ESTIMATION OF THE ENGEL'S CURVES FOR IRAN (URBAN & RURAL)

BY

BEEJAN BEEDABAD

THESIS

SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE

IN

ECONOMICS

SHIRAZ UNIVERSITY

SHIRAZ, IRAN

بخش اقتصاد

APPROVED AND EVALUATED AS good.

Bahman Dadgostar ....B. Dadgostar, Assist. Prof. of Economics (Chairman)

Ahmad Vessal ....A. Vessal, Assist. Prof. of Economics

L. Kasraie ...E. Kasraie, Assist. Prof. of City and Regional Planning

Committee in Charge

NOVEMBER 1981

ACKNOWLEDGEMENTS

I am very grateful to my major advisor, Dr. Dadgostar, for his instrumental comments and valuable guidance during the course of this study. My thanks also go to Dr. Vessal and Dr. Kasraie, for their constructive criticism of the manuscript; and to the staff of the Statistical center of Iran for their assitances in data preparing and permission for using the computer.

ABSTRACT

ESTIMATION OF THE ENGEL'S CURVES
FOR IRAN (URBAN & RURAL)

by Beejan Beedabad

Engel's curves which were applied, for the first time by Ernest Engel in 1857, are of the most useful procedures utilized by the researchers throughout the world. One of the important results of the Engel's curves is income elasticity of commodity expenditure, which has application in projection of demand, and consequently in economic planning.

In this study we have tried to estimate different income elasticities via Engel's curve estimation for Iran(urban & rural seperately). Therefore, the prepared samples by the Statistical Center of Iran which include nearly 15,000 urban and 15,000 rural statistical cases have been utilized. For the first time in Iran raw and sufficient data has been used.

In addition to the produced models by previous researchers, new models also have been introduced to improve this estimating procedure. Commodities have been divided into 18 food and non-food bundles.

Our findings confirm our hypotheses: upward convexity for necessities; upward concavity for luxuries; linear form total non-food bundles. The hypotheses are new steps to complete the Engel's curves theory.

٣

TABLE OF CONTENTS

LIST OF TABLES

Page

Page

Page

Page

LIST OF FIGURES

Page

CHAPTER I. INTRODUCTION

Estimation of income elasticity has made facilities generally for economic planners for long-term and short-term projections of demand. As a scientific tool for governments it is a worthy guide for them to know and distinguish the necessity and non-necessity commodities in the society, and decision making about transfer of their production / distribution to private or public sectors. Governments can apply the income elasticity in development planning and in programming price subsidies, rationing and people's diet. The government can increase her revenues by levying indirect taxes on goods which have low income elasticities; and also indirectly diminishes the luxury production by levying indirect taxes on commodities which have high income elasticities, and are known as socially undesirable goods -with a glance to their income elasticities.

In the private sector, entrepreneurs can use income elasticity with national income statistics to forecast demand and invest accordingly.

The income elasticity may be interpreted as follows: For every one percent increase in family money income, there is a corresponding increase of the indicated percentage in the family expenditure for a particular commodity or commodity bundle.

If an increase of one unit in income, causes less than one unit increasein demand (expenditure), the demand is said to be inelastic or the good is said to be a necessity. On the other hand, if an increase of one unit in income causes the demand for an item to increase by more than unity demand is to be elastic or the good or bundle a luxury. The only exception would be in the case of inferior goods to the extent that a decrease in income will result in an increase in the consumption of a good.

Although the income elasticity based on the family budget statistics underestimates the income elasticity based on the quantity data, it can still be used in estimation and forecasting present and future demand.

The traditional procedure to estimate income elasticity is estimation of the Engel's curve. Engel's curve is a functional relation between family expenditure on a commodity or commodity bundle and family income (total expenditures). These curves have many advantages, can be easily estimated and do not possess the shortcomings of demand functions.

The relation between consumption and income - that is, an Engel curve - is particulary useful in understanding the consequences of economic development. As incomes rise, consumers usually buy many goods that were not purchased before, and decrease their consumption of many other goods. The more narrowly goods are defined, the more both patterns tend to be observed whereas aggregation hides the introduction of new goods and elimination of the old ones. The introduction of goods dominates on balance so that the variety of goods consumed is positively related to income. The agricultural sector has always declined relative to other sectors as countries have experienced significant development. Part of the explanation is that agricultural products have a low income elasticity; therefore,as a country's income grows, resources are shifted (relatively and at times absolutely) from agriculture into services and manufacturing. This is not the whole story, however, since agricultural products also have a low price elasticity, the secular decline in the relative price of agriculture has also contributed to its decreasing importance.

Income elasticities alone, however, cannot explain all the effects of development on consumption, as can be seen in the growth of the service sector. Since the income elasticity of services is not much higher than that of material goods, the secular growth in income can explain only a small part of the redistribution of labor to the service sector.

Other examples of the use of Engel curves can be found in the analysis of fertility, consumption law's proposed by Keynes, and so on (G.S. Becker 1971).

In this study we try to estimate Engel curve for urban and rural areas of Iran in the year 1356 (1977). The present research is based on the raw data -for the first time- derived from the Statistical Center of Iran, family budget files which includes nearly 30,000 statistical cases (observations) with 18 bundles of commodities. Twelve econometric models are chosen, five of them have been examined by the previous researchers.

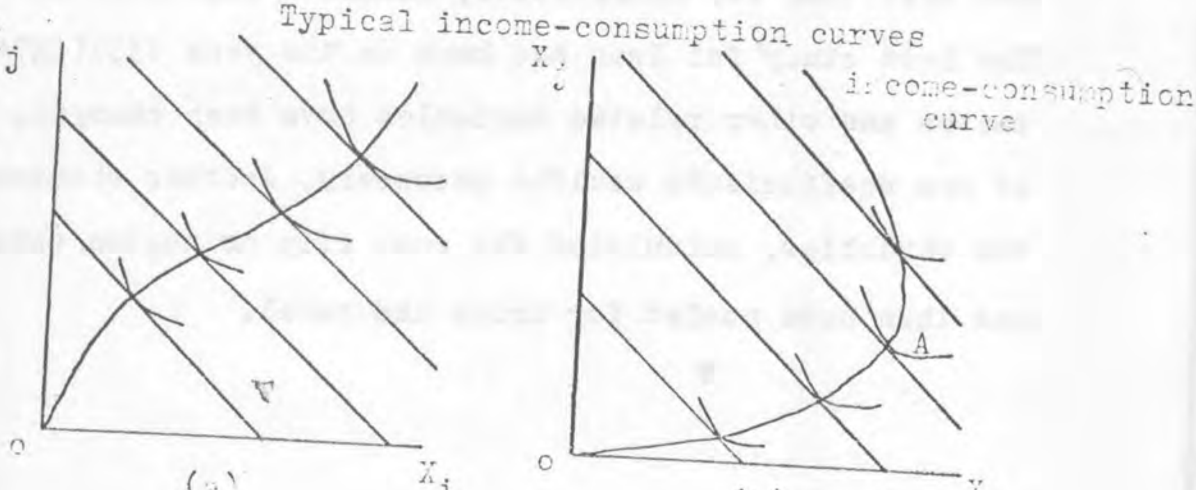
Our endeavour to use the above characters is to improve this method of estimation, so seven extra new models are under examination. According to their shapes we divide the 12 models to three major groups: upward convex, upward concave and linear, and test them for necessities, luxuries and total non-food bundles. The last study for Iran had been in the year 1353(1974), so as tastes and other related variables have been changed, estimation of new coefficients wouldbe necessary. Another shortcoming of the variables, calculated for each city or region seperately, and then have pooled for urban and rural.

CHAPTER II.

INCOME-CONSUMPTION CURVE; ENGEL CURVE AND INCOME ELASTICITY

By increasing income and constant prices, we could move the consumer's budget line steadily outward and note the point he chooses at each income level. We could also decrease income below the original level and trace out points between original level and the origin. If we join all the points representing the consumer's choice at each income level, with prices being constant, the curve we obtain is called the income-consumption curve. It joins points on successive indifference curves that have the same slopes, since the slope of the budget line does not change; on the other hand the income-consumption curve is the locus of equilibrium budgets resulting from various levels of money income and constant money prices. Figure (a) illustrates a typical income-consumption curve with both goods normal. Figure (b) illustrates a case in which x_i becomes an inferior good at the income level corresponding to the point A.

Typical income-consumption curves



both goods normal

one becomes inferior

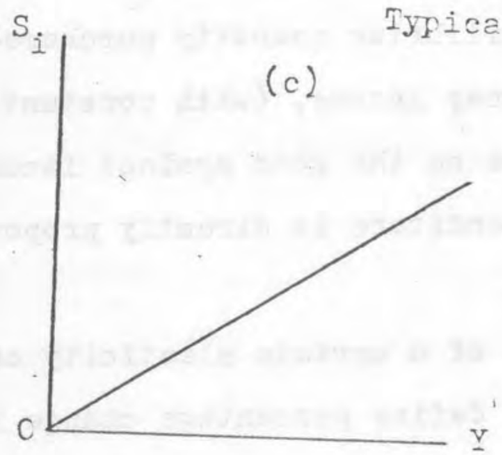
We expect that goods which are inferior at high income levels will be normal at low income levels, and that no goods will be inferior at sufficiently low incomes (Ferguson & Gould 1975).

The information contained in the income-consumption curve may be used to derive Engel curve for each commodity or commodity bundle. Instead of showing how the choice between the two goods varies with income, we can take one of the goods and see how the quantity of this good varies with income. So an Engel curve is a function relating the equilibrium quantity purchased of a commodity to the level of money income, (with constant prices). We usually plot the expenditure on the good against income. Since prices are constant, expenditure is directly proportional to quantity.

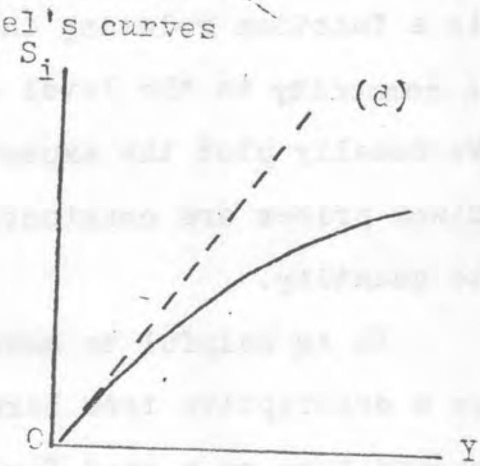
It is helpful to make use of a certain elasticity concept as a descriptive term here. We define percentage change in the expenditure on a good for a 1 per cent change in income as the income elasticity, prices being constant. If the income elasticity is less than unity, expenditure increases by a smaller proportion than income, so that the ratio of expenditure to income falls as income rises, as in figure(d). If the income elasticity is greater than unity, the expenditure/income ratio rises,as in(e) while the ratio is constant, as in (c), for unit elasticity. Engel curves shown in figures (c), (d), and (e), all show expenditure increasing with income, so the good is normal.Figure (f) shows expenditure decreasing beyond the income level "y", so this good is inferior for higher income levels.

Goods whose income elasticity is greater than unity are sometimes called luxury goods or superior goods, and goods whose income elasticity is less than unity and greater than zero are called essential goods or necessaties. The terms are not altogether apt.

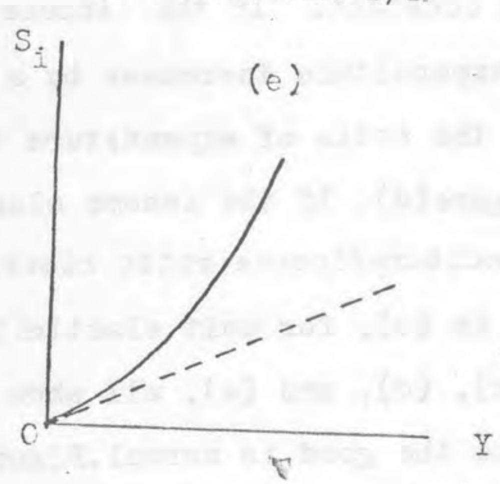
Typical Engel's curves



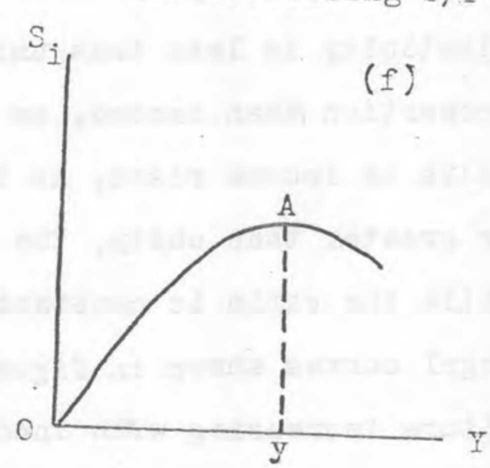
with constant S/Y



with decreasing S/Y



with increasing S/Y



with a diminishing point of return

Thus, we have a set of descriptive terms that expresses the relationship between income and expenditure on a particular commodity or commodity bundle, with prices constant. If expenditure falls with a rise in income, we have an inferior good. If expenditure rises with income, the good is normal. A normal good may be a luxury good (income elasticity greater than unity) or an essential good (income elasticity less than unity but positive). Notice that the words "inferior", "normal", "superior", "luxury", "necessity" and "essential", are used here only to describe the income elasticity of a good, no more and no less. It is possible that a given good will be an inferior good for one consumer and a superior good for some other consumer (Ferguson & Gould 1975; K. Lancaster 1974).

ENGEL'S CURVE THEORY

An Engel curve is a relationship between income and the expenditure on a particular commodity, all other things being equal. So the Engel curves express the expenditure on a good as a function of income only, or:

$$p_i x_i = \phi_i(y)$$

These functions are so named in honour of Ernest Engel (1857) who seems to have been the first to formulate empirical laws governing the relation between income and particular categories of expenditure. The following 'laws' can be found in his work: (E. Engel 1857)

(i) Food is the most important item in household budgets;

(ii) The proportion of total expenditures allocated to food decreases as income increases;

(iii) The proportion devoted to clothing and housing is approximately constant, while the share of luxury items increases when income increases.

Let us take a closer look at the cited 'ceteris paribus' condition. The Engel curve is a demand function derived by (constraint) utility maximization.

Suppose, for example, that a demand equation is specified as:

$$x_i = a_i + b_{ij}\frac{p_j}{p_i} + d_i\frac{y}{p_i} + e_i$$

and rewritten as :

$$p_i x_i = (a_i p_i + b_i p_j) + d_i y + e_i p_i$$

We then see that, in the regression line

$$p_i x_i = c_i + k_i y + u_i$$

c_i is an estimate of $(a_i p_i + b_i p_j)$ and k_i an estimate of d_i, on the assumption that prices are constant. It should be clear that Engel curves are demand equations in which all prices are supposed to be constant. That is why cross-section data are appropriate, as they relate to one period of time, so that prices remain unchanged.

In theory, the d_i coefficient describes the reaction of one and the same individual whose income is increasing, with given prices and a given utility function (Phlips 1974).

CHAPTER III. REVIEW OF LITERATURE

Empirical work on so-called Engel curves - relationship between specific expenditures (or forms of saving) and income level, holding other relevant variables constant - was first done about the mid-nineteenth century, with the work of Engel on household budgets and, some time later, with the work of a number of U.S. and British statisticians on demand relationships (G.J. Stigler 1954). Since then empirical studies in this area have multiplied enormously, spurred by the growing interest in statistical methods. The past three decades have witnessed numerous empirical studies for specific commodities. At the same time, this period has witnessed a growing emphasis on methodological improvments, and it is here that the principal developments in this area have taken place. For this reason, the present review is relatively brief and in view of the orientation of this paper, focuses on the use of household-budget data.

Engel's law - that the proportion of household expenditure on food declines as household income rises - has by now been verified literally hundreds of times (J.N.Morgan 1958).Generally, most studies also provide strong support for what is known as Schwabe's law, namely, that the per cent of income spent for housing declines as income rises, although using permanent income concept M.Reid alleges that high-quality housing in reality is one of the main luxuries for consumers. Further support for both laws was obtained in study by Houthakker in which he derived Engel curves for four expenditure groups based on data from each of forty surveys from seventeen countries (Houthakker 1957). It is interesting that the function used in his study, as in many others, was essentially the same as used by Engel in his original paper, namely, a double-log relationship between the specific expenditure and total expenditures.

Recent studies reflect a growing interest in ascertaining the determinants not only of food expenditures but of a wide range of household purchases, such as housing, clothing, house furnishings and services. These studies tend to bear out earlier findings on income elasticity, yielding low elasticities for food and housing, elasticities close to unity for clothing and education, and higher elasticities for various types of recreation, personal care, home operation and other services (R.P. Mack 1952). In this area, linear (in some cases, logarithmic) single-equation forms have been used to derive marginal propensities and income elasticities for a wide range of consumption categories. This was the approach used by Prais & Houthakker (1955) on English data, and by Crocket & Friend (1962) on American data. The Friend-Crockett study using multiple regression analysis discusses the effects on all major consumption categories of a large number of family characteristics including income. Among other things, their result indicate that family size and age, next to income, appear to exert the main influence on family consumption, particularly through the influence of family size on food expenditures and of age on durable-goods purchases. The study also finds that income elasticities are reduced substantially once variables reflecting other family characteristics are introduced into the relationships.

At the same time dissatisfaction has been expressed over the rigid assumptions inherent in this approach. This dissatisfaction was crystallised to some extent by the findings of Prais & Houthakker that a semi-log form is preferable for necessities and a double-log form is preferable for luxuries (Prais & Houthakker 1955); and by Stuvel & James that the use of only one form of equation to explain variations in food expenditures over the entire range of incomes and social classes in Holland is unsatisfactory (G.Stuvel & S.F.James 1950).

One result of this dissatisfaction has been some interesting attempts to modify the Engel-curve approach. One approach has been to introduce non-linearities into the expenditure-income relationship to allow for the possibility that a commodity may behave as a luxury in one range of income and as a necessity in a different range (S.J.Prais 1952-53). A Sigmoid response curve, which has an upper asymptote and at the same time passes through the origin, appears to yield realistic results in such instances (J.Aitchison & J.A.C.Brown 1954-55).

Another approach, one that uses linear equations, has been to explain consumer purchases of specific goods on the basis of relationships between stocks and wealth rather than between income and expenditure. Quasi-Engel curves relating inventories to a measure of wealth have been derived by Cramer (1958) for a wide variety of household goods based on two Dutch surveys, and by Houthakker & Haldi for automobiles based on panel data for U.S. families (Houthakker & Haldi 1960). The latter study is particularly interesting, showing that at a given level of income gross investment in automobiles varies inversely with beginning-of-the-year inventory, and that at a given level of beginning inventories gross investment rises with income level.

Dissatisfaction with the linear-equation approach has also led to the use of analysis of varinace rather than multiple regression to ascertain the net effect of different variables on household expenditures. Analysis of variance offers a more flexible approach to the estimation of relationships, since no assumption is necessary regarding the form of the functional relationship. As a result, studies using this technique do not always give the clear-cut simple results yielded by multiple regression, but in many ways appear to be more realistic, bringing out effects of various characteristics not only singly but in combination with each other (V.Lippitt 1959 , R.Ferber 1968).

EMPIRICAL MODELS OF THE ENGEL CURVES

A major landmark empirical work in this area is known to be done by both Allen and Bowley (Allen & Bowley 1935).

Allen & Bowley initially assume the marginal rate of substitution R between any two goods x_i and x_j to be the ratio of the linear expression of the amounts of goods purchased: $x_1, x_2, \ldots, x_n$. Clearly the underlying utility function is quadratic. For the two goods example we have:

$$R = \frac{a_1 + a_{11}x_1 + a_{12}x_2}{a_2 + a_{21}x_1 + a_{22}x_2} = \frac{p_1}{p_2} \qquad (1)$$

Assume the budget constraint

$$y = p_1 x_1 + p_2 x_2 \qquad (2)$$

or $$y = s_1 + s_2 \qquad (3)$$

where s_1 and s_2 are expenditures on the respective commodities, and y is the total expenditure. Working with cross-section data, prices could be assumed constant; therefore, (1) may be written as:

$$a_1 p_2 + a_{11}\frac{p_2}{p_1}(p_1 x_1) + a_{12} p_2 x_2 = a_2 p_1 + a_{21} p_1 x_1 + a_{22}\frac{p_1}{p_2}(p_2 x_2) \qquad (4)$$

or:

$$b_1 + b_{11}s_1 + b_{12}s_2 = b_2 + b_{21}s_1 + b_{22}s_2 \qquad (5)$$

Using (3) to eliminate first s_1 and, then s_2 from (5) we will get two equations in the form:

$$s_1 = k_1 . y + c_1 \quad (6)$$

$$s_2 = k_2 . y + c_2 \quad (7)$$

where k_1, k_2, c_1 and c_2 are in terms of constant b's.Beacuse prices are constant, (6),&(7) represent a set of linear Engel curves (Allen and Bowley pp.109-111)

In this case (6),&(7) automatically satisfy the adding up condtion requiring that $k_1 + k_2 = 1$ and $c_1 + c_2 = 0$.

Of course linear specification of Engel curves has some undesirable consequences. To examine this point let us consider the income elasticity "Ey" of commodity 'i',given a linear Engel curve:

$$s_i = p_i x_i = k_i y + c_i \quad (8)$$

$$Ey = \frac{\frac{dx_i}{x_i}}{\frac{dy}{y}} = \frac{dx_i}{dy} . \frac{y}{x} = \frac{k_i}{p_i} . \frac{y}{x_i} = k_i . \frac{y}{s_i} . \quad (9)$$

$$Ey = \frac{k_i}{e_i} \quad \text{where} \quad e_i = p_i x_i / y \quad (10)$$

From (10) it is clear that income elasticity Ey being bigger than, equal to or smaller than unity depends on whether k_i is bigger than, equal to or smaller than e_i. The later depends on the sign of c_i in (8) in the following way.

Let us divide (8) through by y, we get

$$e_i = \frac{s_i}{y} = \frac{p_i x_i}{y} = k_i + \frac{c_i}{y} \quad (11)$$

Using (11) $c_i > 0 \longrightarrow e_i > k_i$, then from (10) $e_i > k_i \longrightarrow Ey < 1$

and furthermore,

$$\lim_{y \to \infty} e_i = \lim_{y \to \infty} (k_i + \frac{c_i}{y}) = k_i \qquad (12)$$

This implies that Ey approaches one as income increases. This latter point is true for both luxuries and necessities i.e for luxuries as income increases the income elasticity decreases and the converse is true for necessities. This result is not consistent with commen sense.

Prais and Houthakker (1955) tried different functional forms on the bases of the following assumptions:

a)...There is an income below which a commodity is not purchased, b)...There is a satiety level, that is, a maximum to the quantity of the commodity consumed which is not exceeded however high income may rise..."(Prais and Houthakker p. 82)- for some commodities.

In addition to the linear form they examine the following forms each of which exhibits a peculiar characteristics.

a.) Double log $\quad \text{Log } s_i = a_i + b_i \text{Log } y$

b.) Semi LOG $\quad s_i = a_i + b_i \text{Log } y$

c.) Hyperbolic $\quad s_i = a_i - b_i / y$

d.) Log -reciprocal Log $\quad s_i = a_i - b_i / y$

Equation a.) represents constant income elasticity b_i, with the attribute that for both luxuries and necesities, as income y increases expenditure s_i increases but the change in the rate of increase is positive for the former and negative for the latter category of goods.

Equation b.) represents a situation where up to certain level of income (i.e $y=\exp(-a_i/b_i)$) commodity i is not consumed, but from that point on expenditure on i increases with income. In this case income elasticity (b_i/s_i) is a decreasing function of expenditure on commodity i.

For equation c.) up to the point $y=b_i/a_i$ commodity i is not consumed, from that point as income increases expenditure on i increases and approaches a satiation level, $s_i=a_i$. In this case income elasticity $Ey=b_i/(y.a_i-b_i)$ is a decreasing function of income .

Finally for equation d.) income elasticity $Ey=b_i/y$ decreases with income and marginal expenditure changes sign from positive to negative as total expenditure y rises. In other words there is an inflection point at point $y=b_i/2$.

After a careful comparison of the statistical results, Prais and Houthakker conclude that the semi-logaritmic function gives the best results, as far as food items are concerned. This is understandable: the semi-logaritmic form makes it possible for a commodity to appear as a luxury at low income levels, and as a necessity (income elasticity below one) at higher income levels. For all other goods and services , the double-logaritmic form gives the best statistical results (Phlips 1974).

THE GAP BETWEEN ENGEL'S CURVE THEORY & EMPIRICAL ANALYSIS

Prais and Houthakker's choice among specifications a. to d. is based on the goodness of fit. But what about their theoritical plausibility? Comparing their approach with Allen and Bowley's, we come to realize that while much has been gained in terms of descriptive power, much has been lost in terms of theoritical plausibility. By introducing more realastic changes of income elasticities, Prais and Houthakker loose contact with the theory of utility maximization. Indeed, there is no longer any reference (except some will be mentioned) to a specific utility function. Moreover, these specifications are not compatible with utility maximization, as they do not satisfy the adding-up criterion exactly. The approach is entirely pragmatic.

The same can be said about similar realistic specifications , such as the lognormal distribution analysed by Aitchison and Brown (1957), the family of the Engel curves introduced by Törnqvist (1941) and used by Wold and Jureen (1952), or the forms suggested by Champernowne (1969). Much work remains to be done to find specifications that are both realistic and theoretically plausible.

To ensure the theoretical plausibility of estimated Engel curves, the investigator has to make sure that the general restrictions of demand theory are satisfied, as emphasized in Houthakker (1960a). The problem simplifies drastically, as all restrictions in terms of price derivatives (homogenity, symmetry, negativity of the own substitution effect) disappear, given that prices are constant. The only restriction that remains is the adding-up condition, which says that, if

$$s_i = \phi_i(y) \qquad i=1,2,\ldots,n \tag{13}$$

where

$$s_i = p_i x_i \tag{14}$$

$$\sum_{i=1}^{n} \phi_i(y) = y$$

or

$$\sum_{i=1}^{n} \frac{ds_i}{dy} = 1 \tag{15}$$

The sum of the marginal propensities to consume (or the marginal budget shares) has to be equal to one at all income levels.

It is a property of linear regression equation that they satisfy the adding-up criterion. That is if a set of linear Engel curves obeying (8) are fitted to an additive data set, then the regression estimates will satisfy:

$\sum_{i=1}^{n} c_i = 0$ and $\sum_{i=1}^{n} k_i = 1$.

However, linearity is not without other theoretical implications. Linearity of the Engle curves implies that the utility function is of a special form. Investigating the class of additive utility functions yielding demand functions which are locally linear in income, or,equivalently, yielding Engel curves which are linear in some region of the commodity space, Pollak (1971b) finds that an additive utility function yields demand functions locally linear in income if and only if it is either of the form

$$U = \sum_{i=1}^{n} b_i \mathrm{Log}(x_i - d_i) \qquad (17)$$

$$b_i > 0, \quad (x_i - d_i) > 0, \quad \sum_{i=1}^{n} b_i = 1 \qquad (18)$$

which is the familiar Stone-Geary function, or

$$U = \sum_{i=1}^{n} v_i (b_i + \varnothing_i x_i)^{@} \qquad (19)$$

which is a generalization of the additive quadratic utility function, or

$$U = -\sum_{i=1}^{n} v_i e^{-b_i x_i}, \quad v_i > 0, \quad b_i > 0, \qquad (20)$$

which is an additive function used by Chipman (1965).

Furthermore, they find that linear form appropriate s only for fruits, beacuse income elasticity for fruits is about unity.

Although these forms exhibit a better empirical fit, they do not even satisfy the adding-up condition, and therefore,there is lack of compatibility with utility maximization behavior. To the best of our knowledge, so far no system of Engel curves has been developed that overcomes the inconveniences of Allen-Bowley's linearity and Houthakker's lack of theoretical compatibility. In one case Carlevaro(1976), proposes the system of demand equations $x_i=f_i(y).g(p_1,p_2,\ldots,p_n)$. After imposing the theoretical constraints, he concludes that in order for theoretical restrictions to hold $f_i(y)$ should equal to y. This leads back to the system of Engel curves linear in income.

Interestingly it is in fact possible to utilize flexible functional forms to construct systems of Engel curves that could overcome these dificulties.

PAST STUDIES FOR IRAN

The empirical studies in this field for Iran are very brief; there have been no innovations to enable them to estimate income elasticity.

The first study was done by Bank Markazi Iran for the years 1338 (1959), under the title: "Survey of Consumer Expenditure and Income in 32 Urban Cities of Iran", (Bank Markazi Iran, 1962), in which urban income elasticity has been estimated; (the estimated income elasticities are for 32 cities altogether, not separately). Their data was presented in the average forms; and elasticity is derived from constant elasticity model (Double-Log).

The second study was carried out for the year 1347 (1968), by Bank Markazi Iran, (Bank Markazi Iran 1971), under the title: "Income Elasticity of Demand for Goods and Services in Urban Areas of Iran during 1347." The scope of the study is wide but the variables are the averages of the raw data; the double-log model has been chosen.

The Statistical Center of Iran studies are for the years 1347-48 (1968-69), and 1351 (1972), which is for urban areas with some items for rural areas, double-log model has been used. Variables are in the form of averages (SCI 1347-1348 , SCI 1351).

For the years 1351(1972) (BMA, Industry & Construction Center), 1353(1974) (BMA 1356) Bank Markazi Iran has two estimations using Prais & Houthakker's five models. Estimations are for food items and for urban areas; the data is in the form of averages.

Utah State University under the direction of A. Le Baron has stimated a pooled model for the years: 1338 & 1347 (1959 & 1968) for urban areas; and another model for the years: 1342 & 1343 & 1344 (1963-65) for rural areas and 1342(1963) for Tehran (A. Le Baron 1970). The household-size variable has entered into the models which are Double-Log and Semi-Log; variables are in the form of averages.

This study does not use average data and so is not similar to the past studies for Iran. The methodology of the application of the data (raw data) of this research is similar to the works of R.G.D. Allen & A.L. Bowley (1953), and Nurul-Islam (1966).*

*Nurul Islam applied Prais & Houthakker's five models to the rural data of East Pakistan.

CHAPTER IV. MODEL BUILDING

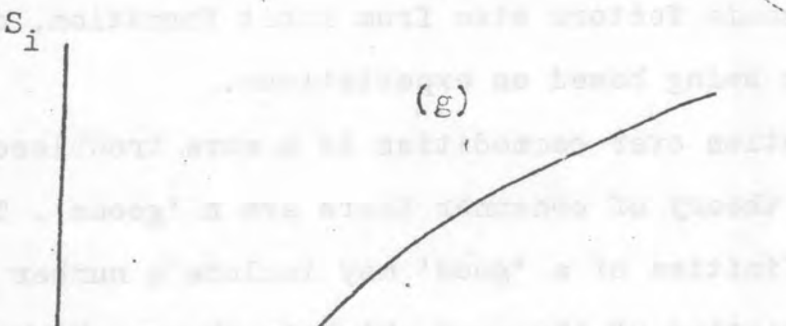
In this chapter we shall be concerned with the use of budget studies or family expenditure survey to explor the allocation decision.The reasons for using this data stems from the apparent richness of the statistical information. With reference to demand functions which aim to measure the effects of price and income changes on quantities demanded, it is bright that the estimates of price effects have not been very successful. This, it has been claimed, stems from the correlation between income and prices which usually occurs in time series data. With cross-section data prices are usually considered fixed and thus it is possible that the income effect can be measured best by using this kind of data.

Expenditure surveys often enable us to do much more than just measuring income effects, beacuse observations on the so-called 'nuisance' factors can provide estimates which allow us to assess the effects on demand of demographic changes. Even more interesting , expenditure surveys can provide the data to measure the economies of scale in consumption,and derive equivalent adult scales. Most of these things are done in Prais and Houthakker (1955) where two British surveys are analysed. A similar work has been performed in the U.S.A. but this study has some more advantages and completness in some aspects of the previous studies.

Now we begin with a consideration of the difficulties of using cross-section data to quantify the concepts of theoretical demand analysis. The basic assumption is that "... by observing consumers in different circumstances at the same time, information may be obtained which is relevant in forcasting the behaviour of any particular consumer when his circumstances change through time". This means that budget studies may not be usefull if dynamic factors or consumer interdependence are present. Dynamic factors stem from habit formation, durability or decisions being based on expectations.

Aggregation over commodities is a more troublesome problem. In the pure theory of consumer there are n 'goods'. The statistical definition of a 'good' may include a number of qualities or varieties of the good which in theory should be separate goods. Furthermore, new goods are introduced to the consumer whereas the theory assumes that number of the goods are fixed. When a new good is introduced expenditure on substitute goods is discouraged. Since substitutes must predominate in a consumer's budget and since more new goods are introduced as a consumer becomes wealthier we should expect a typical Engel curve (i.e., the relation between expenditure on good i and income) to approach an asymptote. We shall only concern ourselves here with nine food and seven non-food aggregates.

The first step in the analysis is to decide on a functional form. Two a priori considerations are taken into account namely (1) in general there will be a level of income below which the consumer purchase none of the good and (2) there will be a saturation level unless the consumer switches to a better quality in which case the expenditure will continue to rise but more slowly. Thus the function should have the shape illustrated in figure (g), (Bridge 1971).



Typical shape of an Engel's curve

HYPOTHESES

Now we try to explain our hypotheses upon which our models will be based, and then test them with urban and rural data of Iran.

First Hypothesis:

Upward convex Engel curves should fit better to necessities (Commodity or Bundle). Mathematically these conditions should be satisfied:

$$\frac{dS}{dY} > 0$$

$$\frac{d^2S}{dY^2} < 0$$

When d^2S/dY^2 isnegative, by increasing income the proportion allocated to the expenditure of the purchasing of the commodity or commodity bundle increases but less than income increments. This phenomenon is similar to the situation of the necessities in the consumer budget.

Second Hypothesis:

Upward concave Engel curves should fit better to the luxuries (Commodity or Bundle). Mathematically these conditions should be satisfied:

$$\frac{dS}{dY} > 0$$

$$\frac{d^2S}{dY^2} > 0$$

When d^2S/dY^2 is positive, by increasing income the proportion allocated to the expenditure of the purchasing of the commodity or commodity bundle increases but greater than income increments. This phenomenon is similar to the situation of the luxuries in the consumer budget theory.

Third Hypothesis:

Total non-food bundle has constant marginal propensity to consume; or as a consumer becomes wealthier, he allocates a constant proportion of his budget to the total non-food expenditures. On the other hand we also cannot take this bundle inside the groups of luxuries or necessities theoritically. Mathematically - with respect to the first and second hypotheses - these conditions should satisfy:

$$\frac{dS}{dY} = MPE^* = B = \text{Constant}$$

$$\frac{d^2S}{dY^2} = 0$$

*MPE = Marginal Propensity to Expend.

In this research with respect to our hypotheses we consider twelve functions which five of them have been used by previous researchers and they have been explained in the previous chapters. One of the new seven models has been chosen to express the the converse characters of the Prais & Houthakker Semi-log model, so that it fits to the luxuries better. Three of the remaining six models which are builth to test the first hypothesis are convex upward. The remaining three models which are builth to test the second hypothesis are concave upward. The differences among the previous six models are related to their curvatures which will be explained in the following sections.

The estimating econometric models are as follow:

$$S_i = a_i + b_i Y \quad (A)$$

$$S_i = a_i + b_i \ln(Y) \quad (B)$$

$$S_i = a_i + b_i \left(\frac{1}{Y}\right) \quad (C)$$

$$S_i = a_i + b_i (Y)^2 \quad (D)$$

$$S_i = a_i + b_i (Y)^{1/2} \quad (E)$$

$$\ln(S_i) = a_i + b_i Y \quad (F)$$

$$\ln(S_i) = a_i + b_i \ln(Y) \quad (G)$$

$$\ln(S_i) = a_i + b_i \left(\frac{1}{Y}\right) \quad (H)$$

$$S_i = a_i + b_i (Y)^3 \quad (I)$$

$$S_i = a_i + b_i (Y)^{1/3} \quad (J)$$

$$S_i = a_i + b_i (Y)^{2/3} \quad (K)$$

$$S_i = a_i + b_i (Y)^{3/2} \quad (L)$$

The commodity bundles are as follow:

$i = 02,03,\ldots,08,10,11,\ldots,19,20$

S_{02} : Clothing

S_{03} : Housing

S_{04} : Furniture

S_{05} : Health & Medical Care

S_{06} : Transport & Communications

S_{07} : Entertainment

S_{08} : Personal Services

S_{10} : Total Non-Food

S_{11} : Farinaceous

S_{12} : Meat & Fish

S_{13} : Dairy Products

S_{14} : Edible Oil

S_{15} : Vegetable & Fruit

S_{16} : Nut & Seed

S_{17} : Confectionary & Tea

S_{18} : Sauce , Taste & Remainder Foods

S_{19} : Drink & Tobacco

S_{20} : Total Food

The estimation method is O.L.S.(Ordinary Least Square) and optimum values for coefficients a_i and b_i are obtained from the following formulas:

$$B = \frac{\sum(Y-\overline{Y})(S-\overline{S})}{(Y-\overline{Y})^2}$$

$$A = \overline{S} - B\overline{Y}$$

The significance of B can be tested by evaluating the following F ratio:

$$F = \frac{\sum(\hat{S}-\overline{S})/1}{\sum(S-\hat{S})/(N-2)}$$

The proportion of variance of S explained, i.e., the goodness of fit of the regression equation, can be evaluated by examining the square of bivariate correlation: which is a natural measure of prediction accuracy and the strength of linear association is the ratio of explained variation in the dependent variable S to the total variation in S.

$$R^2 = \frac{\sum(S-\overline{S})^2 - \sum(S-\hat{S})^2}{\sum(S-\overline{S})^2}$$

or:

$$R^2 = \frac{\sum(\hat{S}-\overline{S})^2}{\sum(S-\overline{S})^2}$$

Durbin-Watson test for autocorrelation:

$$D.W. = \frac{\sum_{i=2}^{n}(e_i - e_{i-1})^2}{\sum_{i=1}^{n} e_i^2}$$

where:

A : Intercept

B : Slope

$\hat{S}$: Estimation of S

$\overline{S}$: Mean of S

$\overline{Y}$: Mean of Y

N : Number of Observations

e_i : Residual for Observation i

S_J : Expenditure of Commodity J

Y : Total Expenditure

ANALYSIS OF THE MODELS

The demand by a single consumer for each commodity can be written as a function of the consumer's income and all market prices. If prices are held constant we have:

$$x_i = x_i(y|p_1,\ldots,p_n)$$

expressing demand as a function solely of the consumer's income; a relation now generally known as the consumer's Engel curve for commodity i which can be written as:

$$p_i x_i = \phi_i(y)$$

The estimation of the form and parameters of functions of the above types from a cross-section of budget data rests on the assumption that on average the differences in consumption patterns between rich and poor households can be ascribed to their differences in current income. Other differences between the consumption patterns of individual households are regarded as stochastic and adequately described by a selected probability distribution.

It is,however,necessary to pay special attention to the concept of income and its representation by the statistical measures typically available. Given the ideal conditions for the selection of the sample of households described above, it is still clear that a household's wealth, both in total and in terms of its ownership of particular assets, will influence its current consumption pattern. Since in a cross-section of households wealth is in general positively correlated with current income, the calculation of Engel curves without allowance for the separate influence of wealth is likely to be misleading if the relationship is used for prediction through time, scince a sudden increase in income will not be matched by a similar increase in wealth. In a similar way we shall ignore for the time being both the effects of the household's past income and consumption history and effect of its expectations. Indeed, it will be also simpilistic to ignore the problem of savings altogether, and to treat the income variable as though it were identical with total expenditure on consumer goods and services.

Given all the above simplifying assumptions, from the pure theory, or rather directly from the budget restraint itself, we draw the conclusion that Engel curve should possess the property of aggregation: predicted expenditures for each good should add up to the given total. This is the only help that theory gives us, and it is at first sight odd that this is one property of Engel curves which, since Allen & Bowley (1935), has most consistently ignored. The reason appears to be that, as Nicholson and Champernowne have shown, if ordinary least square estimation is used, the most general form of Engel curve which satisfies the restriction must contain a linear term in income. In general other equations have for various reasons been preferred. Let us look, therefore, at the most important characteristics which the mathematical form of the curve should have.

Ideally an Engel curve ought to be capable of represnting luxuries, necessaties and inferior goods. There is a good deal of empirical evidence to support the proposition that for a wide range of commodities, income elasticities are declining functions of income. Certainly we might extend Engel's law for food consumption, namely that its income elasticity is less than unity, by the further proposition that the income elasticity of food consumption declines as income increases, Prais & Houthakker(1955) noted that Engel curves with declining income elasticities fit budgetary data better than curves with constant elasticities.

The hypothsis of declining income elasticity is consistent with but weaker than the hypothesis of a saturation level demand, which in turn may be based on physiological or technical considerations, and certainly seems to apply at least to a sub-class of commodities. It is worth distinguishing between two variations of the saturation hypothesis, which may be called the absolute and relative saturation hypotheses respectively. The absolute hypothesis means that for the commodity in question there exists a finite level of demand which is not exceeded, either as income increases indefinitely or as prices decrease indefinitely; this hypothesis reflects the fact that the marginal utility of the commodity becomes zero, or turns negative, at a finite level of consumption. Mathematically, therefore, for this case of absolute saturation, we have:

$$x_i = x_i(y, p_1, \ldots p_i, \ldots, p_n)$$

$$x_i \longrightarrow k_i \text{ as } y \longrightarrow \infty \text{ given } p_i \text{ or as } p_i \longrightarrow 0, \text{ given } y.$$

The relative saturation hypothesis on the other hand relates only to Engel curve behaviour: consumption tends to a saturation level as income increases at a given price, but the saturation level is itself a function of price. As price falls, the relative saturation level in general increases, but it may or may not tend to an absolute saturation level.

These considerations indicate that the idealised Engel curve has the form:

$$x_i = k_i(I^{-1}p)f_i(yI^{-1})$$

wherein the saturation level k_i is a function of relative prices only (I is a general price index) and the function f_i is continuous such that:

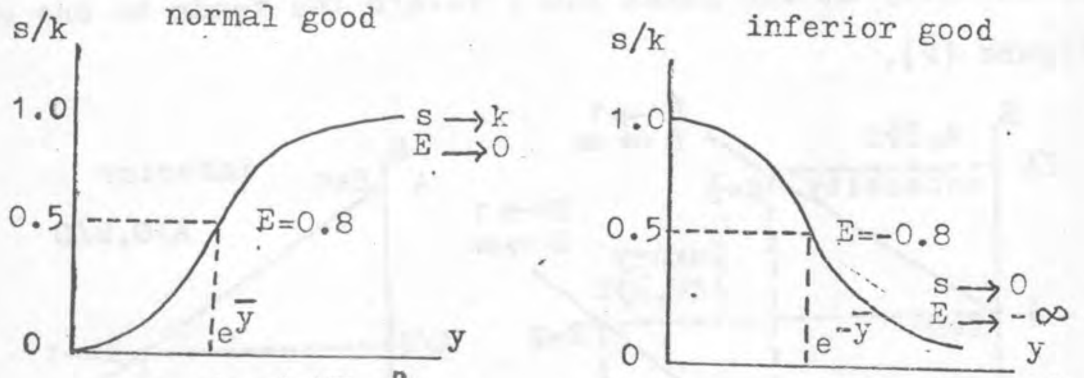
$$f_i(0) = 0$$

$$f_i(\infty) = 1$$

that is, it has the form of a statistical distribution function.

Such a function exhibits infinite elasticity at zero income, which tends continuously to zero as income increases, remaining positive throughout. Since the curve passes through the origin and represents luxuries in the lower range and necessities in the higher range, it is necessarily sigmoid in shape and possesses a point of inflexion. Mathematical candidates for such a function which have been widely used,(Tornqvist 1941; Wold & Jureen 1953; Fisk 1958-9; Champernowne1969.) are the lognormal distribution function, the logistic distribution function, and the log-reciprocal function. Such an Engel curve cannot represent inferior goods, though it is plausible in some cases that after reaching a maximum level of consumption at finite income, the income elasticity may turn negative and the good becomes inferior. It is however, rare that the observed range of income is sufficient to show all the phases of luxury, necessity and inferiority, and most analysts have been content to treat inferior goods as special cases. Figure (1) shows the graphical characteristics of the lognormal Engel curve, for the normal and inferior good respectively.

In all the models, it is assumed that the stochastic vector e_i has the usual properties of zero expectation, constant variance and independence of y. All the models have the property that simple regression techniques can be applied after the appropriate transformation, so that the basic models may easily be elaborated in other directions. A point worth noting here is that it is usual, where transformation is needed to assume that the error term e_i may be similarly transformed (Deaton & Brown 1972).



$s = k\Lambda(y|\bar{y}, \sigma^2)$, $s = k\Lambda(y^{-1}|-\bar{y}, \sigma^2)$

Fig.(1): Lognormal Engel curves.

The simple two-parameter curves which have been used in this study, can be applied for cross-section samples, and may be regarded as convenient approximations to different ranges of the full Sigmoid curve. Now let's have a closer look at the cited models.

MODEL (A): $S = A + BY$

The shape of this model is linear as shown by figures (2) & (3). Its income elasticity :

$$E = \frac{S - A}{S} = 1 - A/S = 1 / (1 + A/BY)$$

When $B > 0$ the Engel curve shows a normal commodity, figure (2), by $B>0$ and $A>0$ commodity is a necessity, its income elasticity is zero at the point $S=A$, $Y=0$ and tends to one when $Y \to \infty$ figure (2). By $B>0$ and $A<0$ commodity is a luxury, its income elasticity is infinity at the point $S=0$, $Y=-A/B$ and tends to one when $Y \to \infty$ figure (2).

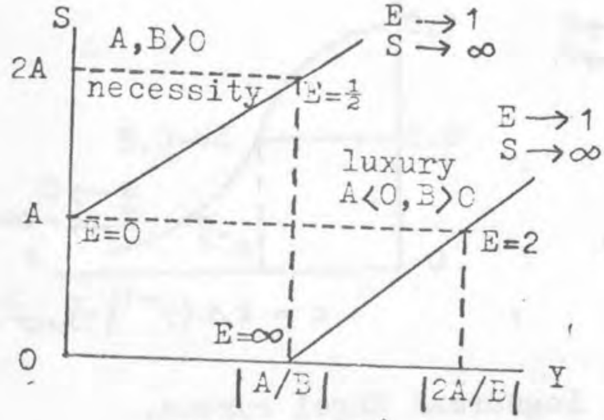


figure (2)

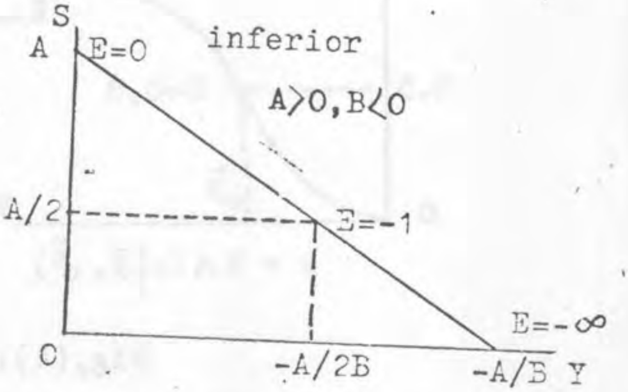


figure (3)

When $B<0, A>0$ commodity is an inferior one; its income elasticity is zero at the point $S=A, Y=0$ and tends to minus infinity up to the point $S=0, Y=-A/B$. figure (3).

In the region where the elasticity is around unity, the linear form is a good approximation, though it should be noted that if the intercept is positive (yielding an elasticity less than unity) the elasticity then tends upwards towards unity as income increases.

MODEL (B): $S = A + B \, LnY$

Shape of the model is shown by the figures (4) & (5).

Its income elasticity:

$$E = B/S = B/(A+BLnY)$$

B>0 is for normal goods; when B>0 and S<B commodity is luxury, by B>0 and S>B commodity is necessity and $0 \leq E \leq 1$, figure (4). When B<0 the curve is expressing an inferior good figure (5).

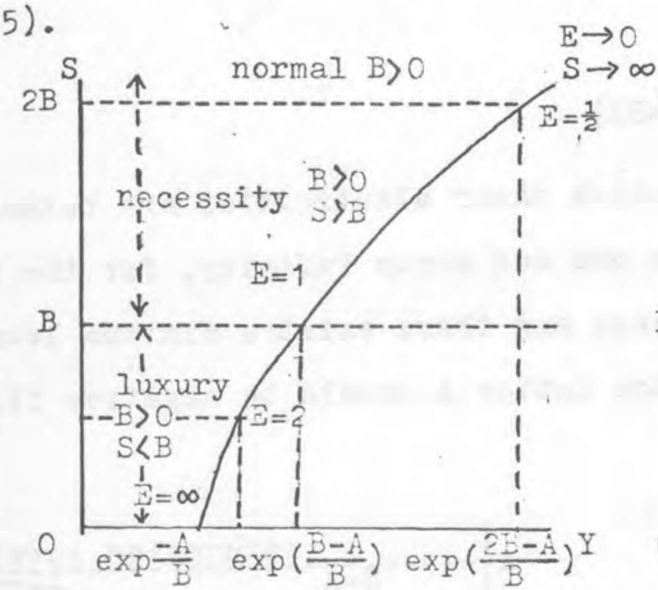


figure (4)

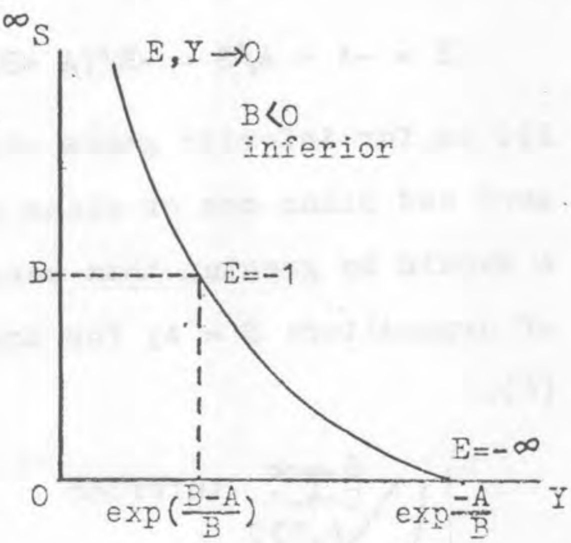


figure (5)

In the first part of the range of necessities the semi-log form is useful, since although this form does not possess a saturation value, its income elasticity continuously declines toward zero as income increases. Income elasticity is infinity at the point S=0,Y=exp(-A/B) and tends to one up to the point S=B,Y=exp((B-A)/B) and then tends to zero when $S, Y \longrightarrow \infty$. for iferior goods in the case B<0 income elasticity is minus infinity at the point S=0,Y=exp(-A/B) and tends to zero by tending S toward infinity or decreasing income toward zero.

MODEL (C): $S = A + B/Y$

Shape of this model is shown by the figures (6) & (7).

Its income elasticity:

$$E = -1 + A/S = -B/(A + BY)$$

B>0 is for inferior goods which their elasticities are between zero and minus one or minus one and minus infinity, for the former A should be greater than zero; and there exists a minimum level of expenditure S = A; for the latter A should be negative figure (6).

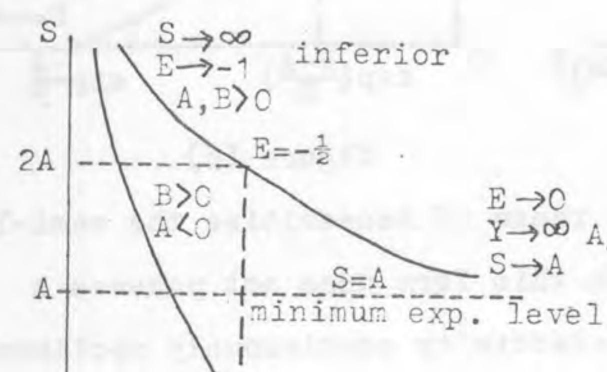


figure (6)

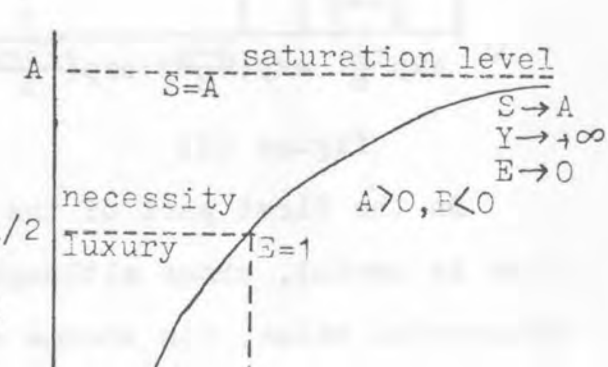


figure (7)

By $B<0$ and $A>0$ the model shows normal goods with a saturation level $S=A$; when income is less than $-2B/A$, or $Y<-2B/A$; or expenditure on a commodity is less than $A/2$, or $S<A/2$, commodity is luxury; when this condition does not satisfy or $S>A/2$, $Y>2B/-A$, commodity is necessity. In this case there is a saturation level $S = A$, figure (7). The range of variations of income elasticity in this case is: $0<E\leqslant\infty$.

MODEL (D): $\quad S = A + BY^2$

Shape of this model is shown at the figures (8) & (9).

Its income elasticity:

$$E = 2(1 - A/S) = 2(1 - A/(A+BY^2))$$

By $A<0, B>0$ for normals $0\leqslant E<2$; $S<2A$ necessity, $S>2A$ luxuries.

If $B>0$ so $A<0$, model is suitable for luxuries which their elasticities are between two and infinity, $2<E\leqslant\infty$, Figure (8). Income elasticity is infinity at the point $S=0$ & $Y=|(-A/B)^{\frac{1}{2}}|$ and declines to two when income tends to infinity $E\rightarrow 2$ by $Y\rightarrow\infty$.

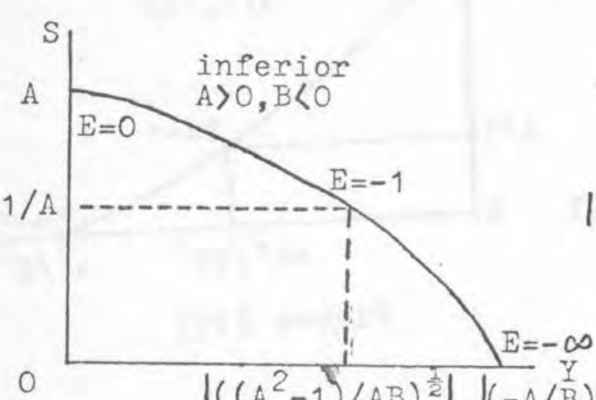


figure (9)

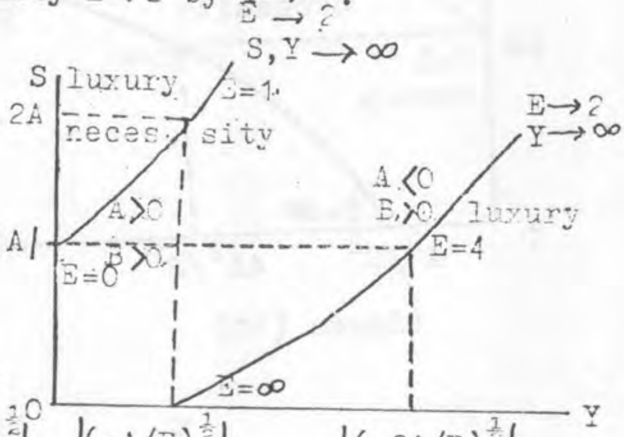


figure (8)

By $B<0$ and $A>0$ the model is expressing an inferior good figure (9). In this case income elasticity is zero at the point $S=A$ & $Y=0$ and declines to minus infinity up to the point $S=0$ & $Y=|(-A/B)^{\frac{1}{2}}|$ where the income elasticity at this point is minus infinity. This model is not suitable for necessities.

MODEL (E): $S = A + BY^{\frac{1}{2}}$

Shape of this model is shown at the figures (10) & (11). Its income elasticity is:

$$E = \tfrac{1}{2}(1-A/S) = \tfrac{1}{2}(1-A/(A+BY)^{\frac{1}{2}})$$

If $B>0$ model is expressing normal goods, by $A<0$ the model is suitable for commodities which their income elasticities are between infinity and half $\infty \leq E < \frac{1}{2}$; by $A>0$ for commodities whose income elasticities are between zero and half, $\frac{1}{2} < E \leq 0$.

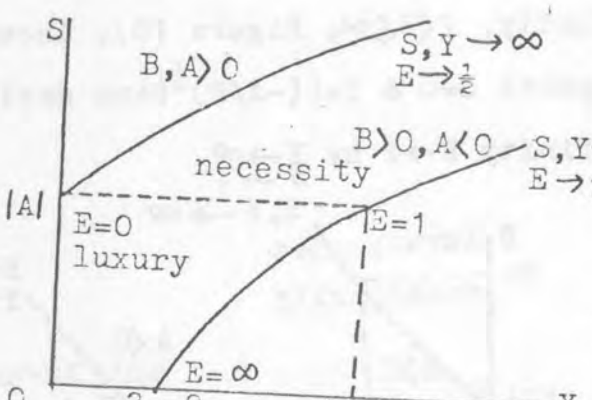


figure (10)

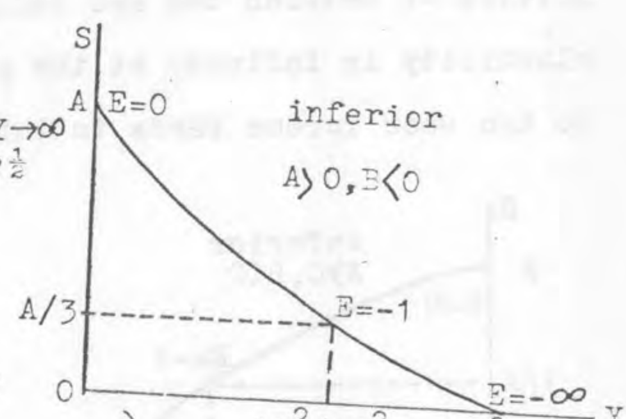


figure (11)

For the former up to the point $S = |A|$ or $Y = 4A^2/B^2$ the income elasticity is between infinity and one and shows luxuries after that point or $S > |A|$ model shows necessities figure (10). By $B < 0$ and $A > 0$ model is suitable for inferior goods figure (11); the income elasticity is zero at the point $S=A$ & $Y=0$ and declines to minus infinity up to the point $S=0$ & $Y=A^2/B^2$.

MODEL (F): $\quad LnS = A + BY$

Shape of this model is shown by the figures (12) & (13). The functional form of this model had been $S = ae^{BY}$ before transformation. By taking natural logarithm of both sides we get:

$$LnS = Ln(ae^{BY})$$

or

$$LnS = Lna + Lne^{BY}$$

we define $A = Lna$

so

$$LnS = A + BY$$

Its income elasticity is:

$$E = BY = LnS - A$$

A should be positive for having real solution.

If $B > 0$ & $A > 0$ model is suitable for normal goods, the range of its income elasticity is between zero and infinity $0 \leq E < \infty$. Income elasticity is zero at the point $S = e^A$ & $Y = 0$ and tends to one up to the point $S = e^{A+1}$ and $Y = 1/B$ which is the range of necessities by increasing income toward infinity income elasticity also tends to infinity for luxuries. Figure (12). By $B<0$ & $A>0$ model is expressing inferior goods; income elasticity is zero at the point $S=e^{A-1}$ & $Y=0$ and tends to minus infinity by tending income toward infinity. Figure (13).

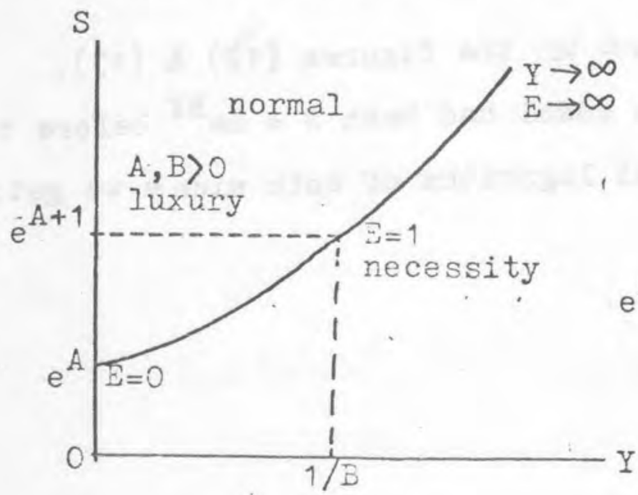


figure (12)

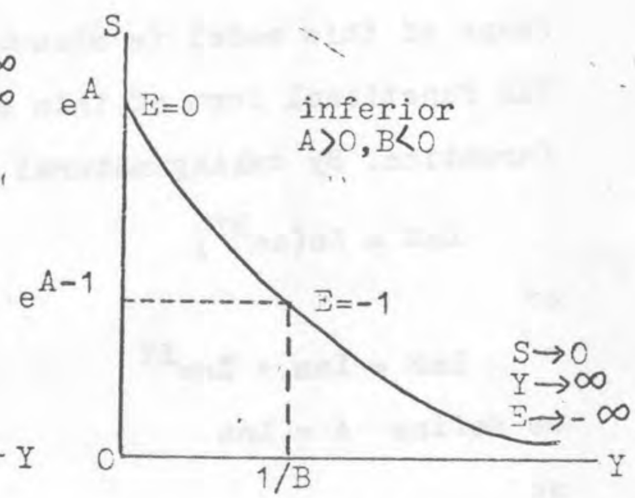


figure (13)

MODEL (G): $\quad LnS = A + BLnY$

Shape of this model is shown at the figures (14) & (15). The functional form of this model had been $S = aY^B$ or $S = e^A Y^B$ before transformation, by taking natural logarithm of both sides we get

$$LnS = Lna + BLnY$$

we define $A = Lna$

so

$$LnS = A + BLnY$$

Its income elasticity:

$$E = B$$

By $B>0$ we have normal goods if $0<B<1$ commodity is necessity and if $1<B$ commodity is luxury Figure (14).

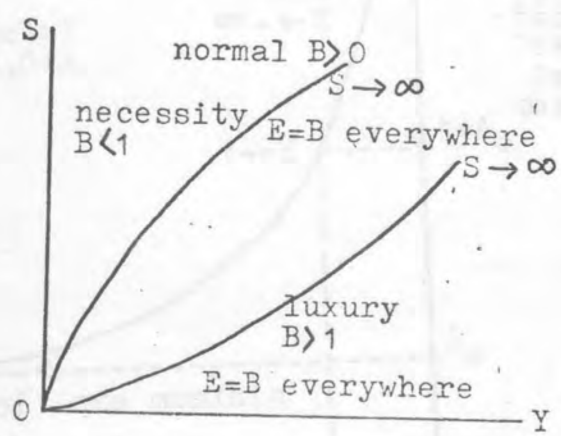


figure (14)

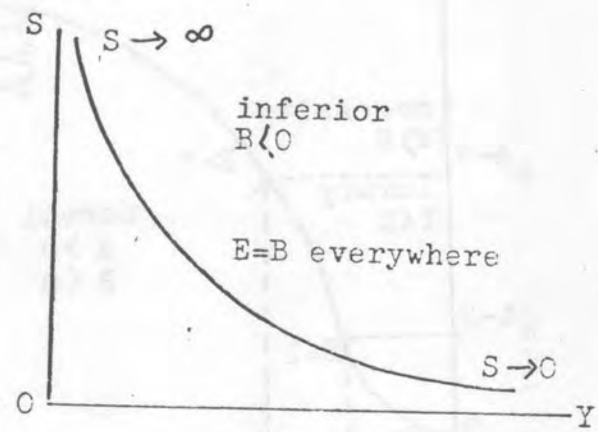


figure (15)

If $B<0$ commodity is an inferior one as showed at the figure (15).

MODEL (H): $LnS = A + B/Y$

shape of this model is shown at the figures (16) & (17).

Its income elasticity:

$$E = -B/Y = A - LnS$$

If B<0 and A>0 the model shows normal goods, the income elasticity at the origin is infinity and declines to two till the inflexion point by coordinate of $S = e^{A-2}$ & $Y = B/2$; then tends to one up to the point $S = e^{A-1}$ & $Y = B$; so the model is for luxuries when $Y<B$ or $S < e^{A-1}$; finally declines to zero when income is greater than B and tends to infinity; by this, S tends to a saturation level $S = e^{A}$ Figure (16).

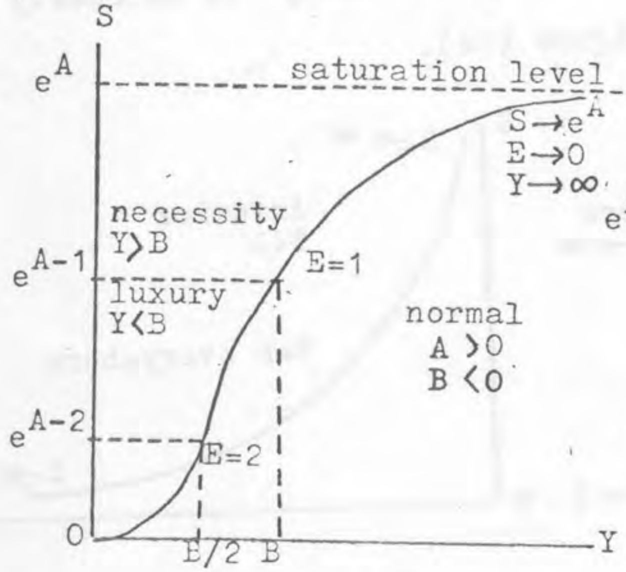


figure (16)

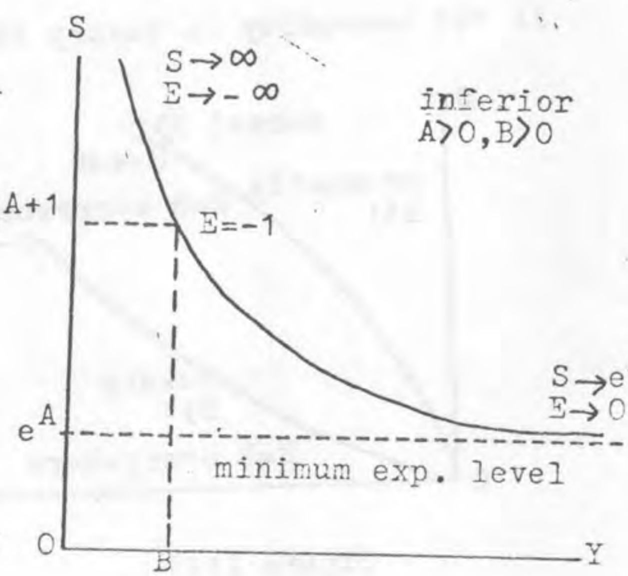


figure (17)

When B>0 and A>0 model shows inferior goods with a minumum expenditure level $S = e^{A}$; when income is zero, expenditure is infinity , with an income elasticity equal to minus infinity, when income increases income elasticity tends to zero and expenditure tends to e^{A}, figure (17).

MODEL (I): $S = A + BY^3$

shape of this model is shown at the figures (18) & (19).
Its income elasticity is:

$$E = 3(1 - A/S) = 3(1 - A/(A+BY^3))$$

If $B>0$ model is for normal goods, if $A>0$ it has minimum level of expenditure equal to $S = A$, the income elasticity at this point by $Y=0$ is zero, and tends to one up to the point $S=3A/2$ and $Y=(A/2B)^{1/3}$ so if $S<3A/2$ commodity is necessity and if $S>3A/2$ commodity is luxury. The variation range of income elasticity in this case is between zero and three, $0 \leqslant E < 3$.

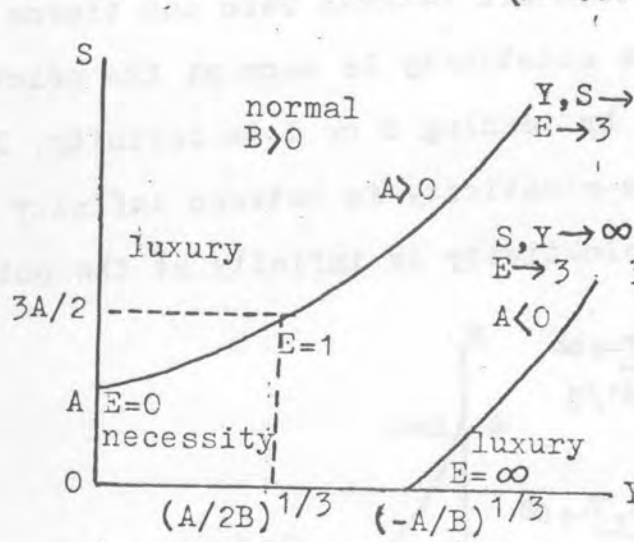


figure (18)

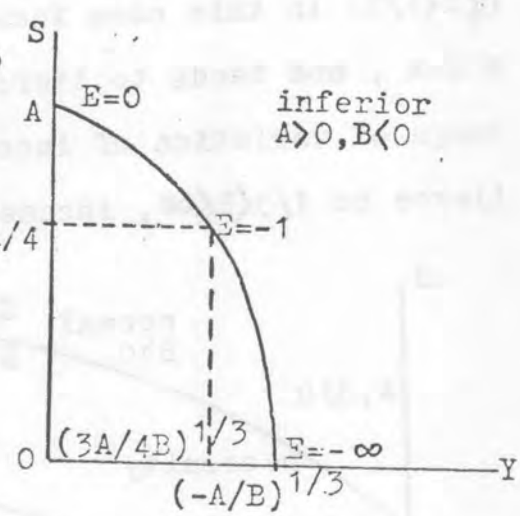


figure (19)

If $A<0$ the income elasticity varies between infinity and three so the model is suitable for luxuries. Figure (18).

If $B<0$ so $A>0$, model is for inferior goods, its income elasticity is zero at the point $S=A$ & $Y=0$, and tends to minus infinity down to the point $S=0$ & $Y=(-A/B)^{1/3}$, figure (19).

MODEL (J): $S = A + BY^{1/3}$

shape of this model is shown at the figures (20) & (21).
Its income elasticity:

$$E = (1/3)(1-A/S) = (1/3)(1-A/(A+BY^{1/3}))$$

$B>0$ is for normal goods, if $A>0$ model is suitable for commodities whose income elasticities are between zero and tierce or $0<E<1/3$; in this case income elasticity is zero at the point $Y=0$ & $S=A$, and tends to tierce by tending S or Y to infinity. If $A<0$ range of variation of income elasticity is between infinity and tierce or $1/3<E<\infty$, income elasticity is infinity at the point

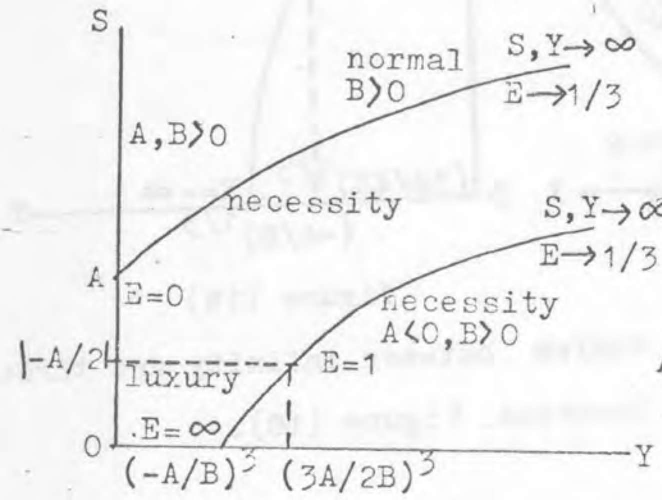


figure (20)

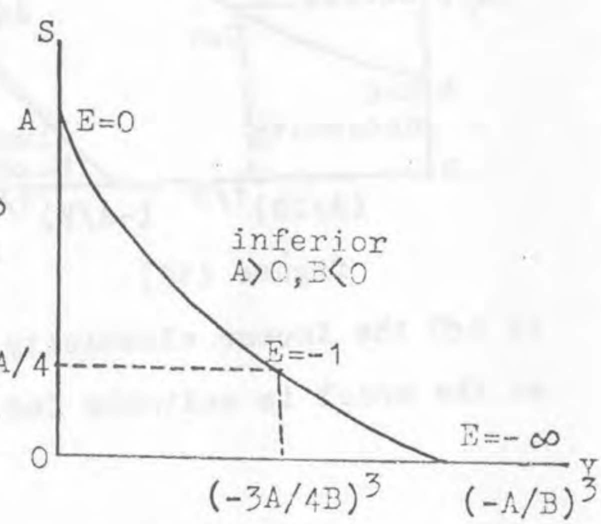


figure (21)

$S=0$ & $Y=(-A/B)^3$ and declines to one down to the point $S=|-A/2|$ and $Y=(3A/2B)^3$ and then tends to tierce by increasing S or Y towards infinity, figure (20). If $B<0$ and $A>0$, commodity is inferior. Income elasticity is zero at the point $S=A$ & $Y=0$ and declines to minus infinity down to the point $S=0$ & $Y=(-A/B)^3$, figure (21).

MODEL (K): $S = A + BY^{2/3}$

Shape of this model is shown at the figures (22) & (23).
Its income elasticity:

$$E = (2/3)(1-A/S) = (2/3)(1-A/(A+BY^{2/3})$$

$B>0$ is for normal goods, for the commodities whose income elasticities are between zero and 2/3, A should be positive; in this case income elasticity is zero at the point $S=A$ and $Y=0$, then tends to 2/3 by tending Y or S to infinity. For commodities whose income elasticities are between infinity and 2/3, A should be negative, $A<0$; in this case income elasticity is infinity at the point $S=0$ & $Y=(-A/B)^{3/2}$, and declines to one down to the point $S=A$ & $Y=(-2A/B)^{3/2}$, then tends 2/3 by tending S or Y to infinity, figure (22). If $B<0$ and $A>0$ model is for inferior goods, its income elasticity is zero at the point $S=A$ & $Y=0$ and tends to minus infinity down to the point $S=0$ & $Y=(-A/B)^{3/2}$ figure (23).

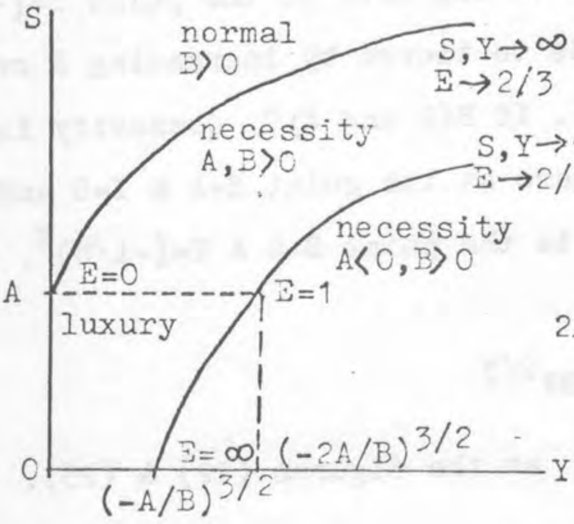


figure (22)

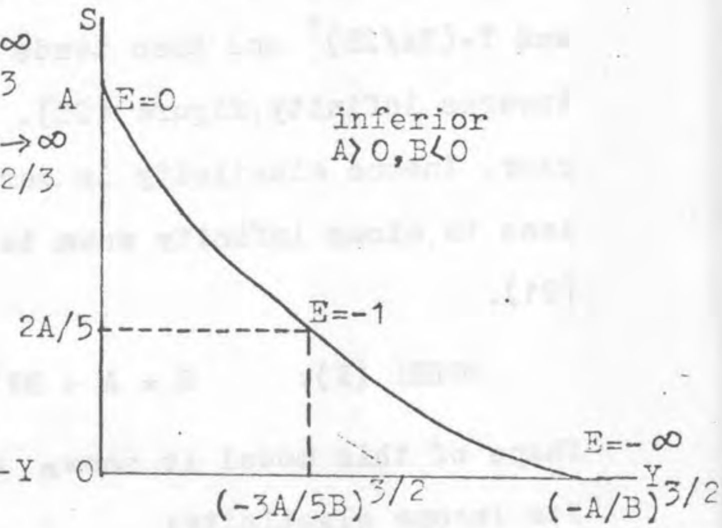


figure (23)

MODEL (L): $S = A + BY^{3/2}$

Shape of this model is shown at the figures (24) & (25).

Its income elasticity is:

$$E = (3/2)(1-A/S) = (3/2)(1-A/(A+BY^{3/2}))$$

If $B>0$ model is for normal goods, by $A>0$, it is suitable for commodities whose income elasticities are between zero and 3/2, or $0\leq E<3/2$. If $S<3A$ or $Y<(2A/B)^{2/3}$, the model is suitable for necessities, its income elasticity is zero at the point $S=A$ & $Y=0$ and tends to one up to the point $S=3A$ or $Y=(2A/B)^{2/3}$, after that point model fits luxuries when $S>3A$ or $Y>(2A/B)^{2/3}$, its income elasticity tends to 3/2, when S or Y tends to infinity.

By A<0 model fits luxuries, income elasticity is infinity at the point S=0 & $Y=(-A/B)^{2/3}$, and tends to 3/2 when Y or S tends to infinity, figure (24).

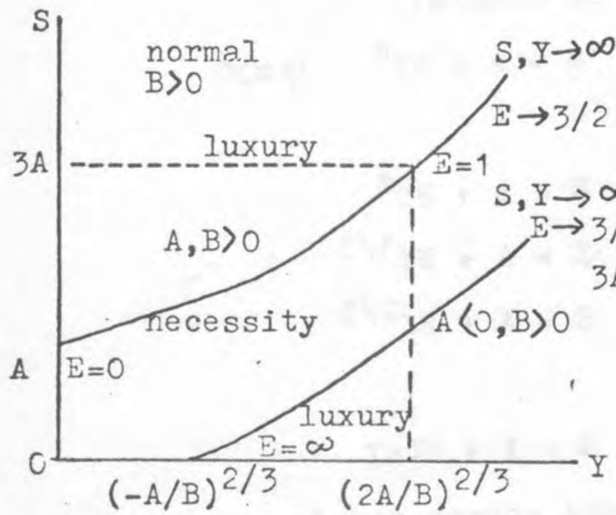


Figure (24)

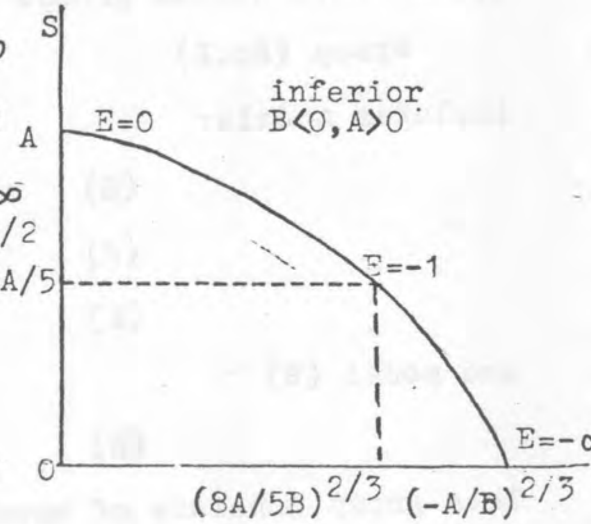


figure (25)

If B<0 & A>0 the model fits inferior goods, its income elasticity is zero at the point S=A & Y=0 and declines to minus infinity down to the point S=0 & $Y=(-A/B)^{2/3}$.

MODEL SELECTION AND THEORITICAL HYPOTHESIS

As a general division of the cited 12 models, we categorize them to the groups of models:

Group (No.I) $S = A + BY^m \quad 1 > m > 0$

includes models:

(E) $S = A + BY^{\frac{1}{2}}$

(J) $S = A + BY^{1/3}$

(K) $S = A + BY^{2/3}$

and model (B)

(B) $S = A + BLnY$

This group consists of upward convex models, or can be said that the signs of their second derivatives are negative:

$\frac{dS}{dY} = mBY^{m-1} > 0$ $\quad$ B>0 for normal goods

$$\frac{d^2S}{dY^2} = m(m-1)BY^{m-2} < 0$$

or for model (B):

$\frac{dS}{dY} = B/Y > 0$ $\quad$ B>0 for normal goods

$$\frac{d^2S}{dY^2} = -B/(Y^2) < 0$$

The first hypothesis is: upward convex Engel curves fit to necessities better, beacuse d^2S/dY^2 is less than zero and by increasing income the proportions allocated to necessities increase, but less than income increments; or on the other hand when a function is convex upward, the derivative of its slope is decreasing.

Group (No.II) $S = A + BY^m \quad m > 1$

includes models:

(D) $S = A + BY^2$

(I) $S = A + BY^3$

(L) $S = A + BY^{3/2}$

and model(F)

(F) $LnS = A + BY$

This group consists of upward cocave models, or can be said that the signs of their second derivatives are positive:

$$\frac{dS}{dY} = mBY^{m-1} > 0 \qquad B > 0 \text{ for normal goods}$$

$$\frac{d^2S}{dY^2} = m(m-1)BY^{m-2} > 0$$

or for the model (F):

$$S = ae^{BY} \qquad \text{(before transformation)}$$

$$\frac{dS}{dY} = aBe^{BY} > 0 \qquad B > 0 \text{ for normal goods}$$

$$a > 0 \; ; \; A = Lna$$

$$\frac{d^2S}{dY^2} = aB^2e^{BY} > 0$$

The second hypothesis is: upward concave Engel curves fit better to the luxuries, beacuse d^2S/dY^2 is greater than zero, and by increasing income the proportions devoted to luxuries increase more than income; or on the other hand when a function is concave upward, the derivtive of its slope is increasing.

Group (No.III) (A) $S = A + BY$

This model is linear and is suitable for bundles of commodities whose marginal propensity to consume is constant:

$$\frac{dS}{dY} = B$$

$$\frac{d^2S}{dY^2} = 0$$

The third hypothesis is: total non-food expenditure possesses this charachter, beacuse this bundle is neither luxury nor necessity; so according to the last hypotheses this curve is neither concave upward, nor convex upward, so by integrating back of$(d^2S/dY^2) = 0$, we must derive the suitable function.

$$\int \frac{d^2S}{dY^2}\, dY = \text{constant}$$

or

$$\frac{dS}{dY} = \text{constant} = B$$

$$\int \frac{dS}{dY}\, dY = BY + \text{constant} = A + BY = S$$

which is the linear form.

When the exponent of Y, (m) in the general form of the model : $S = A + BY^m$ (m>0), varies the shape of the model varies accordingly.

When m=0, the curve is a horizontal line; by tending towards unity, shape of the curve is convex upward, the convexity ray increases towards infinity up to the point m=1, where the curve is astraight line; then upward convexity stops and upward concavity starts, by increasing m towards infinity. (Figure 26).

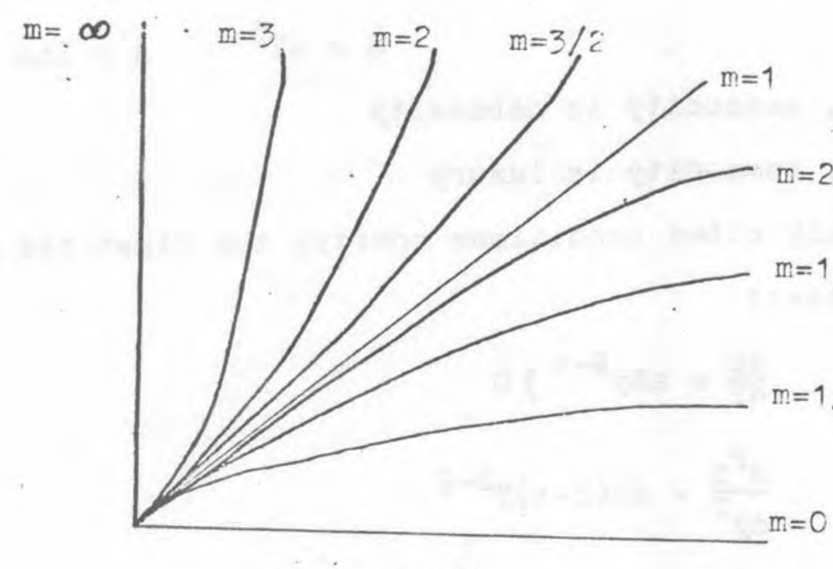


Figure (26)
Variation of the "m" in the models
$S = A + BY^m$.

Group (No.IV)

includes models:

$$(C) \qquad S = A + B/Y$$

$$(H) \qquad LnS = A + B/Y$$

this group are the models with a saturation level for normal goods; and minimum expenditure level for inferior goods.

When demand approaches saturation these models are suitable.

Group (No.V) (G) $LnS = A + BLnY$

or before transformation:

$$S = aY^B \qquad A = Lna$$

if $B < 1$, commodity is necessity

if $B > 1$, commodity is luxury

Obviously cited conditions confirm the first and second hypotheses:

$$\frac{dS}{dY} = aBy^{B-1} > 0$$

$$\frac{d^2S}{dy^2} = aB(B-1)Y^{B-2}$$

if $B < 1 \longrightarrow \frac{d^2S}{dY^2} < 0$, the curve is convex upward.

if $B > 1 \longrightarrow \frac{d^2S}{dY^2}\ 0$, the curve is concave upward.

CHAPTER V. MATERIALS

The purpose of this chapter is to gather information about the sample and the statistics derived from the Urban and Rural Household Budget Survey in the year 1356.

Household: Regarding the available results presented, certain comments should be made. The statistical unit referred to in the tables is a setteld household, defined as one or several persons sharing meals and expenditures and living together in a normal housing unit. Thus according to this definition tribal and nomadic population is excluded.

Rural and Urban: Rural areas are defined to be those centers containing population not exceeding 5000 inhabitants according to the last processed Census. Similarly, Urban areas are those centers having populations more than 5000 inhabitants.

Expenditure: By Expenditure it is meant the market value of goods and services purchased or acquired by the household during the specific sample period. In the tabulation expenditure is devided into two main categories: Food and Non-Food, and disaggregated into sixteen divisions.

Reference Period: The used reference period varies according to the type of information should be collected.

For Food data, information is asked on expenditure in the previous two days, and Non-Food data, is asked in the last month.

Method of collecting data: Completion of the questionnaire is based on direct interview with the primary sampling unit. In order to improve the accuracy of data, the methods of direct measurement of various quantities have also been taken into consideration.

Sample Design of the Urban Household Budget Survey:

Statistical Population:

The covered population consists of all urban household. Thus communal residents such as persons in prisons, armed forces bases, and similar institutions are excluded. Urban areas are defined to be those places that according to the 1355(Iranian calender year) census had a population of 5000 or more.

Statistical Frame:

The frame consists of the complete list of all households enumerated in the 1355 sample survey of urban household consumption.

Methods of Sampling:

Two-stage sampling with stratification is the basis for the sampling procedure, the first stage is selection of sample circuits in urban areas and the second is selection of sample households inside the circuits.

Determination of sample size:

Among all urban circuits of each Ostan (province), 5% to 6% of circuits were selected as sample circuits, then in each sampled circuit for each season one block has been selected randomly (Somewhere the numbers of household in a block were few, two blocks have been choosen). Finally for each season, ten households have been selected as sampled households.

Estimation formulas:

The sample average for each attribute in one ostan and the country is computed from the following formulas:

$$\hat{X}_k = \frac{\sum_{k=1}^{n_k} X_{ki}}{n_k}$$

$$\hat{X} = \frac{1}{n} \sum_{k=0}^{22} n_k . \hat{X}_k$$

Where:

$\hat{X}_k$ = Estimation of the average value of one attribute for an urban household in Kth ostan.

n_k = The sample size at the Kth ostan.

X_{ki} = The value of attribute in the Ith sampled household in the Kth ostan. $i=1,2,\ldots,10$

$\hat{X}$ = Estimation of the average value of one attribute for an urban household in the country.

n= The sample size of the survey for the country.

Sample Design of the Rural Household Budget Survey:

Note: The word "VILLAGE",used in the following sections, will have a broader meaning as compared to its normal usage in the English language. In our context, "village" will be synonymous to the Persian word "ABADI" which has been defined in the "Preliminary Report of the Agricultural Survey 1352 (Iranian Calender Year), Statistical Center of Iran".

Statistical Population:

statistical population consists of all rural areas in the country for which the "village" questionnaires have been completed in the Agricultural Survey of 1352.

Statistical Frame:

The frame consists of all villages enumerated in the Priliminary Agricultural Survey of 1352 which included less than 5000 inhabitants.

Method of sampling:

Two-stage sampling with stratification is the basis for the sampling procedure,where in the first stage sampled villages and in the second stage sampled households inside the sampled units of the first stage were selected.

Stratification:

The villages of each ostan were stratified into seven strata as follows:

Stratum 1: villages having 1 to 10 households

Stratum 2: villages having 11 to 30 households

Stratum 3: villages having 31 to 50 households

Stratum 4: villages having 51 to 100 households

Stratum 5: villages having 101 to 200 households

Stratum 6: villages having 201 to 400 households

Stratum 7: villages having 401 or more households (up to 5000 inhabitants)

Determination of sample size:

On the basis of the previous experience, the sample size at 5% level of significance, 15,000 sampled households or nearly 3000 sampled villages are sufficient. The numbers of sampled villages for each <u>ostan</u> are based on the numbers of villages in each stratum and standard deviation of the household in each stratum among seven strata, systematics ("circular") sampling was used for each stratum.

Second stage sampling:

The numbers of samples at the second stage for seven strata are as follow:

Village classification	1	2	3	4	5	6	7
Numbers of households	2	3	4	4	6	8	10

Estimation Formulas:

Estimation formulas for rural areas are as follow:

$$\hat{\bar{X}}_k = \frac{1}{\hat{M}_k} \sum_{h=1}^{7} \frac{N_{kh}}{n_{kh}} \sum_{i=1}^{n_{kh}} \frac{M_{khi}}{m_{khi}} \sum_{j=1}^{m_{khi}} x_{khij}$$

$$\hat{X}_k = \hat{M}_k . \hat{\bar{X}}_k = \sum_{h=1}^{7} \frac{N_{kh}}{n_{kh}} \sum_{i=1}^{n_{kh}} \frac{M_{khi}}{m_{khi}} \sum_{j=1}^{m_{khi}} x_{khij}$$

$$\hat{X} = \sum_{k=0}^{22} \hat{X}_k$$

$$\hat{\bar{X}} = \frac{\hat{X}}{\hat{M}}$$

$$\hat{M}_k = \sum_{h=1}^{7} \frac{N_{kh}}{n_{kh}} \sum_{i=1}^{n_{kh}} M_{khi}$$

$$\hat{M} = \sum_{k=0}^{22} \hat{M}_k$$

Where:

x_{khij} is the attribute being measured for jth household from ith village in the hth stratum from kth ostan.

m_{khi} is the number of households, in the sample, from ith village in the hth stratum from kth ostan.

M_{khi} is the total number of households from ith village in hth stratum from kth ostan.

n_{kh} is the number of villages in the sample, from hth stratum in kth ostan.

N_{kh} is the total number of villages from hth stratum of kth ostan.

$\hat{M}_k$ is the estimator for the total number of rural households in the kth ostan.

$\hat{\bar{X}}_k$ is the estimator for the awerage of the attribute being studied for kth ostan.

$\hat{X}_k$ is the estimator for the total of the attribute being studied for kth ostan.

$\hat{X}$ is the estimator for the total of the attribute being studied for all rural areas.

$\hat{M}$ is the estimator for the total number of the households.

$\hat{\bar{X}}$ is the estimator for the mean of the attribute being studied for a typical rural household.

i is the subscript for village.

j is the subscript for household.

h is the subscript for classification of village.

k is the subscript for ostan.

	I	II	III	IV
TOTAL	13588	67260	100.0	100.0
FAMILY SIZE = 1	764	764	5.6	1.1
FAMILY SIZE = 2	1404	2808	10.3	4.2
FAMILY SIZE = 3	1733	5199	12.8	7.7
FAMILY SIZE = 4	2261	9044	16.6	13.5
FAMILY SIZE = 5	2185	10925	16.1	16.2
FAMILY SIZE = 6	1894	11364	13.9	16.9
FAMILY SIZE = 7	1495	10465	11.0	15.6
FAMILY SIZE = 8	920	7360	6.8	10.9
FAMILY SIZE = 9	503	4527	3.7	6.7
FAMILY SIZE ≥ 10	429	4804	3.2	7.1

TABLE 1. (URBAN) NUMBERS AND DISTRIBUTION OF HOUSEHOID AND THE HOUSEHOLD PERSONS IN THE 1356 SAMPLE BY FAMILY SIZE.

I. NUMBERS OF HOUSEHOLD IN THE SAMPLE.

II. NUMBERS OF HOUSEHOLD PERSONS IN THE SAMPLE.

III. PERCENTAGE DISTRIBUTION OF HOUSEHOLD IN THE SAMPLE.

IV. PERCENTAGE DISTRIBUTION OF HOUSEHOLD PERSONS IN THE SAMPLE.

Source: Statistical results of urban household budget year 1356. SCI.

	I	II	III	IV
TOTAL	14873	79045	100.0	100.0
FAMILY SIZE = 1	623	623	4.2	0.8
FAMILY SIZE = 2	1490	2980	10.0	3.8
FAMILY SIZE = 3	1677	5031	11.3	6.4
FAMILY SIZE = 4	2113	8452	14.2	10.7
FAMILY SIZE = 5	2263	11315	15.2	14.3
FAMILY SIZE = 6	2156	11954	14.5	16.4
FAMILY SIZE = 7	1792	12544	12.1	15.9
FAMILY SIZE = 8	1340	10720	9.0	13.6
FAMILY SIZE = 9	703	6327	4.7	8.0
FAMILY SIZE ⩾10	713	8099	4.8	10.3

TABLE 2. (RURAL) NUMBERS AND DISTRIBUTION OF HOUSEHOLD AND THE HOUSEHOLD PERSONS IN THE 1356 SAMPLE BY FAMILY SIZE.

I. NUMBERS OF HOUSEHOLD IN THE SAMPLE.

II.NUMBERS OF HOUSEHOLD PERSONS IN THE SAMPLE.

III.PERCENTAGE DISTRIBUTION OF HOUSEHOLD IN THE SAMPLE.

IV.PERCENTAGE DISTRIBUTION OF HOUSEHOLD PERSONS IN THE SAMPLE.

Source:Statistical results of rural household budget year 1356. SCI.

	I	II	III	IV
TOTAL	13588	67260	100.0	100.0
LESS THAN 2500	230	494	1.7	0.7
2500 TO 4999	529	1629	3.9	2.4
5000 TO 7499	753	2733	5.5	4.1
7500 TO 9999	897	3635	6.6	5.4
10000 TO 14999	1915	8801	14.1	13.1
15000 TO 19999	1668	8181	12.3	12.2
20000 TO 29999	2465	13209	18.1	19.6
30000 TO 49999	2613	14533	19.2	21.6
50000 TO 99999	1741	9748	12.8	14.5
100000 & MORE	777	4297	5.7	6.4

TABLE 3. (URBAN) NUMBERS AND DISTRIBUTION OF HOUSEHOLD AND HOUSEHOLD PERSONS IN THE 1356 SAMPLE BY SEPARATED EXPENDITURE GROUPS/monthly,rial.

I. NUMBERS OF HOUSEHOLD IN THE SAMPLE.

II. NUMBERS OF HOUSEHOLD PERSONS IN THE SAMPLE.

III. PERCENTAGE DISTRIBUTION OF HOUSEHOLD IN THE SAMPLE.

IV. PERCENTAGE DISTRIBUTION OF HOUSEHOLD PERSONS IN THE SAMPLE.

Source: Statistical results of urban household budget year 1356. SCI.

	I	II	III	IV
TOTAL	14873	79045	100.0	100.0
LESS THAN 2500	471	818	3.2	1.0
2500 TO 4999	1428	4470	9.6	5.7
5000 TO 7499	2135	9137	14.4	11.6
7500 TO 9999	2112	10456	14.2	13.2
10000 TO 14999	3342	18570	22.5	23.5
15000 TO 19999	2010	12461	13.5	15.8
20000 TO 29999	1811	11841	12.2	15.0
30000 TO 49999	1010	7300	6.8	9.3
50000 TO 99999	443	3211	3.0	4.1
100000 & MORE	111	781	0.8	1.0

TABLE 4. (RURAL) NUMBERS AND DISTRIBUTION OF HOUSEHOLD AND HOUSEHOLD PERSONS IN THE 1356 SAMPLE BY SEPARATED EXPENDITURE GROUPS/monthly,rial.

I. NUMBERS OF HOUSEHOLD IN THE SAMPLE.

II. NUMBERS OF HOUSEHOLD PERSONS IN THE SAMPLE.

III. PERCENTAGE DISTRIBUTION OF HOUSEHOLD IN THE SAMPLE.

IV. PERCENTAGE DISTRIBUTION OF HOUSEHOLD PERSONS IN THE SAMPLE.

Source: Statistical results of urban household budget year 1356. SCI.

CHAPTER VI. RESULTS & DISCUSSION

The following tables are the estimated Engel curves and the respected means and standard deviations, and correlation coefficients matrices, of the variables, for the URBAN & RURAL AREAS of Iran. At the Engel curves tables, the first column which consists of: (A),(B),...,(L), are representatives of the econometric models. Other columns sequently are: constant 'a'; slope 'b'; general significant test of the model 'F'; 'R' square; and Durbin-Watson test 'D.W.'.

MAIN TABLES

Variable	Mean	Standard Dev.
S10	24332.0361	47893.1684
S20	12224.2154	14917.1706
S02	2714.3033	5342.3292
S03	11897.9193	21165.4336
S04	3079.7001	17917.5512
S05	1011.4291	6359.0850
S06	2990.3634	23886.3758
S07	527.2496	2770.5235
S08	2111.0713	16961.0648
S11	2448.3560	7442.1319
S12	3253.5140	4684.8711
S13	1218.4892	1677.5004
S14	589.5879	3547.6710
S15	2572.4756	3780.0329
S16	239.8468	1311.1661
S17	964.6345	2989.8970
S18	99.0582	541.7069
S19	838.2532	3114.8937
Y	36556.2515	53983.9563

TABLE(5) URBAN Mean and Standard Deviation of the Variables

Variable	Mean	Standard Dev.
S10	8307.5455	21345.8183
S20	8214.4913	6907.3025
S02	1947.9971	6218.5367
S03	1864.8421	4873.8806
S04	1845.1911	12418.2878
S05	629.6572	3212.8205
S06	712.7082	7162.0190
S07	194.5532	5019.4734
S08	1112.5967	7405.0910
S11	2643.4292	2062.9783
S12	1965.2456	3732.9407
S13	1090.9727	1320.4672
S14	402.7095	893.6992
S15	858.7643	1417.4871
S16	214.1421	453.3262
S17	654.5953	804.1256
S18	22.0510	70.6248
S19	362.5824	884.2521
Y	16522.0385	23748.7001

TABLE (6) RURAL Mean and Standard Deviation of the Variables

	S10	S20	S02	S03	S04	S05
S10	1.00000	0.27854	0.35456	0.56351	0.52346	0.21135
S20	0.27854	1.00000	0.30188	0.22026	0.14904	0.07562
S02	0.35456	0.30188	1.00000	0.16919	0.15347	0.06439
S03	0.56351	0.22026	0.16919	1.00000	0.09149	0.05347
S04	0.52346	0.14904	0.15347	0.09149	1.00000	0.02261
S05	0.21135	0.07562	0.06439	0.05347	0.02261	1.00000
S06	0.59531	0.09639	0.11421	0.07630	0.04019	0.04261
S07	0.22111	0.13137	0.12617	0.10936	0.07651	0.03462
S08	0.50211	0.07355	0.10734	0.04801	0.18164	0.04533
S11	0.04913	0.63415	0.07216	0.04707	0.03677	0.01617
S12	0.26997	0.62572	0.25031	0.22473	0.12968	0.04904
S13	0.20817	0.48212	0.25123	0.17644	0.09716	0.05014
S14	0.05049	0.39005	0.06580	0.03238	0.02394	0.04291
S15	0.25214	0.56481	0.26587	0.23302	0.11409	0.05640
S16	0.07695	0.33008	0.13649	0.04860	0.07498	0.00822
S17	0.11781	0.44783	0.16921	0.06071	0.08008	0.06423
S18	0.07260	0.22268	0.07808	0.05254	0.02955	0.05860
S19	0.17679	0.33593	0.13053	0.10180	0.09926	0.03015
Y	0.96414	0.52344	0.39797	0.56080	0.50559	0.20840

TABLE (7) URBAN Correlation Coefficients Matrix

	S06	S07	S08	S11	S12	S13
S10	0.59531	0.22111	0.50211	0.04913	0.26997	0.20817
S20	0.09639	0.13137	0.07355	0.63415	0.62572	0.48212
S02	0.11421	0.12617	0.10734	0.07216	0.25031	0.25123
S03	0.07630	0.10936	0.04801	0.04707	0.22473	0.17644
S04	0.04019	0.07651	0.18164	0.03677	0.12968	0.09716
S05	0.04261	0.03462	0.04533	0.01617	0.04904	0.05014
S06	1.00000	0.07164	0.07136	0.00385	0.10425	0.08027
S07	0.07164	1.00000	0.09012	0.00852	0.13438	0.08556
S08	0.07136	0.09012	1.00000	0.00553	0.07889	0.04004
S11	0.00385	0.00852	0.00553	1.00000	0.13117	0.12363
S12	0.10425	0.13438	0.07889	0.13117	1.00000	0.36902
S13	0.08027	0.08556	0.04004	0.12363	0.36902	1.00000
S14	0.02195	0.00637	0.00812	0.09499	0.09763	0.14473
S15	0.08993	0.09524	0.05357	0.07966	0.37420	0.35453
S16	0.01377	0.03037	0.00700	0.10627	0.16888	0.13709
S17	0.04260	0.03499	0.02921	0.11614	0.17595	0.17073
S18	0.03294	0.02474	0.01123	0.06040	0.12472	0.11080
S19	0.06586	0.18707	0.09159	0.01230	0.15345	0.08400
Y	0.55478	0.23247	0.46578	0.21882	0.41241	0.31790

TABLE (7) Continued

	S14	S15	S16	S17	S18	S19
S10	0.05049	0.25214	0.07695	0.11781	0.07260	0.17679
S20	0.39005	0.56481	0.33008	0.44783	0.22268	0.33593
S02	0.06580	0.26587	0.13649	0.16921	0.07808	0.13053
S03	0.03238	0.23302	0.04860	0.06071	0.05254	0.10180
S04	0.02394	0.11409	0.07498	0.08008	0.02955	0.09926
S05	0.04291	0.05640	0.00882	0.06423	0.05860	0.03015
S06	0.02195	0.08993	0.01377	0.04260	0.03294	0.06586
S07	0.00637	0.09524	0.03037	0.03499	0.02474	0.18707
S08	0.00812	0.05357	0.00700	0.02921	0.01123	0.09159
S11	0.09499	0.07966	0.10627	0.11614	0.06040	0.01230
S12	0.09763	0.37420	0.16888	0.17595	0.12472	0.15345
S13	0.14473	0.35453	0.13709	0.17073	0.11080	0.08400
S14	1.00000	0.08930	0.07483	0.12855	0.04602	0.00602
S15	0.08930	1.00000	0.18422	0.19386	0.14469	0.15679
S16	0.07483	0.18422	1.00000	0.17497	0.16654	0.07238
S17	0.12855	0.19386	0.17479	1.00000	0.15310	0.06880
S18	0.04602	0.14469	0.16654	0.15310	1.00000	0.05590
S19	0.00602	0.15679	0.07238	0.06880	0.05590	1.00000
Y	0.15258	0.37977	0.15948	0.22826	0.12594	0.24967

TABLE (7) Continued

	Y
S10	0.96414
S20	0.52344
S02	0.39797
S03	0.56080
S04	0.50559
S05	0.20840
S06	0.55478
S07	0.23247
S08	0.46578
S11	0.21882
S12	0.41241
S13	0.31790
S14	0.15258
S15	0.37977
S16	0.15948
S17	0.22826
S18	0.12594
S19	0.24967
Y	1.00000

TABLE (7) Continued

	S10	S20	S02	S03	S04	S05
S10	1.00000	0.20566	0.43135	0.31660	0.68397	0.21051
S20	0.20566	1.00000	0.17294	0.14582	0.09404	0.07574
S02	0.43135	0.17294	1.00000	0.05485	0.09935	0.05272
S03	0.31660	0.14582	0.05485	1.00000	0.03912	0.03916
S04	0.68397	0.09404	0.09935	0.03912	1.00000	0.02625
S05	0.21051	0.07574	0.05272	0.03916	0.02625	1.00000
S06	0.39754	0.05621	0.03574	0.04734	0.02759	0.02651
S07	0.31840	0.02581	0.03119	0.01630	0.09733	0.01895
S08	0.47331	0.08920	0.12235	0.06895	0.08139	0.02040
S11	0.15140	0.66410	0.14828	0.12189	0.05500	0.06397
S12	0.11571	0.79156	0.09607	0.08309	0.05639	0.04257
S13	0.12886	0.46600	0.10494	0.06610	0.07532	0.04021
S14	0.09232	0.40443	0.07656	0.03224	0.05176	0.01679
S15	0.14666	0.50885	0.10250	0.11940	0.06085	0.06640
S16	0.08894	0.28786	0.06144	0.06799	0.03105	0.02596
S17	0.09370	0.58306	0.09128	0.06700	0.04055	0.03012
S18	0.07888	0.14860	0.01989	0.06768	0.03308	0.00591
S19	0.10769	0.31049	0.08490	0.08001	0.05046	0.03809
Y	0.95864	0.47570	0.43801	0.32697	0.64212	0.21124

TABLE (8) RURAL Correlation Coefficients Matrix

	S06	S07	S08	S11	S12	S13
S10	0.39754	0.31840	0.47331	0.15104	0.11571	0.12886
S20	0.05621	0.02581	0.08920	0.66410	0.79156	0.46600
S02	0.03574	0.03119	0.12235	0.14828	0.09607	0.10494
S03	0.04734	0.01630	0.06895	0.12189	0.08309	0.06610
S04	0.02759	0.09733	0.08139	0.05500	0.05639	0.07532
S05	0.02651	0.01895	0.02040	0.06397	0.04257	0.04021
S06	1.00000	0.00638	0.05549	0.03294	0.02871	0.03701
S07	0.00638	1.00000	0.02544	0.02767	0.01416	0.01378
S08	0.05549	0.02544	1.00000	0.06002	0.04780	0.05092
S11	0.03294	0.02767	0.06002	1.00000	0.25685	0.31095
S12	0.02871	0.01416	0.04780	0.25685	1.00000	0.16006
S13	0.03701	0.01378	0.05092	0.31095	0.16006	1.00000
S14	0.02423	0.00589	0.05909	0.31467	0.14164	0.15776
S15	0.05419	0.01140	0.06711	0.27805	0.23007	0.16071
S16	0.02016	0.03645	0.05250	0.18220	0.16537	0.06655
S17	0.02195	0.00730	0.04209	0.34641	0.41915	0.23553
S18	0.07169	0.00591	0.03475	0.09104	0.10929	0.01110
S19	0.03836	0.00669	0.04369	0.12648	0.13673	0.07937
Y	0.37366	0.29369	0.45137	0.32891	0.33423	0.25136

TABLE (8) Continued

	S14	S15	S16	S17	S18	S19
S10	0.09232	0.14666	0.08894	0.09370	0.07888	0.10769
S20	0.40443	0.50885	0.28786	0.58306	0.14860	0.31049
S02	0.07656	0.10250	0.06144	0.09128	0.01989	0.08490
S03	0.03224	0.11940	0.06799	0.06700	0.06768	0.08001
S04	0.05176	0.06085	0.03105	0.04055	0.03308	0.05046
S05	0.01679	0.06640	0.02596	0.03012	0.00591	0.03809
S06	0.02423	0.05419	0.02016	0.02195	0.07169	0.03836
S07	0.00589	0.01140	0.03645	0.00730	0.00591	0.00669
S08	0.05909	0.06711	0.05250	0.04209	0.03475	0.04369
S11	0.31467	0.17805	0.18220	0.34641	0.09104	0.12648
S12	0.14164	0.23007	0.16537	0.41915	0.10929	0.13673
S13	0.15776	0.16071	0.06655	0.23553	0.01110	0.07937
S14	1.00000	0.13485	0.08117	0.26515	0.05729	0.07732
S15	0.13485	1.00000	0.15169	0.17190	0.10962	0.13273
S16	0.08117	0.15169	1.00000	0.11220	0.10083	0.07809
S17	0.26515	0.17190	0.11220	1.00000	0.06240	0.10970
S18	0.05729	0.10962	0.10083	0.06240	1.00000	0.04847
S19	0.07732	0.13273	0.07809	0.10970	0.04847	1.00000
Y	0.20060	0.27982	0.16366	0.25380	0.11412	0.18710

TABLE (8) Continued

	Y
S10	0.95846
S20	0.47570
S02	0.43801
S03	0.32697
S04	0.64212
S05	0.21124
S06	0.37366
S07	0.29369
S08	0.45137
S11	0.32891
S12	0.33423
S13	0.25136
S14	0.20060
S15	0.27982
S16	0.16366
S17	0.25380
S18	0.11412
S19	0.18710
Y	1.00000

TABLE (8) Continued

Model	a	b	F	R^2	D.W.
(A)	6936.75282	0.14464	5099.957	0.274	1.838
(B)	-77266.63977	8922.69477	7142.796	0.346	1.831
(C)	14337.58814	-29194582.36957	933.890	0.065	1.760
(D)	11850.85836	0.00000	628.341	0.044	1.730
(E)	-5773.31155	106.33036	9076.535	0.402	1.844
(F)	8.44773	0.00001	1512.515	0.101	1.786
(G)	-1.30263	1.00646	8346.917	0.382	1.796
(H)	9.24495	-6260.63643	4698.287	0.258	1.834
(I)	12166.18778	0.00000	113.306	0.008	1.717
(J)	-16455.21858	961.80456	9238.812	0.406	1.836
(K)	226.64877	12.15806	8132.926	0.376	—
(L)	10863.69108	0.00013	1813.010	0.118	—

TABLE (9) URBAN S20 Total Food Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	-6936.75282	0.85536	178358.585	0.930	1.838
(B)	-261876.53694	28536.45473	7058.838	0.343	1.879
(C)	29283.23684	-68396943.36370	481.705	0.034	1.738
(D)	19615.16953	0.00000	29793.556	0.688	1.534
(E)	-50776.35085	443.74441	28565.357	0.679	1.852
(F)	8.95798	0.00001	9612.117	0.416	1.500
(G)	-1.02315	1.04449	62026.132	0.821	1.743
(H)	9.78693	-4617.24826	5259.929	0.280	1.439
(I)	23057.10816	0.00000	8617.478	0.389	1.589
(J)	-84154.62903	3638.25065	17457.370	0.564	1.875
(K)	-31443.43703	56.52158	50149.751	0.788	—
(L)	12437.08987	0.00113	96502.968	0.877	—

TABLE (10) URBAN S10 Total Non-Food Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	1274.56617	0.03938	2543.204	0.159	1.770
(B)	-20966.35407	2361.08234	3144.780	0.189	1.748
(C)	3241.50302	-7282848.78562	437.546	0.031	1.699
(D)	2607.23733	0.00000	396.256	0.028	1.694
(E)	-2128.26360	28.61015	3963.869	0.227	1.766
(F)	4.89947	0.00002	976.652	0.067	1.744
(G)	-10.92271	1.63710	3910.012	0.224	1.750
(H)	6.10117	-8349.59862	1533.749	0.102	1.736
(I)	2695.86292	0.00000	89.056	0.007	1.679
(J)	-4967.41815	257.61718	3971.407	0.227	1.758
(K)	-526.81468	3.28447	3674.557	0.214	—
(L)	2337.07568	0.00004	1031.266	0.071	—

TABLE (11) URBAN SO2 Clothing Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	3860.25821	0.21987	6199.879	0.314	1.705
(B)	-93961.06065	10554.68030	4275.484	0.240	1.711
(C)	14090.22463	-30284973.88112	483.631	0.035	1.513
(D)	11019.77757	0.00000	1879.345	0.122	1.484
(E)	-11668.25009	139.23020	7029.856	0.342	1.774
(F)	8.37823	0.00001	3050.873	0.184	1.352
(G)	-0.15690	0.88704	13061.899	0.491	1.530
(H)	9.04221	-4178.69394	3179.296	0.190	1.325
(I)	11693.34202	0.00000	731.268	0.051	1.453
(J)	-24254.03511	1212.40589	6374.024	0.320	1.765
(K)	-4509.60622	16.62701	7245.949	0.349	—
(L)	9360.92069	0.00024	3469.998	0.204	—

TABLE (12) URBAN S03 Housing Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	-3054.71606	0.16781	4640.712	0.256	1.944
(B)	-46355.16001	4928.90772	1066.346	0.073	1.943
(C)	3809.25337	-10078205.04967	72.540	0.005	1.932
(D)	1977.84057	0.00000	4953.339	0.268	1.945
(E)	-10803.53648	82.02291	2684.325	0.166	1.931
(F)	5.83720	0.00001	2931.437	0.178	1.776
(G)	-0.23746	0.95022	7073.785	0.344	1.774
(H)	6.60630	-4330.31787	1923.465	0.125	1.749
(I)	2699.69270	0.00000	4436.614	0.247	1.921
(J)	-16559.55868	658.62976	2054.752	0.132	1.935
(K)	-7435.97619	10.65634	3379.709	0.200	—
(L)	567.55606	0.00024	5343.309	0.280	—

TABLE (13) URBAN S04 Furniture Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	114.01436	0.02455	613.580	0.043	1.983
(B)	-9407.78830	1038.84913	357.796	0.026	1.984
(C)	1205.96548	-2687366.77486	40.853	0.003	1.981
(D)	929.71091	0.00000	160.158	0.012	1.950
(E)	-1499.65635	14.83563	607.806	0.043	1.980
(F)	3.48740	0.00001	504.901	0.036	1.778
(G)	-5.99174	0.98390	1537.415	0.102	1.794
(H)	4.22870	-4867.60407	616.860	0.044	1.788
(I)	999.67359	0.00000	25.424	0.002	1.978
(J)	-2743.64301	125.93155	538.278	0.038	1.981
(K)	-775.81897	1.81116	649.828	0.046	—
(L)	738.99660	0.00003	362.161	0.026	—

TABLE (14) URBAN S05 Health & Medical Care Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	-5983.28787	0.24548	6008.766	0.308	1.940
(B)	-54129.37532	5695.12933	785.629	0.054	1.996
(C)	3718.52076	-10058920.86105	40.565	0.003	1.989
(D)	1541.41066	0.00000	4772.369	0.261	1.998
(E)	-15351.07119	108.36219	2626.836	0.163	1.960
(F)	5.10195	0.00002	2088.279	0.134	1.466
(G)	-9.05849	1.47655	5994.740	0.307	1.582
(H)	6.27754	-7278.12624	2025.835	0.130	1.468
(I)	2668.81932	0.00000	1494.376	0.100	1.989
(J)	-21812.81271	831.80888	1815.778	0.118	1.976
(K)	-11490.75309	14.67483	3667.840	0.213	—
(L)	-696.91431	0.00035	6926.308	0.339	—

TABLE (15) URBAN S06 Transport & Communications Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	91.11561	0.01193	772.029	0.054	1.851
(B)	-5171.04048	568.14858	572.519	0.041	1.828
(C)	636.94139	-1515306.37478	68.568	0.005	1.800
(D)	484.78012	0.00000	229.040	0.017	1.813
(E)	-765.59668	7.63821	864.202	0.060	1.846
(F)	3.00662	0.00001	1028.269	0.071	1.660
(G)	-9.50637	1.29962	3263.863	0.195	1.700
(H)	3.94583	-5768.89515	969.380	0.067	1.642
(I)	518.79118	0.00000	69.568	0.005	1.800
(J)	-1449.01530	66.27678	800.098	0.056	1.840
(K)	-373.04712	0.91234	882.992	0.061	—
(L)	395.74882	0.00001	447.260	0.032	—

TABLE (16) URBAN S07 Entertainment Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	-3238.70325	0.14634	3744.280	0.217	1.935
(B)	-31885.75811	3389.65732	542.590	0.039	1.969
(C)	2580.82819	-6489321.63661	33.467	0.002	1.975
(D)	1054.41237	0.00000	5132.996	0.275	1.992
(E)	-8559.97647	63.04513	1657.602	0.109	1.943
(F)	5.76339	0.00001	1462.568	0.098	1.770
(G)	-1.26275	0.73490	3312.390	0.197	1.752
(H)	6.37263	-3656.00353	1256.546	0.085	1.776
(I)	1780.92643	0.00000	3553.109	0.208	1.987
(J)	-12368.14608	485.58062	1176.033	0.080	1.953
(K)	-6331.42077	8.55543	2271.609	0.144	—
(L)	-266.29366	0.00023	5239.185	0.279	—

TABLE (17) URBAN S08 Personal Services Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	1345.60923	0.03017	679.604	0.048	1.940
(B)	-16791.51163	1918.31295	927.337	0.064	1.934
(C)	2872.07077	-5853285.97360	142.563	0.010	1.950
(D)	2394.84721	0.00000	49.732	0.004	1.947
(E)	-1467.92427	23.13760	1118.434	0.076	1.927
(F)	6.03862	0.00001	279.296	0.020	1.545
(G)	-1.54953	0.78030	1443.631	0.097	1.538
(H)	6.62636	-4832.29855	933.797	0.065	1.568
(I)	2444.78373	0.00000	1.711	0.000	1.948
(J)	-3794.82608	209.37376	1132.290	0.077	1.926
(K)	-145.65542	2.62871	1026.008	0.071	—
(L)	2199.43651	0.00002	218.461	0.016	—

TABLE (18) URBAN S11 Farinaceous Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	1945.16139	0.03579	2769.552	0.170	1.926
(B)	-19594.03242	2278.01693	4002.747	0.229	1.933
(C)	3818.59586	-7806161.55432	664.299	0.047	1.833
(D)	3152.99302	0.00000	456.161	0.033	1.815
(E)	-1232.98427	26.50647	4580.419	0.253	1.957
(F)	5.10831	0.00001	605.642	0.043	1.785
(G)	-9.83505	1.54304	2563.207	0.159	1.773
(H)	6.24755	-8377.17913	1207.941	0.082	1.789
(I)	3235.13534	0.00000	115.252	0.008	1.796
(J)	-3945.33882	241.42350	4732.987	0.259	1.953
(K)	277.95539	3.01536	4135.292	0.234	—
(L)	2908.52402	0.00003	1129.160	0.077	—

TABLE (19) S12 Meat & Fish Engel Curve Estimation.URBAN.

Model	a	b	F	R^2	D.W.
(A)	857.36632	0.00988	1519.306	0.101	1.831
(B)	-5982.81160	718.00642	2907.586	0.177	1.860
(C)	1410.04995	-2646261.16473	592.402	0.042	1.784
(D)	1196.59068	0.00000	165.336	0.012	1.752
(E)	-118.72153	7.90031	2874.437	0.175	1.868
(F)	4.75144	0.00001	583.300	0.041	1.705
(G)	-6.89932	1.20526	2184.966	0.139	1.755
(H)	5.65091	-6381.94941	988.156	0.068	1.728
(I)	1215.45179	0.00000	24.389	0.001	1.743
(J)	-971.39021	73.44064	3112.671	0.187	1.869
(K)	351.58136	0.87850	2481.103	0.155	—
(L)	1132.80637	0.00001	520.676	0.037	—

TABLE (20) URBAN S13 Dairy Products Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	223.03647	0.01003	322.109	0.023	1.978
(B)	-4902.60695	547.59984	313.513	0.023	1.979
(C)	703.81835	-1578003.80548	45.272	0.003	1.980
(D)	566.60756	0.00000	40.337	0.003	1.978
(E)	-598.83909	7.02129	431.964	0.031	1.976
(F)	1.00339	0.00000	94.711	0.007	1.819
(G)	-2.67814	0.38265	254.479	0.018	1.812
(H)	1.29122	-1816.71981	99.029	0.007	1.824
(I)	587.45279	0.00000	2.690	0.000	1.978
(J)	-1260.83952	62.05665	416.324	0.030	1.976
(K)	-219.12550	0.81953	420.565	0.030	—
(L)	496.46314	0.00001	133.723	0.010	—

TABLE (21) URBAN S14 Edible Oils Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	1600.38003	0.02659	2277.487	0.144	1.820
(B)	-15463.33828	1798.26265	3783.397	0.219	1.859
(C)	3020.77202	-6192862.67675	641.160	0.045	1.739
(D)	2510.48486	0.00000	262.790	0.019	1.703
(E)	-905.32945	20.54706	4120.170	0.234	1.871
(F)	5.60844	0.00000	768.132	0.054	1.575
(G)	-8.52065	1.45829	3491.079	0.205	1.637
(H)	6.69757	-8181.23815	1718.332	0.113	1.629
(I)	2563.41122	0.00000	42.834	0.003	1.686
(J)	-3053.28842	188.66779	4345.688	0.243	1.873
(K)	290.64659	2.32235	3628.068	0.212	—
(L)	2335.27265	0.00002	801.608	0.056	—

TABLE (22) URBAN S15 Vegetable & Fruit Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	8.24910	0.00387	352.676	0.025	1.952
(B)	-1949.44118	218.28318	371.952	0.027	1.954
(C)	286.81369	-648809.99879	56.074	0.004	1.946
(D)	229.49303	0.00000	60.033	0.004	1.942
(E)	-222.10569	2.72924	479.452	0.034	1.954
(F)	0.71001	0.00000	157.883	0.012	1.758
(G)	-3.12574	0.39947	389.582	0.028	1.763
(H)	1.00380	-1700.06713	120.828	0.009	1.761
(I)	238.23899	0.00000	11.176	0.001	1.941
(J)	-484.86749	24.30430	469.289	0.034	1.954
(K)	-72.79192	0.31682	461.503	0.033	—
(L)	202.39750	0.00000	158.609	0.012	—

TABLE (23) URBAN S16 Nut & Seed Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	502.47685	0.01264	742.844	0.052	1.873
(B)	-6144.59904	708.82685	776.235	0.054	1.864
(C)	1131.65250	-2307222.17484	137.182	0.010	1.865
(D)	926.14661	0.00000	160.714	0.012	1.865
(E)	-509.44931	8.70897	971.892	0.067	1.866
(F)	2.28203	0.00001	152.690	0.011	1.740
(G)	-4.22687	0.67427	489.470	0.035	1.729
(H)	2.78418	-3431.06759	219.997	0.016	1.736
(I)	958.36240	0.00000	32.756	0.002	1.863
(J)	-1352.14793	77.69651	954.308	0.066	1.864
(K)	-35.71240	1.01373	939.737	0.065	—
(L)	834.83946	0.00001	372.124	0.027	—

TABLE (24) URBAN S17 Confectionary & tea Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	52.85813	0.00126	217.816	0.016	1.846
(B)	-754.34706	85.08885	330.117	0.024	1.856
(C)	118.81642	-272944.96425	58.147	0.004	1.842
(D)	96.24841	0.00000	25.835	0.002	1.836
(E)	-67.38932	0.98338	361.591	0.026	1.853
(F)	0.47688	0.00000	186.042	0.014	1.717
(G)	-2.88436	0.35018	452.628	0.032	1.731
(H)	0.72791	-1383.13213	120.367	0.009	1.718
(I)	98.68562	0.00000	3.513	0.000	1.835
(J)	-169.78944	9.01618	375.832	0.027	1.854
(K)	-10.08981	0.11061	326.352	0.024	—
(L)	88.00375	0.00000	80.502	0.006	—

TABLE (25) URBAN S18 Sauce & Taste & Remainder Foods Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	311.61529	0.01441	898.423	0.062	1.818
(B)	-5883.95161	650.29709	594.289	0.042	1.805
(C)	974.99858	-1889030.05680	84.399	0.006	1.780
(D)	777.49699	0.00000	375.397	0.027	1.784
(E)	-650.56862	8.79604	909.517	0.063	1.819
(F)	3.01727	0.00001	325.079	0.023	1.740
(G)	-5.02307	0.83719	824.079	0.057	1.746
(H)	3.66585	-4037.67384	323.007	0.023	1.731
(I)	824.66591	0.00000	142.782	0.010	1.775
(J)	-1422.73067	78.82523	830.230	0.058	1.815
(K)	-210.15953	1.06244	951.828	0.066	—
(L)	665.94768	0.00002	614.780	0.044	—

TABLE (26) URBAN S19 Drink & Tobacco Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	5928.54287	0.13836	4369.900	0.226	1.789
(B)	-38656.21294	5012.14239	9604.080	0.391	1.869
(C)	10557.55522	-19454151.47657	2863.498	0.161	1.807
(D)	8146.29671	0.00000	268.040	0.018	1.707
(E)	-1597.65595	83.85571	10693.227	0.417	1.854
(F)	8.47485	0.00001	1460.725	0.089	1.606
(G)	0.87513	0.52135	12875.805	0.463	1.544
(H)	9.28751	-4835.95767	9378.740	0.386	1.619
(I)	8205.93866	0.00000	32.938	0.002	1.705
(J)	-7924.49319	687.63144	11773.839	0.441	1.860
(K)	1984.21029	10.46533	8744.443	0.369	—
(L)	7844.28582	0.00012	1052.019	0.066	—

TABLE (27) RURAL Total Food Engel Curve Estimation.S20.

Model	a	b	F	R^2	D.W.
(A)	-5928.54287	0.86164	169480.348	0.919	1.789
(B)	-106230.96784	12248.23322	4839.788	0.245	1.958
(C)	11852.09367	-29429939.66688	598.909	0.039	1.929
(D)	7003.20923	0.00000	30965.004	0.675	1.794
(E)	-27776.12520	308.37503	21563.522	0.591	1.874
(F)	7.83312	0.00003	7782.070	0.342	1.526
(G)	-2.50363	1.15610	40675.661	0.731	1.486
(H)	8.85172	-4517.92860	6548.477	0.305	1.571
(I)	7926.77308	0.00000	12541.812	0.456	1.830
(J)	-42825.25429	2178.60776	12894.391	0.463	1.913
(K)	-18666.30980	45.30938	39315.652	0.725	—
(L)	4173.94495	0.00136	90813.727	0.859	—

TABLE (28) RURAL S10 Total Non-Food Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	53.07580	0.11469	3546.870	0.192	1.863
(B)	-20154.28893	2363.51902	1790.809	0.107	1.862
(C)	2781.91473	-6923913.43464	385.231	0.025	1.836
(D)	1809.80144	0.00000	1463.615	0.089	1.815
(E)	-3865.44738	49.68234	3294.463	0.181	1.868
(F)	3.89852	0.00004	1360.966	0.083	1.580
(G)	-14.86175	2.08444	4805.448	0.243	1.591
(H)	5.74178	-9225.07860	2233.526	0.130	1.585
(I)	1913.46573	0.00000	691.303	0.044	1.812
(J)	-6837.88377	374.33875	2870.241	0.161	1.866
(K)	-2120.61573	6.83426	3602.048	0.194	—
(L)	1469.75762	0.00016	2340.547	0.135	—

TABLE (29) RURAL SO2 Clothing Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	756.14429	0.06710	1788.606	0.107	1.894
(B)	-11807.14502	1462.02070	1070.669	0.067	1.910
(C)	2386.48748	-4331156.52457	243.112	0.016	1.894
(D)	1815.17690	0.00000	285.631	0.019	1.876
(E)	-1748.64850	30.88129	1915.334	0.114	1.902
(F)	6.91292	0.00001	1505.212	0.092	1.259
(G)	1.55151	0.59358	7136.365	0.323	1.238
(H)	7.39528	-2432.24597	2596.936	0.148	1.287
(I)	1858.39090	0.00000	37.635	0.003	1.876
(J)	-3599.08269	232.80065	1687.063	0.101	1.906
(K)	-644.04954	4.21432	2042.132	0.120	—
(L)	1634.15013	0.00008	807.955	0.051	—

TABLE (30) RURAL S03 Housing Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	-3702.35342	0.33577	10482.543	0.412	1.957
(B)	-33446.55970	3773.94102	1100.998	0.069	1.981
(C)	2784.69364	-7800572.21108	20.492	0.008	1.978
(D)	1191.17391	0.00000	15005.402	0.501	1.967
(E)	-10525.84441	105.72423	3856.194	0.205	1.954
(F)	5.46489	0.00003	3409.426	0.186	1.634
(G)	-4.41777	1.10613	9324.040	0.384	1.688
(H)	6.48409	-4632.33742	3366.080	0.184	1.674
(I)	1618.94904	0.00000	13572.953	0.476	1.951
(J)	-15033.13038	719.13219	2618.674	0.149	1.964
(K)	-7785.45766	16.17710	5608.398	0.273	—
(L)	3.44593	0.00061	15162.649	0.504	—

TABLE (31) RURAL S04 Furniture Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	157.49310	0.02858	697.864	0.045	1.987
(B)	-6337.41466	745.02732	621.904	0.040	1.988
(C)	896.54850	-2215964.75972	145.513	0.010	1.980
(D)	611.63306	0.00000	85.389	0.006	1.975
(E)	-1091.64559	14.71044	942.462	0.059	1.988
(F)	2.33557	0.00003	718.443	0.046	1.649
(G)	-9.04548	1.26589	2168.194	0.127	1.687
(H)	3.43741	-5355.78325	985.712	0.062	1.651
(I)	627.05831	0.00000	14.034	0.001	1.974
(J)	-2050.64812	114.19938	889.444	0.056	1.988
(K)	-524.98774	1.93952	930.222	0.059	—
(L)	541.37729	0.00003	262.860	0.017	—

TABLE (32) S05 Health & Medical Care Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	-1149.11453	0.11269	2424.651	0.140	1.970
(B)	-11532.64827	1309.46332	380.611	0.025	1.979
(C)	1043.31648	-2744999.44809	44.632	0.003	1.983
(D)	557.22253	0.00000	1390.545	0.085	1.982
(E)	-3621.61388	37.04159	1223.826	0.076	1.966
(F)	3.41702	0.00003	1218.445	0.075	1.500
(G)	-10.79204	1.57964	4059.257	0.214	1.543
(H)	4.83925	-7135.71471	2017.077	0.119	1.503
(I)	680.32368	0.00000	451.337	0.029	1.982
(J)	-5195.52962	251.73143	868.549	0.055	1.970
(K)	-2644.02360	5.63848	1654.238	0.100	—
(L)	173.16889	0.00018	2231.690	0.130	—

TABLE (33) RURAL S06 Transport & Communications Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	-831.04474	0.06207	1410.411	0.086	1.992
(B)	-3725.84840	419.23010	77.855	0.005	1.993
(C)	289.08467	-784883.21456	7.411	0.000	1.990
(D)	26.02644	0.00000	3820.685	0.204	1.990
(E)	-1527.69943	14.71856	372.678	0.024	1.994
(F)	1.92738	0.00002	834.022	0.053	1.543
(G)	-8.06139	1.11161	2477.995	0.142	1.560
(H)	2.92546	-4912.48570	1225.416	0.076	1.540
(I)	132.17882	0.00000	4249.978	0.221	1.987
(J)	-1956.00730	91.62862	224.740	0.015	1.994
(K)	-1280.64763	2.47797	609.513	0.039	—
(L)	-227.33125	0.00014	2383.408	0.162	—

TABLE (34) RURAL S07 Entertainment Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	-1212.74336	0.14074	3822.842	0.204	1.992
(B)	-19227.06286	2175.03167	1023.498	0.064	1.988
(C)	1670.04818	-4628450.07421	119.290	0.008	1.985
(D)	992.16996	0.00000	749.678	0.048	1.983
(E)	-5395.22601	55.61657	2838.644	0.160	1.976
(F)	4.62304	0.00003	1806.042	0.108	1.290
(G)	-6.40789	1.22964	5464.472	0.268	1.281
(H)	5.75113	-5480.82070	2537.033	0.145	1.281
(I)	1096.40660	0.00000	103.133	0.007	1.979
(J)	-8152.97241	394.77675	2161.601	0.126	1.979
(K)	-3666.52790	8.02774	3482.193	0.189	—
(L)	579.37633	0.00018	2013.007	0.119	—

TABLE (35) RURAL S08 Personal Services Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	2171.36739	0.02857	1812.446	0.108	1.601
(B)	-9135.11090	1259.54408	5724.632	0.277	1.650
(C)	3289.55796	-5364725.88462	2374.045	0.137	1.640
(D)	2634.28083	0.00000	53.269	0.004	1.570
(E)	360.94916	19.50633	5061.608	0.253	1.628
(F)	7.36111	0.00001	776.430	0.049	1.637
(G)	0.70025	0.73142	6306.538	0.297	1.614
(H)	8.04828	-4219.68137	5512.964	0.270	1.659
(I)	2642.62280	0.00000	3.275	0.000	1.571
(J)	-1218.71175	164.55368	5859.519	0.283	1.630
(K)	1241.28641	2.35525	3962.733	0.210	—
(L)	2580.22397	0.00002	328.212	0.021	—

TABLE (36) RURAL S11 Farinaceous Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	1097.24487	0.05254	1878.954	0.112	1.886
(B)	-13393.34733	1642.37892	2510.355	0.144	1.889
(C)	2674.08587	-5885404.22811	792.954	0.050	1.881
(D)	1913.73789	0.00000	220.703	0.015	1.856
(E)	-1444.92094	29.14367	3114.913	0.173	1.888
(F)	3.73629	0.00004	792.362	0.050	1.507
(G)	-13.73590	1.93481	3186.608	0.176	1.491
(H)	5.44521	-9032.21276	1743.894	0.105	1.497
(I)	1960.34241	0.00000	37.074	0.002	1.854
(J)	-3525.52975	233.94471	3161.859	0.175	1.886
(K)	-254.54734	3.72870	2855.716	0.160	—
(L)	1805.62984	0.00005	652.873	0.042	—

TABLE (37) RURAL S12 Meat & Fish Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	860.06193	0.01398	1007.649	0.063	1.635
(B)	-3925.24817	536.41209	2088.340	0.123	1.636
(C)	1356.93645	-2208263.70772	898.126	0.057	1.630
(D)	1084.42530	0.00000	66.657	0.004	1.615
(E)	72.23386	8.70625	2096.273	0.123	1.637
(F)	5.19036	0.00002	339.308	0.022	1.527
(G)	-3.27166	0.93674	1282.037	0.079	1.518
(H)	6.06504	-4789.52482	892.464	0.056	1.516
(I)	1090.11017	0.00000	9.148	0.001	1.613
(J)	-599.99364	72.04676	2279.807	0.132	1.634
(K)	449.86674	1.07690	1789.655	0.107	—
(L)	1054.66533	0.00001	263.220	0.017	—

TABLE (38) RURAL S13 Dairy Products Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	227.98363	0.00755	626.471	0.040	1.673
(B)	-2132.28943	271.08138	1096.516	0.068	1.672
(C)	524.69553	-1012834.75545	399.478	0.026	1.680
(D)	399.71429	0.00000	30.379	0.002	1.669
(E)	-137.68656	4.61826	1221.603	0.076	1.669
(F)	3.61555	0.00002	398.899	0.026	1.613
(G)	-5.00694	0.95573	1408.206	0.086	1.604
(H)	4.51942	-4889.77991	979.329	0.062	1.616
(I)	402.47686	0.00000	1.452	0.000	1.669
(J)	-482.38076	37.71091	1284.777	0.079	1.668
(K)	59.11271	0.57716	1074.239	0.067	—
(L)	383.86405	0.00001	153.700	0.010	—

TABLE (39) RURAL S14 Edible Oils Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	582.82296	0.01670	1269.219	0.078	1.572
(B)	-5081.44179	635.21891	2620.837	0.149	1.601
(C)	1141.98781	-2351569.31432	882.984	0.056	1.581
(D)	852.56970	0.00000	51.727	0.003	1.544
(E)	-384.89245	10.62843	2827.409	0.159	1.591
(F)	4.59635	0.00002	658.692	0.042	1.473
(G)	-7.19400	1.30277	3003.934	0.167	1.479
(H)	5.80570	-6783.00863	2111.242	0.124	1.470
(I)	858.19504	0.00000	3.457	0.000	1.543
(J)	-1195.87628	87.54177	3051.852	0.170	1.594
(K)	76.74832	1.31359	2394.287	0.138	—
(L)	818.97312	0.00001	274.564	0.018	—

TABLE (40) RURAL S15 Vegetable & Fruit Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	162.52554	0.00312	411.226	0.027	1.745
(B)	-957.70135	125.31167	899.479	0.057	1.753
(C)	276.49445	-517703.39172	405.805	0.026	1.750
(D)	212.68634	0.00000	27.888	0.002	1.733
(E)	-20.29853	2.00356	874.382	0.055	1.753
(F)	2.73116	0.00002	348.069	0.023	1.399
(G)	-6.13366	0.98001	1433.560	0.088	1.392
(H)	3.64258	-5078.87657	1024.212	0.064	1.387
(I)	213.90674	0.00000	5.780	0.000	1.733
(J)	-177.79457	16.69919	959.514	0.060	1.754
(K)	67.88595	0.24567	740.717	0.047	—
(L)	206.22001	0.00000	105.223	0.007	—

TABLE (41) RURAL S16 Nut & Seed Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	512.61044	0.00859	1028.691	0.064	1.742
(B)	-2064.29082	290.74544	1607.694	0.097	1.765
(C)	797.54040	-1186855.54840	690.408	0.044	1.757
(D)	649.64816	0.00000	102.864	0.006	1.726
(E)	79.94548	4.91102	1763.473	0.106	1.755
(F)	5.69717	0.00001	626.094	0.040	1.508
(G)	0.64134	0.58566	4162.067	0.218	1.488
(H)	6.52266	-3359.17587	3632.186	0.196	1.511
(I)	653.99444	0.00000	11.972	0.001	1.727
(J)	-281.92570	39.90221	1837.229	0.109	1.758
(K)	284.32395	0.62196	1590.593	0.096	—
(L)	629.51900	0.00001	340.297	0.022	—

TABLE (42) RURAL S17 Confectionary & Tea Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	16.44376	0.00034	197.155	0.013	1.834
(B)	-79.46970	10.85617	267.038	0.018	1.836
(C)	27.47889	-45067.14417	124.378	0.008	1.834
(D)	21.81067	0.00000	31.321	0.002	1.829
(E)	0.40314	0.18500	295.930	0.019	1.836
(F)	1.87290	0.00001	430.435	0.028	1.388
(G)	-3.35746	0.57777	1900.037	0.113	1.357
(H)	2.41755	-3088.88834	1441.319	0.088	1.377
(I)	22.01487	0.00000	5.608	0.000	1.829
(J)	-13.03172	1.49476	303.682	0.020	1.836
(K)	7.96083	0.02367	274.830	0.018	—
(L)	20.96233	0.00000	81.741	0.005	—

TABLE (43) RURAL S18 Sauce & Taste & Remainder Foods Engel Curve Estimation.

Model	a	b	F	R^2	D.W.
(A)	247.48235	0.00697	542.009	0.035	1.850
(B)	-1887.31345	240.59374	869.826	0.055	1.863
(C)	468.77786	-881727.50206	307.398	0.020	1.844
(D)	359.39653	0.00000	35.120	0.002	1.823
(E)	-123.38911	4.15317	995.007	0.062	1.866
(F)	2.53073	0.00002	335.151	0.022	1.696
(G)	-5.91786	0.93822	1051.028	0.066	1.722
(H)	3.37169	-4283.07328	580.004	0.037	1.705
(I)	362.27533	0.00000	2.585	0.000	1.821
(J)	-429.24902	33.73745	1034.162	0.065	1.867
(K)	51.57271	0.52242	888.625	0.056	—
(L)	344.22817	0.00001	148.877	0.010	—

TABLE (44) RURAL S19 Drink & Tobacco Engel Curve Estimation.

BEST FITTED MODELS

Best fitted models with respect to "F"*, "R^2"*, Standard error of est.

$$S_{20}^{U} = -16455.21858 + 961.80456\ Y^{1/3}$$
(0.63722)

$$\ln S_{20}^{R} = 0.87513 + 0.52135\ \ln Y$$
(0.68035)

$$S_{10}^{U} = -6936.75282 + 0.85536\ Y$$
(0.96414)

$$S_{10}^{R} = -5928.54287 + 0.86164\ Y$$
(0.95864)

$$S_{02}^{U} = -4967.41815 + 257.61718\ Y^{1/3}$$
(0.47658)

$$\ln S_{02}^{R} = -14.86175 + 2.08444\ \ln Y$$
(0.49331)

$$\ln S_{03}^{U} = -0.15690 + 0.88704\ \ln Y$$
(0.70107)

$$\ln S_{03}^{R} = 1.55151 + 0.59358\ \ln Y$$
(0.56855)

$$\ln S_{04}^{U} = -0.23746 + 0.95022\ \ln Y$$
(0.58617)

$$S_{04}^{R} = 3.44593 + 0.00061\ Y^{3/2}$$
(0.70971)

$$\ln S_{05}^{U} = -5.99174 + 0.98390\ \ln Y$$
(0.31960)

$$\ln S_{05}^{R} = -9.04548 + 1.26589\ \ln Y$$
(0.35599)

$$S_{06}^{U} = -696.91431 + 0.00035\ Y^{3/2}$$
(0.58211)

$$\ln S_{06}^{R} = -10.79204 + 1.57964\ \ln Y$$
(0.46221)

* With 0.01% significance level; $P[F > 6.64] = 0.01$.

$$LnS_{07}^{U} = -9.50637 + 1.29962\ LnY$$
$$(0.44106)$$

$$S_{07}^{R} = 132.17882 + 0.00000\ Y^{3}$$
$$(0.47059)$$

$$S_{08}^{U} = -266.29366 + 0.00023\ Y^{3/2}$$
$$(0.52856)$$

$$LnS_{08}^{R} = -6.40789 + 1.22964\ LnY$$
$$(0.51479)$$

$$LnS_{11}^{U} = -1.54953 + 0.78030\ LnY$$
$$(0.31067)$$

$$LnS_{11}^{R} = 0.70025 + 0.73142\ LnY$$
$$(0.54481)$$

$$S_{12}^{U} = -3945.33882 + 241.42350\ Y^{1/3}$$
$$(0.50930)$$

$$LnS_{12}^{R} = -13.73590 + 1.93481\ LnY$$
$$(0.41927)$$

$$S_{13}^{U} = -971.39021 + 73.44064\ Y^{1/3}$$
$$(0.43268)$$

$$S_{13}^{R} = -599.99364 + 72.04676\ Y^{1/3}$$
$$(0.36385)$$

$$S_{14}^{U} = -598.83909 + 7.02129\ Y^{1/2}$$
$$(0.17599)$$

$$LnS_{14}^{R} = -5.00694 + 0.95573\ LnY$$
$$(0.29348)$$

$$S_{15}^{U} = -3053.28842 + 188.66779\ Y^{1/3}$$
$$(0.49328)$$

$$S_{15}^{R} = -1195.87628 + 87.54177\ Y^{1/3}$$
$$(0.41184)$$

$$S^U_{16} = -222.10569 + 2.72924\ Y^{1/2}$$
$$(0.18510)$$

$$\ln S^R_{16} = -6.13366 + 0.98001\ \ln Y$$
$$(0.29589)$$

$$S^U_{17} = -509.44931 + 8.70897\ Y^{1/2}$$
$$(0.25902)$$

$$\ln S^R_{17} = 0.64134 + 0.58566\ \ln Y$$
$$(0.46677)$$

$$\ln S^U_{18} = -2.88436 + 0.35018\ \ln Y$$
$$(0.18002)$$

$$\ln S^R_{18} = -3.35746 + 0.57777\ \ln Y$$
$$(0.33589)$$

$$S^U_{19} = -210.15953 + 1.06244\ Y^{2/3}$$
$$(0.25651)$$

$$\ln S^R_{19} = -5.91786 + 0.93822\ \ln Y$$
$$(0.25636)$$

FINDINGS

As a concluding note, and also gatherring the important points of the present research, in this part there is a glance at the reached findings briefly. Generally as the title of the study expresses: this study is an estimation of Engel's curve but parallel to estimating, improvement of techniques is under consideration.

As a remembrance let's count some of the important cited points throughout the text:

(i) Food is the most important item in household budgets; (Engel's law).

(ii) The proportion of total expenditure allocated to food decreases as icome increases;(Engel's law).

(iii) The propotion devoted to clothing and housing is approximately constant, while the share of luxury items increases, when income increases;(Engel's law).

(iv) The percent of income spent for housing declines as income rises;(Schwabe's law).

(v) High-quality housing in reality is one of the main luxuries of consumers;(M. Reid, permanent income concept).

(vi) Housing and food have low income elasticities;(other researchers findings).

(vii) Clothing and education have income elasticities close to unity;(other researchers findings).

(iix) Recreation, personal care, home operation and other services have higher income elasticities;(other researchers findings).

For most commodity bundles the income elasticities estimated for Iran(Urban & Rural), confirm the cited points; and are comparable with the income elasticities obtained in other countries. Attempts have also been made to compare the income elasticities derived in the present study with income elasticities derived in other studies in Iran, either on the basis of different data and/or of different methodologies. This comparability strengthens confidence in the present study, specially in view of a considerable difference in terms of methods.

In the present study seven new models have been added to the selected models by the previous researchers.

Prais & Houthakker concluded that: the semi-log function gives the best results, as far as food items are concerned;

for all other goods and services, the double-log form gives the best statistical results.

Semi-log form in our findings does not show the best statistical results, and is among the next best models; but double-log function is the best fitted model nearly for half of the bundles, and also, has better fitting to rural data;(13 best of 19 double-log estimations have been fitted to the rural data).

The results also confirm our hypotheses about upward convexity for necessities; upward concavity for luxuries; and linear form for bundles which have constant marginal propensity to consume. But among them there is an exception: rural entertainment best fitted model is concave upward, by income elasticity at the means of the variables, equal to "0.96". This point does not reject the hypothesis as will be explained.*

According to our considerations in the previous parts: In general there will be a level of income below which the consumer purchases none of the good; the results show negative intercepts for the best fitted models (except double-log models which have no intercepts -as a general functional form); except rural furniture (a=3.44593) and entertainment (a=132.17882).

* It should be noted that the urban data are more reliable than rural data, (beacuse there are many problems facing the statisticians, in practical data collecting -specially at the rural areas of Iran).

Total Non-Food S10

Best fitted models for Urban and Rural, both, are linear ('(A)'). This point confirms the third hypothesis about constancy of marginal propensity to expend (MPE), for total non-food bundle.

$$S_{10}^{U} = -6939.75282 + 0.85536\ Y$$

$$S_{10}^{R} = -5928.54287 + 0.86164\ Y$$

their MPEs are:

$$MPE_{10}^{U} = 0.85536$$

$$MPE_{10}^{R} = 0.86164$$

their income elasticity at the means of the variables:

$$E_{10}^{U} = 1.28$$

$$E_{10}^{R} = 1.71$$

The rural income elasticity for total non-food bundle, is greater than income elasticity at the urban areas. this is not a contradiction. The problem is obvious, beacuse the rural people are self-sufficient of food productions there are emphasis to purchase commodities -non food- for rural peoples. On the other hand, income elasticities difference shows that demand for total non-food as a whole is more elastic at the rural areas than urban areas.

Urban and rural income elasticities difference can be shown mathematically in this way:

$$E = \frac{\frac{dS}{dY}}{\frac{S}{Y}} = \frac{MPE}{APE}$$

we have:

$$MPE^{U}_{10} \# MPE^{R}_{10} \# 0.85$$

and,

$$APE^{U}_{10} = 0.66560 > APE^{R}_{10} = 0.50281$$

so:

$$\frac{MPE^{U}_{10}}{APE^{U}_{10}} < \frac{MPE^{R}_{10}}{APE^{R}_{10}}$$

or:

$$E^{U}_{10} < E^{R}_{10}$$

Total Food S20

Selected fitted models are:

$$S_{20}^{U} = 226.64877 + 12.15806\ Y^{2/3}$$

$$S_{20}^{R} = 1984.21029 + 10.46533\ Y^{2/3}$$

These two functions both are convex upward; the first, the second and the third best models, which have been fitted to both urban and rural total food data are convex upward too. This is a confirmation for the first hypothesis.

Their income elasticities are:

$E_{20}^{U} = 0.65$ (at the means)

$E_{20}^{R} = 0.82$ (at the means)

The rural income elasticity is greater than income elasticity at the urban areas, which is consistent with the Engel's laws. Our selection is based upon choosing the models which satisfy both the Engel's laws and possessing significant statistical results.

Estimated income elasticities for the year 1338 for urban areas (Bank Markazi 1962) are:

0.51	food at home
0.77	food away from home

We mixed them together by the procedure at the appendix 'A', and found:

0.52 total food (est.)

In the year 1347 (Bank Markazi 1971):

0.58 food at home

0.82 food away from home

0.59 total food (est.)

A. Le Baron estimated income elasticities for the pooled years: 1338 & 1344 for urban Iran, and for the pooled years 1342,1343,1344 for rural Iran, which are inconsistent with other estimations, his income elasticities are based on

	1338	1338,1344	1347	1356
Urban	0.52 est.	0.92 pooled	0.59 est.	0.65
Rural	-	1.71 pooled 1342,3,44	-	0.82

quantity data, not expenditure data. Except Le Baron's estimation, trends of income elasticity at the urban areas show that the real income tends to decrease.

Clothing S02

Best fitted models are:

$$S^U_{02} = -4967.41815 + 257.61718\, Y^{1/3}$$

$$\ln S^R_{02} = -14.86175 + 2.08444 \ln Y$$

Their income elasticities are:

$E^U_{02} = 0.94$ (at the means)

$E^R_{02} = 2.08$ (constant)

Engel believed that the proportion devoted to clothing and housing is approximately constant, while the share of luxury items increases when income increases. Income elasticity for clothing at the urban areas confirms his idea; but its income elasticity at the rural areas does not confirm this concept and shows that clothing is a luxury bundle for rural areas. The reason is that Iranian farmers receive their revenue at the end of each season after the sale of their products. So, they rush to the market at the end of the season, when they have cash money. Therefore, this phenomenon appears at the monthly data of budget survey strictly, so higher income owners purchase more clothes; this point makes the income elasticity higher.

The best cited models for clothing both confirm the hypotheses.*

	1338	1347	1356
Urban	0.83 est.	0.91	0.94
Rural	-	-	2.08

Source: Bank Markazi Iran

The trend of urban income elasticities is positive, and shows that the increasing importance of the clothing - but it is not conclusive- and its fashions with respect to relation and communication of the urban people of Iran with other countries.

* It should be noted that, double-log models automatically satisfy our hypotheses. By this we mean that if b<1 shape of the model is convex upward and commodity is necessity too. If b>1 shape of the model is concave upward and commodity is luxury too. When b=1 model is linear and satisfies the third hypothesis criteria.

Housing SO3

Best fitted models for urban and rural areas are both double-Log (,(G),):

$$LnS^{U}_{03} = -0.15690 + 0.88704\ LnY$$

$$LnS^{R}_{03} = 1.55151 + 0.59358\ LnY$$

so they possess constant elasticities:

$$E^{U}_{03} = 0.89$$

$$E^{R}_{03} = 0.59$$

Income elasticity of housing expenditure at the urban areas confirms the Engel's idea about approximate constancy of the proportion devoted to housing, when income increases. Though some researchers findings that is food and housing have low income elasticities, (R.P.Mack 1952) are more consistant with our findings at the rural areas.

	1338	1347	1356
Urban	0.88 est.	0.81 est.	0.89
Rural	-	-	0.59

Source: Bank Markazi Iran.

Income elasticity at the urban areas is greather than income elasticity at the rural areas, beacuse at the rural areas the rural people construct their houses themselves with assistance of their friends. This situation is not similar with construction procedure in the urban areas of Iran.

The urban income elasticity fluctuations are expected to be in some part due to the price fluctuations of construction materials during the cited period - but not conclusively.

Furniture S04

Best fitted models are:

$$\ln S^{U}_{04} = -0.23746 + 0.95022 \ln Y$$

$$S^{R}_{04} = 3.44593 + 0.00061 \, Y^{3/2}$$

Rural furniture model confirms the second hypothesis; it is concave upward and its income elasticity is greater than unit at the means of the variables.

Income elasticities for both urban and rural areas are:

$E^{U}_{04} = 0.95$ (constant)

$E^{R}_{04} = 1.49$ (at the means)

They show that furniture is a luxury bundle for rural areas; but proportion devoted to furniture is approximately constant when income increases (for urban areas).

	1338	1347	1356
Urban	1.01 est.	0.98 est.	0.95
Rural	-	-	1.49

Source: Bank Markazi

The trend of urban income elasticities is decreasing and shows the decreasing importance of the furniture in the urban consumer budget during the cited period; but it should be noted that we cannot compare the income elasticities at different points of time conclusively, beacuse the data coverage as well as the models used might not be the same. Moreover, situations under which the Engel's curves were estimated have changed.

Health & Medical Care S05

Best fitted models for urban and rural both are double-log, (,(G),),

$$\ln S^U_{05} = -5.99174 + 0.98390 \ln Y$$

$$\ln S^R_{05} = -9.04548 + 1.26589 \ln Y$$

Their income elasticities are constant:

$$E^U_{05} = 0.98$$

$$E^R_{05} = 1.26$$

Therefore, proportion devoted to health and medical care is nearly constant at the urban areas; but the higher income elasticity for rural areas arises from their relative backwardness and inaccessibility to physicians and medicine, and other seasonal problems they are confronted with.

	1338	1347	1356
Urban	0.87	0.82	0.98
Rural	-	-	1.26

Source: Bank Markazi

Another problem which causes this difference is: the proportion of people insured in the rural areas is less than the proportion of the people insured in the urban areas.

The increments of urban health and medical care income elasticities in the year 1356 is beacuse of the obligative insurance and also promotion of general level education and urbanization.

Transport & Communications SO6

Best fitted models are:

$$S^{U}_{06} = -696.91431 + 0.00035\ Y^{3/2}$$

$$\ln S^{R}_{06} = -10.79204 + 1.57964\ \ln Y$$

Both models are concave upward which the first one confirms the second hypothesis.

Their income elasticities are:

$E^{U}_{06} = 1.84$ (at the means)

$E^{R}_{06} = 1.58$ (constant)

Transport & communication for both urban and rural people is a luxury; but urban's income elasticity is greater than rurals',it is beacuse of the need for the rural people to transport their products in order to sell them in the markets and purchase their necessatties.

	1338	1347	1356
Urban	1.17	1.75	1.84
Rural	-	-	1.58

Source: Bank Markazi.

High income elasticities for transport and communications also show that travelling is luxury item. It should be noted that existance of the item "trips to forign countries" in this bundle is one of the points which make the urban and rural income elasticities different, beacuse usually urban people use this item. Another reason is te fact that private transportation is included in this bundle. It can be accounted as household saving and can be regarded as a luxury item as well.

Urban income elasticities trend is positive beacuse of some reasons. First, permanent increment in prices of the private transportation. Second, the growth of cities. Third, injection of the oil revenue into the economy during the cited period.

Entertainment SO7

Best fitted models are:

$$LnS^{U}_{07} = -9.50637 + 1.29962\ LnY$$

$$S^{R}_{07} = 132.17882 + 0.00000\ Y^{3}$$

The coefficient of Y is not zero, we calculated by the procedure cited at the appendix B, and it is equal to: $(1.38298)10^{-11}$ so:

$$S^{R}_{07} = 132.17882 + (1.38298).10^{-11}\ Y^{3}$$

Their income elasticities are:

$$E^{U}_{07} = 1.30 \qquad \text{(constant)}$$

$$E^{R}_{07} = 0.96 \qquad \text{(at the means)}$$

Income elasticity of Entertainment expenditure, shows that it is a luxury bundle at the urban areas, and is consistent with other researchers findings:"recreation has higher income elasticity"(R.P. Mack 1952). Its income elasticity for rural areas is low with respect to urbans'. This is beacuse of existence of expensive amusement in the urban areas. For example we can refer to the following list of amusement which do not exist, nor are usable at the rural areas. On the other hand rural people are not familiar with them. The rural low purchasing power is another point.

List of selective urban amusement:

Cinema, theater, sport activity, concerts, television, tape recorder, record-player, musical instruments, orchestra, photography, toys, mountain-climbing, ski, playing chess, lotto, and so on.

	1338	1347	1356
Urban	1.25	1.22	1.30
Rural	-	-	0.96

Source: Bank Markazi.

Rural best fitted model is concave upward, but its income elasticity is less than unit. This point does not reject the hypothesis, beacuse shape of the model shows that the upward concavity of the model begins when the income approaches high levels*, and also it is obvious that income level at the rural areas is very low, so rural people do not use the cited list of amusement and their income elasticity remaines lower.

* This is the point that we did not leave the coefficient of "y" as zero. When the exponent of "Y" is three and its coefficient is very small, model is shown as a line in low income ranges and then tends upward strictly by increasing income.

Personal Services S08

Best fitted models are:

$$S^{U}_{08} = -266.29366 + 0.00023\ Y^{3/2}$$

$$\ln S^{U}_{08} = -6.40789 + 1.22964\ \ln Y$$

Their income elasticities are:

$E^{U}_{08} = 1.69$ (at the means)

$E^{R}_{08} = 1.23$ (constant)

Both models are concave upward, and the first one is a confirmation for the second hypothesis. Both are consistent with other researchers findings:"Personal services have higher income elasticities", (R.P. Mack 1952).

Income elasticity of personal services for the urban areas is greater than rural. This is beacuse of the existence of some items inside the urban's bundle, which do not exist inside the rurals'. For example we can count the following item:

Beauty salons, electric shavers, shaving cream, pipe, shampoo, spray , lotions, perfumes, tooth brush, lighter, and so on.

The above items are not usually used at the rural areas, to some extents, customs, traditions and their mode of daily works are the preventives of using them; and also we can say that the rural people are not familiar with the cited items. The rural low purchasing power is another point in this field.

	1338	1347	1356
Urban	0.60	0.52	1.69
Rural	-	-	1.23

Source: Bank Markazi, Iran.

As an explanation, it should be noted that: the same reasons for the lower income elasticity in the rural areas could be mentioned, the low income elasticities of personal services for the urban areas in the years 1338 , 1347 , relative to 1356.

Farinaceous S11

Best fitted models are both double-log for urban and rural areas:

$$LnS^{U}_{11} = -1.54953 + 0.78030\ LnY$$

$$LnS^{R}_{11} = 0.70025 + 0.73142\ LnY$$

Their income elasticities are constant (both are necessities).

$$E^{U}_{11} = 0.78$$

$$E^{R}_{11} = 0.73$$

Urban's income elasticity of farinaceous is greater than rurals'. This is beacuse of rural peoples are self-sufficient of farinaceous products -but the difference is not conclusive*.

	1338	1347	1351	1353	1356
Urban	flour &rice 0.33 bread 0.27	flour &rice 0.13 bread 0.17	farin-aceous 0.56	flour &rice 0.30 bread 0.84	farin-aceous 0.78
Rural	-	-	-	-	0.73

Source: Bank Markazi.

Low income elasticities of farinaceous are consistent with other researcher's findings (R.P. Mack 1952).

* Since the difference is small, we can test the hypothesis: $H_0: \eta^{u}_{11} = \eta^{r}_{11}$, using Chow test, where η is real elasticity. To do this, we have to pool the urban and rural data and run new regression. Since at this stage, we do not have access to computer facilities, we cannot do the test. So if we reject the null hypothesis, the reason could be due to the self-sufficiency situation for farinaceous products in the rural areas.

Meat & Fish S12

Best fitted models are:

$$S^U_{12} = -3945.33882 + 24.42350\ Y^{1/3}$$

$$\ln S^R_{12} = -13.73590 + 1.93481\ \ln Y$$

Their income elasticities are:

$$E^U_{12} = 0.73 \qquad \text{(at the means)}$$

$$E^R_{12} = 1.93 \qquad \text{(constant)}$$

Urban best fitted model confirms the first hypothesis. Income elasticities show that meat & fish are necessities at the urban areas, and luxuries for rural areas. This point confirms the Engel's law:"The proportion of total expenditures allocated to food decreases as income increases"; but it shows that when the income level gap is wide, the expensive foods are luxuries for lower income levels. As a confirmation mean of the total expenditure at the urban areas is more than two times greater than the mean of the rural total expenditures.

$$\overline{Y}_U = 36556.2515$$

$$\overline{Y}_R = 16522.0385$$

	1338	poolled 1338,1344	1347	1351	1353	1356
Urban	0.91 est.	0.93 est.	0.75	0.83	0.84 est.	0.73
Rural	-	1342,3,4 2.33 est.	-	-	-	1.93

Source:Bank Markazi Iran.
Le Baron 1972.

This point should be noted that the rural people are self-sufficient of meat products; but they produce them for sale rather than for consumption.

Dairy Products S13

Best fitted models are:

$$S^{U}_{13} = -971.39021 + 73.44064\ Y^{1/3}$$

$$S^{R}_{13} = -599.99364 + 72.04676\ Y^{1/3}$$

Both models are of kind (J), convex upward, which with respect to their income elasticities, they confirm the first hypothesis. Their income elasticities at the means of the variables are:

$$E^{U}_{13} = 0.60$$

$$E^{R}_{13} = 0.51$$

Urban income elasticity is greater than rurals' beacuse of the self-sufficiency situation for dairy products at the rural areas; but they are consistent with other researchers findings, (R.P. Mack 1952). The difference is not conclusive.*

	1338	1347	1351	1353	1356
Urban	0.59	0.70	0.85	0.69	0.60
Rural	-	-	-	-	0.51

Source: Bank Markazi Iran.

* See page 142 footnote.

Edible Oils S14

Best fitted models are:

$$S^{U}_{14} = -598.83909 + 7.02129\ Y^{1/2}$$

$$LnS^{R}_{14} = -5.00694 + 0.95573\ LnY$$

Their income elasticities are:

$E^{U}_{14} = 1.00$ (at the means)

$E^{R}_{14} = 0.95$ (constant)

Urban income elasticity of edible oils is less than rural income elasticity, beacuse animal oils item exists inside the bundle, and rural people are self- producers of this item ,but this point is not conclusive.

	1338	1338,1344 poolled	1347	1351	1353	1356
Urban	0.67	0.56	0.31	0.83	0.81	1.00
		1342,3,44 poolled				
Rural	-	1.11	-	-	-	0.95

Source: Bank Markazi Iran.
Le Baron 1972.

Vegetable & Fruit S15

Best fitted models are of the form (J) :

$$S^U_{15} = -3053.28842 + 188.66779\ Y^{1/3}$$

$$S^R_{15} = -1195.87628 + 87.54177\ Y^{1/3}$$

Their income elasticities at the means of the variables are:

$$E^U_{15} = 0.73$$

$$E^R_{15} = 0.79$$

Both models are convex upward and confirm the first hypothesis. Income elasticities of vegetable & fruit confirm the Engel's law and other researchers findings about low income elasticity for foods,(R.P. Mack 1952), but not strongly.*

	1338	1338,1344 poolled	1347	1351	1353	1356
Urban	0.64 est.	0.74 est.	0.72 est.	0.97	0.88 est.	0.73
		1342,3,44 poolled				
Rural	-	1.00 est.	-	-	-	0.79

Source: Bank Markazi Iran.
Le Baron 1972.

* See page 142 footnote.

Nut & Seed S16

Best fitted models are:

$$S_{16}^{U} = -222.10569 + 2.72924\ Y^{1/2}$$

$$LnS_{16}^{R} = -6.13366 + 0.98001\ LnY$$

Their income elasticities are:

$E_{16}^{U} = 0.96$ (at the means)

$E_{16}^{R} = 0.98$ (constant)

Both models are convex upward and with respect to their income elasticities confirm the hypotheses. They also confirm the Engel's law, and are consistent with other researchers findings (R.P. Mack 1952) but not strongly.*

	1338	pool ed 1338,1344	1347	1351	1353	1356
Urban	nut 0.57 seed 0.49	nut 1.36 seed 0.48	nut 1.22 seed 1.10	nut 1.09 seed 0.22	nut 1.42 seed 0.39	nut& seed 0.96
		1342,3,44 pool ed				
Rural	-	nut 2.30 seed 0.69	-	-	-	nut& seed 0.98

Source: Bank Markazi Iran.

* By testing the null hypothesis $H_0 : E_{16}^{r} = 1$, it cannot be rejected, with $\alpha = 0.005$ significance level. So we assume that the elasticity is equal to one.

Confectionary & Tea S17

Best fitted models are:

$$S^U_{17} = -509.44931 + 8.70897\ Y^{1/2}$$

$$\text{In}S^R_{17} = 0.64134 + 0.58566\ \text{In}Y$$

Their income elasticities are:

$E^U_{17} = 0.76$ (at the means)

$E^R_{17} = 0.58$ (constant)

Both are convex upward and with respect to their income elasticities, confirm the hypotheses, and are consistent with other researchers findings,(R.P. Mack 1952). Urban income elasticity of confectionary & tea is greater than rurals', beacuse drinking tea is a constant tradition at the rural areas of Iran.

Sauce & Taste and Remainder Foods S18

Best fitted models are both double-log (,(G),):

$$LnS^{U}_{18} = -2.88436 + 0.35018\ LnY$$

$$LnS^{R}_{18} = -3.35746 + 0.57777\ LnY$$

They have constant income elasticities and are convex upward:

$$E^{U}_{18} = 0.35$$

$$E^{R}_{18} = 0.58$$

Their income elasticities are consistent with other researchers findings (R.P.Mack 1952); and confirm the Engel's law.

Drinks & Tobacco S19

Best fitted models are:

$$S^{U}_{19} = -210.15953 + 1.06244\ Y^{2/3}$$

$$LnS^{R}_{19} = -5.91786 + 0.93822\ LnY$$

Their income elasticities are:

$$E^{U}_{19} = 0.83$$

$$E^{R}_{19} = 0.93$$

Both models are convex upward and confirm the hypotheses. Our findings are consistent with other researchers findings, and confirm Engel's Idea.

Bundle	URBAN	RURAL
S20 Total Food	1.00646	0.52135
S10 Total Non-Food	1.04449	1.15610
S02 Clothing	1.63710	2.08444
S03 Housing	0.88704	0.59358
S04 Furniture	0.95022	1.10613
S05 Health & Medical Care	0.98390	1.26589
S06 Transport & Communications	1.47655	1.57964
S07 Entertainment	1.29962	1.11161
S08 Personal Services	0.73490	1.22964
S11 Farinaceous	0.78030	0.73142
S12 Meat & Fish	1.54304	1.93481
S13 Dairy Products	1.20526	0.93674
S14 Edible Oils	0.38265	0.95573
S15 Vegetable & Fruit	1.45829	1.30277
S16 Nut & Seeds	0.39947	0.98001
S17 Confectionary & Tea	0.67427	0.58566
S18 Sauce & Taste & Remainder Foods	0.35018	0.57777
S19 Drink & Tobacco	0.83719	0.93822

TABLE (45) Income Elasticity of Expenditure for URBAN & RURAL AREAS derived from Constant Elasticity Model(,(G),).

Bundle	URBAN	RURAL
S20 Total Food	0.78	0.52
S10 Total Non-Food	1.28	1.71
S02 Clothing	0.94	2.08
S03 Housing	0.89	0.59
S04 Furniture	0.95	1.49
S05 Health & Medical Care	0.98	1.26
S06 Transport & Communications	1.84	1.58
S07 Entertainment	1.30	0.96
S08 Personal Services	1.69	1.23
S11 Farinaceous	0.78	0.73
S12 Meat & Fish	0.73	1.93
S13 Dairy Products	0.60	0.51
S14 Edible Oils	1.00	0.95
S15 Vegetable & Fruit	0.73	0.79
S16 Nut & Seed	0.96	0.98
S17 Confectionary & Tea	0.76	0.58
S18 Sauce Taste & Remainder Foods	0.35	0.58
S19 Drinks & Tobacco	0.83	0.93

TABLE (46) Income Elasticity of Expenditure for URBAN & RURAL AREAS derived from the best fitted models at the means of the variables.

EXPENDITURE ELASTICITIES OF RURAL AND/OR FARM POPULATIONS FOR SELECTED COMMODITIES IN DIFFERENT COUNTRIES

Country/ Year	Bread & cereals	Starchy roots	Pulses & nuts	Sugar	Meat products	Fish products	Eggs	Milk products inc. butter	Total food	Fats & oils ex. butter	Vegetables & fruits	Clothing
Egypt/55	0.59	—	—	0.88	—	1.13	—	0.91	0.92	1.22	—	—
France/56	0.45	0.06	0.37	0.31	—	—	—	—	—	—	0.89	—
Germany/53	0.25	0.49	—	0.61(1)	0.69	0.87	—	0.31	0.66	1.08	—	1.47
Germany/53	0.19A	—	—	0.39A(1)	—	—	—	—	0.59A	0.81	0.58	1.08A
India/51-53	0.63A	—	—	1.48A	—	1.16A	—	1.89A	0.85A	0.79	0.58	—
India/56-57	0.57A	—	—	1.52A	—	1.34A	—	—	0.89A	0.69	0.57	2.38A
Italy/53	0.31A	—	—	0.90A	1.23A	1.40A	—	0.74(5)	0.72A	0.43	0.45	1.19A
Italy/53	0.25A	—	—	0.76A(2)	0.86A	0.79A	—	0.48(5)	0.63A	−0.13	0.19	—
Japan/51-52	0.60A	0.01A	0.86A(3)	—	0.83	1.03A	—	0.83(4)	0.68A	−0.03	0.38	1.84A
Japan/55-56	0.50A	−0.43A	0.42A(3)	—	—	1.15A	—	0.94(4)	0.58A	—	—	1.65A
USA/55	0.02A	0.23A	—	0.03	0.31A	—	0.02A	0.03	0.21A	—	—	—
USA/55	0.18A	0.22A	—	—	0.44A	—	0.13A	0.26	0.41A	—	—	—
Norway/54	—	—	—	—	—	—	—	—	0.45A	1.1748	1.2886	—
E. Pakistan/60	0.6039 −1.1107 (other cereals)	—	0.8091	1.8885	1.0623	0.7048	1.7651	1·6177	0.6753	—	—	0.5340 0.7479 (men's clothing) 0.8008 (women's clothing)

(A) Correction factor + 0.12 has been applied to take into account the size of the household.
(1) Includes chocolate
(2) Includes sugar products
(3) Excludes nuts
(4) Includes eggs and milk products
(5) Includes eggs

Source: J.A.C. Brown, "Demand Analysis for Agricultural Products". Unpublished paper presented at the meeting of Experts on Agricultural Projections in Asia and the Far East, F.A.O., 1963.

Table (47).
Source: Nurul Islam (1966).

ELASTICITIES FOR INDIVIDUAL COUNTRIES AND FOR ALL COUNTRIES COMBINED

Country	Total Weight	Food		Clothing		Rent		Durables		Miscellaneous	
		Total Exp.	Price	Total Exp.	Price	Total Exp.	Price	Total Exp.	Price	Total Exp.	Price
Austria	77	.742	−.535	.636	.017	.450	−.199	2.428	−.943	1.114	−.580
Belgium	106	.917	−.686	.055	.323	.330	.053	2.233	.438	1.126	−.106
Denmark	53	.482	−.529	.347	.029	.847	.522	3.676	.346	.868	−.078
France	474	.677	−.156	1.469	.531	.871	−.165	2.531	−.146	1.041	−.061
Greece	51	.729	−.344	1.168	−.876	1.666	−.119	1.804	−1.132	−1.283	−.941
Italy	525	.782	−.262	.593	−.193	.695	−.102	2.722	.413	1.343	−.319
Luxemburg	2	1.147	−1.020	.153	−.106	.592	5.689	1.812	−.807	1.063	−.286
Netherlands	117	.574	.595	1.810	.466	.322	.357	1.992	−2.188	.850	−.292
Norway	37	.779	−.198	1.378	−.168	1.992	−.277	.801	−2.209	.562	.439
Sweden	86	.381	.060	−.944	−1.810	1.567	−.332	2.867	.521	1.276	−.860
United Kingdom	612	.728	.124	1.035	−.091	.658	−.188	3.005	−1.456	.811	.245
Canada	182	.689	−.292	−.036	−.376	1.266	−.091	3.438	.964	.902	−.355
United States	1937	.319	−.339	.779	.422	1.667	.076	2.026	1.088	1.108	−.059
Combined	4258	.714	.083	.705	−.103	1.285	−.288	2.363	−.124	1.006	.238

Table(48).

Source: H.S. Houthakker (1969).

GROSS ELASTICITIES FOR FOUR EXPENDITURE GROUPS WITH RESPECT TO TOTAL EXPENDITURE, AND ADJUSTED ELASTICITIES FOR FOOD

Country	Food: Unadjusted b	Food: Adjusted b	Clothing: Unadjusted b	Housing: Unadjusted b	Miscellaneous: Unadjusted b
Australia, Queensland	.390	a	1.025	1.180	1.223
	(.037)		(.043)	(.076)	(.087)
Austria	.722	.500	1.559	.504	1.422
	(.041)		(.063)	(.042)	(.048)
Belgium	.849	.849	1.238	.794	1.252
	(.010)		(.087)	(.014)	(.056)
Brazil	.502	.795	1.522	1.227	1.174
	(.028)		(.105)	(.136)	(.120)
Burma, Rangoon, Hindustani	.826	.828	.775	.947	1.465
	(.024)		(.069)	(.037)	(.073)
Burma, Rangoon, Tamils, Telugus, Uriyas	.847	.847	.858	1.316	1.430
	(.036)		(.049)	(.113)	(.042)
Burma, Rangoon, Chittagonians	.703	.703	1.443	1.031	1.650
	(.024)		(.101)	(.103)	(.095)
Canada	.857	.712	1.250	.777	1.055
	(.051)		(.060)	(.079)	(.028)
Ceylon	.856	.810	1.108	1.118	1.230
	(.037)		(.063)	(.168)	(.053)
China, Peiping	.651	.591	1.328	.940	1.459
	(.011)		(.054)	(.032)	(.041)
China, Shanghai	.769	.617	1.609	.714	1.440
	(.065)		(.045)	(.046)	(.100)
Cuba	.704	a	1.104	1.160	1.232
	(.020)		(.034)	(.061)	(.033)
France	.581	a	1.404	.761	1.621
	(.035)		(.062)	(.059)	(.033)
Germany 1928 (combined)	.632	.383	1.070	.948	1.454
	(.058)		(.050)	(.133)	(.082)
Germany 1951	.679	.526	1.435	.661	1.552
	(.034)		(.085)	(.024)	(.042)
Ghana, Accra	.852	.840	.967	.635	1.365
	(.024)		(.098)	(.062)	(.029)
Ghana, Kumasi	.954	.818	1.042	.618	1.405
	(.032)		(.091)	(.044)	(.084)
Ghana, Sekondi-Takoradi	.823	.654	1.289	.725	1.600
	(.037)		(.065)	(.065)	(.064)
Ghana, Akuse	.873	.791	.865	1.142	1.503
	(.037)		(.053)	(.099)	(.089)
Guatemala, Guatemala City	.750	.508	1.328	1.029	1.545
	(.038)		(.091)	(.067)	(.012)
India, Bombay Single workers	.709	.709	.456	1.475	1.538
	(.049)		(.050)	(.009)	(.103)
India, Bombay Workers' families	.837	.837	.775	.733	1.501
	(.015)		(.141)	(.038)	(.437)
India, Bhopal City	1.004	.521	.900	.730	1.223
	(.013)		(.045)	(.042)	(.050)
India, Punjab	.943	.811	1.261	.764	1.394
	(.027)		(.252)	(.037)	(.024)
Ireland	.775	.621	1.224	.592	1.358
	(.052)		(.191)	(.038)	(.039)
Italy	.615	a	1.219		
	(.026)		(.034)		
Japan 1953	.648	.533	1.336	.905	1.357
	(.017)		(.149)	(.074)	(.011)
Libya	.805	.805	1.830	.900	1.427
	(.073)		(.105)	(.105)	(.229)
Northern Rhodesia	.514	.203	1.081	.229	1.308
	(.109)		(.043)	(.131)	(.040)
Panama, Panama City	.790	.717	1.225	.932	1.232
	(.055)		(.064)	(.072)	(.030)
Philippines, Manila	.810	.757	1.141	.874	1.312
	(.028)		(.077)	(.047)	(.026)
Portugal, Porto	.779	.623	1.256	.364	1.216
	(.047)		(.443)	(.201)	(.122)
Puerto Rico, San Juan	.639	.602	.957	1.019	1.177
	(.040)		(.020)	.083	(.070)
Puerto Rico, Whole Territory	.812	a	1.147	.933	1.315
	(.031)		(.032)	(.108)	(.019)
Sweden	.843	.652	1.139	.749	1.241
	(.092)		(.077)	(.061)	(.057)
United States 1950	.816	.642	1.336	.731	1.222
	(.025)		(.045)	(.273)	[illegible]

a. adjustment not possible.

Table(49).

Source: H.S. Houthakker (1957).

Country	Food	Clothing	Housing	Durables	Personal care	Transport	Recreation	Other services
Korea	0.72	0.66	0.74	2.76	1.76	3.12	1.78	1.71
Thailand	0.84	1.20	0.16	1.61	0.93	1.57	1.99	1.55
Philippines	0.52	0.75	1.82	2.23	1.72	2.39	1.69	2.08
Taiwan	0.57	1.26	1.33		1.69	2.77	1.76	1.81
Jamaica	0.58	1.95	0.71	2.67	2.35	1.52	2.03	−1.83
Panama	0.92	1.08	0.68	1.77	0.92	0.90	1.69	0.87
South Africa	0.80	1.39	0.40	1.47	1.02	1.56	0.98	1.44
Greece	0.73	1.37	0.96	1.28	1.35	1.55	1.37	1.22
Ireland	0.64	1.33	0.85	2.02	1.07	1.92	1.21	1.19
Puerto Rico	0.49	1.06	0.94	0.98	1.70	1.43	1.57	1.93
Italy	0.87	0.86	1.03	2.17	1.04	1.44	0.93	1.09
Israel	0.66	1.10	0.90	1.61	0.99	1.59	1.44	0.97
United Kingdom	0.30	0.62	1.41	1.14	1.35	2.53	0.89	2.63
Australia	0.43	0.45	1.73	1.06	2.34	1.70	0.22	1.14
West Germany	0.66	0.78	1.22		1.21	1.45	1.12	1.74
Sweden	0.76	0.62	0.92	1.13	1.43	1.78	1.09	1.03
United States	0.34	1.14	0.90	1.45	1.69	1.14	1.18	2.31
Mean values[a]								
100–500	0.66	0.97	1.01	1.98	1.53	2.46	1.81	1.79
500–1,000	0.82	1.28	0.68	1.51	1.10	1.34	1.35	1.18
1,000–1,500	0.67	1.09	0.93	1.70	1.20	1.60	1.29	1.30
1,500 and over	0.50	0.72	1.24	1.20	1.60	1.72	0.90	1.77
Overall	0.64	0.98	1.00	1.58	1.39	1.80	1.31	1.54

a. Class intervals refer to GNP per capita at sample midpoints in 1970 U.S. dollars as given in column (5) of table 3.2. Jamaica is excluded.

Table (50). Income elasticities for eight expenditure groups for different countries.

Source: A. Clluch, A. Powell, R.A. Willams (1977).

INTERPRETATION & CONCLUSIONS

In this part we try to interpret briefly our findings which are in terms income elasticities.

In the year 1356 that is under considerations of this study, urban and rural populations are approximately equal. Urban total expenditures per family is more than 2.2 times greater than rural total expenditures per family(at the means of the total expenditures).

Therefore, according to our findings, if general level of income at urban and rural increases by one percent for both total demands for food (as a bundle) increases by less than one percent at both urban(0.65%), and rural(0.82%) areas. The demand for farinaceous will be expected to increase by 0.78% at the urban, which is greater than rural increments(0.73%). Dairy products, edible oils, confectionary & tea, all have this situation, when income increases one percent demand for mentioned bundles will increase less than one percent, (except urban edible oils that will increase one percent), with the urban incremental percentages greater than rural percentages. On the other hand we can say if the general level of income increases one percent the demand pressure on the farinacious, dairy product, edible oils, confectionary and tea will be expected to be more at the urban than rural areas. Demand for the mentioned bundles will be expected to increase as follows: Urban dairy product by 0.60%, rural dairy product by 0.51%; urban edible oils by 1.00%, and rural by 0.95%, confectionary and tea at the urban areas by 0.76% and at the rural by 0.58%. But, for other food bundles:

Meat & fish, vegetable & fruit, nut & seed, drinks and tobacco, sauce and taste and remainder foods, can be regarded as necessities, as income increases one percent for both urban and rural, their demands also will increase but less than one percent at both urban and rural (except meat & fish for rural areas will increase by 1.93%). So the demand pressure on the mentioned bundles will be more at the rural areas than urban's. It should be noted that more and more pressure will be on the rural demand for meat and fish products. By one percent increment in rural income, nearly 1.93% increase will be expected in meat & fish demand at the rural areas.

Among all of the urban food bundles sauce & taste & remainder foods has the lowest income elasticity (0.35%), and shows that demand pressure for this bundle will be the lowest -by increasing income and ceteris-paribus. This point also exists for rural dairy products which has the lowest income elasticity in the rural food bundles and is equal to: 0.51%.

Generally, if the urban income increases by one percent the pressure will be first on edible oils (1.00%), and then on nut & seed (0.96%), drinks and tobacco (0.83%), farinaceous products (0.78%), confectionary and tea (0.76%), vegetable and fruit, meat and fish (0.73%), sauce and taste and remainder foods (0.35%). If the rural income increases by one percent the demand pressure will be first on meat and fish (1.93%), and then on nut and seed (0.98%), edible oils (0.95%), drinks and tobacco (0.93%), vegetable and fruit (0.79%), farinaceous products (0.73%), confectionary and tea, sauce and taste and remainder foods (0.58%).

For total non-food in general, an increase of one percent in income will cause 1.28% increase in demand at the urban and 1.71% increase in demand at the rural areas.

If urban and rural income increase by one percent, the demand for clothing will be expected to increase by 0.94% for urban and 2.08% for rural . So the demand pressure will be more on the rural clothing than urban. This situation will also occur for furniture , health & medical care. The mentioned bundles income elasticities show, when income increases by one percent at both urban and rural, urban demand for furniture 0.95% , and for health & medical care 0.98% will be expected to increase; but rural demand increments for them will be more, and are equal to 1.49% for furniture and 1.26% for health & medical care.

Housing is in the class of necessities for both urban and rural, by this we mean, when income increases one percent at the both urban and rural, the demand for housing will increas less than one percent, or precisely 0.89% increment in urban demand, and 0.59% increment in rural demand. So the demand pressure will be more on the urban housing than rural.

Transport & communications is in class of luxuries, for both urban and rural. So by increasing one percent in each urban and rural incomes , the increment in demand for transport & communications will be expected to be 1.84% at the urban, and 1.58% at the rural areas. So the demand pressure will be more on the urban transport & communications than rural. This situation also exists at urban and rural personal services and entertainment. By one percent increase in each urban and rural incomes, the demand for personal services will be expected to increase by 1.69% at urban and 1.23% at rural areas.

Urban entertainment is a luxury but entertainment at the rural areas has an income elasticity near one. One percent increase in each urban and rural incomes will cause entertainment demand to increase by 1.30% at the urban and by 0.96% at the rural areas.

Generally, if the urban income increases by one percent the demand pressure will be first on transport & communications (1.84%), and then on personal services (1.69%), entertainment (1.30%), health & medical care (0.98%), furniture (0.95%), clothing (0.94%), housing (0.89%). If the rural income increases by one percent, the demand pressure will be first on clothing (2.08%), and then on transport and communication (1.58%), furniture (1.49%), health and medical care (1.26%), personal services (1.23%), entertainment (0.96%), and housing (0.59%). So in brief:

i. Demands for farinaceous products, dairy products, edible oils, confectionery and tea are more inelastic at the rural areas than those in urban areas.

ii. Demands for meat and fish, vegetable and fruit, nut and seed, drinks and tobacco, sauce and taste and remainder foods are more inelastic at the urban areas than rural.

iii. Demands for housing, transport and communication, entertainment, personal services are more inelastic at the rural areas than those in urban areas.

iv. Demands for clothing, furniture, health and medical care are more inelastic at the urban areas than those in rural areas.

Generally, with respect to income elasticity tables and the above mentioned notes, we can discuss that: by increasing income at a point of time, prices will be expected to increase more on urban transport and communication, personal services, entertainment (sequently); and rural clothing, meat and fish, transport and communication, furniture, health and medical care, personal services (sequently) than other items. So in order to freeze the prices the import of the mentioned bundles should increase more than others (among all bundles of goods) beacuse increment in the production of industries is not as soon as price increment.

If prices change, the variation in the demand for all the bundles will depend on gatherring and evaluating new information about price elasticities, substitutability and complementarity indicators for the bundles and their items. Since the amount of variations need to have enough information about the different aspects of consumer behavior for both urban and rural areas, we cannot conclude anymore. So our results and conclusions are based upon ceteris-paribus.

CHAPTER VII. SUMMARY AND RECOMENDATIONS

SUMMARY

Engel curve is a functional relation between family expenditure on a commodity, or commodity bundle and family income. Engel curves estimation is one of the famous procedures to estimate income elasticity of expenditure of commodities. Income elasticity of expenditure is the percentage change in expenditure of the purchased commodity per one percent change in income.

In the present study, income elasticities for urban & rural of Iran, year 1356 -via Engel curves- have been estimated.

Used samples are: " Urban & Rural Samples of Statistical Center of Iran, year 1356", which include nearly 15000 rural and 15000 urban statistical cases.

Commodities have broken into two: total food and total non-food, main bundles. They are divided again to nine food and seven non-food smaller bundles.

For every rural or urban bundle, there are twelve estimated models, which seven of them (models) have been introduced for the first time. The procedure to estimate regression (model) coefficients is O.L.S. by using SPSS computer package program.

The results are mostly consistent with the other's findings. Total food bundles consist of 33.4% urban and 49.7% rural total expenditures. Total food income elasticities for urban and rural are 0.65 and 0.82 respectively, which express that total food expenditure at the rural areas is more inelastic than rural. Income elasticities of food at the rural and urban areas except the meat & fish bundle at the rural (1.93), and edible oils at the urban (1.00), are all less than unit; therefore, they are necessities, except meat & fish for rural areas which is known as a luxury bundle. Among all foods according to their estimated income elasticities demand for bundles: meat & fish, vegetable & fruit, nut & seed, drinks & tobacco, sauce & taste and remainder foods, is more inelastic at the urban than rural areas; and for farinaceous, dairy product, edible oils, confectionary and tea demand is more inelastic in the rural than urban areas.

Estimated total non-food income elasticities for urban and rural are 1.28 and 1.71 respectively, while include 66.5% of urban and 50.2% of rural total expenditures. Clothing is a necessity for urban(0.94) and a luxury for rural areas(2.08). Housing is necessity both for urban(0.89) and rural(0.59).

Furniture is a necessity bundle for urban(0.95), and a luxury for rural(1.49). Health & Medical Care is a necessity for urban (0.98), and a luxury for rural(1.26). Transport & communication is a luxury bundle for both urban(1.84), and rural(1.58). Entertainment bundle is a luxury for urban(1.30),are a necessity for rural(0.96). Personal services is a luxury for both urban (1.69), and rural(1.23).

POLICY RECOMMENDATIONS

If the government's policy is to increase the welfare of the people by increasing their purchasing power, by redistribution of income; or is to control inflation by leving direct and indirect taxes; or is cession of the production or distribution groups of commodities to public or private sectors, and so on, she needs ,however, to consider different aspects particularly income side of the demand.

This study gives some recommendations about urban and rural income side of demands for different commodity bundles in Iran.

However, if the government plans cause a constant increase (*decrease*) in each urban and rural real income, this study recommends her to observe the following recommendations:

i. Percentage of increase(*decrease*) of the supplies of farinaceous, dairy products edible oils, confectionary and tea at the urban areas should be more than rural.

ii.Percentage of increase(*decrease*) of the supplies of meat & fish, vegetable & fruit, nut & seed, drinks & tobacco, sauce & taste and remainder foods at the rural should be more than urban areas.

iii. Percentage of increase(*decrease*) of the supplies of housing, transport and communication, entertainment, personal services at the urban areas should be more than rural areas.

iv. Percentage of increase(*decrease*) of the supplies of clothing, furniture, health and medical care should be more at the rural areas than urban.

With respect to the above mentioned points and also the results in the previous chapters, it is concluded and would be recommended that our country needs to have new industries for the bundles whose income elasticities are higher than the others -in the process of development it is expected that the general level of income will grow up- so importance should be given to the following bundles sequently:

v. For urban areas sequently: transport & communication, personal services, entertainment, edible oils, health & medical care, nut & seed, furniture, clothing, housing, drinks & tobacco, farinaceous, confectionary & tea, meat & fish, vegatable & fruit, dairy products, sauce & taste & remainder foods.

vi. For rural areas sequently: clothing, meat & fish, transport & communication, furniture, health & medical care, personal services, nut & seed, entertainment, edible oils, drinks & tobacco, sauce & taste & remainder foods, dairy products.

The notes v, vi, will be suitable if the government does not want to interfere in the consumer consumption pattern anymore. If she wants to share the commodities, the notes v, vi, will be expected to be desirable as notes i, ii, iii, iv.

Recommondations for Further Research

Just as other studies have been used in the preparation of this one, the present study can serve as a basis for further research. To develope this study there are some points which are interesting to pursue; but the existence of limitations did not let this study be complete.

a. Breaking the commodity bundles to primary items.

b. Division of families with respect to their incomes or total expenditures. By this procedure and with a careful comparison , differences among variate income brackets will be brighten.

c. Enterring new variables inside the models:

i. Family size;

ii. Household composition;

iii. The highest level so far attained by the household's income;

iv. The prices of the goods in the group or bundle;

v. The prices of goods in competing groups;

vi. Stocks of other goods in the group already held by the household;

vii. Stocks of goods already held by the household;

d. Classification of the families with respect to the following objectives:

i. Social classes and occupation of the head of the household.

ii. Geographical divisions of the government, which is very useful for public planneres;

iii. Education of the head of household;

iv. Number of occupied persons in the family.

SELECTED BIBLIOGRAPHY

AITCHISON, J.& J.A.C. BROWN (1957), The Lognormal Distribution with Special Reference to its Uses in Economics. Cambridge University Press, Cambridge, England.

ALLEN, R.G.D. & A.L. BOWLEY (1935), Family Expenditure. Staples Press, London.

AITCHISON, J.& J.A.C. BROWN (1954-5), A Synthesis of Engel Curve Theory, Review of Econ. Stud., 1954-5,22(1), 35-46

BECKER, G.S. (1971), Economic Theory ,A.A. Knopf Books in Economics U.S.A.

BLACKORBY, C., G.LADY, D.NISSEN & R.R. RUSSELL (1970), Homothetic Separability & Consumer Budgeting. Econometrica 38 (1970) 468-472.

BROWN, J.A.C. & A.DEATON (1972), Survey in Applied Economics: Models of Consumer Behaviour .Economic Journal 82 (1972) 1145-1236.

BAUMOL, W.J. (1972), Economic Theory and Operations Analysis. Englewood Cliffs, N.J.:Prentice Hall, Inc.

BRIDGE, G.E. (1971), Applied Econometrics, London, North - Holland Publishing Company.

BARON, A.Le, (1970) Long Term Projections of Supply and Demand for Seleted Agricultural Products in Iran; Utah State University.

CHAMPERNOWNE, D.G. (1969), *Uncertainty and Estimation in Economics*, Vol.2, Oliver & Boyd, Edinburg.

CHAMPERNOWNE, D.G. (1957), The General Form of the Adding-Up Criterion, Journal of Royal Statistical Society, Series A (General), Vol. 120.

CROCKET J. & FRIEND I. (1962), *A Complete Set of Consumer Demand Relationships* United States, 1962.

CHIPMAN, J.S. (1965), A Survey of the Theory of International Trade: Part I: The Classic Theory, Econometrica 33 (1965) 477-519.

CRAMER J.S. (1958), Ownership Elasticities of Durable Consumer Goods, Review of Economic Studies, Feb. 1958; 25; 87-96.

CRAMER, J.S. (1969), *Empirical Econometrics*, North-Holland Company, Amsterdam.

CRAMER, J.S., (1962), *A Statistical Model of the Ownership of Major Consumer Durables with an Application to some Findings of the 1953 Oxford Savings Survey*, Cambridge University Press, Cambridge.

COURT, R.H., (1967), Utility Maximization and Demand for New Zealand Meats; Econometrica, Vol.35, 1967.

CLUGH A., POWELL A., WILLIAM R.A. (1977), *Patterns in Household Demand and Saving*; World Bank, Oxford University Press.

CHIPMAN, J.S. (1960), The Foundation of Utility. Econometrica 28(2): 193-224

CRAMER, J.S. (1970), Interaction of Prices& Income in Consumer Demand. European Economic Review 1 (1970) 428-436.

DRAPER J.E. & KLINGMAN, J.S., (1972), Mathematical Analysis Harper and Row, International Edition.

DADGOSTAR, B. (1977), Consumer Demand for Agricultural Products in Thailand, Iowa State University; PH.D. Thesis, No.3 CARD.

DORFMAN, R. (1964), The Price System. Englewood Cliffs, N.J.: Prentice-Hall, Inc.

DUESENBERRY, J.S. (1949). Income, Saving, and the Theory of Consumer Behavior. Harvard University Press, Cambridge, Mass.

ENGEL, E. (1857), Die Produktions- und Konsumptionsverhältnisse des königreichs Sächsen. Zeitschrift des statistischen Bureaus des Königlichen Sächsischen Ministerium des Innern, Nos. 8 and 9, 1857. Reprinted in Bulletin de l'Institut International de Statistique 9 (1895).

FOOTE, R.J, (1958), Analytical Tools for Studing Demand and Price Structure. U.S.D.A. Agricultural Handbook 146.

FOX, K.A. (1968), Intermediate Economic Statistics. New York: John Wiley and Sons, Inc.

FRIEND, I. & R.JONES, (1960), A Study of Consumer Expenditures, Income and Saving: Proceeding of conference on consumption and savings (University of Pennsylvania, Philadelphia)

FISK, P.R.,(1958-9), Maximum Likelihood Estimation of Törnqvist Demand Equations, Review of Economic Studies; Vol. 26, 1958 - 59.

FERGUSON, & GOULD, (1975); Micro Economic Theory; Richard D. Irwin Inc. Illinois.

FORSYTH, F.G. (1960), The Relationship Between Family Size and Family Expenditure; Journal of Royal Statistical Society, Series A (General), Vol. 123, 1960.

FERBER R. (1968), Research on Household Behaviour, XII in Surveys of Economic Theory, Vol. III. Mac Millan London.

FARRELL, M.J. (1953-4), Some Aggregation Problems in Demand Analysis; Review of Economic Studies, Vol. 21 ,1953-54.

FINNEY, D.J. (1952), Probit Analysis. A Statistical Treatment of Sigmoid Response Curve, Cambridge University Press, Cambridge, 1947,(2nd,edition, 1952).

FRIEDMAN, M. (1935-6), Professor Pigou's Method for Measuring Elasticities of Demand from Budgetary Data, Quarterly Journal of Economics, Vol.50, 1953 -54.

FRISCH,R., (1954), Linear Expenditure Functions, An Expository Article, Econometrica, Vol. 22, 1954.

GOLDBERGER, A.S. (1964), Economic Theory Wiley New york.

GOLDBERGER, A.S. (1967), Functional Form and Utility:A Review ofConsumer Demand Theory: System, Methodology, and Policy Workshop Paper n° 6703, Social System Research Institute University of Wisconsin Mimeo.

GOLDBERGER, A.S. (1969), Directly Additive Utility& Constant Marginal Budget Shares. Review of Economic Studies 36, 251-262.

GOLDBERGER, A.S. & GAMAIETSOS, T.(1970), A Cross-Country Comparis-on of Consumer Expenditure Patterns. European Economic Review 1, (1970), 357-400.

GREEN, H.A.J., (1964), Aggregation in Economic Analysis, An Introductory Survey, Princeton University Press, New Jersey.

HENDERSON, J.M. & R.E. QUANDT, (1971) Microeconomic Theory. Tokyo: McGraw-hill Kkogakusha, ltd.

HICKS, J.R. (1956), Arevision of Demand Theory. Oxford University Press,Oxford.

HU, T.W. (1975),Econometrics, University Park Press. london.

HOUTHAKKER, H.S.(1952), The Econometrics of Family Budgets. Journal of the Royal Statistical Society, Series A (General) 115.

HOUTHAKKER, H.S.(1957), An International Comparision of Household Expenditure Patterns, Commemorating the centery of

Engel's Law. Econometrica 25, 532-551.

HICKS, J.R., (1936), Value and Capital., Oxford University Press, Oxford.

HOUTHAKKER H.S. & HAIDI J.,(1960), Household Investment in Automobiles; An Intemporal Cross-section Analysis; in Friend I. & Jones R., Proceedings of the conference on consumption & saving, VOL. I Philadelphia 1960, p.p. 175 - 225.

HOUTHAKKER H.S., (1951-2), Compensated Changes in Quality and Quantity Consumed, Review of Economic Studies, vol. 19, 1951 - 52.

HOA, T.V. (1968), Inter-Regional Elasticities and Aggregation Bias, A study of consumer demand in Australia, Australian Economic papers, Vol.7, 1968.

HENDERSON A.M., (1949 - 50), The Cost of a Family, Review of Economic studies., Vol.17.

HENDERSON A.M., (1949 - 50), The Cost of Children, Parts I-III, Population Studies, vols. 3-4, 1949-50.

HOUTHAKKER H.S.,(1954), La Forme des Courbes d'Engel; Cahiers du seminaire d'econometrie, No.2, 1954.

HOUTHAKKER, H.S. (1960_a), The Influence of Prices and Incomes on Household Expenditure. Bulletin of the International Institute of Statistics 37 .

HOUTHAKKER, H.S. (1960_b), Additive Preference. Econometrica 28 244-257

HOUTHAKKER, H.S. (1961_a), Some Problems in the International Comparison of Consumption patterns, in R. MOSSE, L'evaluation et le role des besoins de biens de consommation dans les divers regimes economiques. C.N.R.S., Paris, 89-102.

HOUTHAKKER, H.S. (1961_b),The Present State of Consumption Theory. Econometrica 29 , 704-740.

HOUTHAKKER,H.S.(1965), New Evidence on Demand Elasticities. Econometrica 33, 277-288.

JOHNSTON, J. (1963) , Econometric Methods. McGraw-Hill, London.

KMENTA, J. (1971), Elements of Econometrics. New York: McMillan.

KLEIN,L.R. (1962), An Introduction to Econometrics. Prentice-Hall, Inc.,Englewood cliffs N.J..

LESER, C.E.V. (1941-2), Family Budget Data and Price Elasticities of Demand. Review of Economic Studies 9 (1941-42).

LANCASTER K. (1974) Introduction to Modern Micro Economics Rand McNally College Publishing Co. Chicago.

LEONTIEF, W. (1936), Composite Commodities and the Problem of Index Numbers, Econometrica, vol.4, 1936.

LIVIATAN, A.N., (1961), Errors in Variables and Engel Curve Analysis, Econometrica, July 1961; 29, 336 - 62.

LIPPITT, V., (1959), Determinants of Consumer Demand for Housefurnishings and Equipment, Cambridge, Mass.

MORGAN, J.N., (1958), A Review of Recent Research on Consumer Behaviour; in L.H. Clark, edition, Consumer behavior: Research on consumer reactions, New York, 93 - 219.

MACK, R.P. (1952), Economics of Consumption, in: B.F. Haley edition: A survey of contemporary economics, vol.2 Homewood, I11. 1952, 39 - 78.

NURUIISLAM, (1966), Studies in Consumer Demand, vol.2, Dacca University, Oxford University Press, Pakistan Branch.

NICHOLSON, J.L., (1949), Variations in Working Class Family Expenditure, Journal of the Royal Statistical Society Series A (General), vol.112, 1949.

NICHOLSON, J.L., (1957), The General Form of the Adding-up criterion. Journal of Royal Statistical Society, Series A(General) vol. 120, 1957

PRAIS, S.J. (1952-3), Nonlinear Estimates of the Engel Curve Review of Economic Studies, Pt.2, 1952-3, 20, 87-104.

PEARCE, I.F. (1964), A Contribution to Demand Analysis, Oxford.

POLLAK,R.A.(1971), Additive Utility Functions and Linear Engel Curves, Review of Economic Studies,38, 401-413.

PRAIS,S.J. & H.S.HOUTHAKKER (1955), The Analysis of the Family Budgets. Cambridge University Press, Cambridge.

PHLIPS, L. (1974), Applied Consumption Analysis. North-Holland Company, New York.

STONE, R. (1954), The Measurement of Consumer's Expenditure and Behaviour in the U.K. 1920-1938. Vol. 1 , Cambridge University Press, Cambridge.

SLUTSKY, H. (1952), On the Theory of the Budget of the Consumer. in Reading in Price Theory. Edited by G.J.STIGLER and K.E. BOULDING.,R.D. Irwin, Inc.

SAMUELSON, P.A. (1950), The Problem ofIntegrability in Utility Theory. Economica 17, 355-385.

SCHULTZ, H. (1938),The Theory and Measurment of Demand. Chicago University Press, Chicago.

STUVEL, G. & JAMES, S.F.,(1950), Household Expenditures of Food in Holland, Journal of Royal Statistical Society, Series A. 113, pt.1, 59-80.

STIGLER G.J.(1954),The Early History of Empirical Studies of Consumer Behavior,Journal of Political Economy,April, 42,95-113.

THEIL, H. (1975), Theory and Measurment of Consumer Demand. New York, North-Holland Company.

THEIL, H.(1965), Linear Aggregation of Economic Relations. North-Holland, Amsterdam.

THEIL, H. & NEUDECKER H.(1958), Substitution, Complementarity and the Residual Variation around Engel Curves. Review of Economic Studies, 25, 114-123.

TORNQVIST, L. (1941), Review of Work by H.Wold. Ekonomisk Tidskrift, 43, 216-225.

WOLD, H. & JUREEN, L.(1953), Demand Analysis. New York, Wiley.

YOSHIHARA, K.(1969), Demand Functions: An Application to the Japanese Expenditure Pattern. Econometrica, 37, 257-274.

SCI (Statistical Center of Iran) publications

INCOME DISTRIBUTION DATA (1967-1973); H.Barjini & F.Mehran; No.2 Aprill 1977 Department of Financial Statistics and National Accounts (DFSNA)

A LINEAR EXPENDITURE MODEL FOR URBAN IRAN; Mahmoud Arabi & Farhad Mehran; No.3 July 1977 (DFSNA)

URBAN CONSUMER PRICES AND INEQUALITY; Mahmoud Arabi & Farhad Mehran No.4 August 1977;(DFSNA)

URBAN HOUSEHOLD BUDGET SURVEY - 2534,Preliminary and selected results; No.5 August 1977 (DFSNA)

SAMPLE DESIGN OF THE URBAN AND RURAL HOUSEHOLD BUDGET SURVEYS (2533 - 2534) No.6 sept.1977; (DFSNA)

STATISTICAL RESULTS OF URBAN HOUSEHOLD BUDGET SURVEY 1356; (Persain); 1359.

STATISTICAL RESULTS OF RURAL HOUSEHOLD BUDGET SURVEY 1356; (Persian); 1359.

INCOME ELASTICITY OF DEMAND FOR GOODS OF URBAN AND RURAL HOUSEHOLD YEAR 1351; (Persian)

INCOME ELASTICITY OF DEMAND FOR GOODS OF URBAN AND RURAL HOUSEHOLD YEARS 1347-1348 (Persian)

STATISTICAL MANUAL OF URBAN HOUSEHOLD BUDGET SURVEY 1356; (Persian)

STATISTICAL MANUAL OF RURAL HOUSEHOLD BUDGET SURVEY 1356; (Persian)

DESCRIPTION OF SAMPLE SURVEYS OF URBAN AND RURAL HOUSE-HOLD CONSUMPTION AND INCOME; 1975 (2534),(Persain),(DFSNA)

HOUSEHOLD BUDGET SURVEY QUESTIONNAIRE 1356;(Persain)

Bank Markazi Iran Publications

SURVEY OF CONSUMER EXPENDITURES AND INCOME IN 32 URBAN CITIES OF IRAN, 1962, Bulletin, Vol.1, No.2; pp. 23-43.

INCOME ELASTICITY OF DEMAND FOR GOODS AND SERVICES IN URBAN AREAS OF IRAN DURING 1347; Bulletin, Vol. 10, No.55; pp. 15-35.

ESTIMATION OF INCOME ELASTICITY OF DEMAND FOR FOOD COMMODITIES OF URBAN IRAN 1353; Bulletin 1356, 16th year, No. 174; pp. 3-47; (persian).

ESTIMATION OF INCOME ELASTICITY OF DEMAND FOR FOOD COMMODITIES OF URBAN IRAN 1351; Industry & Construction Dept. unpublished,(persain).

APPENDIX A

There are 'i' items of commodities whose Engel's curves have been estimated before; now combined Engel's curve and income elasticity of all items inside a new complex bundle is requested:

S_k expenditure of the new complex bundle;

S_i expenditure of the item i, $i=1,2,3,\ldots,n$

so:

$$S_k = \sum_{i=1}^{n} S_i$$

If the items Engel curves had the following functional form:

$$S_i = A_i + B_i Y^m$$

so:

$$S_k = \sum_{i=1}^{n} A_i + Y^m \sum_{i=1}^{n} B_i$$

and its income elasticity(complex bundle):

$$E_k = \frac{mY^m \sum_{i=1}^{n} B_i}{\sum_{i=1}^{n} A_i + Y^m \sum_{i=1}^{n} B_i} = m\left(1 - \frac{\sum_{i=1}^{n} A_i}{\sum_{i=1}^{n} S_i}\right)$$

If the Engel's curve of the items had not the same exponent (m), we use these formula:

$$S_j = A_j + B_j Y^{m_j}$$

so the complex Engel curve:

$$S_k = \sum_{j=1}^{n} S_j = \sum_{j=1}^{n} A_j + \sum_{j=1}^{n} B_j Y^{m_j}$$

and its income elasticity:

$$E_k = \frac{\sum_{j=1}^{n} m_j B_j Y^{m_j}}{\sum_{j=1}^{n} A_j + \sum_{j=1}^{n} B_j Y^{m_j}} = \frac{\sum_{j=1}^{n} m_j B_j Y^{m_j}}{\sum_{j=1}^{n} S_j}$$

The above formula are applicable to the models:(A),(C),(D),(E),(I),(J),(K),(L).

If the models of the items all were of kind (G):

$$S_j = a_j Y^{B_j}$$

So:

$$S_k = \sum_{j=1}^{n} S_j = \sum_{j=1}^{n} a_j Y^{B_j}$$

and its income elasticity:

$$E_k = \frac{\sum_{j=1}^{n} B_j S_j}{\sum_{j=1}^{n} S_j}$$

And for general form:

$$S_j = f_j(Y) \qquad j=1,2,3,\ldots,n$$

so the combined Engel curve:

$$S_k = \sum_{j=1}^{n} S_j = \sum_{j=1}^{n} f_j(Y)$$

and its income elasticity:

$$E_k = \frac{dS_k}{dY} \cdot \frac{Y}{S_k} = \frac{Y \sum_{j=1}^{n} \frac{df_j(Y)}{dY}}{\sum_{j=1}^{n} S_j}$$

These calculating formula also can be applied to combine income elasticities and Engel curves of some different regions markets and etc.

APPENDIX B

With a careful comparison we will find that at the models with the general form $S = A + BY^m$,m>1, when'm'increases slowely, amount of 'B' decreases incrementally; so for some models in the text B's are equal to C.00000 , but they are not actually zero, beacuse SPSS computer program calculations is not able to write down the digits less than 0.00001 .

Now we calculate the actual amount of'B' by using means of the variables, in this way:

$$S = A + BY^m$$

and also we can write:

$$\overline{S} = A + B\overline{Y}^m$$

so:

$$B = \frac{\overline{S} - A}{\overline{Y}^{(m)}}$$

And also for the model InS = A + BY this problem exists.

$$\text{InS} = A + BY$$

and also we can write:

$$\text{In}\overline{S} = A + B\overline{Y}$$

so:

$$B = \frac{\text{Ln}\overline{S}-A}{\overline{Y}}$$

"چکیـــــــــــده"

برآورد منحنی انگل در ایران شهری و روستائـــی

بیژن بید آبـــاد

منحنی انگل که اولین بار توسط (Ernest Engel) در تاریـــخ ۱۸۵۷ بکاربرده شد ، یکی از روشهائی است که در حال حاضر نیز مورد استفاده محققیـن وکارشناسان سرتاسر دنیا میباشد • از نتایج مهمی که منحنیهای انگل ارائـه میدهند حساسیت درآمدی هزینه کالا ها بوده که کاربرد زیادی در بـرآورد تقاضای آینده و در نتیجه برنامه ریزی اقتصادی دارند •

در این تحقیق سعی براین بوده که این حساسیتها از طریق منحنی انگـل برای سال ۱۳۵٦ ایران (شهری وروستائی ، هرکدام جداگانه) محاسبـه شود • بدین ترتیب از نمونه های تهیه شده توسط مرکز آمار ایران کـه حدوداً ۱۰۰۰۰ واحد آماری شهری و ۱۰۰۰۰ واحد آماری روستائـی را شامل میشد استفاده بعمل آمد •— در ایران برای اولین بار میباشد که بـرای محاسبه این حساسیتها از آمار خام وکافی استفاده شده است • بدیـن منظور نه تنها الگوهائی که تابحال توسط سایر محققین استفاده شده بود بکـار گرفته شده بلکه الگوهای جدیدی برای بهبود این روش محاسبه معـرفی شده اند • کالا ها بطورکلی بدودسته خوراکی و غیرخوراکی وآنها نیـز بترتیب بدنه وهفت گروه تقسیم شده اند •

اکثر نتایج نه تنها بخوبی قابل مقایسه با نتایج بدست آمده توسط سایـر محققین در ایران بوده بلکه با نتایج محققین خارجی در مورد کشورهای گوناگـون نیز مطابقت دارد •