but the model does stress the importance of user price in the detailed analysis of transport flows.10/

10/ It was in the quest for empirical estimates of price elasticities to be used in the Colombian model that this study was first undertaken.

Another reason for the omission of price coefficients is that few attempts have been made to estimate price and expenditure elasticities directly from time series data. Watanabe (50), using United Nations' data, has estimated expenditure elasticities of a "cross-country" sample by converting each of twenty-four country observations into German purchasing power equivalents (42). Professor Houthakker, 1965 (27), estimates "short-run" elasticities by pooling annual observations from time series of thirteen OECD countries and "long-run" elasticities by pooling country averages. Several of his estimates, however, yield positive price elasticities. Russell (40) relates the different country expenditure elasticities to income level,

relative prices, and a social class dummy. At the conclusion of this paper, estimates from the above sources will be compared with the results obtained in the following sections.

The Data:

The two major difficulties in estimating price elasticities are first, that few developing countries have sufficiently long expenditure and price series for the postwar period,[11/] and second, that parity exchange rates have never been calculated for these countries.

11/ The I.L.O. Yearbook of Labour Statistics (1966), Chapter VIII, gives the percentage of the family budget spent on food, housing, clothing, and miscellaneous for many countries in Table 28, "Consumption Expenditure" (p. 661-665). However, the price indices given for selected cities in the various countries in Chapter VII, "Consumer Prices," do not necessarily correspond to the expenditure categories of Table 28.

The U. N. Statistical Office in the Yearbook of National Account Statistics (48) reports time series of annual "Composition of Private Consumption Expenditure" (Tables 7a and b) for detailed categories of goods. Our sample is limited to those fifteen low-income countries which report consumption expenditure in both current and constant prices. United Nations worksheets were made available to supplement the published series. The sample consists of the countries listed on page 8. Population for each annual observation was obtained from Table 4, "Estimates of Midyear Population," United Nations Demographic Yearbook, 1966 (46).

Code	Country	No. of Observations	Years	Base Year
6	Nigeria	7	1951 - 57	1957
7	Federation of Rhodesia and Nyasaland*	10	1954 - 63	1954
9	South Africa*	17	1950 - 66	1958
23	Jamaica	7	1959 - 65	1960
24	Puerto Rico	16	1950 - 65	1963
27	Honduras	11	1954 - 64	1948
34	Ecuador	15	1950 - 64	1960
42	Peru	9	1950 - 58	1954
45	Dominican Republic	15	1950 - 64	1960
51	Thailand	10	1957 - 66	1962
53	Ceylon	8	1958 - 65	1958
54	Korea	14	1953 - 66	1965
56	Israel	13	1952 - 64	1952
67	Taiwan	8	1958 - 65	1964
71	Greece	8	1958 - 65	1958
87	Ireland	12	1953 - 64	1958

* South Africa has been included only in the country studies and is excluded from the pooled sample. Consumption accounts for the Federation of Rhodesia and Nyasaland, which has since split into Zambia, Malawi, and Southern Rhodesia exclude African rural household expenditure. See United Nations, 1964 (48), p. 261.

While the individual country series are relatively short (ranging from 7 to 17 years), it is hoped that meaningful results can be derived by pooling data from a variety of countries. In doing so, we postulate that there is a common expenditure pattern within this sample of countries that will emerge despite national and institutional differences. Later in our analysis, we shall attempt to identify the influence of these "national" differences.

We avoid the problem of converting the different national currencies to a common unit by adopting a ratio form of all observations, or, in logarithmic form, by using first differences.

The categories in the United Nations expenditure accounts have been aggregated into the commodity groups listed on page 10.

The Model:

The basic expenditure relationship appears in exponential form:12/

12/ See H. S. Houthakker (23) for discussion of defects and advantages of this form.

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(1) $$C_{ijt} = a_i \, E_{jt}^{\beta_1} \, P_{ijt}^{\beta_2} \, N_{jt}^{\beta_3} \, u_{ijt} \qquad \begin{array}{l}(i = 1....6)\\(j = 1...15)\\(t = 1...6...15)\end{array}$$

where C_{ijt} = Consumption expenditure on commodity i in country j at time t at constant market prices.

a_i = Constant for each commodity i.

E_{jt} = Total expenditure in country j at time t, evaluated at constant market prices.

P_{ijt} = Relative price of commodity i in country j in time t.

United Nations National Accounts Categories:	Commodity Groups:
Food; Beverages; Tobacco.	Food
Rent and water charges; Fuel and light; Household operation	Rent
Personal care and health expenses; Recreation and entertainment; Miscellaneous services (includes financial services; education and research; other services).	Services
Clothing and other personal effects.	Clothing
Transport and communications.*	Transport
Furniture, furnishings, and household equipment; Passenger cars*	Durables
Sum of all the above.	Total Expenditure

* The Transport category is composed of four items: a) Personal Transport equipment; b) Operation of personal transport equipment; c) Purchased transport; and d) Communication. No breakdowns for these items are entered in the published accounts or on the questionnaires, except "Passenger Cars" in the case of South Africa. See United Nations, A System of National Accounts and Supporting Tables , (47), p. 39-41, for further detailed classification of private consumption expenditure.

$$= \frac{\text{expenditure on i in j at t}}{\text{total expenditure in j at t}} \Big/ \frac{\text{expenditure on i in j at t}}{\text{total expenditure in j at t}}$$

N_{jt} = Population in country j at t

u_{ijt} = Error term, log-normally dis unity and constant variance.

β_1 = Elasticity of expenditure on respect to total expenditure

β_2 = Elasticity of expenditure on respect to own-price.

β_3 = Elasticity of expenditure on respect to population.

In double logarithmic form, the demand equation appears as

(2) $$\log C_{ijt} = \alpha_i + \beta_1 \log E_{jt} + \beta_2 \log P_{ijt} + \beta_3 \log N_{jt} + \varepsilon_{ijt}$$

where ε_{ijt} = Error term normally distributed with mean zero and constant variance.

By taking first differences and subtracting each of the country means from that country's annual observations, we derive an expression for the relationship which involves the deviations of the growth rates of the variables around their mean growth rates. The coefficients of this "within" countries equation[13/]

13/ See H. S. Houthakker (27), p. 279.

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are estimated from pooled series of annual observations of all the fifteen countries in the form:

$$(3)\quad \Delta\log C_{ijt} - \overline{\Delta\log C}_{ij} = \beta_{1wi}[\Delta\log E_{jt} - \overline{\Delta\log E}_j] + \beta_{2wi}[\Delta\log P_{ijt} - \overline{\Delta\log P}_{ij}] + \beta_{3wi}[\Delta\log N_{jt} - \overline{\Delta\log N}_j] + \varepsilon'_{ijt}$$

$(i = 1...6;\ j = 1...15;\ t = 1...6...15)$, where the first differences appear as "Δ," the country means as barred terms, and ε'_{ijt} is the disturbance term assumed to be normally distributed with zero mean and constant variance.

The fifteen country means themselves are taken as the observations in the "between" countries model:

$$(4)\quad \overline{\Delta\log C}_{ij} = \beta_{1bi}\overline{\Delta\log E}_j + \beta_{2bi}\overline{\Delta\log P}_{ij} + \beta_{3bi}\overline{\Delta\log N}_j + \varepsilon''_{ij}$$

$(i = 1...6;\ j = 1...15)$ where ε''_{ij} is the error term which is assumed to be normally distributed with mean zero and variance inversely proportional to the number of observations in each country series. The elasticities are assumed to be constant over time as well as constant over the range of income.

The "within" equation (3) may be taken to measure the short-run influence of total expenditure and price on consumption, while the "between" equation (4) captures the longer-run effects. The "long-run," in this case, refers to an 8 to 15 year span in the postwar period.

<u>The Population Variable:</u>

Only under special condition is the elasticity of total

expenditure (β_1) the same as the elasticity of per capita expenditure which is commonly used in demand analysis. Equation (1) above can be converted to per capita terms:

$$(5) \quad \frac{C}{N} = \left(\frac{E}{N}\right)^{\beta_1} P^{\beta_2} N^{(\beta_3 + \beta_1 - 1)}$$

If $\beta_3 + \beta_1 = 1$, then the estimates of β_1 are equivalent in the per capita and total expenditure formulation. If $\beta_3 + \beta_1 \neq 1$, then we are testing a different hypothesis about expenditure behavior: namely, that population itself influences consumption other than through its effect on income per person. Indeed, in countries where the distribution of income is highly skewed, "expenditure" and "population" may be very separable realities from "per capita expenditure."

If ($\beta_3 + \beta_1$) is significantly less than one, then an increasing population leads to a decrease in per capita consumption expenditure. This is expected if economies of scale in utilization can be realized (as in durables and housing), or if the variable is a proxy for changes in age composition. If ($\beta_3 + \beta_1$) is significantly greater than unity, then the rise in consumption per person of transport or services may be due to increasing congestion or to a greater level of mobility. Increasing population, in this case, acts as a proxy for changes in the degree of urbanization or population density.[14/]

14/ More can be said against the use of population estimates to obtain per capita expenditure. First, although the

Demographic Yearbook 1966 has reduced the number of discontinuities in the country series by replacing "out-of-line" estimates with "smoothed" or consistent series, there are still serious doubts about the reliability of the annual estimates. See United Nations, 1966 (46), p. 22-23, 120-131. Thus the use of per capita variables would introduce an additional source of error into the series.

In the case of the Nigerian population statistics, P. B. Clark, 1967 (13), p. 76-85, comments on his own consumption research:

> "A better specification of the function might have been to use per capita income in place of gross domestic product. However, the last two Nigerian population censuses were rejected....making it impossible to find an agreed estimate of Nigeria's population."

Second, national consumption expenditure may refer to a different proportion of the population from the population estimates. Especially in those countries which have large rural populations, the consumption expenditure of the non-market economy may be grossly underestimated. S. N. Braithwaite, 1967 (5), p. 29, writes about the Latin American accounts:

> "...real income figures expressed in per capita terms reflect not only the errors of the national accounts data but also the inadequacies of the demographic statistics. For many countries in the region, no recent census has been conducted, and the annual figures given are extrapolations based on trends which may or may not be indicative of current growth rates.. ..A further problem arises through basing per capita estimates on demographic figures which include a sizable population at the margin of, or completely outside, the market economy, e.g., in Brazil, Ecuador, Central America, etc. When this is the case, the per capita income figures tend to be low in comparison with a country where virtually all inhabitants contribute to or participate in economic activity."

Results:

The unweighted ordinary least squares regression estimates of the "within" countries equation (3) and the weighted estimates of the "between" countries equation (4) are presented in Table 1. The population variable is added for both equations on lines 3) and 4).[15/] Professor Houthakker's results for similar models using OECD per capita data are presented on lines 5) and 6). His intercept form is added on line 7) with the constant in place of the population coefficient.

15/ Intercepts were introduced in the two variable "between" equations for the developing country sample, but not one was found to be significant or to affect the expenditure or price coefficients.

The "between" data are weighted by the square root of the number of first-differenced observations from which each country mean was constructed. The effects of this and other weighting schemes will be examined in a later section.

All the expenditure and price elasticities in Table 1 are of the theoretically admissible sign, and almost all are significantly different from zero. Measures of the goodness of fit (R-square corrected for degrees of freedom) for these equations follow in Table II.

Are the differences between the elasticities derived from equation (3) and those from equation (4) statistically significant? We obtain a "total" residual sum of squares by pooling the "between" and "within" observations in one "total" equation. A residual sum of squares due to the different regression coefficients is

calculated by subtracting the residual sum of squares of the "within" and between" from the residual sum of squares of the "total" regression. The mean square of the "within" equation is then compared to the mean square due to the different regressions by the F-statistic.

The results are shown in Table III, and indicate that in the cases of food, rent, and durables, are the elasticities of the "within" equation significantly different from the "between" model.

In comparing the coefficients (Table I) of the "within" and "between" models, we note that only in the case of food is the "between" expenditure elasticity less than the "within" coefficient.[16/] The rest of the "between" expenditure elasticities,

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16/ Since the "within" expenditure coefficients for food are not significantly greater than one, these results should not significantly affect our faith in Engel's law.

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especially for rent, clothing, and durables, are greater than the "within" coefficients. This evidence is contrary to Professor Houthakker's hypothesis and findings that the "between" expenditure elasticity for durables should be lower in the long run than the "within" elasticity due to a negative stock adjustment effect. On the other hand, Houthakker expects the "between" elasticities for perishable goods, such as food and services, to be higher due to habit formation.[17/]

17/ The explanation appears in Houthakker, 1965 (27), p. 282-3, and also in Houthakker and Taylor, 1966 (29), p. 8 ff.

The dynamic "stock adjustment" and "habit formation" effects appear to operate in the opposite directions for the sample of developing countries. This may be explained by, first, noting that the purchases of durables and housing may be the major form of personal saving, especially under inflationary conditions. Expenditure on these items can be expected to increase over time as the public comes to rely on this form of accumulation or "hedging," and "habit forming" behavior might accurately describe the consumption of durables.[18/]

18/ In our sample, Korea, Taiwan, and Peru experienced high annual rates of inflation; Thailand and Ceylon experienced "mild" inflation of less than 5%, per year, and Ecuador, Honduras, Dominican Republic, and Puerto Rico demonstrate price stability. See Dorrace, "The Effect of Inflation on Economic Development," Tables 11-13, in Baer and Kerstenetsky, 1964 (3).

Grunwald notes for the Chilean case in Hirschman (21), p. 100:

> "Nearly all the sectors of the community hedged through the building up of inventories. This applied also to consumer groups, who bought consumer goods for storage rather than for use."

Second, although our model postulates a constant expenditure elasticity over the entire range of countries, there is evidence which suggests that the coefficients themselves are functions of per capita income (Russell, 1967 (40), p. 581). If this is the case, we would expect the "between" expenditure elasticity

of demand for food to be lower than the short-run ("within") elasticity.

Comparison with European Patterns:

How do our estimates for a developing economy compare with Professor Houthakker's European elasticities? (See Table 1.) Only food, rent, and clothing are strictly comparable, since our "transport" group draws on expenditure from both the services and durables categories (see footnote, p. 10). In comparing the "within" equations (lines 4 and 5, Table I), we find that for food and rent (necessities, since $\beta_1 < 1$) the developing group yields higher income and price elasticities, while the European sample (U.S. included) reveals higher expenditure elasticities for clothing. The higher European "between" elasticities (lines 3 and 7, Table I), for rent may be due to greater market responsiveness in the developed countries. Clothing coefficients of expenditure in both samples are similar and greater than unity.

Population:

Does population exert an independent influence? In Table IV, we test the null hypothesis that population influences consumption only through per capita expenditure, as expressed in equation (5). For the "within countries" model, we note that the population coefficient ($\beta_1 + \beta_3 - 1$) in line (a) is significantly less than unity for rent and durables, indicating that in the short run, a rise in population (holding per capita expenditure

constant) leads to a decrease in per capita consumption. This result is explained by the hypothesis that significant economies of scale in utilization are realized in the consumption of these goods; they are, in a limited, short-run sense, "common goods." Alternatively, a rapidly growing population is on the whole younger and demands less per person of these commodities.

The change from negative to positive in the population elasticity for the rent coefficient in the "between" model reflects rising housing standards and the liquidation of serious short-term overcrowding characteristic of urban areas in developing countries. The short and long-run population coefficients for transport are significantly positive and probably reflect an increasingly mobile and urbanized society.

Weighting Schemes:

There is reason to believe that the variance of the error terms in equations (3) and (4) are not constant, and various weighting schemes may be employed to correct for hypothesized heteroscedasticity.

If we regard each observation as the sum of all the individuals' consumption expenditure in each country and if the error of the individuals' expenditure have constant variance, then it follows that the variance of the error associated with total national expenditure is proportional to the population in each country (since the variance of the sum equals the sum of the variances of the errors). Each annual observation should therefore be weighted by the inverse of the square root of the

annual population. In our sample, this would give the small countries (Jamaica, Puerto Rico, Honduras, Israel) four times the weight of the large countries.[19/]

19/ Houthakker, 1965 (27), p. 279, uses per capita consumption expenditure and therefore weights directly by population. Furthermore, Houthakker, 1965 (28), p. 213, cautions against the undue importance which would be given to numerous small country observations, in the absence of population weights:

> "That weighting is necessary can also be seen by supposing we had separate figures for each of the 50 states of the U. S.; these would swamp any unweighted mean, but have no particular effect on a weighted mean."

Houthakker applies the weights directly to the matrix of sums of squares and cross products rather than directly to the observations.

It should also be noted that weighting per capita expenditure directly by the root of population is equivalent to weighting total expenditure by the inverse of the root of population except for its effect on the price variable.

If we regard the transitory component of income to be proportional to the level of income, then we would expect the variance of the error of consumption expenditure in the wealthier countries to be larger. Each observation should then be weighted by the square root of the inverse of per capita income.

If we regard the variance of the error of consumption expenditure in the wealthier countries to be larger due to a larger transitory component, then each observation should be weighted by the inverse of per capita income. In this scheme, the observations of the poorer countries, regardless of population size, would receive greater importance in the sample.

Finally, we might consider that each country samples from its own population to obtain expenditure estimates in such a way that the variance of the error of mean expenditure for the large country is no different from the variance in a small country. No weights would then be necessary for pooling cross-country

observations.[20/]

20/ Kuznets, 1962 (33), p. 26-27, uses unweighted per capita expenditure to estimate expenditure elasticities, for example.

Houthakker, 1965 (28), employs weights in estimating a direct linear relationship between personal savings and income. However, the application of population weights to a double logarithmic function, as in Houthakker, 1965 (27), loses meaning unless we argue that the variance of the error of the growth rate of consumptions (the first differenced logs, which are the variables in our equation) is proportional to country size.[21/]

21/ It may make more sense to hypothesize that the variance of the error of the growth rate of durables expenditure, for example, is proportional to the actual growth rate of total expenditure, while the variance of the error of the growth rate of food expenditure may be inversely related to the growth rate of total expenditure. Estimates of the variance of the error of the growth rates can be obtained from the original data and may suggest other hypotheses.

How much do the different weighting schemes influence the estimated parameters? The results of five different weights are presented in Table V.

In the first scheme (line 1, Table V), it was decided to limit each country series to six central observations rather than "over-represent" countries with longer annual series.[22/]

22/ To limit the six observations to the same actual years would have eliminated four countries from the sample, since all series do not cover the same period. See p. 8 for description of the data.

There are no notable differences in the estimates, except in the case of transport price elasticity.

The results of weighting by the inverse of the square root of population are presented on line 4, and the results of weighting directly by the square root of population are presented on line 3. Compared to the unweighted results (line 2), the price elasticities are reduced in absolute terms across all the categories. The expenditure elasticities, however, do not appear to be very different from the unweighted case. In the "between" model as well, the weighting of the observations by population (lines 6 and 7) does not appear to alter coefficients, although no further significance tests were performed.

The "between" observations, it should be remembered, are themselves derived by averaging the annual country observations. On the assumption that the variance of the error of each of these means is inversely proportional to the number of country observations,[23/] each observation is weighted by the square root of the

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23/ We maintain that the variance of the disturbance of each observation is constant across countries and time.

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number of observations available for that country (line 8). Again, the coefficients themselves do not appear to be altered by the weights.

The constancy of the regression coefficients is to be expected if the least squares fit to the original data is relatively good and the underlying relationship stable. The application

Chart 1. International Engel's Curve for Food Expenditure

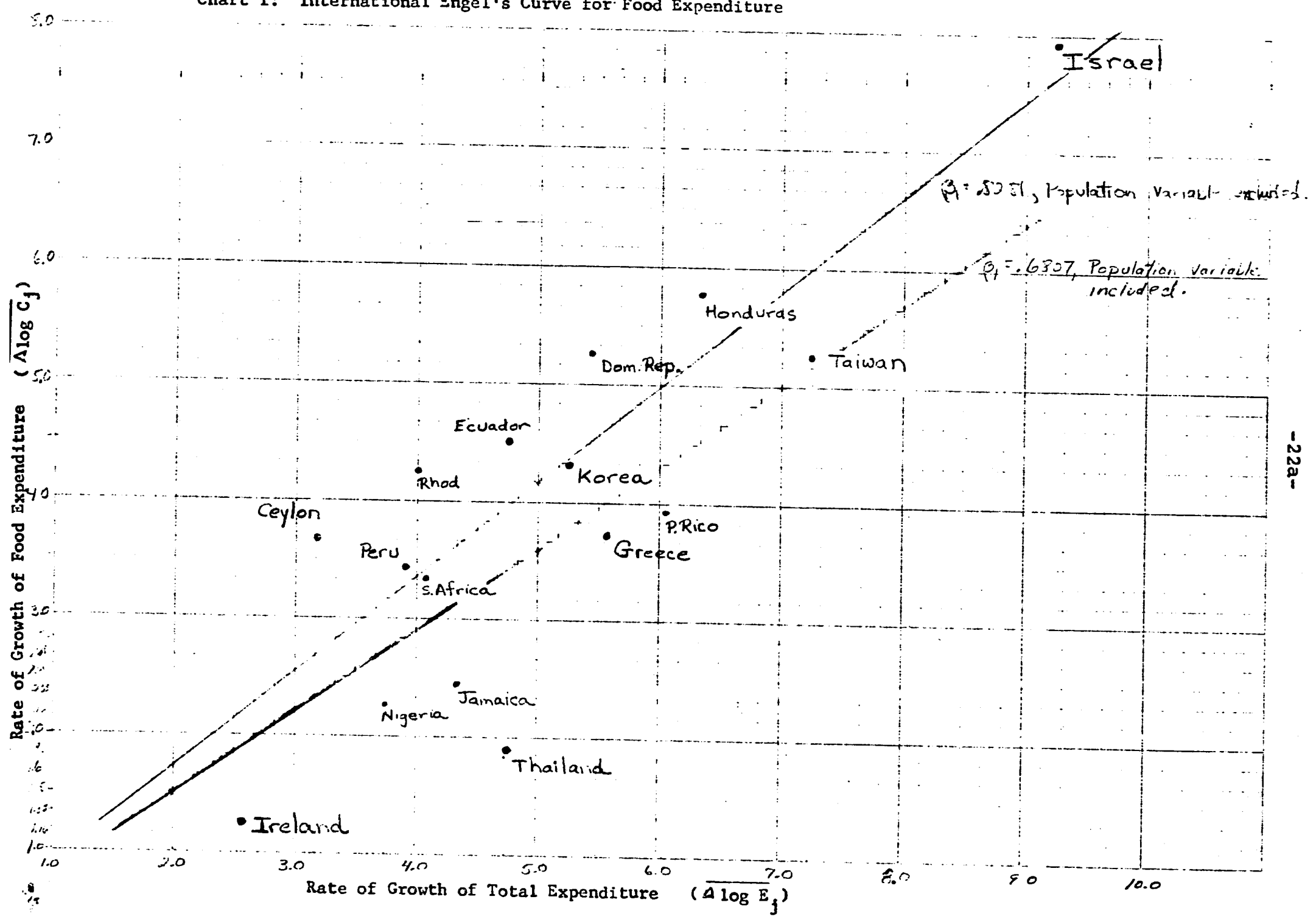


Chart Ia: Weighted Engel's Curve for Food Expenditure

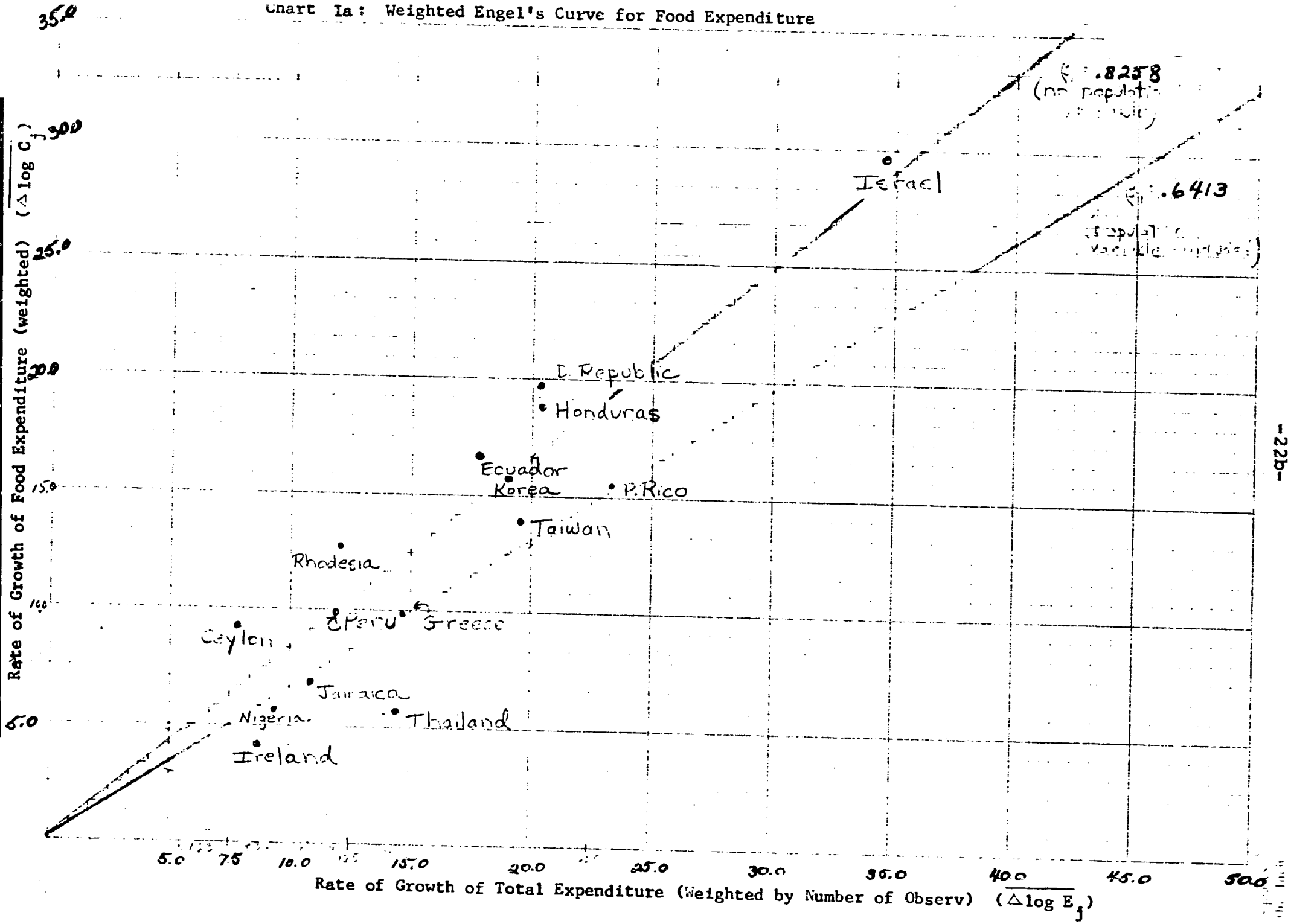


Chart II:

International Engel's Curve for Expenditure on Durables

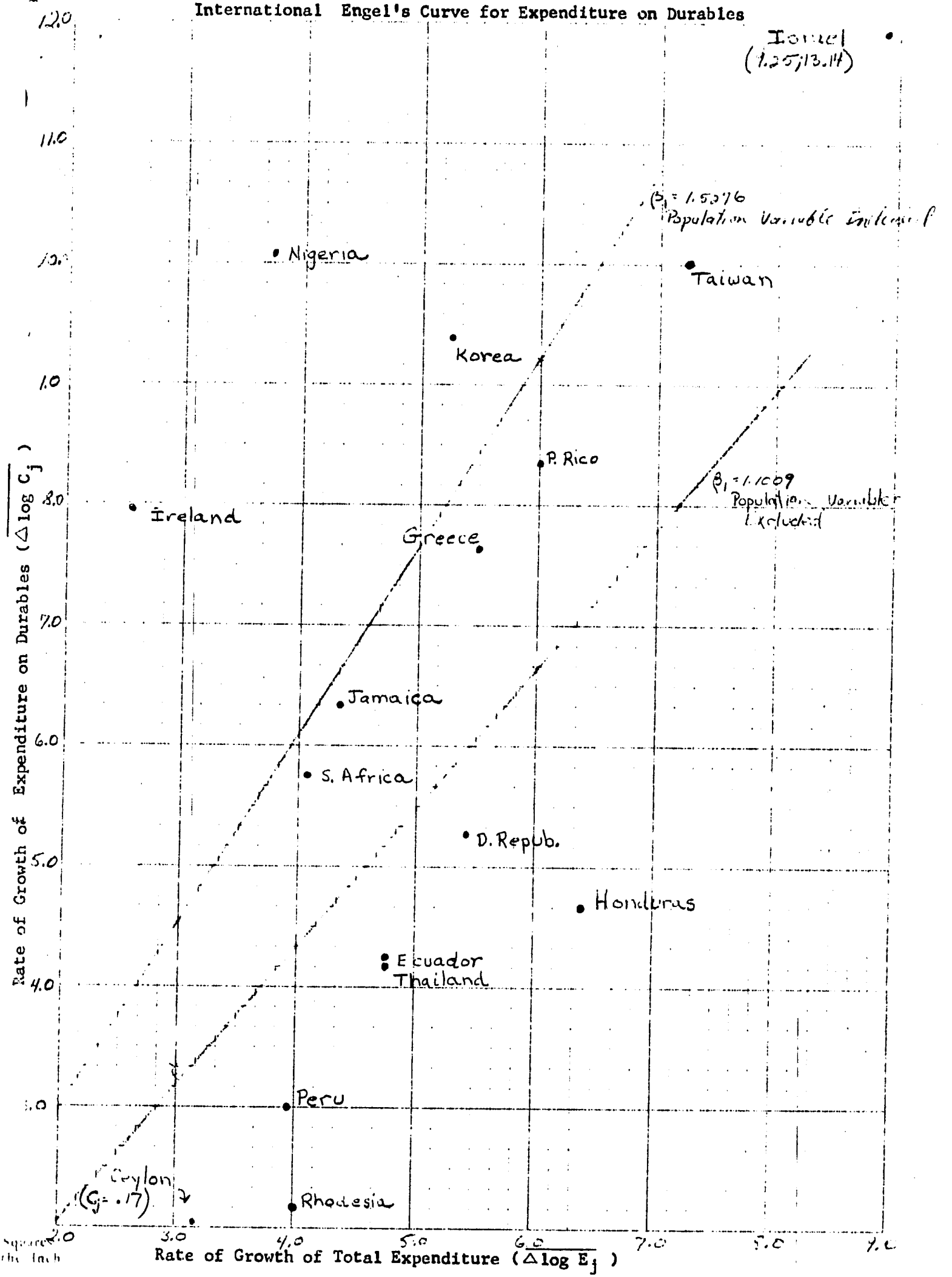
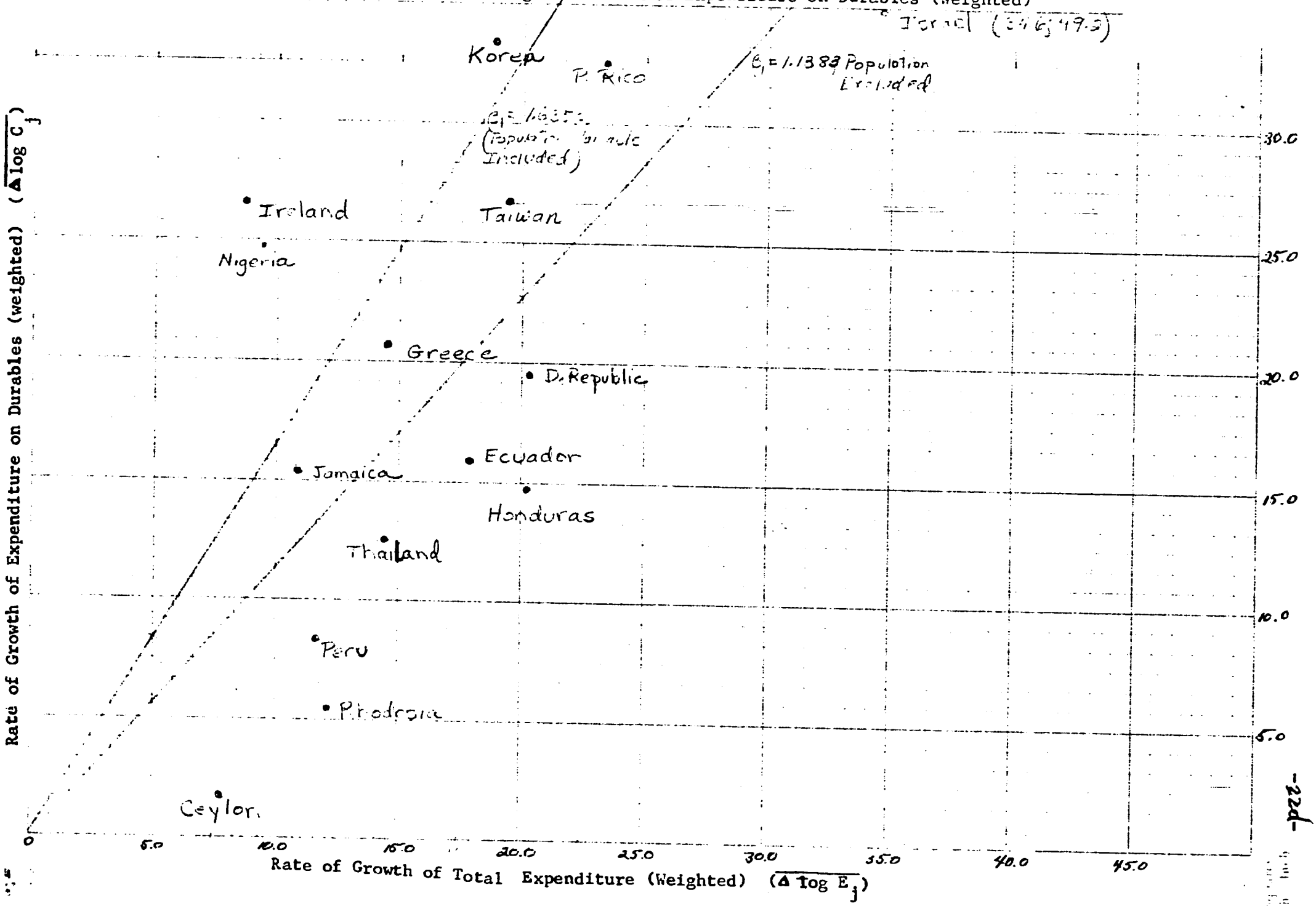


Chart IIa : International Engel's Curve for Expenditure on Durables (Weighted)



of ordinary least squares to the unweighted data, despite the hypothesized, heteroscedastic error term, results in estimates which are inefficient but nevertheless unbiased.

The influence of weights on the "between" observations can be seen in Charts I (unweighted food expenditure) and Ia (weighted by the square root of the number of observations per country). The scale of measurement is extended, and the observations are "re-arranged" along the same basic ray. Taiwan and Greece, for example,(which have short series), slide toward the origin (relative to other countries), while the Dominican Republic, Honduras, Puerto Rico, Ecuador, and Korea gain in relative importance.

The expenditure functions for durables are plotted in Chart II (unweighted) and IIa (weighted by the number of observations). Note the change in relative positions of Ireland (which has a long series) and Nigeria (short series). Taiwan and Greece are also re-ordered relative to the surrounding country observations.

The gain in efficiency in applying generalized least squares in the "between" model is apparent from the increase in the variance of the estimates as shown in Table VI. The "fit" of the weighted regressions is improved slightly (lines 1 and 2), while the residual sum of squares (lines 3 and 4) and the variance of the estimated expenditure elasticity, β_1, (lines 5 and 6) have increased tenfold. Although the regression coefficients are still highly significant, tests of other hypotheses are marginally affected.[24/]

24/ For example, on the basis of an F-test, we concluded

(Table III) that the "between" elasticities for food, rent, and durables, were significantly different from the "within" elasticities. If we had used the residuals of the unweighted "between" regressions, then only the rent coefficients would have been significantly different. We would have then concluded that there is no major difference in the short-run and long-run elasticities, which is plausible given the shortness of the country series.

Secondly, in our analysis of the impact of population on per capita consumption, we concluded (Table IV) that population exerts a significant independent influence only on the consumption of transport and durables in the "between" model. When the unweighted results are used to test this hypothesis, the independent influence of population is significant in the consumption of rent, services, and clothing as well.

Country Results:

In the following sections, we examine the patterns for individual countries and for various regional groups.

Individual country elasticities are presented in Table VII (South Africa is now included). Measures of goodness of fit appear in Table VIII.

Glancing first at the arrays of expenditure elasticities, we note that all the significant coefficients are of the correct sign and plausible magnitude. The expenditure elasticities for food are, for the most part, close to unity, or noticeably lower in the higher-income countries (South Africa, Puerto Rico, Israel, Ireland). Although the "pooled" clothing and service elasticities are less than unity, eight countries indicate higher than unity coefficients for these goods. Expenditure elasticities for transport are greater than unity in five countries and more than twice unity in six others. Expenditure elasticities for

durables are unusually high ($\beta_1 > 2$) in seven countries.

It is more difficult to discern patterns in the absolute value of the price elasticities. Four of the significant food price elasticities and six transport price elasticities are greater than unity. Rent coefficients are lower, but this might reflect a "frozen" price variable, due to rent controls in many countries. Six significant service price elasticities are less than one, while only two are greater than unity. On the whole, these country patterns and the over-all significance of the price elasticities do seem to support the hypothesis that relative price is an important variable in determining expenditure patterns in low-income countries.

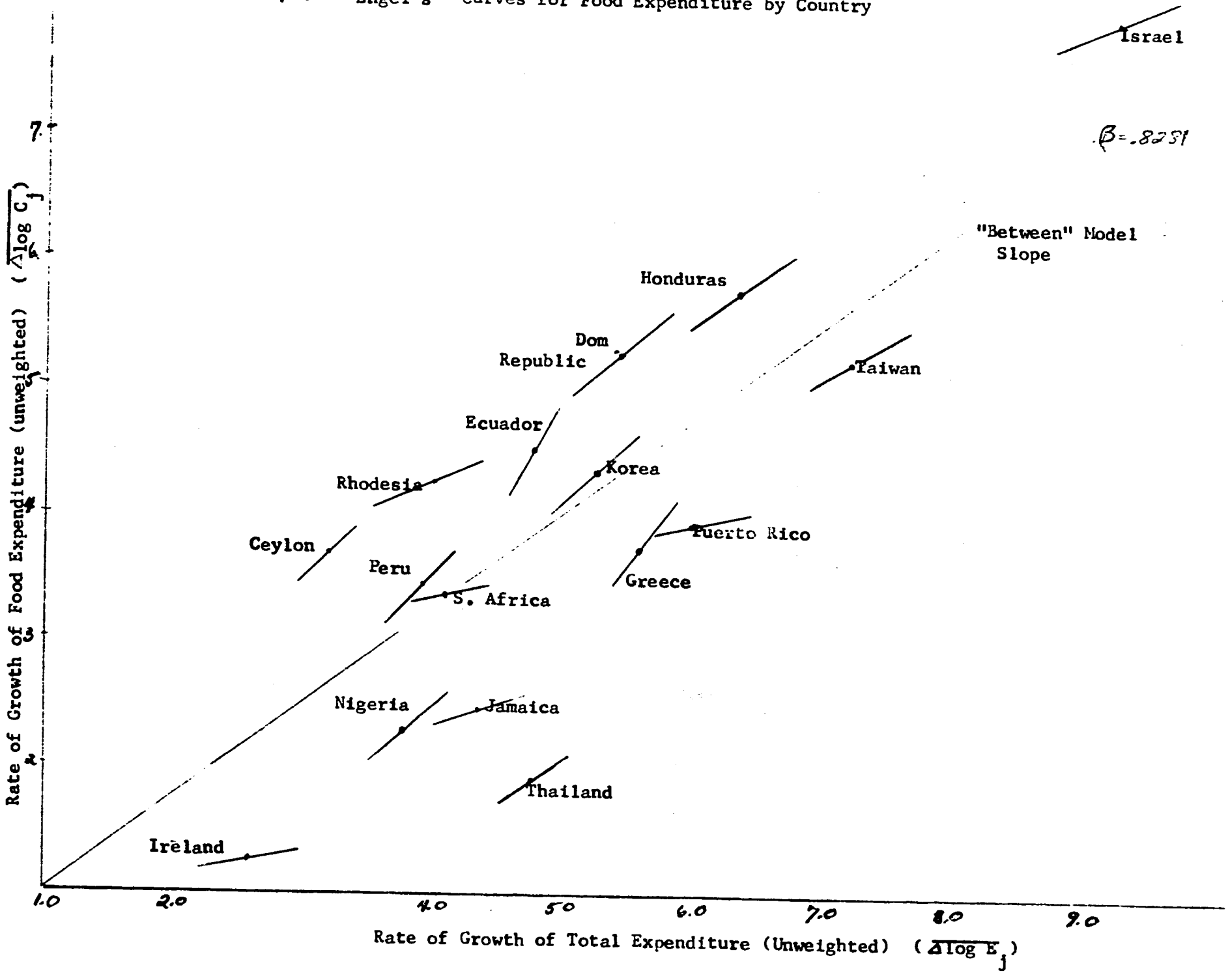
The analysis of covariance of the country residuals (Table IX) indicates that the differences among the various coefficients, taken as a group, are not statistically significant except in the case of clothing. Although these country coefficients should not be given too much importance due to the shortness of the individual time series, we may conclude that pooling of country data is justifiable on the basis of the homogeneous relationships which underly the consumption function.

The variety of country expenditure elasticities for food is sketched in Chart V. Each country slope passes through the cell mean. Note that the mean rate of growth of total expenditure appears on the horizontal axis, not the mean level of income.

Life-Style and Geographical Patterns:

Three types of patterns are explored in Table X; goodness

Chart V : Engel's Curves for Food Expenditure by Country



of fit for these elasticities follow in Table XI.

The first "life-style" groups attempt to separate those countries exposed to greater "European" influence than the "typical" underdeveloped nation. These include Rhodesia (since rural African consumption is excluded in the accounts), South Africa, Israel, Greece, and Ireland. These countries also have the highest levels of per capita consumption.

The "developing" countries (Table X, line b) exhibit higher expenditure and price elasticities for food, while the "European" expenditure elasticity for durables is higher than in the "developing" countries. The differences between these elasticities are statistically significant, as shown in the analysis of covariance presented in Table XII. The expenditure elasticity for clothing in the "European" countries is greater than unity and higher than the elasticity of the "developing" group, although this difference is not statistically significant. According to the conventional classification of goods, clothing, and durables are "luxuries" ($\beta_1 > 1$) in the "European" group, while food and transport are the "luxuries" in the "developing" countries.

Too few countries are available for us to isolate many meaningful continental patterns except for Latin America (62 observations) and Asia (36 observations) (Table X, lines d and e). The elasticities for food in Asia are significantly higher, while the elasticities for Asian rent and services are lower. The statistical significance of these differences is tested in Table XIII.

Two further samples were formed by pooling "Island" and

"Continental" countries (Table X, lines f and g). Food elasticities in the Continental group are higher than the coefficients of the Islands. The expenditure elasticities for clothing and durables on the Islands (Jamaica, Puerto Rico, Dominican Republic, Ceylon, Taiwan, Ireland) are greater than unity, and while the Continental sample shows inelastic coefficients for these goods. These differences are all statistically significant (see Table XIV).

It is difficult to explain the differences in the consumption patterns between these last two groups of countries. Continental countries (Nigeria, Rhodesia, Honduras, Ecuador, Peru, Thailand, Korea, Greece, and Israel, which perhaps should be shifted to the Island group) typically are self-sufficient providers of food and hence may experience more variation in their food prices which are subject to local rather than international fluctuations. Islands import larger portions of their food supply at stable and perhaps lower relative prices. The continental countries are typically rural and less densely populated. Therefore, we expect rural food consumption to increase faster with rising incomes than food consumption on the islands.[25/] The greater

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25/ Edmundo Flores suggests this in the case of Mexico, 1959 (18).

---

urban concentration and density of the islands may also be a factor in explaining the higher expenditure elasticities for clothing and durables.[26/] Note also that the clothing expenditure

26/ Budget studies for Sudan, India, and Mexico suggest higher income elasticities in rural areas for food, clothing, and miscellaneous goods, but lower income elasticities for housing and transport than in the urban areas. The evidence, however, is by no means unanimous. See articles by J. Roy, G. G. Laha, Ashok Rudra, and Bina Roy, p. 13, 14, 33, 64, in Indian Statistical Institute, 1960 (30); also National Council of Applied Economic Research, Long Term Projections of Demand and Supply of Selected Agricultural Commodities (New Delhi, 1962), p. 209, 213.

elasticity for the Islands is close to the European value. I leave further speculation on these phenomena to the reader.27/

27/ See J. Barrie, The Admirable Crichton, W. Golding, Lord of the Flies.

Conclusions:

To summarize some of the empirical findings in this study, we have found, first, that pooling time series data for fifteen "developing" countries yields significant estimates of expenditure and price elasticities for six categories of goods; these estimates distinguish different consumption patterns between the short run (annual) and the long run (8-15 years).

A. Expenditure Elasticities

In the short run, as indicated in the "within countries" model, the expenditure elasticities for food and transport are greater than unity (β_{1w} = 1.11, β_{5w} = 1.27), while the elasticities for rent (.39), services (.99), clothing (.79),

and durables (.93) are all less than unity. In the long run, as indicated in the "between countries" model, food (.64) and rent (.74) may be classified "necessities," while services (1.12), clothing (1.21), transport (1.29), and durables (1.64) are "luxuries" with elasticities greater than unity (see Table I).

The expenditure elasticities for both rent and durables increase from the short to the long run (Table I). This may be due to the effect of positive habit formation and the increasing use of these goods as forms of saving. The fall in the expenditure elasticity for food over time, may indicate a growing "satisfaction" with consumption levels of this good.

The partitioning of our own sample into "European" and "developing" countries (Tables X, XII) indicates significantly lower expenditure elasticities for food and higher elasticities for clothing and durables among the "European" group in the short run. When we compare our "pooled" results to Professor Houthakker's all-European coefficients (Table I), we note a similar short-run effect: a lower elasticity for food and a higher elasticity for clothing in the European countries. We conclude that the level of income itself is an important factor in determining demand elasticities.

It was also found that the more densely populated, urbanized islands in the sample yield a lower expenditure elasticity for food and higher elasticities for clothing and durables than the land-extensive countries (Tables X, XIV).

B. Price Elasticities

Our findings emphasize the importance of price elasticities in determining expenditure patterns in developing countries. For every commodity, the price elasticity of demand is significantly different from zero (Table I). Only the long-run demand elasticity for services is greater than unity ($\beta_{2b} = -1.11$). The price elasticities rise in absolute value from the short to the long run for clothing (-.55 to -.93), transport (-.41 to -.54), and durables (-.55 to -.98), while the price elasticity for food declines from -.88 in the short run to -.64 in the long run.

In many individual countries (Tables VII, VIII, IX), the demand for food, transport, and clothing is extremely elastic with respect to price. We expect that even slight declines in relative price of these goods will result in large surges of demand for these commodities.

The significance of our estimates indicates that substitution does occur between all the broad groups of commodities. Our coefficients give little support to the "structuralist" contention that price adjustments are unlikely to reduce excess demand. The pooled results indicate that if per capita expenditure increases 2% in one year, then a 2.5% rise in the relative price of food will leave per capita demand for food unchanged. Using our long-run estimates, we conclude that over a longer period, little rise in per capita demand for food will occur if the percentage increase

in per capita expenditure is matched by an equal percentage increase in relative price. Even in the case of the higher expenditure elasticity for transport, the short-run increase in demand which results from a 2% rise in expenditure can be offset by a rise in relative price of 6%, assuming constant population.

The estimates of price elasticities found in this study are not consistent with the extremely low values hypothesized by the "structuralists." However, our coefficients do support an alternative explanation of the persistent, excess demand for consumer goods, which is the central phenomenon of "structuralist" attention.

Our explanation is based on the behavior that government policy may attempt to "freeze" certain prices, especially food and transport prices, in an effort to maintain the value of workers' real wages. This well-intended action, guided perhaps by the "structuralist" assumption of near-zero price elasticity and supported by imports of near-free foodstuffs, leads to a decline in their relative price, if other commodities are permitted to rise in price. This fall in relative price strengthens the demand for the price-frozen commodities, and reinforces, rather than offsets, the elastic demand due to rising incomes.

C. Population

The elasticities estimated in this study measure the influence of a change in per capita total expenditure and price on per capita consumption of the commodity. We have shown, moreover, that population growth has an independent and sig-

nificant influence on per capita consumption (Table IV). In the short run, population growth leads to a decrease in per capita consumption of durables and rent, indicating both a more intensive utilization and the influence of a younger age distribution. In the long run, population growth exerts a positive impact on rent and transport expenditures, indicating rising standards in the case of rent and increased mobility in the case of transport.

D. Homogeneity of Underlying Country Patterns

In analyzing the results of individual country data (Table VI), we found that the underlying consumption relationship is homogeneous, as indicated by our analysis of covariance (Table IX). We conclude that rather than rely on statistically unacceptable estimates of elasticities for an individual country, we are justified in pooling multi-national data and in "borrowing" elasticities from these pooled results in the absence of more extensive country information.

E. Comparisons to Other Consumption Studies

The reader may note that these pooled results are comparable to elasticities calculated from other studies of time series and budget data (Table XV).

In Table XVI, we summarize the array of information gathered in Table XV. Are our elasticities comparable to the results of other international studies? If we assume that our long-run between-countries coefficients are drawn from a normally distributed sample of "universal" elasticities, then we expect other estimates of the same parameters also to

fall within an established interval. In lines 1 and 2 of Table XVI, we set 99% confidence intervals around the between-countries parameters. Using a simple arithmetic mean to summarize the expenditure elasticities of the three other international comparisons (line 3, Table XVI), we conclude that the estimates of these studies are drawn from the same universe of inter-temporal and international consumption patterns. Those individual estimates which fall within the interval are indicated by an asterisk (*) in Table XV.

We also establish confidence intervals around the within-countries parameters (lines 4 and 5, Table XVI), and compare them to the unweighted averages of the elasticities from individual time series and budget studies (lines 6 and 7). In only two cases of the twelve coefficients can we conclude that these individual elasticities are drawn from the same universe as our within-countries coefficients.

It is interesting that most of the average expenditure elasticities and all of the average price elasticities calculated from the independent studies (lines 6 and 7, Table XVI) do fall in the confidence interval of our between-countries model. We conclude that the individual studies, presented in detail in Table XV, measure patterns that are similar to our long-run, between-countries results, rather than our annual, within-countries patterns.

What then can be made of the within-countries parameters? Are they to be ignored, since most of the independent country studies fail to corroborate these patterns? On the contrary, these short-run patterns are quite unique, for they reflect the

immediate effects on consumption demand which a single country might expect as the result of its annual prices or incomes policy.

TABLE I

ELASTICITIES FOR POOLED COUNTRIES

Model	FOOD			RENT			SERVICES			CLOTHING			TRANSPORT			DURABLES INCL. CARS		
	Exp.	Price	Popul.	Exp.	Price	Popul.	Exp.	Price	Popul.	Exp.	Price	Popul.	Exp.	Price	Popul.	Exp.	Price	Popul.
Within Countries	1.1095	-.8743		.4202	-0.3090		.9974	-0.6443		0.8123	-.5760		1.3139	-.4099		.7993	-0.5037	
Between Countries	.8258	-.4612		.9454	-.3213		1.1884	-1.1108		1.0218	-.8536		1.5884	-.5972'		1.1383	-.6601'	
Between Countries	.6413	-.6404	.4135	.7375	-.2506	.4427	1.1178	-1.1057	.1512'	1.2148	-.9332	-.4485'	1.2864	-.5379'	.6339'	1.6352	-.9839	-1.1972
Within Countries	1.1074	-.8750	.0170'	.3930	-.3103	.3278	.9935	-.6438	.0441'	.7875	-.5514	.2568'	1.2738	-.4062	.4652'	.9277	-0.5461	-1.3163
Within Countries Houthakker, 1965	.351	-.161		.029*	-.114		.755	-.388		1.574	-.282		----	----	----	3.919	-.502	
Between Countries Houthakker, 1965	.744	.234*		1.545	-.362		.934	.455		.713	-.052		----	----	----	1.946	-1.371*	
Between Countries Houthakker, 1965 With Intercept	1.145	.277	-.0044	1.831	-1.397	.0012*	1.035	.424	-.0011*	1.050	-.476	-.0064	----	----	----	1.831	-1.397	0.0012*

Note: ' = Not significant at 95% level.

* = Probably not significant at 95% level; no t-statistic given.

TABLE II

GOODNESS OF FIT

"WITHIN" AND "BETWEEN" MODELS WITH TWO AND THREE VARIABLES

MODEL:	FOOD	RENT	SERVICE	CLOTHING	TRANSPORT	DURABLES
R-Squared (C)*:						
Within	.9390	.2142	.5189	.3295	.4089	.1575
Between**	.8285	.5355	.5365	.7817	.3973	.4992
Between** (Incl. β_3)	.8887	.5776	.4999	.7915	.3888	.6561
Within (Incl. β_3)	.9356	.2268	.5157	.3273	.4108	.2071

Note: * = Corrected for degrees of freedom.

** = Observations weighted by square root of number of annual observations.

TABLE III

RESIDUAL SUM OF SQUARES AND ANALYSIS OF COVARIANCE
FOR TWO AND THREE VARIABLE EQUATIONS OF "WITHIN" AND "BETWEEN" MODELS

	Degrees of Freedom	FOOD		RENT		SERVICES		CLOTHING		TRANSPORT		DURABLES	
		2v	3v	2v	3v	2v	3v	2v	3v	2v	3v	2v	3v
1) Residual s.s. total	162/161	.12341	.12353	.26440	.23126	.29675	.29354	.69927	.69707	1.05502	1.02782	1.19815	1.15775
2) Residual s.s. within countries	147/146	.10323	.10330	.19799	.19344	.25317	.25266	.65202	.64953	.91510	.90428	1.09481	1.022283
3) Residual s.s. between countries	13/12	.00692	.00575	.02574	.02167	.03762	.03749	.03528	.03108	.14033	.13129	.08977	.056966
4) Residual s.s. due to different regressions	2/3	.01326	.02774	.04068	.01615	.00596	.00340	.01197	.01646	------	.00225	.01557	.07851
5) Mean Sq. within countries		.00070	.00071	.00135	.00132	.00172	.00173	.00444	.00449	.00623	.00619	.00745	.00701
6) Mean Sq. due to different regressions		.00663	.00924	.02034	.00538	.00298	.00113	.00598	.00548	------	.00075	.00778	.02617
7) F-Ratio (line 6 ÷ line 5)		9.47**	13.02**	15.07**	4.08*	1.73	.65	1.35	1.22	------	.12	1.04	3.73*

Note: * F(2, 147) significant at 95.0% level.
** F(2, 147) significant at 99.5% level.

TABLE IV

THE IMPACT OF POPULATION AS AN INDEPENDENT VARIABLE

$(\beta_1 + \beta_3 - 1) = 0$

	FOOD	RENT	SERVICES	CLOTHING	TRANSPORT	DURABLES
Within Countries						
a) Coefficient $(\beta_3 + \beta_1 - 1)$	.1244 (.1082)	-.2792 (.0469)	.0376 (.0640)	.0443 (.0883)	.7390 (.0108)	-1.3886 (.0917)
b) t(147 d.f.)	1.1497	5.9531**	.5875	.5017	68.4259**	15.1429**
Between Countries						
c) Coefficient $(\beta_3 + \beta_1 - 1)$	.0548 (.2383)	.1802 (.2672	.2690 (.3153)	-.2337 (.3143)	.9203 (.3950	-.5620 (.3243)
d) t(12 d.f.)	.2300	.6744	.8532	.7435	2.3299**	1.7319*

Note: * significant at 90% level

** significant at 97.5% level

t-test where $t = \frac{\beta_1 + \beta_3 - 1}{\sqrt{\text{var}\ (\beta_1 + \beta_3)}}$, $\text{var}\ (\beta_1 + \beta_3) = \text{Var}\ \beta_1 + \text{var}\ \beta_3 + 2\ \text{cov}\ \beta_1\beta_3$

TABLE V

DEMAND ELASTICITIES

RESULTS OF DIFFERENT WEIGHTING SCHEMES

(Two Variables Only - Population Variable Excluded)

	FOOD		RENT		SERVICES		CLOTHING		TRANSPORT		DURABLES	
	Exp.	Price	Exp.	Price	Exp.	Price	Exp.	Price	Exp.	Price	Exp.	Price
Within Countries:												
1) No weights 6 obs./country	1.1095	-.8743	.4202	-.3090	.9974	-.6443	.8123	-.5760	1.3139	-.4099	.7993	-.5037
2) No weights	.9637	-.9671	.4619	-.4591	.8501	-.6896	.8649	-.7101	1.5623	-.8620	.8274	-.6279
3) Weight $\sqrt{N}$	1.1442	-.8829	.3725	-.2972	.7591	-.5141	.7126	-.6234	.9384	.0001*	.3705	-----
4) Weight $1 \div \sqrt{N}$	1.2550	-.8321	-----	-----	1.2967	-.4627	1.0019	-.2653	1.7421	-.1534	.5797	-.1779
Between Countries:												
5) No weights	.8281	-.5440	.9527	.4803	1.2068	-1.2399	1.0306	-.8336	1.5805	-.4845*	1.1009	-.7988
6) Weight $\sqrt{N}$	.8611	-.7474	.9400	-.5606	1.2532	-1.3705	1.0357	-.7163	1.7206	.0383*	1.0933	-.9206
7) Weight $1 \div \sqrt{N}$	.8126	-.2692*	.9504	-.4356	1.1785	-1.0090	1.0183	-.9870	1.5131	-.8544*	1.1104	-.6620
8) Weight $\sqrt{obs}$	.8258	-.4612	.9454	-.3213	1.1884	-1.1108	1.0218	-.8536	1.5884	-.5972*	1.1383	-.6101*

Note: * Insignificant at 90% level.

TABLE VI

COMPARISON OF "BETWEEN COUNTRIES" MODEL:

UNWEIGHTED AND WEIGHTED* REGRESSIONS WITH THREE VARIABLES

	FOOD	RENT	SERVICES	CLOTHING	TRANSPORT	DURABLES
1) $R^2(C)$ unweighted	.7874	.3642	.4302	.7719	.3888	.5010
2) $R^2(C)$ weighted	.8887	.5776	.4999	.7195	.3888	.6561
3) Residual s.s. unweighted	.00068	.00263	.00415	.00338	.01275	.00657
4) Residual s.s. weighted	.00575	.02167	.03749	.03108	.13129	.05696
5) Var (β_1) unweighted	.0020	.0031	.0054	.0054	.0083	.0057
6) Var (β_1) weighted	.0221	.0315	.0523	.0529	.0875	.0600

* Country means weighted by square root of number of country observations.

TABLE VII

ELASTICITIES FOR INDIVIDUAL COUNTRIES: "WITHIN COUNTRIES" MODEL**

Country	Size*** Weight	FOOD		RENT		SERVICES		CLOTHING		TRANSPORT		DURABLES	
		Exp.	Price	Exp.	Price	Exp.	Price	Exp.	Price	Exp.	Price	Exp.	Price
Pooled		1.1074*	-.8750*	.3935*	-.3103*	.9935*	-.6438*	.7875*	-.5514*	1.2738*	-.4052*	.9277*	-.5461*
Nigeria	178	.9439	.9583	.4336[a]	-.4396	-.1701	.0800	1.5063	-.1904	-.9658	-.8367	4.9506	-1.4209
Rhodesia	77	.7373	-.1279	.6529*	-.9104*	.8162	-1.4700	1.1317*	.0221	.9330'	-1.6167'	2.2486*	-3.5763*
South Africa	124	.5883*	.0176	.2005*	-.1037'	.5007*	.1759	1.5481*	-.8579*	2.2025*	-.6495	3.6395*	.1245
Jamaica	41	.6901'	-1.2277	.0896	-1.7766*	2.1909*	-1.3035*	1.3920'	-3.9917*	.7870	-1.9928*	1.4387[a']	-1.4819*
Puerto Rico	48	.4677'	-.2438	.3334	-.3848*	1.7432*	-.7758*	1.2887	-1.6139	2.0037*	.1852	2.5648*	-.9667*
Honduras	42	.9181*	.3725	.0130	.1325	.5327'	.2545	2.1241*	1.0653'	2.2930*	-1.3270'	.0557	-.7230*
Ecuador	63	1.4138*	7.8312	.3529	32.2778	.3852	9.1967	.3491	-12.1794	5.1198*	-24.5210	-.0770	23.4744'
Peru	97	.9868*	-1.0117*	1.1313'	-.5782	1.0886*	-1.0648*	-.1473	-3.5277'	.8987*	-.9305*	.6969'	-.8174*
Dom. Republic	53	.9367*	-6.4505	1.2411*	6.0726	1.0220*	.6571	.6493	-.2014	1.4175'	4.0013	1.1892	-.5557
Thailand	167	.8350*	-1.0270*	.1732*	-.1251*	1.0589*	-.9435*	2.8886*	-3.1748*	1.5390*	-.8587*	.3933	-.6888
Ceylon	102	.9338*	-2.3840*	-.1541	-5.7324	.6894	-2.2737	2.6197*	.2597	1.6175'	-2.4805'	.2818	-4.9572
Korea	158	.9319*	-.1625	.2595	-.3565*	1.7206*	-.3399'	1.1954	-.2165	2.6211*	-.2168*	2.0040'	-.2882
Israel	45	.2482	-1.0662*	.0921	.0521	1.1562*	-.8333*	.1257	.3348	1.1238'	-1.0258	2.4714*	-.0248
Taiwan	106	1.1900*	-.0367	.1624	-.1442	.1044	.2024	.6773*	.1413	5.7243*	-.5850*	.7852	-.3505
Greece	92	1.1761*	.4124	.2858	-.3204	.3929[a]	-.9350'	3.0535'	.8278	1.4724*	-.4139	5.7952*	-4.0567*
Ireland	53	.6166*	.1568'	.7007*	-.2491*	1.2452*	-.3339*	1.6106*	.2323	------	-----	2.6048*	-.1371

Note:
' = Indicates significance at 90% level.
* Indicates significance at 95% level.
** Population coefficients are omitted in this table.
*** Weights not used in these estimates. Weight is the square root of mean population.
a = Population variable excluded from this equation.

TABLE VIII

GOODNESS OF FIT

ELASTICITIES FOR INDIVIDUAL COUNTRIES: "WITHIN COUNTRIES" MODEL

CORRECTED R-SQUARES*

	Code	FOOD	RENT	SERVICES	CLOTHING	TRANSPORT	DURABLES
Pooled		.9356	.2268	.5157	.3273	.4108	.2071
Nigeria	06	.6351	-----	-----	.3428	-----	-----
Rhodesia	07	.5808	.5707	.3171	.7876	.3268	.7016
South Africa	09	.4469	.2540	.4093	.5069	.6211	.5359
Jamaica	23	.4570	.6334	.8902	.5845	.5453	.4405
Puerto Rico	24	.2702	.6765	.5588	.4176	.3688	.5180
Honduras	27	.9519	.7648	.8298	.7126	.8512	.1706
Ecuador	34	.6828	-----	-----	.5453	-----	-----
Peru	42	.9000	.5402	.9842	-----	.9793	.8125
Dominican Republic	45	.0767	.0015	.0485	-----	-----	-----

(Continued on following page)

TABLE VIII (Continued)

		FOOD	RENT	SERVICES	CLOTHING	TRANSPORT	DURABLES
Thailand	51	.9990	.5831	.5417	.7954	.7450	.0012
Ceylon	53	.9698	-----	.1588	.9179	.0611	-----
Korea	54	.3307	.1408	.2195	.3545	.4708	.1198
Israel	56	.7931	-----	.5439	.3470	.4760	.5417
Taiwan	67	.8091	-----	-----	.6993	.9713	-----
Greece	71	.0358	.3525	.7705	.2119	.4436	.8250
Ireland	87	.7932	.7778	.8427	.3253	-----	.4818

Note: * Corrected for degrees of freedom. Includes population variable, as in Table VII.

TABLE IX

ANALYSIS OF COVARIANCE ON "WITHIN" REGRESSIONS FOR INDIVIDUAL COUNTRIES AND POOLED

(Test for Homogeneity of Regression Coefficients of Three Variable Model)

	d.f.	FOOD	RENT	SERVICES	CLOTHING	TRANSPORT	DURABLES
1) Residual s.s. - pooled*	162	.11290	.19506	.25920	.66770	.93571	1.12950
2) Residual s.s. - individual	117	.04697	.15183	.18535	.35936	.58060	.81140
3) Residual s.s. due to different regressions	45	.06592	.04322	.07384	.30833	.35511	.31809
4) Mean Square - individual		.00040	.00129	.00158	.00307	.00496	.00693
5) Mean Square due to different regressions		.00014	.00096	.00164	.00685	.00789	.00706
6) Ratio (45, 116 d.f.) line 5 ÷ line 4		.365	.740	1.036	2.231**	.629	1.019

Note: * Includes South Africa.

** Significant at 99.5% level.

TABLE X

ELASTICITIES FOR REGIONAL GROUPS OF "WITHIN COUNTRIES" MODEL*

	FOOD		RENT		SERVICES		CLOTHING		TRANSPORT		DURABLES	
	Exp.	Price	Exp.	Price	Exp.	Price	Exp.	Price	Exp.	Price	Exp.	Price
a) Pooled***	1.0985	-.8699	.3877	-.3071	.9749	-.6277	.8052	-.5569	1.2936	-.4074	.9791	-.5089
"Life-Style" Groups:												
b) "Developing"	1.1964	-.8591	.3205	-.3085	.9717	-.6459	.6416	-.5156	1.3101	-.3955	.8075	-.6353
c) "European"***	.7045	-.1024'	.5058	-.2331	.9328	-.3814	1.3499	1.0275'	.9800	-1.0123	2.7082	-.0475'
Continental Groups:												
d) Latin American	.9305	-.2269'	.4972	-.3210'	1.0336	-.8264	.9429	-.0341'	1.9544	-.6831'	.7474	-.6228
e) Asian	1.0668	-.9273	.2791'	-.2796	.6183	-.4317	.6356'	-.5098	1.0746	-.3561	.5798'	-.5158'
Boundary Groups:												
f) Island	.8072	-.2399'	.4289'	-.3671	1.0828	-.7034	1.5027	-.4660'	1.8708	-.8591	1.7887	-.6005
g) Continental**	1.1946	-.8676	.3687	-.2887	.9705	-.6230	.6309	-.5612	1.1717	-.3868	.7410	-.5522

Note: ' = Insignificant at 99% level.

* For three variables, including population which is excluded from this table.

** Excludes South Africa.

*** Includes South Africa.

TABLE XI

GOODNESS OF FIT

ELASTICITIES FOR REGIONAL GROUPS OF "WITHIN COUNTRIES" MODEL

CORRECTED R-SQUARES

	Degrees of Freedom	FOOD	RENT	SERVICES	CLOTHING	TRANSPORT	DURABLES
a) Pooled***	162	.9298	.2275	.5079	.3307	.4138	.2002
"Life-Style" Groups							
b) Developing	107	.9470	.2196	.4980	.3594	.4078	.2107
c) European 7,9,56,71,87	52	.6224	.5877	.5556	.3263	.4500	.5657
Continental Groups							
d) Latin American 24,27,34,42,45	59	.7166	.2503	.6884	.3157	.4496	.1935
e) Asian 51,53,54,67	33	.9761	.1181	.2632	.1614	.3618	.0893
Boundary Groups							
f) Island	57	.5841	.5785	.6613	.4647	.5092	.5401
g) Continental**	86	.5023	.1616	.4726	.3271	.3468	.2575

** Excludes S. Africa

*** Includes S. Africa

TABLE XII

ANALYSIS OF COVARIANCE -- ELASTICITIES FOR "LIFE-STYLE" GROUPS

THREE VARIABLE REGRESSIONS

	d.f.	FOOD	RENT	SERVICES	CLOTHING	TRANSPORT	DURABLES
1) Residual s.s. total**	162	.11290	.19506	.25920	.66770	.93571	1.12950
2) Residual s.s. "Developing"	107	.08328	.17637	.23036	.51386	.83615	.78219
3) Residual s.s. "European"	52	.00933	.00947	.02679	.12332	.09042	.17252
4) Residual s.s. due to different regressions	3	.02028	.00921	.00203	.03051	.00913	.17478
5) Mean Square, "Developing"		.00077	.00164	.00215	.00480	.00781	.00731
6) Mean Square due to different regressions		.00676	.00307	.00067	.01017	.00304	.03826
7) F-Ratio (3, 107) line 6 ÷ line 5		8.68***	1.86	.31	2.12	.39	7.97***

Note: ** Includes S. Africa.

*** Significant at 99.5% level.

TABLE XIII

ANALYSIS OF COVARIANCE

ELASTICITIES FOR TWO CONTINENTAL GROUPS: LATIN AMERICA AND ASIA

THREE VARIABLE REGRESSIONS

		d.f.	FOOD	RENT	SERVICES	CLOTHING	TRANSPORT	DURABLES
1)	Residual s.s. total	95	.08324	.17321	.18392	.41885	.77121	.53438
2)	Residual s.s. Latin America	59	.03067	.08700	.10112	.18701	.39382	.22606
3)	Residual s.s. Asia	33	.03254	.05629	.07135	.24350	.36313	.31499
4)	Residual due to different regressions	3	.02003	.02993	.01144	------	.01420	------
5)	Mean Square, Latin America		.00052	.00147	.00171	.00317	.00667	.00383
6)	Mean Square due to different regressions		.00668	.00998	.00381	------	.00475	------
7)	F-Ratio (3, 59) line 6 ÷ line 5		12.84**	6.76**	2.23*	------	.71	------

Notes: * Significant at 90% level.
** Significant at 99.5% level.

TABLE XIV

ANALYSIS OF COVARIANCE - ELASTICITIES FOR ISLAND-CONTINENTAL GROUPS

	d.f.	FOOD	RENT	SERVICES	CLOTHING	TRANSPORT	DURABLES
1) Residual s.s. total	146	.10330	.19344	.25266	.64953	.90427	1.02283
2) Residual s.s. Islands	57	.03041	.08714	.07552	.00326	.27850	.31128
3) Residual s.s. Continentals	86	.05680	.10716	.17804	.18584	.60105	.66901
4) Residual due to different regressions	3	.01608	------	------	.46043	.02427	.04253
5) Means Square, Islands		.00053	.00152	.00132	.00326	.00488	.00546
6) Mean Square due to different regressions		.00536	------	------	.15347	.00809	.01417
7) F-Ratio (3, 57) line 6 ÷ line 5		10.048**	------	------	47.07**	1.66	2.60*

Note: * 90% level
** 99.5% level

TABLE XV

COMPARISON OF ELASTICITIES FROM MANY SOURCES
See Accompanying Notes

	FOOD		RENT		SERVICES		CLOTHING		TRANSPORT		DURABLES	
	Exp.	Price	Exp.	Price	Exp.	Price	Exp.	Price	Exp.	Price	Exp.	Price
A. Between Countries (Table I)	.64	-.64	.74	-.25	1.12	-1.11	1.21	-.93	1.29	-.54	1.64	-.98
1) All - Watanabe	.75*		1.04*		1.36*		1.22*					
2) All - Houthakker, 1957	.6*		.8*				1.24*				--	
3) All - Kuznets, 1962	.49*		1.19*		1.81		1.25*				1.81*	
	1.17											
B. Within Countries (Table I)	1.11	-.88	.39	-.31	.99	-.64	.79	-.55	1.27	-.41	.93	-.55
4) Peru - Gilbert	.75*	.26	.96*	.45			1.15*	-.51'			1.80*	.05
5) Sweden - Parks	.38	-.11*	.10	-.04*	1.32*	-.60'			3.34	-.95*	1.47*	-.62'
					.43	-.04						
					.81	-.49						
6) Norway - Johansen	.79*	-.54*	.89*	-.50*	1.18'	-.68'	1.01'	-.62'	2.04*	-1.07*	1.81*	-.96*
7) Greece - Goldberger	.73*	-.56*	1.67	-.86	1.20'	-.73'	.93'	-.54'			1.34'	-.70'
8) Greece - Houthakker, 1965	.73*	-.34*	1.67	-.12*	-1.28	-.94*	1.17*	-.88*			1.80*	-1.13*
9) Greece - Nugent	.54*				1.36*		1.13'		2.76		1.47*	
10) Greece - This Report	1.18'	.41	.29'	-.32'	.39	-.94*	3.05	.83	1.47'	-.41'	5.80	-4.06
11) Ireland - Goldberger	.73*	-.39*	.93*	-.25'	1.06'	-.56'	.76'	-.24			2.40	-.63'
12) Ireland - This Report	.62*	.16	.70*	-.25'	1.26	-.33*	1.61*	.23	----	----	2.60	-.13
13) Chile (1962)	.73*	-1.07*										
14) Chile (1965) - Santiago only	.45*	-.45*			1.30*	-1.30*	1.11'	-.99*			1.40*	-1.21*
15) Nigeria (1966)	.94'		.85*				.97'		1.67'		4.43	
16) Argentina (1963) Budgets	.50*		.75*		1.87		.98'		.89'		2.13*	
17) Sudan (Urban Budgets)	.76*		1.02*				1.09'		2.55			
(Budgets) (Rural)	.84*		.75*				1.14'		1.54'			
18) India (Urban) (1960)	.86*				1.44*		1.39*					
(Budgets) (Rural)	.82*				1.72		1.38*					
19) Pakistan (Budgets)	.8*		.8*		1.5*		1.2*					

(Continued on following page)

TABLE XV continued

	FOOD		RENT		SERVICES		CLOTHING		TRANSPORT		DURABLES	
	Exp.	Price	Exp.	Price	Exp.	Price	Exp.	Price	Exp.	Price	Exp.	Price
20) Israel - This Report	.25	-1.07*	.09		1.16'	- .83'	.13		1.12'	-1.03*	2.47	-.02
21) Israel - Time Series	.64*	-.63*										
22) Israel - All Budgets	.52*		.98*		1.84		1.10'				2.04*	
b) Asian origin 56/57	.58		.77		2.00		1.53*		-		1.51*	
c) European origin	.52		.78		1.22		1.42*		-		2.31*	
23) Israel - All Budgets	.51*		.77*		1.32*		1.37*				1.41'	
b) Asian origin 59/60	.58		.57		2.09		1.31				1.73*	
c) European origin	.46		.86		.98		1.32				1.00'	
d) Israeli origin	.55		.61		2.13		1.77				.32	
24) Other Budgets												
a) Sweden	.53*						1.15*					
b) Greece	.70*						1.40*					
c) Ireland	.62*						1.39*					
25) Mexico - Total (Budgets, 1963)	.81*		1.20*				.69'				2.11*	
Urban	.81		1.13				.69				1.80	
Rural	.83		1.06				.66				3.85	

NOTES R TABLE XV "Comparison of Elasticities from Many Sources."

* Value falls in 99% confidence interval around Between Countries Estimates. See Table XVI, lines 1 & 2 for intervals.

' Value falls in 99% confidence interval around Within Countries Estimates. See Table XVI, lines 4 & 5 for intervals.

1) Watanabe for pooled data [50].

2) Houthakker, H. S. [25].

3) Kuznets [33], p. 27. (1) Food; also alcoholic beverages and tobacco; (2) Housing; (3) Other; (4) Clothing.

4) Gilbert for Peru [50].

5) Parks [36], Table 4.3 and 4.4, "Linear Expenditure System with Trend," p. 47. (1) Agriculture; (2) Housing; (3) Commerce, Domestic Services, Public Services; (6) Manufacturing.

6) Johansen [31], Tables 6.3.2;1 and 6.4.2;1, p. 102, 109. (2) Dwelling; (4) Textiles; (5) Land Transport; (6) Wood.

7) and 11) Goldberger, A. S., "International Comparison of Consumption Patterns: An Application of Stone's Linear Expenditure System," dated 17 November, 1966. Table 5, p. 10

8) Houthakker [27], p. 286.

9) Nugent [35], Appendix C, Table 4.34. (1) Agriculture; (4) Clothing and Footwear; (5) Transport Equipment; (6) Manufacturing.

10) and 12) Table VII this paper.

11) See above; line 7.

12) See above, line 10.

13) Eduardo García,D'Acuna, "Inflation in Chile, A Quantitative Analysis," unpublished doctoral dissertation, M.I.T., January 1964.

14) J. L. Dillon and A. A. Powell, "Un Modelo Econométrico de la Demanda al Detalle en Santiago de Chile" in Caudernos de Economía 2, 7 (septiembre 1965), p. 34.

15) P. B. Clark, 1967 (13), Table III-16, p. 82-3. (1) Food, Drink; (2) House Rent; (4) Craft Weave; (5) Transportation; (6) Metal Furniture.

16) OAS, "Estudio sobre política fiscal en la Argentina," (Buenos Aires, 1963), Chapter VI. From budget studies. Income, not expenditure elasticities.

17) F.A.O., "Analysis of Family Budget Data of Wadi Halfa," 1960.

(Continued on following page)

Notes for Table XV (Continued)

18) J. Roy and R. G. Laha, "Preliminary Estimates of Relative Increase in Consumer Demand in Rural and Urban India," Studies on Consumer Behavior, Indian Statistical Institute, Calcutta, 1960.

19) Md. Irshad Khan, "A Note on Consumption Patterns in Rural Areas of East Pakistan," Pakistan Development Review, Autumn, 1963. A. N. M. Azuzur Rahman, "Expenditure Elasticity in Rural West Pakistan," Pakistan Development Review, Summer, 1963.

20) Table VII, this paper.

21) Yair Mundlak, Long-Term Projections of Supply and Demand for Agricultural Products in Israel, Falk Project for Economic Research in Israel, Jerusalem, May 1964. Table 37, p. 92. Co-efficients are income elasticities.

22) Nissan Liviatan, Consumption Patterns in Israel, Falk Project for Economic Research in Israel. Jerusalem, May 1964. (a) Table 1, p. 15. (1) Total Food, (2) Maintenance (of household), (3) Health, education and literary expenditures, (4) Clothing, and footwear, (6) Durables. (b) and (c): Budgets classified by continent of origin of immigrant household heads. Table 18, p. 50, for Food; Table 28, p. 63, for others: (2) Maintenance, (3) Education only, (4) Clothing, excluding footwear, (6) Durables.

23) Michael Landsberger, "Changes in Israeli Consumption Patterns During the Period 1956/57 to 1959/60," in Bank of Israel Bulletin, No. 23 (Jerusalem, Adar B, 5725), Appendix A, Tables 2 & 3, p.63. (1) Total food; (2) Housing maintenance; (3) Education only; (4) Clothing excluding footwear, (6) Durables.

24) (a) Sweden, from H. Wold & L. Jureen, Demand Analysis, Wiley, New York, 1952, p. 265. (b) & (c) from L. M. Goreux, Income Elasticity of the Demand for Food, FAO, Rome, 1959, pp.36-37.

25) Banco de Mexico, Oficina de Estudios sobre Proyecciones Agrícolas, Encuesta sobre ingresos y gastos familiares en Mexico, 1963 (Mexico, D.F., March, 1966). Table 32, p. 407. (1) Food, drink, tobacco, (2) Housing, light and other services, (4) Clothing and footwear, (6) Vehicles, furniture, and household appliances.

TABLE XVI

SUMMARY COMPARISON OF ELASTICITIES:

AVERAGES OF MANY SOURCES COMPARED TO CONFIDENCE LIMITS AROUND POOLED ESTIMATES***

	FOOD		RENT		SERVICES		CLOTHING		TRANSPORT		DURABLES	
	Exp.	Price	Exp.	Price	Exp.	Price	Exp.	Price	Exp.	Price	Exp.	Price
A. Between Countries Limits: This Report												
1. Upper limit	.86	-1.30	1.18	-.77	1.68	-2.59	1.73	-1.60	2.36	-2.60	2.33	-2.20
2. Lower limit	.42	.00	.30	.00	.55	.00	.70	-.26	.22	.00	.94	.00
3. Average Value of Table XV, lines 1-3:	.61	---	1.01	---	1.59	---	1.24	---	---	---	1.81	---
B. Within Countries Limits: This Report												
4. Upper limit	1.27	-.96	.59	-.46	1.22	-.84	1.14	-.80	1.68	-.58	1.38	-.85
5. Lower limit	.94	-.79	.19	-.16	.77	-.44	.44	-.31	.87	-.24	.48	-.24
Average Value of:												
6. Time Series**	.69	-.68	1.21	-.71	1.23	-1.26	1.29	-.64	2.87	---	2.33	-1.42
7. Budget Studies*	.69	---	.90	---	1.82	---	1.31	---	1.66	---	2.43	---

Note: *** Confidence limits are set at 99%.
** From Table XV, lines 4,7,8,9,11,13,14,15,21.
* From Table XV, lines 16,17,18,19,22,23,24b,24c,25.

N.B.: Lines 3,6, and 7 of this table are unweighted arithmetic means.

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