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A Forecast of Iranian Demand for Agricultural Food Products

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A FORECAST OF IRANIAN DEMAND FOR AGRICULTURAL FOOD PRODUCTS

by

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Ivan Felix Beutler

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ABSTRACT

A Forecast of Iranian Demand for

Agricultural Food Products

by

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Domestic demand for Iranian agricultural food commodities was projected for 1970, 1975 and 1980. Demand for particular commodities was projected separately for Tehran (the capital city), urban Iran and rural Iran.

Income and population growth were the most significant explanatory variables in this long term projection.

Two cross-sectional family budget surveys, taken six years apart, provided consumption data for Tehran and urban Iran. A series of family budget studies provided Engel curve data for rural Iran.

The income effect was estimated for each food item by least squares regression analysis. The resulting income elasticities were found to be significantly different from those published by the Iranian Central Bank.

The income elasticities were adjusted for the quality effect and expected changes in the market margin.

Demand for a few major products was projected for the forecast years via a disaggregated model developed in this paper and a traditional aggregate model. The disaggregated model projected demand at levels six to twelve percent above the aggregate model. This difference is apparent due to the unequal distribution of income accounted for by the disaggregate model.

Demand for all food products was projected by the traditional method. Various conversion factors were employed to translate results into farmgate demand for basic crop and livestock products.

(166 pages)

INTRODUCTION

Central planning is being used as a major tool to accelerate agricultural growth in Asia, Africa, and Latin America, where before economic and social objectives can be realized, low income, peasant agriculture must become more productive.

One of the major planning areas involves the projection of future domestic demand for agricultural goods. Once this is known or estimated, planners can determine, from a knowledge of future supply (which must also be estimated), how much of which commodities will be in surplus. Import requirements and export possibilities can thus be translated into foreign exchange requirements.

The United States and other countries are also interested in the future food requirements of these countries. These nations represent existing markets as well as a potential for the future. Their surpluses represent valuable sources of raw materials for industrialized economies.

Iran is one of many developing countries which has established a planning organization. The earliest planning documents were rather crude, and consisted mainly of targets. They lacked the detailed analysis necessary for coordination and execution. Succeeding plans have been formulated with ever increasing sophistication. The fourth five-year plan began in March 1968, however they have not yet engaged themselves in detailed agricultural demand estimates.

In general, past plans have relied upon schemes to foster industrial output, trusting that an adequate growth rate in the agricultural sector would be forthcoming. In this hope, the Iranians have been somewhat disappointed. During recent years the average annual population increase in Iran has been about 2.6 percent, or about 600,000. The annual rate of population increase in most European countries is about one percent, in North America about 1.6 percent,and falling. The Gross National Product of Iran at 1965 prices increased from rials 307 billion in 1959 to rials 481 billion in 1965, a total increase of 56 percent and an average annual increase of 6.6 percent over the period.[1]

These two factors (increased income and population growth) increased the demand for agricultural production considerably during the period of the Third Plan. However, agriculture production did not respond adequately. The Iranians hoped for an annual increase of about 4 percent, but, averaged not more than a 2.6 percent increase.[2] This caused a sharp increase in the prices of foodstuffs by about 6.4 percent per annum. During the same period prices of other items in the cost of living, such as clothing and housing, rose only slightly.

It should be evident that success in achieving rapid industrial growth necessitates the expansion of the domestic and foreign markets for various products and elimination of possible bottlenecks in the supply of raw materials and capital goods. The rapid expansion of domestic markets in Iran, where the majority of the population is still active in the agricultural sector, cannot be attained except by the proper increase of agricultural production, Further-more, if constantly increasing requirements for foodstuffs and agricultural raw materials for industry are not met through domestic production, the foreign exchange resources of the country will have to be utilized, thus restricting the ability to import capital goods and thereby limiting economic growth.

In view of these premises, efforts to achieve adequate increases in agricultural production should be an important step in Iranian government planning. It seems evident that a forecast of future Iranian agricultural demands can be useful for domestic and foreign planning purposes. It is the purpose of this paper to set up a theoretical model for estimating the increase in domestic agriculture demand from cross sectional data. The model will then be tested by forecasting domestic Iranian agriculture demand for 1970, 1975 and 1980.

A simple outline of this paper will now be given. Chapter I presents the general theoretical model for forecasting future demand from family budget studies. The relevant variables are examined and an explanation is given of how demand and supply schedules can be generated so cross-sectional data can be used to determine quantity demanded at a given point in time. In Chapter II the source and general content of the data used in this study are presented. Several necessary adjustments and pooling techniques are also explained. The shift of the demand schedule through the analysis of Engel curves is discussed in Chapter III. Specification, the functional form and statistical problems for estimating the parameters of Engel curves are also covered in the third chapter. In Chapter IV the empirical estimates of the elasticicoefficients are presented. The elasticities are also adjusted for the market margin and quality effect expected through time given economic development and rising income levels. Chapter V concludes with an aggregate and a disaggregated model for estimating quantities demanded in some future time. The results from these models are also compared for significant differences. Finally, projected consumer demand is converted to its farm gate equivalent for various food commodities through 1970, 1975 and 1980.

CHAPTER I

THE THEORETICAL MODEL

There are many domestic agricultural commodities, and thus demand analysis will be necessary for each of the several commodity groups denoted by the letter i. The typical demand curve is usually considered to be a function of several variables as follows:

(1) $Q_D i = F\ (P_i,\ P_{si},\ Y,\ H,\ Pop,\ T)$

where:

$Q_D i$ = quantity demanded of the i^{th} good

P_i = price of the i^{th} good

P_{si} = price of the substitute for the i^{th} good

Pop = population

Y = income

H = household size

T = tastes

The above model can be simplified for the problem at hand. Population will not be included in the demand equation since family budget studies for food products will first be examined independently of aggregate population. Then, after per capita demand is determined, the aggregate demand schedule will be a simple horizontal summation of total population. However, with this type of approach, household size becomes an important factor, the reason being that larger families may enjoy certain economies of scale when purchasing and consuming many food products.

To make the different household sizes comparable they must be adjusted into equivalent adult scales.[3]

Tastes will be assumed as constant over the period in question.[4] The price of substitute goods could be a very useful variable for obtaining cross-elasticity coefficients. Unfortunately there is not sufficient data available from Iran to utilize this concept. Furthermore the data used is a cross-sectional nature so that it is taken at a point in time making prices constant. Nevertheless it shall be shown within the next few pages how absolute price can be included within the demand model.

At this point a model of the following nature is to be used:

(2) $Q_{Di} = f\ (P_i, Y, H)$

The resulting equation is:

(3) $Q_{Di} = B_o + B_1P_i + B_2Y\ B_3H + E$

It shall be assumed that household size will remain constant through the relevant time period. This being the case, it would normally be considered proper to drop household size from the model. However, income and household sizes are correlated. Therefore, as shall be shown in Section III, it is necessary to include household size to avoid misspecification of the model and a biased estimate of B_2.

Propensities of the model can be studied by dropping household size temporarily and analyzing a simple equation of the form:

(4) $Q_o = B_o + B_1P + B_2\ Y$

This equation can be illustrated in graphic form as in Figure 1. The slope of the function DD is given by $\frac{\partial Q_o}{\partial P} = B_1$. The amount DD shifts is dependent upon the level of income (Y) and is given by $\frac{\partial Q_o}{\partial Y} = B_2$. That is, if income were at a level of Y_o, the demand schedule DD may be appropriate. However, if income increased to Y' the entire demand schedule would shift out some distance depending on the value of B_2 to say D'D'.

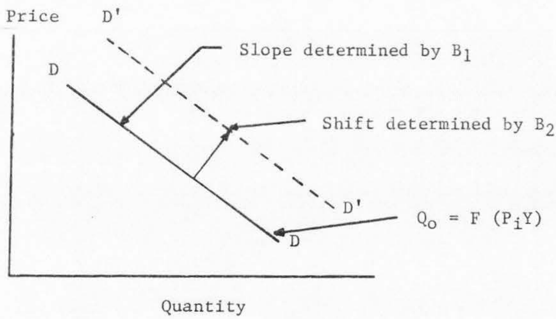


Figure 1. Demand, a function of price and income.

Since the data for the Iranian problem is cross-sectional and prices are constant, there will not be a complete demand schedule as in Figure 1. Rather, there will be but one price and quantity at that point in time. The information will be one point on the demand schedule like that in Figure 2a. Now assuming a typical price elasticity to be valid for the commodity in question, the value of B_1 can be derived[5] and a demand schedule can be assumed as in Figure 2b. Although the demand function may not be linear throughout the DD schedule, it shall be assumed linear within the relevant region.

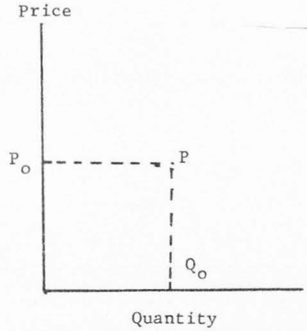


Figure 2a. Cross-sectional demand schedule as a point in time

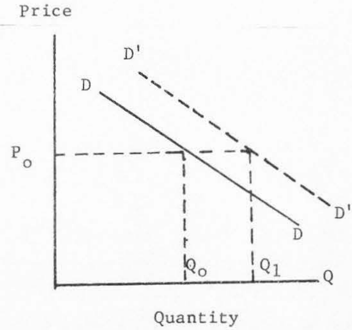


Figure 2b. Complete demand schedule

Since relative prices are assumed to be constant, as income increases through time the result will be a shifting of the demand schedule as in Figure 2b from DD to D'D'. The amount of this shift will depend on the value of B_2. There may be a temptation to assume that with this shift in demand the quantity consumed will increase from Q_o to Q_1. This will only be the case if the supply curve is perfectly elastic or if the quantity supplied increases sufficiently to shift the supply schedule out enough to keep absolute price constant.

However, this is unlikely for many food goods in Iran. Referring to Figure 2a again, it is evident that point P is also a point on the supply schedule. Assuming a typical elasticity of supply for the commodity in question, the supply schedule passing through point P can be derived in Figure 3. Note that with an increase in income and a shift in the demand schedule to D'D', the resultant quantity demanded may be Q_r or Q_s rather than Q^1 depending on the slope and the shift of the supply schedule. Therefore, it is evident that while shifts in the demand schedule can be studied quite easily independent of supply, a combined study of supply and demand is desirable if the actual change in quantity demanded is to be determined.

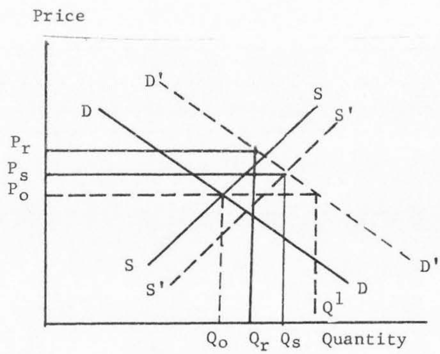


Figure 3. Supply and demand determining quantity and price.

In a long range forecast, such as this study, population and income growth are the two most important factors contributing to future increases in consumer demand. Population growth is of obvious importance when one contemplates the impact of a 57 percent population growth in the next fifteen years. The purpose of a long range forecast is to determine the general trends in consumption and possible structural changes which may result. Short term projections are mainly concerned with the development of the market situation which depends on such things as the political situation, prices, salary demands, weather conditions, etc.[6] Therefore, in a long term demand study the income effect is more important in terms of magnitude than the price effect. A simple example will illustrate. Over a period of the next fifteen years Iranian income is expected to increase by approximately 50 percent. The income elasticity of demand for cheese is about 0.8. Thus, cheese demands are expected to increase by 40 percent. During the same period cheese prices will likely rise at most 20 percent. The price elasticity for cheese is close to 0.25. Therefore, the price effect will decrease cheese demands by no more than 5 percent compared to a 40 percent increase due to the income effect. Although in the short run price effects may be much more significant than income; the opposite is expected for most commodities in the long range forecast.

It is evident that the price effect is small compared to income and population, yet useful for precision. However, to include the price effect would require a detailed study of future supply which is out of the scope of this paper. Therefore the remainder of this paper will be devoted to forecasting the increase in demand for Iranian agricultural commodities due to the income effect and population growth.

Shifts in the demand schedule (the income effect) can be determined independently of prices from cross-sectional data. Because family budget studies are of the cross-sectional nature, the traditional technique of estimating the parameters for Engel curves can be used to compute the income effect and obtain income elasticity coefficients for each commodity.[7]

In order to forecast future aggregate demand in year t, both income (Y_t) and population (P_t) must be predicted for year (t). Once Y_t, P_t, and the necessary income elasticity coefficients (ηi) are estimated, the shift in the per capita demand schedule of each commodity between year t_o and t can be calculated by assuming absolute price as constant and referring to the original equation from which the elasticity was estimated. The aggregate demand schedule can then be calculated by multiplying per capita demand by population for year t. The assumption of constant price can then be relaxed and final demand forecast for year t by determining equilibrium between supply and demand.

This procedure will generate forecast demand of food products and also some agricultural commodities. However, if forecast demand for agricultural commodities at the farm gate is desired, it is necessary to translate the foodstuffs to raw agricultural commodities, such as bread converted to wheat and cheese to milk. These conversions can be accomplished by simply determining the necessary conversion coefficients and multiplying to get back to the raw agricultural products.

CHAPTER II

THE DATA AND ADJUSTMENTS

The theoretical model for projecting future demand of various agricultural commodities in Iran has been presented. Before expanding on certain practical phases of the theory and presenting the empirical findings, the data will be discussed. The reader not interested in the source of the data, its general reliability, and some methodological techniques may wish to skip this section.

Urban Studies

Iran like most developing countries has collected relatively no useful data for domestic demand analysis. This type of information is particularly expensive to obtain in countries where market prices and conditions tend to be quite heterogeneous and trained personnel are scarce. Many of these countries have recently been conducting family budget surveys in their urban areas making some cross-sectional data available. Rural coverage is usually scanty and less common. Fortunately there are two family budget surveys available for urban Iran and three less dependable surveys for rural Iran.

The two urban surveys were taken within the 32 largest Iranian cities in 1959 and 1965 and provide adequate coverage of urban Iran. The surveys were conducted by the Central Bank of Iran (Bank Markazi).[8]

The 4,429 households included in the urban budget studies were grouped according to the level of income, but were not cross-classified by household size although average household size is given. The budget studies are disaggregated to a desirable level such that there are approximately 20 major food groups with numerous separate food commodities broken out in each major group (both in terms of quantities consumed and expenditures). The surveys also cover other family expenditures from cotton and wool clothing items to transportation costs. Average family expenditures are classified according to 12 and 14 different income groups for the 1959 and 1965 surveys respectively.

There were several adjustments made in the data. The base year was considered as 1965 and all expenditures and income were inflated to 1965 prices. Income groups appeared understated compared to food expenditures. Upon analysis total expenditures were found to be greater than reported income, particularly in the lower income groups. This was not too surprising in that it is a common bias found in many budget studies.[9] After cross checking it was apparent that total expenditures would be a better proxy for real income than reported income. Therefore, throughout this demand study, when reference is made to income elasticities, it may be well to remember that total expenditures have been used to represent income. Nevertheless, the word income shall be used instead of total expenditures for simplicity.

It was necessary to make a slight adjustment on the 1959 urban data because the bank did not make allowance for a 17 percent inflation which occurred between the 1959 and 1965 survey periods. If 1965 is taken to be the base year, the survey procedures had the effect of making income groups lower in the 1954 study than the corresponding income groups of the 1959 survey.

From these urban budget surveys, preliminary income elasticities have been computed and per capita consumption of the various food items have been calculated. The results checked well with other cross checks from nutritional studies and a priori expectations. Hence, the urban data appears quite reliable.

Rural Studies

A series of family budget surveys have been carried out on a more or less continuing basis in the rural towns and villages. The Iranian Statistical Center has been responsible for these studies taken during 1963, 1964, and 1965. Fortunately, reported expenditures (also quantities in grams) per commodity were recorded in two groups, the value of purchased and nonpurchased goods. These rural studies are similar to the urban surveys in the breakdown of commodity groups.

There was no problem with under-reported incomes as in the urban data; the survey is stratified according to total expenditures rather than income groups. Again 1965 was taken as the base year, and all expenditures and income were inflated to the 1965 price level. The general reliability of the surveys is questionable on two acounts. It has been reported that although the surveys were actually conducted in 1963 and 1964, the small villages were not covered. Also, the per capita consumption of food appears low compared to urban consumption and other rural checks. Therefore, the computed income elasticity coefficients from this data have been examined and adjusted according to international and urban comparisons. Also, per capita consumption has been cross checked with rural Iranian nutritional studies.

Pooling of Data

A history of cross-sectional studies repeated continuously for several years would provide an ideal source of data for predicting future consumption. From such data price effects could be studied for various income groups, as well as obtaining insight as to how static income and consumption relationships change through time for a given country. There are other interesting questions which might be answered from this type information. However, for most countries, such data are not available. In fact, a single family budget survey covering both the urban and rural area of a country is more data than many developing countries have yet collected. One may imagine the difficulty in obtaining time series data.

Since there are two family budget surveys for urban Iran taken six years apart, 1959 and 1965, a decision must be made as to their most effective use. Figure 4 helps to illustrate the general difference in information provided by the surveys. Note the relationship between the expenditures on mutton and lamb and income for the two budget study years. Between 1959 and 1965 the price of red meat increased 22.3 percent compared to the general food price index. As a result, at each level of income less mutton and lamb were purchased in 1965 than in 1959. It is interesting to observe that for products such as fresh vegetables, prices decreased compared to the general food index and hence, as can be seen from Figure 5; at each level of income less vegetables were purchased in 1965. It would be valuable to have several other budget surveys for different years so that a general relationship

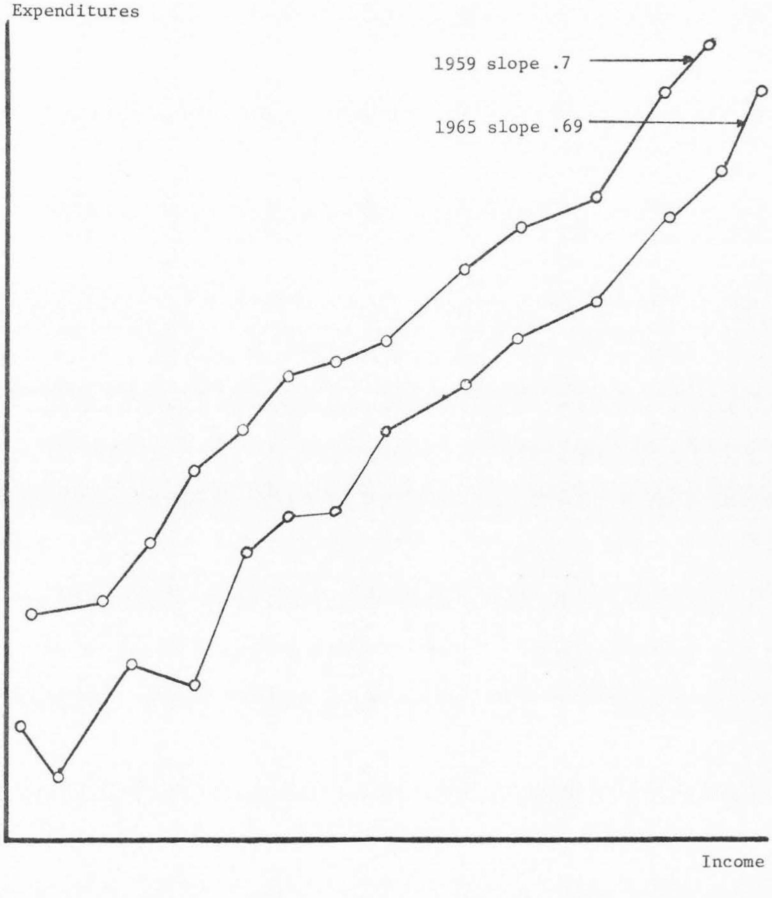


Figure 4. Mutton and lamb expenditures. Plotted against income (in rials). Both axes are in logarithmic scales.

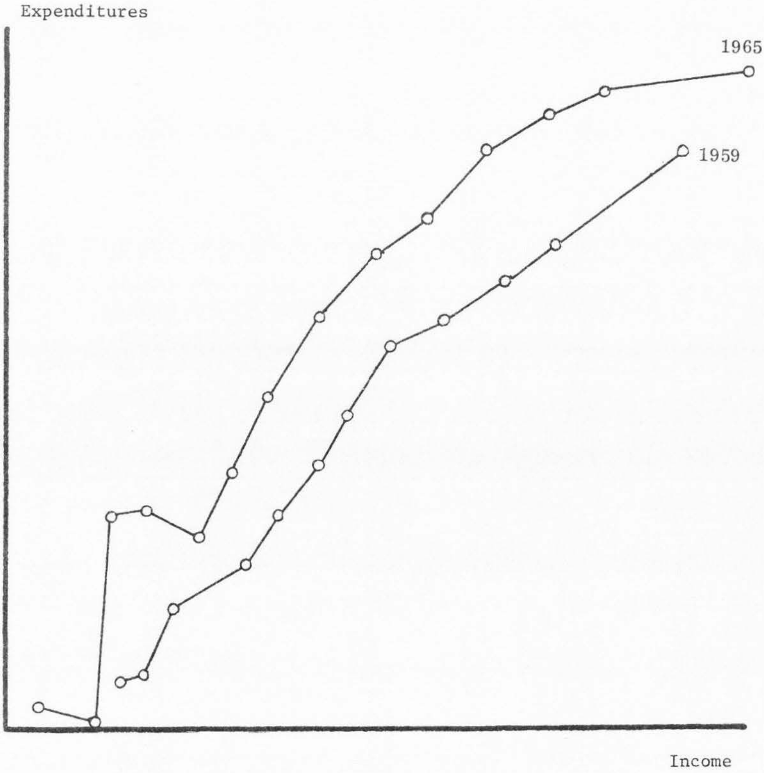


Figure 5. Fresh vegetable expenditures. Plotted against income (in rials). Both axes are in logarithmic units.

or trend could be established. Since more surveys have not been conducted, the only available observations at two points in time cannot give rise to a significant trend theory.

In Figures 4 and 5 both the expenditure and income axes are in logarithmic units. This means the slope of the functional relationship between income and expenditures is in fact the value of the income elasticity coefficient. The income elasticity coefficient measures the percent change in consumption due to a one percent change in income. This coefficient is the statistic we're interested in estimating. Therefore, the slope of the regression equations becomes the important consideration. Note in Figure 5 that if the 1965 regression were simply shifted up so that its intercept passed through C_o, 1959's intercept, no relevent information would be lost. This adjustment would have the effect of pooling the two sets of data. The general assumption of cross-sectional analysis, that relative prices are constant, can still be assumed so far as the effect prices might have on the slope is concerned. This is seen in the fact that price changes between 1959 and 1965 seemed to effect change in consumption at each income level somewhat equally. For example, the difference in the slope coefficients between the two years is not significant at the alpha 0.10 level for vegetable products. Table 1 shows similar results for most other products.

A dummy variable will be used in this study to pool the data taken from the 1959 and 1965 family budget surveys. The procedures will be similar to the theoretical example presented in the Appendix to this chapter.[10] To briefly illustrate the procedure, the expenditure on

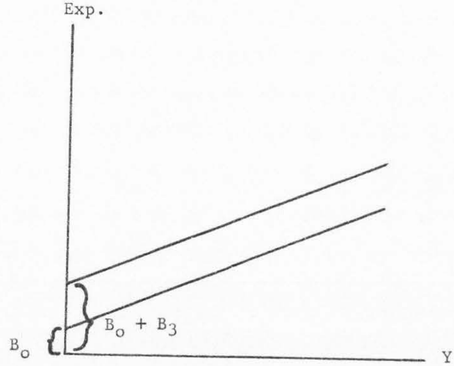


Figure 6. A case for one dummy variable.

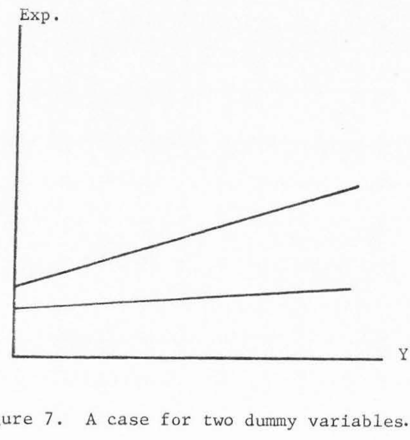


Figure 7. A case for two dummy variables.

Table 1. Test of slope coefficients for significant differences

	1959 B_2	1965 B_2	Significant difference between B's 59 & 60 t^a	Pooled 1959 & 1965 B_2	Average of 1959 & 1965 B's
Dairy product	.620	.908	-4.310	0.98	0.770
Cheese	1.250	0.919	1.800	0.93	1.086
Rice	.740	0.980	-3.540	0.66	0.861
Bread & bakery	.309	0.365	-2.780	0.18	0.337
Mutton & lamb	.839	0.690	2.940	0.87	0.765
Fresh vegetables	.719	0.692	0.102	0.77	0.710
Canned Fruit & vegetables	.700	0.995	-3.140	1.35	0.848

[a] $H:B_{59}$ is rejected when t - 4.318 or $t \leq -4.318$ at $\alpha =$ .025 level
$t_{(14,\ \alpha = 0.01)} = 1.782$

rice is fitted according to the following logarithmic equation:

$$(5) \quad \log X_R = 4.64 + 1.04\ Z + .55 \log Y$$

where:

X_R = average expenditures on rice for 1965 and 1959

Y = average income

Z = 0 for 1965 data
1 for 1959 data

The dummy variable (Z) has absorbed the variation in expenditures due to different levels of consumption in 1959 and 1965. However, the slopes of the two functions have been pooled providing a pooled estimate of the income elasticity coefficient since the function is in logarithmic form. This has the advantage of now using one regression function to estimate the desired parameters B_0 and B_2 instead of two separate equations with 12 and 14 degrees of freedom respectively for 1959 and 1965. The loss of 2 degrees of freedom from each regression to estimate B_0 and B_2 has been replaced by one regression with 26 degrees of freedom. This pooled regression should give a truer estimate of the B's than could be obtained from either the 1959 or 1965 regression. The truer estimate comes from the pooling of the degrees of freedom of the two separate regressions. There may be a temptation to simply compute the income elasticities from the budget data separately and average the two results. This procedure would average what biases may result in the two coefficients due to the limited degrees of freedom. From observing the seven representative food products in Table 1 it is easily seen that the pooling procedure does not result in an average of the two separate regressions.

Similar procedure shall also be followed in computing the elasticities from the rural data. Since three surveys for different years and seasons are available, two dummy variables will be used. The following equation illustrates the technique:

$$(6)\ X_K = B_0\ B_1Y + B_2Z + B_3J$$

where:

X = expenditures on product K

Y = income

$$Z = \begin{cases} 0 \text{ in year } t_1 \\ 0 \text{ in year } t_2 \\ 1 \text{ in year } t_3 \end{cases}$$

$$J = \begin{cases} 0 \text{ in year } t_1 \\ 1 \text{ in year } t_2 \\ 0 \text{ in year } t_3 \end{cases}$$

Since each of the three surveys have 12 observations for each commodity, there will be 36 total degrees of freedom.

CHAPTER III

CONSIDERATIONS AND PROBLEMS IN ESTIMATING THE INCOME EFFECT FROM ENGEL CURVES

The income effect is computed in this study by estimating income elasticities from cross-sectional data taken from family budget surveys. Plotted curves from this type data is often called Engel curves. For this reason this section begins by explaining briefly the origin of the Engel curves. The reader already acquainted with this material may wish to skip part and go on to the following sections which deal with specification, functional forms and statistical problems in estimating the parameters of Engel curves.

Engel Curves and Cross-Sectional Analysis

The first and perhaps most famous of all statistical family budget analyses was made in 1857 by Ernest Engel.[11] He wrote an essay addressed to the problem of population. Engel used budget data from 153 Belgian families to estimate the aggregate food consumption of Saxony. He compared this consumption with current production and agreed that as long as the distribution of labors among production was proportional to the distribution of expenditures among consumption, the absolute size of the population was unimportant. From his analyses he set forth three propositions:

1. The greater the income, the smaller the relative percentage of outlay for food consumption.

2. The percentage of outlay for clothing is approximately the same, whatever the income.

3. The percentage of outlay for lodging, or rent, and for fuel and light, is invariably the same, whatever the income.

After more than a century the first proposition still generally holds. It has become known as "Engels Law." Of course Engel's last two statements are incorrect as Engel himself discovered in 1895 when he analyzed Ducpetiaux's data by income class rather than social-economics class as he had in his first study in 1857. This time he discovered that the percentage of income or total expenditures spent on clothing rose while the percent spent on housing, fuel and lights fell, as income rose. Nevertheless, it was the first statement set forth by E. Engel that has become known as Engel's law and has since been applied extensively in the analysis of income and food consumption.[12]

Those familiar with Engel's law know that with each percent increase in income the corresponding percent change in consumption (described by an Engel curve graph) is called an income elasticity coefficient. This income elasticity coefficient is then used to determine how much future demand for given commodities will increase due to expected increases in income. This is simply another way of talking about the shifting of the demand schedule as income increases. Engel curves amount to about the same thing except the quantity demanded (or consumption) is plotted against income on a two dimensional graph holding price constant. Figure 8 is a typical Engel curve

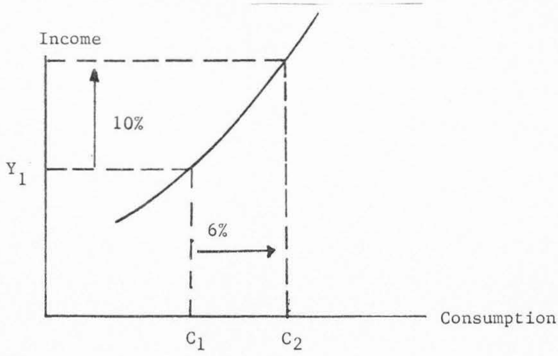


Figure 8. Engel curve relating income and the consumption of rice.

graph showing the relationship between income and the consumption of rice. Note that a 10 percent increase in income results in an increase of rice consumption of 6 percent. This means that the income elasticity of rice is 0.6.

The Engel curve is useful in explaining the theory of cross-sectional analysis. Cross-sectional data is collected at a point in time and hence all prices, both relative and absolute, are assumed as constant. The income effect can then be studied by assuming that prices remain constant through time as income changes from say, Y_1 to Y_2 in Figure 8. The assumption is that as income increases from Y_1 to Y_2, through time t_1 to t_2, those families presently consuming at C_1 at time t_1 will consume C_2 at time t_2. That is, those families presently consuming at C_1 will spend similar to those at C_2 when their income increases to Y_2. One difficulty with this argument is that all incomes may be changing so that the person stays at the same relative point on the socio-economic scale. The estimated income elasticity usually ignores the effect on prices of shifting large numbers of persons from one income category to another. Also ignored in the question is the length of time that it will take consumers to adjust to this higher income.[13] Although cross-sectional analysis has its problems when skillfully applied it is an effective way of estimating the income effect on consumption. Some adjusting techniques are discussed in Chapter IV.[14]

Proper Specification of Engel Curves

In Chapter I (equation [2])it was stated that in theory demand depends on three variables given by the following equation:

$$Qo_i = f(Pi,\ Y_1H)$$

where:

Qo = Quantity demanded of commodity i

Pi = Price of commodity i

Y = Income level

H = Household size

Since this section is dealing with measuring the income effect from cross-sectional data, prices are assumed constant and income (Y) and household size (H) are the relevant independent variables.

It is sometimes assumed that expenditures depend on income only. However, such an assumption may result in a specification error. Other independent variables such as household size should be included. Many survey reports are stratified according to location (urban and rural), household size, and income groups. The Iranians have separate urban and rural surveys with households grouped according to average income or total expenditure levels. However, survey reports for Iran simply report average household size for each income group instead of stratifying the results separately for individual household sizes. Given this data then, average household size shall be entered as an independent variable along with income.

Let us examine the specification error resulting in this study if household size is disregarded. If a relevant variable which is uncorrelated with the other independent variables is omitted from a regression analysis the omission will not bias the estimate of the parameters of the included variables.[15] However, the assumption of no correlation between the excluded variable (household size) and the included variable (income) doesn't hold. The simple correlation between income and household size in Iran's 1965 family budget survey is .835. There is good reason to believe, therefore, that omission of the household variable will result in a bias.

Assume the model with income and household size is the "true model." Let this true model be given by:

(10) $X = \beta_1 y + \beta_2 H + e$

But suppose household size is disregarded and the following model is estimated instead of (10).

(11) $X = A_1 y + \mu$

If A_1 is estimated by the method of least squares, it will be given by:

(12) $A_1 = \frac{\Sigma yX}{\Sigma y^2} = \frac{\Sigma y\ (\beta_1 y + \beta_2 H + e)}{\Sigma y^2}$

$$(13) \quad A_1 = \beta_1 + \beta_2 \frac{\Sigma yX}{\Sigma y^2} + \frac{\Sigma ye}{\Sigma y^2}$$

Substituting (10) in (13) and taking the expected value of A_1 gives:

$$E\ (A_1) = \beta_1 + \frac{\Sigma yH}{\Sigma y^2}\ )\ \beta_2$$

Letting $\frac{\Sigma yH}{\Sigma y^2} = P_{12}$ gives:

$$(14) \quad E(A_1) = \beta_1 + P_{12}\ \beta_2$$

The estimated expected value of A_1 is now expressed in terms of the parameters in the true model. Note that P_{12} is the slope coefficient in what we might call an "auxilliary" regression of H_1, the excluded independent variable, on Y_1, the included independent variable.[16]

It is obvious from equation (14) that if H is uncorrelated with Y_1 $E(A_1) = \beta_2$ and there would be no bias in the estimate of A_1. However, as previously stated, as long as H is correlated with y the coefficient of the latter variable will be biased. It is, therefore, expected that a bias will exist if household size is omitted. In fact, if a logarithmic function is used, the income beta coefficient is given by the income elasticity coefficient, and the elasticity coefficient itself will be biased.

To examine the bias resulting from omitting household size for the expenditures on dairy products in Iran during 1965, assume the true model to be given by:

$$(15)\ \ln X = -7.9808 + .9686\ \ln Y + .4416\ \ln H$$

If a misspecified model is used instead, assuming household size to be explained by the income variable, the equation will be:

(16) $\ln X = -8.6221 + 1.0985\ \ln Y.$[17]

From the auxiliary equation given by:

$$\ln H = -1.770 + 0.2940\ Y$$

a P_{12} of + .2940 is obtained. The sign of P determined if A_1 is underestimated or overstated. Since it is positive, we know A_1 overstates the true income parameter β_1. Substituting into equation (14) the expected value of A_1 is calculated as follows:

$$E(A_1) = .9686 + (.9686 + .2940 + .4416) = 1.0984$$

To summarize briefly, it was assumed that the true model included both income and household size as explanatory variables for expenditures on dairy goods. To get an idea of the misspecification resulting if household size was omitted, a simple model was used with income being the only explanatory variable. The parameters of the misspecified model were than expressed in terms of the true coefficients. A_1 was expressed as a weighted sum of the β's in the true model. The weights were the coefficients from the "auxiliary" regression of household size on income. That is, the weights depend on the inter-relationship in the sample between what the true model predicted and what was observed from the misspecified equation. It was shown that A_1 is biased upward because the weight (P) is positive. This was expected from the beginning because there was a positive correlation between income and household size. Other examples are shown in Table 2.

Although it has been shown that the omission of household size as an independent variable will result in misspecification, that is not to say that including it results in a complete and correctly specified model. It has simply been shown that the model resulting from

Table 2. Specification comparison of Model 1 and Model 2[a]

	Model # 1				Model # 2				
	B_2	B_3	F*	R^2	A_1	$E(A_1)$	R^2	F	P_{12}
Dairy products	0.969	0.442	81.0	.936	1.098	1.099	0.870	82.2	.2940
Bakery & bread	0.093	1.171	211.9	.975	0.438	0.437	0.768	39.7	.2940
Rice	0.659	1.625	33.5	.859	1.137	1.137	0.798	47.3	.2940
Fresh fruit	1.144	0.965	184.4	.971	1.427	1.428	0.954	252.5	.2940
Fresh vegetables	0.732	0.967	57.5	.913	1.016	1.016	1.016	90.2	.2940

[a]1965 prices

*F values for whole model above 8.91 are significant at .005 level

Source: Data taken from Iranian Survey (Urban 1965) including household size is more likely correct than if it were excluded since theory suggests that family size is important.

Partial correlation is another useful test for determining the appropriateness of household size as an independent variable.

Partial correlation coefficients serve to determine the correl-tion between the dependent variable and each of the independent variables, while eliminating any tendency of the remaining independent variables to obscure the relation. Thus in the model correlating expenditures on dairy products with income and household size, the partial correlation of expenditure with household size, while holding income constant, can be computed. The coefficient would then indicate what the average correlation would be between expenditures and household size in samples in which all the families had the same income.

Any group of independent variables may serve to explain some, but not all, of the variation in a dependent variable. If an additional independent variable is added, it may account for part of the variation left unexplained by the factors previously considered. The coefficient of partial correlation may be defined as a measure of the extent to which that part of the variation in the dependent variable, which was not explained by the other independent variables, can be explained by the addition of the new factors.[18] For example, when expenditures on dairy products are regressed against income and household size, the calculations show R^2 to be .94. When income alone is regressed against expenditures the R^2 is 0.87. That is, the three variable model explains 94 percent of the variance in expenditures, whereas the two variable explains 87 percent. Hence, 13 percent of the variance is unexplained when two variables are considered. Only 6 percent is left unexplained when three are considered. Adding household size has increased the explained variance by 7 percent. The importance of this increase is determined by comparing it to the variance left unexplained before the household variable was added. The partial correlation coefficient is a measure of this increase in explained variance. The coefficient of partial correlation for expenditures on dairy products against household size, holding the effect of income constant, is .738.[19] The partial correlation coefficients are given for other selected commodities in Table 3. These results help confirm the suspicion that household size should be included as an explanatory variable in the regression model.

Table 3. Partial correlation coefficients for expenditures on selected food commodities and household size

Food commodities	$Y_{13.2}$[a]
Dairy products	.738
Bakery & bread	.945
Rice	.550
Fresh fruit	.608
Fresh vegetables	.506

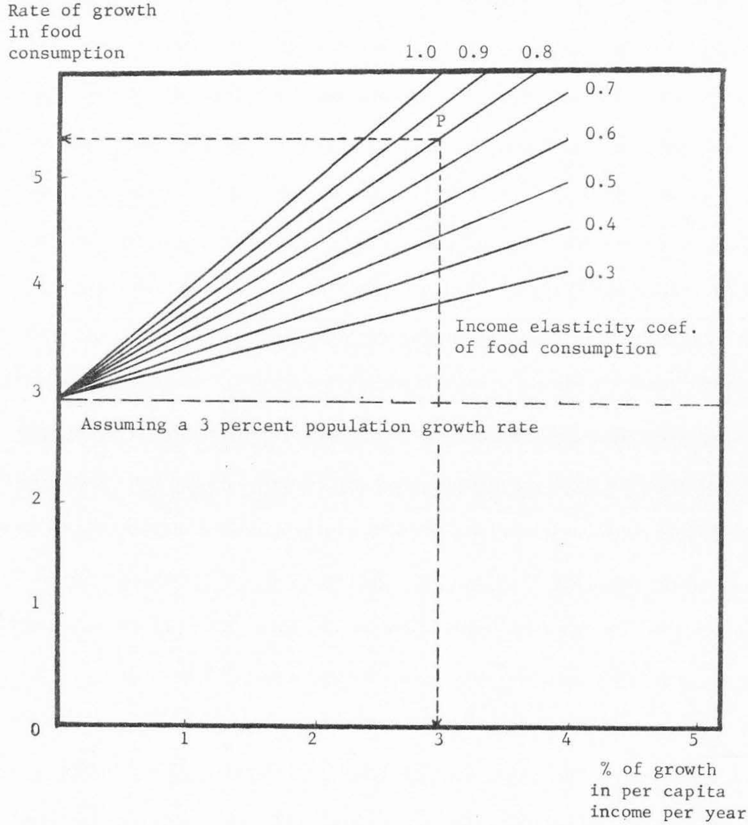
[a](1) = Expenditures; (2) = Income; (3) = Household size

Functional Fitting of Engel Curves

The choice of mathematical form for fitting the relationship between expenditures for a particular commodity and income is a matter of great concern. Prais has shown that calculated income elasticities depend on the type of function that has been fitted.[20]

The importance of correctly estimating elasticity coefficients for food can be seen from Figure 9. At point A a three percent rate of increase in population has been assumed. If there is no increase in per capita income, the rate of growth in demand for food is the same as the population growth rate--three percent. However, should an economy be developing rapidly and achieve a three percent rate of increase in per capita income, the rate of growth in demand will depend on the income elasticity of demand for food, the rate of increase in per capita income, and the population growth rate. If the income elasticity of food were .8, it is seen from point P that the overall national rate of growth in food consumption would be 5.4 percent; three percent due to population growth and 2.4 percent due to the income effect.[21]

The functions used in fitting the data from the Iranian family budget surveys were chosen according to three criteria: 1) the economic interpretation of the function in the framework of the consumption theory; 2) the statistical accuracy of the fitting; and 3) the simplicity of computation.



Source: Stevens, R. D. , Elasticity of food consumption associated with changes in income in developing countries, FAE Report # 23, ERS, USDA, 1965.

Figure 9. Food consumption growth rate related to income elasticity.

Economic Interpretation of the Consumption Function

If an international study were to be made on a particular food product (say, product K), economic theory suggests that a function similar to Figure 10 may be appropriate. This curve represents a log-log-inverse function of the following form:

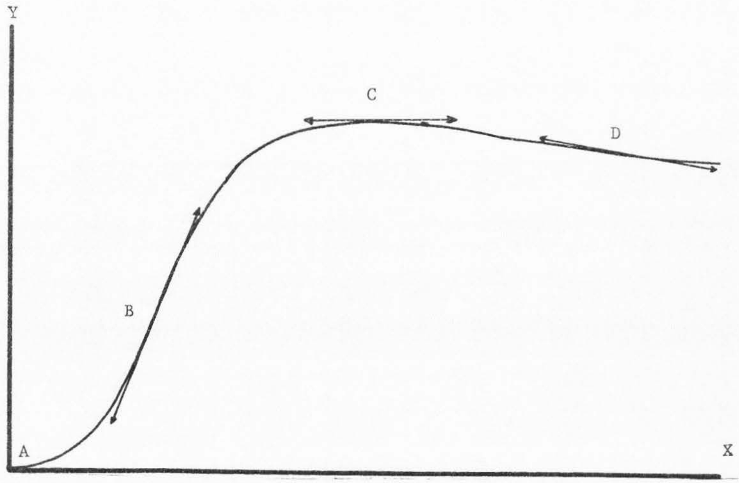
$$(17)\ \log X = A - \frac{b}{y} - C \log Y +$$

where:

X = expenditures on commodity K

Y = income.

The first segment (A) of the curve represents consumption among low income groups for whom product K is a luxury item. Thus, a small increase in income gives rise to a relatively rapid increase in consumption. Segment BC represents consumption among income groups who view product K as a necessity. Thus, the rate of increase in consumption diminishes progressively as income rises. CD represents the income segment through which product K would be viewed as an inferior good with consumption diminishing as income rises. L.M. Goreux suggests that such a function would be valid for the study of cereals, or more generally carbohydrates. If an international study were made where a broad spread of income was considered (that is, if the income ranged from that of developing countries like India to high income countries such as the United States)[22] impoverished developing countries may lie in region AB for at least some commodities. Wealthy nations would be up near the C range with some goods in the CD segment. Other countries would fit somewhere between A and D depending on their economic



Source: L. M. Goreaux, "Income and Food Consumption," Agricultural Economics and Statistics, Vol. IX, No. 10, (Oct. 1960), pp. 2.

Figure 10. Curve representing the quantity (X) of per capita consumption of a food commodity,(product K) with wide changes in income (Y).

development and income.

This study considers consumption and income in Iran only. Therefore, the income range will be confined to a much smaller region than AD. It is obviously preferable to choose a simpler model than the log-log-inverse function just referred to. A function providing better representation of consumption changes in the observable range of income is most desirable.

Practical considerations pretty well limit the choice of the function to three types: the linear, semi-logarithmic, and the double-logarithmic. These functions appear in Table 4. It may be noted that none of these functions have a saturation level of consumption which would provide description of inferior goods. Iran is yet a developing country with most of its income and consumption lying in the lower region of sement BC in Figure 10. Food consumption simply does not show evidence of a saturation level.

The linear function (1) is obviously the most simplified, but is generally considered unsuitable because it assumes that the coefficient of elasticity tends toward unity as income increases indefinitely.[23] The logarithmic function (2) seems to be best suited for luxury and semi-luxury food commodities in urban Iran. Necessity food items seem to be the best fit by the semi-logarithmic function, (3). This shall be shown in the discussion to follow.

Statistical Fitting

In order to illustrate how the statistical fitting of the three functions presented in Table 4 will produce different results, note

Table 4. Family budget consumption functions

	Function	Marginal propensity to consume	Coefficient of elasticity (N)
(1) Linear	$X = \beta_o + \beta_2 Y +$	β_2	$\beta_2 \frac{Y}{X} = \frac{Y}{Y + \frac{\beta_o}{\beta_2}}$
(2) Logarithmic[a]	$LNX = \beta_o + \beta_2 LNY + \mu$	$\beta_2 \frac{x}{y}$	β_2
(3) Semi-logarithmic[a]	$X = \beta_o + \beta_2 LNY + \mu$	β_2/y	$\frac{\beta_2}{X} = \frac{\beta 2}{\beta_o + \beta_2 LNY}$

[a]LN refers to Neperian Logarithms

Income elasticity (N) is given by $\frac{dX}{dY} \quad \frac{Y}{X}$

(1) $\frac{dX}{dY} = \beta_2$ Hence $N = 2 \frac{Y}{X}$

(2) Rewriting $LNX = \beta_o + \beta_2 LNY$ as $X \; \beta_o Y^{\beta_2}$ $\quad \frac{dX}{dY} \quad \beta_o \; \beta_2 Y^{\beta_2 - 1} = \frac{\beta_o \; \beta_2 Y^{\beta_2}}{Y} =$

and $N = \frac{X\beta 2}{Y} \quad \frac{Y}{X} = \beta_2$

(3) $\frac{dX}{dY} = \frac{\beta 2}{Y}$ Hence, $N \frac{\beta 2}{Y} \cdot \frac{Y}{X} = \frac{\beta 2}{X}$

Figure 11. It shows the three functional relationships of average weekly expenditures for bakery products regressed against annual income. The data is the same for all three regression curves as taken from the Iranian 1959 family budget survey.

Although the three functions correspond fairly well through their mid-point regions, they diverge considerably at their extremities. Figure 11 helps illustrate the importance of properly choosing a function for statistical fitting since movement will likely be out towards greater income through time. To demonstrate how one may use this information to choose a function, the expenditures on lamb (a luxury item) are plotted against income in Figure 12. Note that the slope is fairly steep and constant leveling off near the top end. Comparing this with Figure 11 indicates that the logarithmic function may best fit the data. In Figure 13 expenditures on bakeyr products (a necessity) are plotted against income. Note that the slope is less steep than Figure 12 and levels off more rapidly. Inspection of Figure 11 indicates that the semi-logarithmic function may best fit the consumption of bakery products.

Although this procedure is not statistically rigorous, it seems intuitively correct and can be shown to give the same results as a more rigorous approach of plotting the errors against the independent variable, income. Note that in Figure 14 the errors resulting from the semi-logarithmic function stay nearer to zero for almost every observation than either the linear or logarithmic function. Thus indicating that the Engel curve for bread and bakery products is best fitted

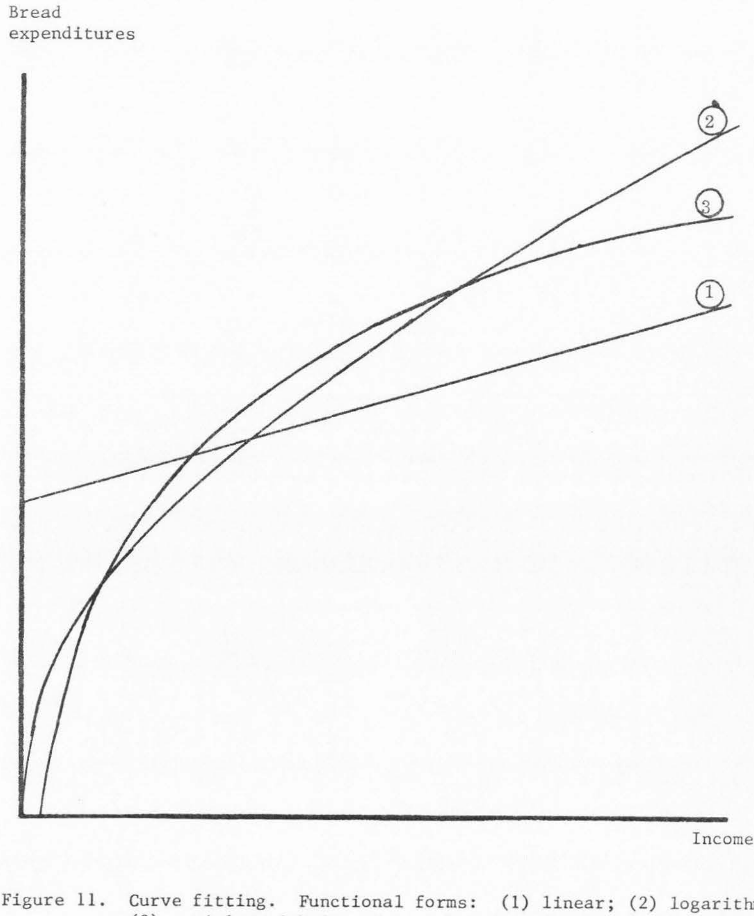


Figure 11. Curve fitting. Functional forms: (1) linear; (2) logarithmic; (3) semi-logarithmic. Data taken from Iranian family budget survey 1965.

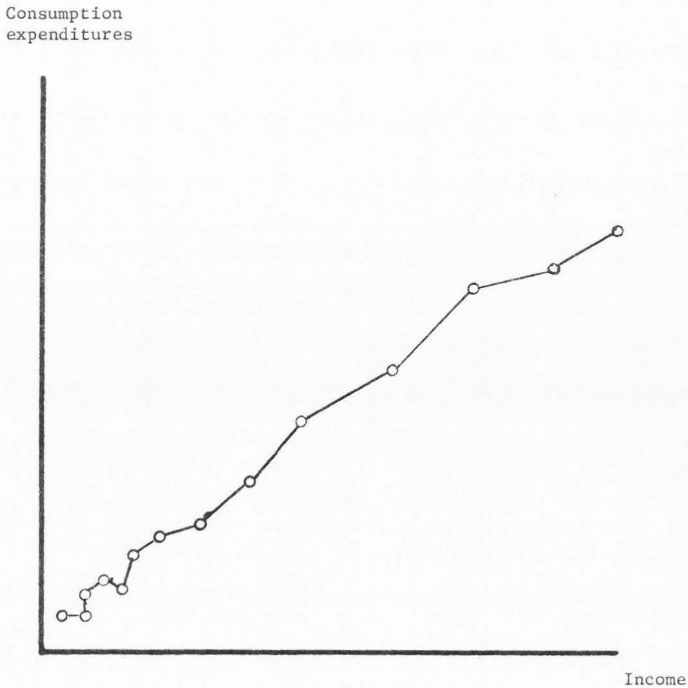


Figure 12. Expenditures on mutton and lamb plotted against income. Data taken from Iranian family budget survey 1965.

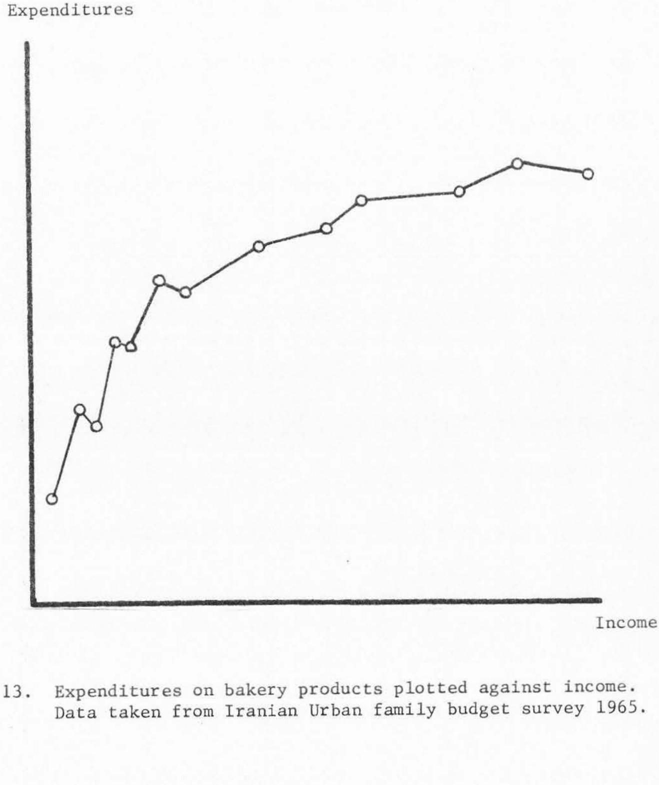


Figure 13. Expenditures on bakery products plotted against income. Data taken from Iranian Urban family budget survey 1965.

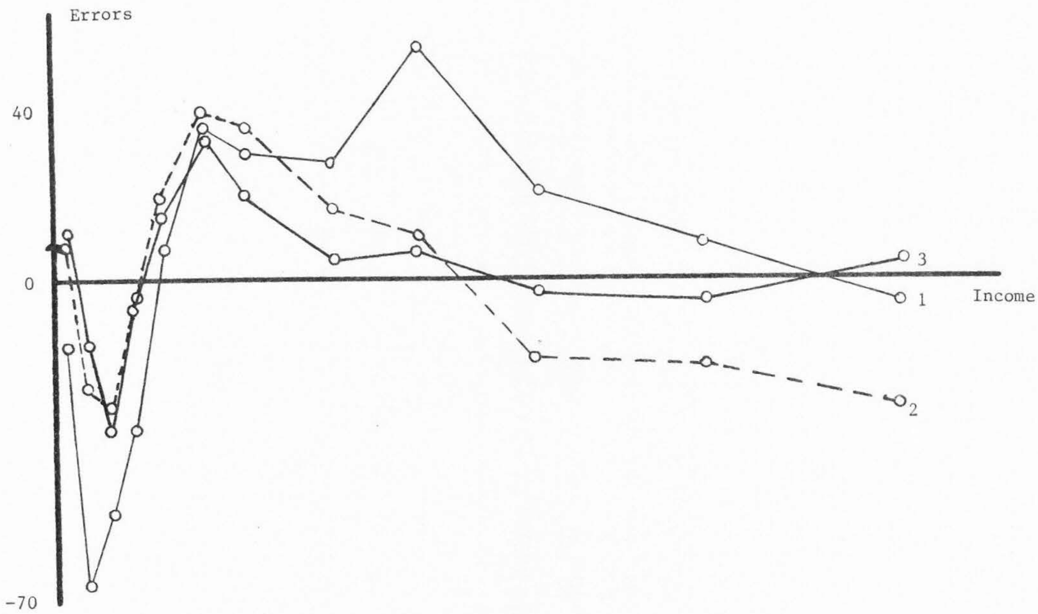


Figure 14. Bakery and bread, goodness of fit test. Errors plotted against income: (1) linear function, (2) logarithmic function, (3) semi-logarithmic function.

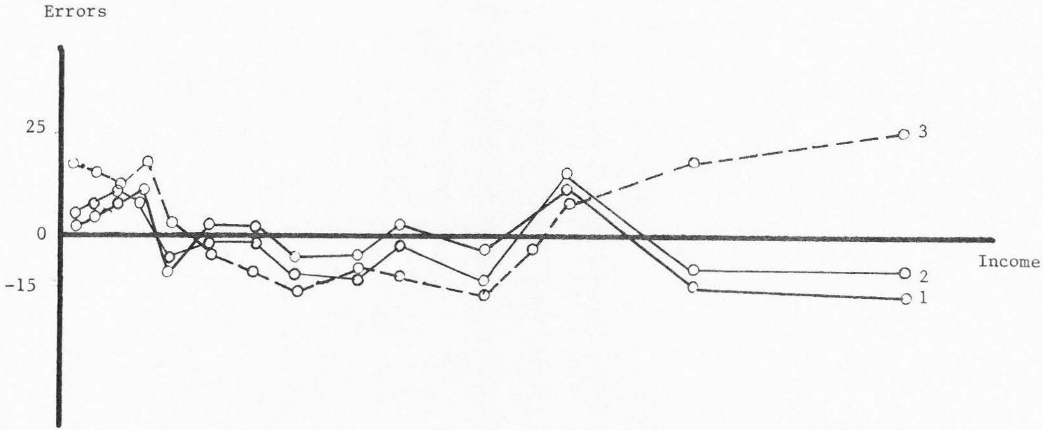


Figure 15. Mutton and lamb, goodness of fit test. Errors plotted against income: (1) Linear function, (2) Logarithmic function, (3) Semi-logarithmic function.

with the semi-logarithmic function. Figure 15 shows the opposite to be true for mutton and lamb. The errors for the semi-logarithmic function are positive then negative and then turn back positive again. This indicates that this function apparently has too much curve to fit the fairly linear data. The errors of either the linear or logarithmic function are consistently near zero indicating that statistically either functional fit may be suitable for the more luxury type items.

Simplicity of Computation

For commodities such as mutton and lamb where either logarithmic or linear fit is suitable, the logarithmic function will be used. The logarithmic function is well known for its computational advantages, such as its constant elasticity and the income beta equal to the income elasticity.[24] It also permits an easier introduction of household size than does the linear form.

Other Statistical Problems

It has been determined that expenditures on various commodities are a function of income and household size.[25] The functional relationship of these variables has also been determined as either logarithmic or semi-logarithmic. However, there is a slight difficulty with the relationship of these variables (Model I). There is a definite problem of multicolliniarity between income and household size in the rural data and a possible problem with the urban. The urban problem shall be considered first.

Multicolliniarity difficulties arise when the explanatory variables are highly correlated between themselves and one of them could well be expressed as a linear function of the others. Such is the case with the two explanatory variables (income and household size) in Model I. In fact, when household size is regressed as a function of income, 70 percent of the variation in household size is explained by income.

What usually happens when some or all of the explanatory variables in a relationship are highly correlated, is that it becomes very difficult, if not impossible, to disentangle their separate influences and obtain a reasonably precise estimate of their relative effects.[26] This problem in regression analysis is called multicolliniarity.

Multicolliniarity is commonly encountered in time series demand studies where the quantity demanded is assumed to be a function of real income and relative prices. Very often there is a high correlation between real income and relative prices causing an inter-correlation problem.

Least squares technique assumes that the dependent variable depends upon the independent variables, and that the independent variables are for the most part independent of each other. Take for example Model I:

$$X_i = B_o + B_2 Y_{2i} + B_3 H_{3i} + e$$

where:

$i = 1, 2, 3, \ldots$ [27]

Y = income

H = Average household size.

Suppose Y and H have a perfect linear relationship, and an attempt is made to estimate the parameters. If we write:

$$X = \begin{bmatrix} X_1 \\ X_2 \\ X_3 \\ . \\ . \\ . \\ X_{26} \end{bmatrix} \qquad Y = \begin{bmatrix} Y_{21} & H_{31} \\ Y_{22} & H_{32} \\ . & . \\ . & . \\ . & . \\ Y_{26} & H_{26} \end{bmatrix} \qquad B = \begin{bmatrix} B_2 \\ B_3 \end{bmatrix}$$

expressed in adjusted form, by least squares technique, the beta estimates are:

$$\hat{B} = (Y^1 Y)^{-1} Y^1 X$$

$$\text{with var. } (\hat{B}) = A^2 (Y^1 Y)^{-1}$$

This estimating procedure would break down if it were impossible to form $(Y^1 Y)^{-1}$ that is if $/Y^1 Y/ = 0$. Since we assumed Y_2 and H_3 to be exactly correlated, an auxillary equation of Y regressed against H can be written as follows:

$$Y_{2i} = K_2 + K_3 H_{3i}$$

then;

$$Y_{2i} = K_3 H_{3i}$$

and;

$$(Y^1 Y) = \begin{bmatrix} \Sigma Y_2^2 & \Sigma Y_2 H_3 \\ \Sigma Y_2 H_3 & \Sigma H_3^2 \end{bmatrix}$$

$$= \Sigma H_3^2 \begin{bmatrix} K_3^2 & K_3 \\ K_3 & 1 \end{bmatrix}$$

since;

$$\begin{bmatrix} K_3^2 & \\ & K_3 \\ K_3 & 1 \end{bmatrix} = 0, \qquad /Y^1 Y/ = 0.$$

This is an example of perfect multicollinearity because the two explanatory variables (Y and H) are perfectly correlated. This makes it impossible to estimate the separate influences of Y_2 and H_3 and the method of least squares breaks down.[28]

There are two alternatives which may be considered. First II already given above and secondly Model III. Model III is somewhat of a per capita model and much the same as Model I except it is divided through by household size so that $X/H = f(Y/H)$. Both Model II and III shall be rejected, however. First Model II would result in a biased estimate of $\left[\beta \right]$ due to misspecification as previously shown. Model III is rejected in that implicit within it is the assumption that $B_2 + B_3 = 1$ or that $B_3 = 1 - B_2$.[29] Observing B_3 of Model I in Table 5 shows that B_3 is certainly not equal to $(1-B_2)$ and hence, the implicit assumption of Model III makes it incorrect. Consumption theory as well, gives no basis for the assumption imposed by Model III.

Model I has then been chosen on the premise that even though a slight multi-collinearity problem may exist, at least the beta estimates are not biased due to misspecification as in Model II. Also, in spite of the larger variance the beta coefficients are highly significant for most commodities at the $\alpha = .05$ level. However, there are some regressions, such as bread and beef, for which the beta estimates are non-sensical.[30] For necessity type items, such as bread, the problem is easily overcome by fitting a semi-logarithmic function to the Engel curve. The variance is then explained much better and the regression coefficient (B_2) becomes highly significant (Tables 5 and 6).

Perfect correlation of independent variables, is an extreme case of what usually exists. In the present case of income and household

Table 5. Regression statistics for urban Iran, 1959-1965[a]

Product	X = f(Y H, D) Model (I)						X = f(Y D) Model (II)				
	β	S_b	t	F	R^2		β	S_b	t	F	R^2
Dairy products	.98	.121	8.10	101.88	.93	Y					
	.44	.341	0.43			H					
	.15	.11	1.35			D					
Cheese	.93	.18	5.25	50.80	.87	Y					
	.45	.50	0.89			H					
	-0.45	.16	-0.28			D					
Eggs	1.03	.157	6.54	94.28	.93	Y					
	.78	0.44	1.76			H					
	0.28	0.14	1.93			D					
Flour	0.081	0.393	0.206	6.61	0.47	Y					
	.11	0.11	0.99			H					
	.13	0.36	3.70			D					
Rice	.66	0.207	3.21	42.84	.85	Y					
	1.30	0.58	2.23			H					
	.59	0.19	3.16			D					
Bread & bakery	-.03	.202	-0.16	14.0	.65	Y					
	1.87	0.57	3.29			H					
	-0.11	0.18	-0.59			D					
Mutton	.87	0.0930	9.39	145.93	.95	Y					
	.22	.26	0.85			H					
	.14	-0.08	1.70			D					

Table 5. Continued

Product	X = f(Y H, D) Model (I)						X = f(Y, D) Model (II)				
	β	S_b	t	F	R^2		β	S_b	t	F	R^2
Beef	.18	0.131	1.37	10.68	.59	Y	.37	0.12	3.31	16.32	.75
	.52	.37	1.41			H					
	-0.18	0.12	-1.49			D					
Poultry	2.63	0.351	7.49	71.92	.91	Y	2.49	0.170	14.65	111.66	.91
	-0.45	1.01	-0.45			H					
	0.65	0.32	2.05			D					
Fish	1.45	0.210	6.89	51.01	.87	Y	1.26	0.104	12.12	75.75	.87
	-0.62	0.60	-1.03			H					
	0.25	0.19	1.33			D	0.28	0.19	1.48		
Fats & oil	.66	0.448	1.48	10.38	.59	Y	1.14	0.22	5.11	14.50	0.56
	1.58	1.29	1.23			H					
	.65	0.41	1.59			D	10.58	0.41	1.43		
Sugar & sweets	.58	0.267	2.17	5.06	.41	Y	.51	0.129	3.92	7.84	0.41
	-0.23	0.77	-0.31			H					
	-0.19	0.24	-0.78			D	-0.18	0.24	-0.76		
Fresh Fruits	1.19	0.234	5.09	51.19	.87	Y	1.40	0.12	12.11	76.11	0.87
	0.69	0.67	1.02			H					
	-0.61	0.21	-2.84			D	0.63	0.21	-3.00		
Fresh vegetables	.77	0.125	6.17	96.72	.92	Y	1.02	0.067	15.20	120.25	0.91
	0.82	0.36	2.29			H					
	-0.44	0.11	-3.86			D	-0.47	0.12	-3.86		
Canned fruit	1.35	0.394	3.41	12.39	.63	Y	1.13	0.19	5.88	18.88	0.62
	-0.72	0.11	-0.63			H					
	0.48	0.36	1.35			D	0.51	0.35	1.47		

Table 5. Continued

Product	X = f(Y, H, D) Model (I)						X = f(Y, D) Model (II)				
	β	S_b	t	F	R^2		β	S_b	t	F	R^2
Dried fruit	2.06	0.282	7.27	42.91	.85	Y	1.46	0.15	9.53	50.77	0.82
	-1.96	0.81	-2.41			H					
	0.69	0.26	2.70			D	0.78	0.28	2.77		
Pulses	0.53	0.221	2.41	22.32	.75	Y	0.86	0.11	7.61	29.62	0.72
	1.03	0.60	1.70			H					
	0.18	0.202	0.89			D	0.14	0.21	0.67		
Tea & coffee	.36	0.091	3.99	65.39	.90	Y	0.58	0.051	11.46	73.49	0.86
	0.68	0.25	2.74			H					
	0.323	0.083	3.90			D	0.29	0.093	3.18		
Spices & other foods	0.43	0.081	5.30	202.07	.96	Y	0.76	0.055	13.81	152.31	0.93
	1.04	0.22	4.70			H					
	1.03	0.074	13.96			D	0.99	0.10	9.74		
Non-alcoholic veverages	1.97	0.314	6.29	63.14	.90	Y	2.07	0.15	13.69	98.39	0.90
	0.30	0.86	0.35			H					
	0.62	0.29	2.16			D	0.61	0.28	2.17		
Alcoholic beverages	1.64	0.607	2.71	16.36	.69	Y	2.00	0.29	6.79	29.93	0.68
	1.101	1.65	0.66			H					
	0.86	0.55	1.55			D	0.82	0.54	1.50		
Food away from home	.54	0.219	2.45	26.81	.79	Y	0.93	0.115	8.06	33.51	0.74
	1.22	0.59	2.04			H					
	-0.36	.20	-1.81			D	-0.41	0.21	-1.94		
Tobacco	.40	0.111	3.64	43.52	.86	Y	0.59	0.574	10.23	56.86	0.83
	.58	.30	1.91			H					
	.27	0.10	2.68			D	0.24	0.106	2.33		

Table 5. Continued

Product	X = f(Y, H, D) Model (I)						X = f(Y, D) Model (II)				
	β	S_b	t	F	R^2		β	S_b	t	F	R^2
H. H. Textiles	.89	0.617	1.44	17.87	.71	Y	1.55	0.31	5.05	25.51	0.69
	2.06	1.69	1.22			H					
	2.75	0.56	4.87			D	2.66	0.57	4.71		
Women's leather shoes	1.00	0.190	5.26	66.55	.90	Y	1.29	0.096	13.41	90.23	0.89
	0.98	0.56	1.75			H					
	0.68	0.18	3.68			D	0.56	0.178	3.13		
Leather gloves	1.94	0.675	2.87	26.91	.79	Y	2.33	0.32	7.21	41.14	0.78
	1.33	1.99	0.67			H					
	4.12	0.65	6.35			D	3.96	0.59	6.65		
Underwear	-0.06	0.63	-0.10	13.45	.65	Y	1.64	0.36	4.58	11.29	0.50
	0.57	1.86	3.08			H					
	2.04	0.61	3.36			D	1.35	0.66	2.04		
Dresses	-0.28	0.70	-0.41	11.28	.61	Y	1.51	0.39	3.85	9.51	0.45
	6.04	2.06	2.93			H					
	2.66	0.67	3.94			D	1.93	0.72	2.67		
Men's cotton shirts	-0.12	0.616	-.19	9.28	.56	Y	1.33	0.34	3.95	8.09	0.41
	4.89	1.82	2.70			H					
	1.49	0.59	2.51			D	0.89	0.62	1.44		
Cloth & leather shoes (HS)	1.01	1.65	6.10	115.02	.95	Y					
	1.21	.48	2.49			H					

Table 5. Continued

Product	Model (I): $X = f(Y, H, D)$ β	S_b	t	F	R^2		Model (II): $X = f(Y, D)$ β	S_b	t	F	R^2
Men's leather gloves (HS)	1.67	.50	3.35	22.17	.80	Y					
	.51	1.46	.35			H					
Table linen	1.49	.312	4.80	34.45	.86	Y					
	-.27	.91	-.30			H					
Men's stockings	.19	.54	0.35	6.40	.54	Y					
	2.64	1.59	1.66			H					
Handkerchiefs	1.02	.45	2.24	18.92	.77	Y					
	1.68	1.33	1.26			H					
Cotton suits	.03	.78	.04	7.21	.57	Y					
	4.69	.23	2.05			H					
Leather cases & wallets (HS)	1.46	.44	3.33	21.13	.79	Y					
	.36	1.29	.28			H					

Significance level	Model I $t(\eta-4) = 22$	F	Model II $t(\eta-3) = 23$	F	Variable or statistic	Notation
$\alpha = .10$	1.717		1.714		Regression coefficients	β
$\alpha = .05$	2.074	3.05	2.069	3.42	Variance of regression coefficients	S_b

Table 5. Continued

Significance level	Model I $t(\eta-4) = 22$	F	Model II $t(\eta-3) = 23$	F	Variable or statistic	Notation
$\alpha = .025$	3.42		2.807		Significance of betas	t
$\alpha = .01$		4.94		5.61	General significance test of model	F

[a] Y represents the regression statistics for the income beta while those for household size and dummy variable correspond to H and D respectively.

Table 6. Regression statistics for urban Iran, 1959-1965

Product	Semi log: $X = f(Y, H, D)$ $(X = {}_1 + {}_1 \text{ Log } Y)$					
	β	S_b	t	F	R^2	
Dairy products	81.27	6.43	12.65	111.29	0.94	$\eta^a = 1.55$
	-28.16	4.99	-5.63			
	-13.59	5.25	-2.59			
Cheese	35.83	4.59	7.81	41.29	0.85	
	-12.92	3.57	-3.62			
	-10.05	3.75	2.68			
Eggs	21.74	1.31	16.63	209.60	0.97	$\eta^a = 1.64$
	- 6.90	1.02	-6.78			
	- 3.63	1.07	-3.40			
Flour	1.13	2.56	0.44	13.70	0.65	$\eta^a = .087$
	0.86	1.99	0.43			
	12.47	2.10	5.95			
Bread & bakery	25.23	8.28	3.048	88.07	0.92	$\eta^a = 0.18$
	27.17	6.44	4.218			
	- 2.29	6.77	-0.339			

[a] η denotes income elasticity which has been shown equal to β/X. See Table 4.

size the simple correlation between the two is 0.835. For a case like this, when the correlation between the independent variables are high, one usually expects a high standard error for the beta coefficients. This high standard error is evidence that the problem of multicollinearity exists. Note that:

$$\text{var}\ (\beta_2) = \frac{\alpha 2}{\Sigma Y^2_{2.3}} \quad \text{var}\ (\beta_3)\ \frac{\alpha 2}{\Sigma H^2_{3.2}}$$

or more generally: $\alpha 2\ /Y^1Y/^{-1}$ when Y_2 and H_3 are highly correlated $\Sigma Y^2_{2.3}$ and $\Sigma\ H^2_{3.2}$ become very small and diminish as the correlation between the two variables increases. This results in an increase in the variance of the beta coefficients, leading one to believe that multicollinearity may be dictated by unduly large standard deviation for the beta coefficient.[31]

Since α^2 is estimated by $\ddot{S}^2 = \frac{(e'e)}{N-k}$, it is apparent that even though the highly correlated $(Y'Y)^{-1}$ matrix tends to blow up, the var ($\hat{\beta}$) may be dampened. However comparing the var ($\hat{\beta}_2$)[32] from Model I with those of Model II $\left[X = f(Y)\right]$ shows that in spite of the high R^2 for most regressions, helping to dampen the var ($\hat{\beta}$), the var $(\hat{B}_2)$ from Model I is consistently about 35 to 55 percent above the var ($\hat{\beta}_2$) from Model II.[33] This is further evidence of a possible problem with multicollinearity in Model I.

For the few remaining regressions with nonsensical beta estimates, adjustments were made from international comparisons and other similar Iranian products. Then a check was made to determine if any gross error was present in the estimated elasticities for food products. The check was an effort to determine if the effect of income and household size on expenditures had been given their proper weight. Since multi-collinearity could confound the proper weight of the two independent variables on the dependent variable, it seemed desirable to make a rough check after adjusting these few problem regressions on a priori grounds. This check was made according to the following equation:

$$(18) \quad E_{Ht} = \Sigma \frac{x_i}{x_t} E_{Hi}$$ [34]

where:

E_{Ht} = partial elasticity of household size with respect to total food

$\Sigma \frac{x_i}{x_t}$ = the ratio of expenditures on commodity i to total food expenditures

E_{Hi} = partial elasticity of household size for commodity food i.

Equation (18) tests to determine if the summed effect of household size on all commodity food expenditures is equal to the effect of household size on total food. The effect of household size on total food (E_{Ht}) is expected to be between 0.28 and 0.35.[35] When E_{Ht} of equation (18) was solved using the parameters estimated from the urban surveys it was calculated equal to 0.3402. This is safely within the expected range.

It is obvious that this crude test does not prove that each of the E_{Hi} are good estimates of the true parameters. It simply shows that the estimates as an over-all group check closely with estimates from other studies and a priori expectations.

Thus far the problem of multicollinearity has been discussed with reference to the urban data only. Such a large multi-collinearity error results from regressing expenditures against income and household size with the rural data that the separate effects of income and household size are greatly confounded.[36] Therefore, instead of regressing expenditures against both income and household size, parameters were estimated from expenditures as a function of income only. Then the resultant income elasticities were adjusted for the effect of household size. This adjustment was made according to an equation suggested by Houthakker and Goreaux.

(19) $b^*_{2i} = b_{2i} - E_{Hi}h$

where:

b^*_2 = the true income elasticity for commodity i.

b_2 = the empirical elasticity estimated from Model II $X - f(Y)$ --un-adjusted for the effect of household size.

E_H = the assumed partial elasticity of demand W.R.T. household size for commodity i.

h = the elasticity of household size W.R.T. income.

The value of b_2 for each commodity was readily estimated from the rural data. The elasticity of household size with respect to income was estimated to be h = 0.4302, according to the equation.

(20) $\log H = B_o = b_2 \log Y + e$.

The only other unknown needed to solve for b^*_{2i} was E_{Hi}. The E_{Hi}'s were taken from the urban results with the assumption that the effect of household size would be very similar between urban and rural Iran. Although it is readily admitted that this technique will probably not provide the true effect of household size for every commodity, the approach seems better than ignoring the influence of household size completely.[37]

It should be noted that the value of E_Hi will vary in magnitude and sign for diverse commodities. The value of E_{Hi} influenced by two factors, an income effect and the effect of economies of scale. Generally, these two factors have the opposite sign. The demand elasticity in relation to household size is, therefore, positive if the income effect predominates, and negative if the specific economies of scale prevail.

CHAPTER IV

FINAL ADJUSTED ELASTICITY COEFFICIENTS

This chapter begins by examining the adjustment of the income elasticities for changes that may occur through time. Two measures of expected changes are given, static and dynamic measure. The reader may be interested in the final adjusted coefficients only; in which case, he may desire to go directly to the concluding section of this chapter where the final adjusted elasticities are presented.

The Change in Elasticity Coefficients Through Time

Income elasticities have been estimated for the purpose of measuring the shift in the demand curve due to the income effect. These elasticities must be adjusted for expected changes through time. The reason adjustment is necessary stems from a fairly simple notion. These elasticities measure the expected increase in expenditures as income rises. However, it is obvious that these expenditures will not be bidding for homogeneous food products through time. That is, as income rises the increased expenditure will be bidding for (1) greater quantities of food, and (2) food services. Food services include such things as better quality, more highly processed foods and increased marketing costs. Food services can be thought of as a normal good and thus as income rises the demand for food services increases according to some functional relationship.

The need for adjusting the elasticities can be conveniently illustrated by the simple diagram in Figure 16. Suppose that for a certain year (t_o) the price and income level are such that the expenditures (E_o) for product K are consumed at price P_o. Now given the computed income elasticity coefficient and predicted income for year t_1, the shift of D D to D'D can be computed. For simplicity assume supply doesn't shift, but is perfectly elastic. Then E_1 will be the predicted expenditure for a given amount of product K. However, this may not be the desired prediction at all. It may be that $E_{11} - E_o$ represents the actual expenditure bidding for increased quantities of K and $E_1 - E_{11}$ is the expenditure bidding for increased food services. Therefore, to get a more correct estimate of expenditures on actual quantities of K, the income elasticity should be adjusted to predict a shift in D D to D"D" instead of D'D'.

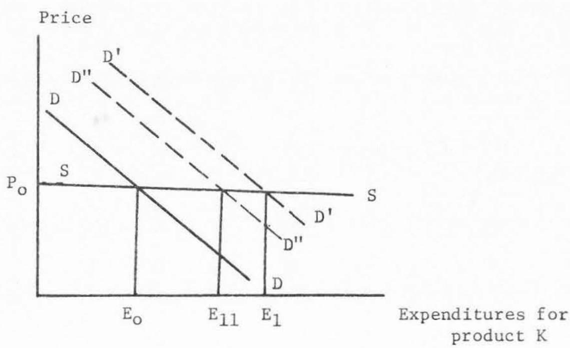


Figure 16. Demand adjustment due to service effect.

Since we desire to forecast the quantity demand of agricultural goods for 1970, 1977 and 1980, it is necessary to forecast quantities of a homogeneous good of the type which is presently on the market. Therefore it is necessary to determine the effect of the so-called food services and remove this bias from the income elasticity so that it reflects only the increase in expenditures for food quantities and not food services also.

A static measure of the effect of food services is the quality elasticity.

Quality Elasticity

Quality elasticities measure the added quality or services which consumers buy in food purchases as their income increases. For each per cent increase in income the quality elasticity measures the percentage increase consumers pay for food services. For example, as a family's income increases they may begin buying prepared soup in a can. Before this time they may have been purchasing potatoes, carrots, onions, and a variety of other items, utilizing them to make their own soup.

This means then, that the quality elasticity which measures how quality purchases increase with incremental increases in income is measuring a price effect. It is measuring the increase in prices associated with purchases of higher quality food, that is, it measures increases in prices due to added preparation, care, and or marketing services.

Quality elasticities can be derived by taking the simple numerical difference between a commodity's expenditure elasticity and its quantity elasticity of demand. This can be shown mathematically by writing per capita expenditure on the i-th commodity (X_i) in terms of its quantity (Q_i) times its price (P_i). ($X_i = P_iQ_i$). The expenditure elasticity is the change in expenditures on commodity i due to a given change in income and can be written

$$\frac{dX_i}{dY} \frac{Y}{X_i} = \frac{d(P_iQ_i)}{dY} \frac{Y}{P_iA_i} = \left[A_i \frac{dP_i}{dY} + \frac{P_i dQ_i}{dY} \right] \frac{Y}{P_iQ_i}$$

which gives

$$(21) \quad \frac{dX_i}{dY} \frac{Y}{X_i} = \left(\frac{dP_i}{dY} \frac{Y}{P_i} \right) + \left(\frac{dQ_i}{dY} \frac{Y}{Q_i} \right)$$

From equation (21) we see that the expenditure elasticity per commodity i is equal to the quality elasticity plus the quantity elasticity.[38]

It is important to realize that all commodities will not take on equal quality changes as income increases. The increase in quality of any one product will depend on the nature of the commodity, its alternative preparations and consumer tastes.

The quality effect is illustrated in Figure 17, which shows both the expenditure (in rials) on meat and the quantity bought as varying with family income. The solid line 1 represents weekly family expenditures for meat in the city of Tehran. The dotted line 2 is the actual quantities (in grams) of meat purchased weekly. Note the increasing divergence between the solid (expenditure) and dotted (quantity) lines. This divergence is a measure of the quality elasticity previously derived and discussed.

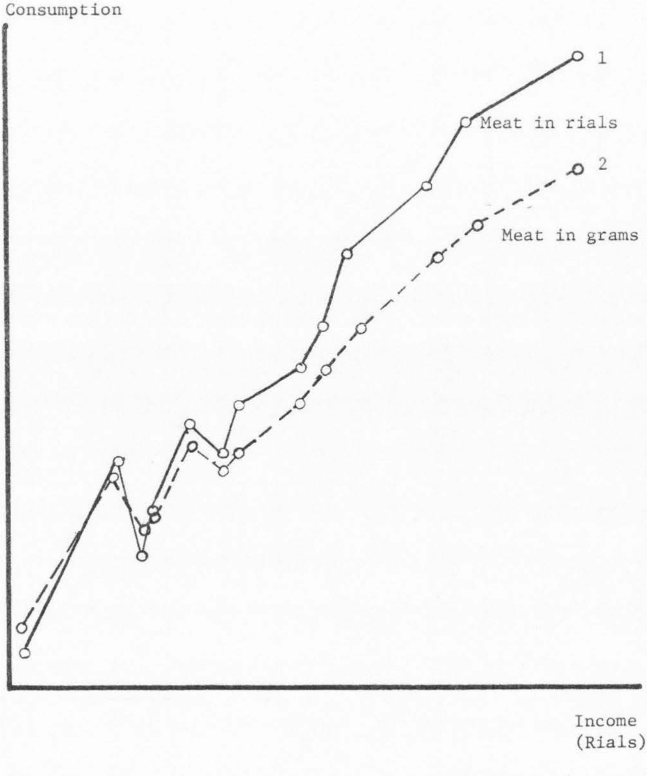


Figure 17. Meat consumption plotted against income. Both axes in logarithmic units. Data taken from 1965 Iranian survey for city of Tehran.

Quality elasticities have been estimated from the 1965 family budget data and appear in Table 7. They provide a means of adjusting the expenditure elasticities for the quality effect. The quality elasticities (N_Q) in Table 7 were calculated by use of equation (21) and the quality and expenditure elasticities are given in Tables 8 and 9, beginning on page 77. Appropriate statistical tests are included in each table and will not be elaborated here.

Inspection of Table 7 shows that the quality effect for such items as fruit, prepared food, dried fruit and nuts and various sweets are of considerable magnitude. These results appear to be in general agreement with a priori expectations in that considerable quality variation for these goods is present in the market place. These commodities also represent a generally small proportion of family food expenditures. Therefore a substantial percentage increase of quality expenditures on these items will not greatly increase the total family food costs. The highly significant quality effect is also accounted for by the high value of the expenditure elasticities.

The quality coefficient for meat and vegetables is high. This apparently stems from the fact that these two items represent basic expenditures in the family food budget. Hence for these commodities, there is a large market with a great amount of variation in product quality so that higher quality is readily available upon demand.

One commodity for which the quality effect appears surprisingly small is dairy products. It seems that Iran (a developing country) should be an a priori example of variation in consumption of dairy

Table 7. Quality and market margin elasticities

	B_2 [a]	N_Q [b]	N_m [c]
Dairy products	1.296	0.028	0.157
Flour, macaroni, noodles, etc.	1.172	0.187	0.156
Bread	0.251	0.075	0.019
Rice	0.676	0.078	0.115
Meat	1.034	0.170	0.156
Fats	0.632	0.046	0.156
Sugar	0.232	0.019	0.010
Honey	1.394	0.120	0.010
Bakery sweets	2.224	0.083	0.121
Other sweets	1.333	0.662	0.121
Fruit	1.206	0.456	0.154
Prepared foods (away from home)	2.077	0.442	0.158
Tea and coffee	0.421	0.071	0.037
Nonalcoholic beverages	2.606	0.583	0.152
Dried fruit and nuts	2.435	0.298	0.156
Pulses	0.529	0.023	0.050
Pickles	1.645	0.315	0.156
Spices	0.511	0.081	0.155
Total food			0.156
Vegetables	0.767	0.159	0.079

[a] B_2 is unadjusted expenditure elasticity for Tehran, (1965). For more detail see Table 8 .

[b] N_Q is the quality elasticity derived in equation (21). These coefficients were calculated from data taken from the Tehran family budget survey 1965.

[c] N_m is the market margin elasticity and are estimates made by Ronaghy.

products. Even from say, raw milk to pasteurized milk, considerable variation exists. However, pasteurization and milk processing of this nature is yet in the developing stages and not wide spread. This may account in part for the low value. As refrigeration becomes more wide spread and the market for general consumption of pasteurized milk, ice cream, etc. develops, more quality variation will be available.

For the remaining commodities the effect of quality variation is on the whole significant and always positive. In magnitude, however, their importance is not as great, being generally less than one-tenth. For example, pulses are only 0.023. One would expect this result since quality variation for dry beans and lentils is very limited.

Dynamic Measure of Demand for Food Services

During economic development changing market structures contribute to a dynamic increase in the demand for food services. This alteration in the market structure stems from two sources: (1) the growth of retail markets in the rapidly expanding urban centers and (2) the spread of urban style retail markets to non-urban areas.

In the process of economic development a nation undergoes a series of major structural changes. But mass movement of population from rural to urban areas is the most important structural change influencing food requirements at different points in the marketing channel.[39] As most countries develop and their population migrates to urban centers better food commodity markets are developed and increasingly more food is channeled and sold through retail markets. Selling food through retail markets involves more processing, preserving, packing and marketing costs than home produced food or food sold at the farm gate.

While urban consumers are somewhat forced (because of their location) to purchase highly marketed retail food, non urban consumers, also seem to favor consuming retail food of urban quality as soon as it becomes available.[40] For example, households in urban centers may begin purchasing more canned goods and other foods such as prepared cereal as their income increases. This is the quality effect. Then these trends in food purchases spread to other areas until they become commonplace among rural communities even though income has not risen to the urban level at which this type of food consumption began.

Since dynamic change in the demand for food services depends on the formation and spread of retail markets, it is necessary to examine how the market structure changes through time.

Robert D. Stevens, with a team of economists from the Economic Research Service, U.S. Department of Agriculture, made a study using data from 70 different counties. In his study, Stevens examined the magnitude and changes in food flows at various market levels as economic growth occurred. The purpose of his study was to work out the methodology for estimating these changes. Stevens found that income elasticities of Food at Retail, Food at Wholesale, and Supplier Food were greatly influenced by market structural changes.[41] That means that the value of income elasticities estimated for food consumption will vary according to the market level at which the elasticities are measured.

It also means that during development the relationship between the elasticities measured at different market levels will not remain constant due to market structure changes. There are four levels at which elasticities can be measured.[42]

The importance of careful specification of the food measures used has been demonstrated by Daly,[43] Goreux,[44] and Burk.[45] Their work has shown that different income elasticities occur when food is measured at various market levels or in different ways over the same time period.[46]

In this study the income elasticities have been measured at the retail level. These elasticities should be adjusted to the wholesale level. If retail elasticities are used instead of wholesale, computed future food requirements will reflect an increased expenditure for the same quantity of food.

As the market margin increases people are paying more and more for the same quantity of goods. The increase in market margin then, represents dynamic added costs for food services.

It is, however, a difficult problem to anticipate the changes through time which will occur in the market margin of different food commodities. This is an area which needs further research. For the purposes of this study the changes in the market margin estimated by Hassen Ali Ronaghy have been used.[47] These estimates appear in Table 7 and were only used to adjust the elasticities when the static measure (quality elasticity) was small compared to the dynamic market margin estimates.

In summary, we desire to forecast the quantity demanded of homogeneous goods of the type presently on the market. Therefore it is necessary to determine the effect of the so-called food service and remove this bias from the income elasticity so that it reflects only the increase in expenditures for food quantities and not the increased demand for food services also.. First the quality elasticity was presented as a static measure of the food service effect. The quality elasticity measured the added "food services" demanded as consumer income increased.

Secondly, we looked at changes in the market structure for an explanation of the food service effect. It was determined that the change of the market margin through time was a dynamic measure of the food service effect. This agrees with the static measure of the food service effect in that the market margin also increases as income rises. However, the market margin increases during economic development at a faster rate than the income effect alone would dictate. Two other effects accelerate the growth of the market margin (i.e., food service effect): 1, the rapid growth of retail markets and 2, the spread of retail markets to non-urban areas. Therefore, if the changes in the market margin could be accurately anticipated, this measure of the food service effect would be a dynamic measure and would exceed the static income measure, particularly during economic development. However, future market margins are not easily estimated. Given present techniques, estimates of the future market margins and quality elasticities have been used in this paper as a measure of the food service effect to adjust the income elasticity coefficients for changes through time.

Estimated Elasticity Coefficients

The final income elasticities (β_2) are now presented in Tables 8, 9, 10, 11, and 12 along with other parameters estimated from the Engel curves.[48] The adjusted income elasticities (η adj) developed in the previous section also appear in these Tables. Tables 8 and 9 give, respectively, the quantity and expenditure elasticities for Tehran, the Capital City. Expenditure elasticities and additional parameters for urban and rural Iran are given in tables 10 and 11. Table 12 contains semi logarithmic estimates for Tehran.

Several comments are in order. First of all, it should be kept in mind that logarithmic functions were used to obtain all the results shown except in the case of certain staple foods such as bread.[49] The beta coefficients are not significant for bread but, the semi logarithmic function gives much better results. Bread is a necessary commodity on two counts; (1) the extensive consumption of bread products and (2) its low elasticity both in the absolute and relative sense.

It is not surprising that problems of insignificance exist for certain alcoholic beverages. Much of the problem arises from the fact that it is difficult to obtain unbiased data for this commodity. It is a well known fact that consumption of alcoholic beverages is usually reported with a downward bias.[50] Especially in a Moslem nation where spirits are frowned upon.

The elasticities for food, including those just mentioned, are all positive and generally significant at the alpha 0.025 level. Looking

Table 8. Estimated parameters of Engel curves, Tehran, 1965 study: quantity (grams) consumed as a function of income and household size $X = f(Y, H)$

Product	β_2	S_{b_2}	T_2	β_3	S_{b_3}	T_3	F	R^2
Dairy products	1.268	0.416	3.05	-0.369	0.836	-0.44	10.34	.67
Flour, macaroni noodles, etc.	0.985	0.584	2.94	0.427	1.174	0.36	14.82	.75
Bread	0.186	0.086	-1.31	1.297	0.73	7.51	59.66	.92
Rice	0.599	0.547	1.05	0.792	1.099	0.72	3.31	.40
Meat	0.864	0.115	7.555	0.470	0.23	2.04	120.86	.96
Fats & oil	0.586	0.383	1.53	0.509	0.770	0.66	6.21	.55
Sugar	0.213	0.129	1.66	0.564	0.259	2.18	18.70	.79
Honey	1.274	0.821	2.44	-0.563	0.165	-0.34	0.25	.05
Bakery sweets	2.216	0.641	3.46	0.109	1.289	0.08	17.50	.79
Other sweets	0.478	0.625	0.77	0.118	1.289	0.08	3.71	.43
Fruit	0.750	0.407	1.85	1.176	0.819	1.44	13.74	.73
Vegetables	0.608	0.116	4.39	0.914	0.233	3.93	87.82	.95
Prepared foods (away from home)	1.635	0.336	4.90	-1.867	0.676	-2.76	13.97	.74
Tea & coffee	0.421	0.203	2.07	0.357	0.408	0.87	11.24	.69
Non-alcoholic beverages	2.023	0.507	4.19	1.307	1.020	1.28	39.14	.89
Alcoholic beverages	2.101	1.053	2.42	-1.122	2.117	-0.53	5.73	.53
Dried fruits & nuts	2.137	0.852	2.51	-0.192	1.713	-0.11	8.25	.62
Pulses	0.506	0.385	1.44	0.345	0.773	0.45	0.99	.16
Pickles	1.330	0.866	2.70	-1.265	1.742	-0.73	6.55	.57
Spices	0.4300	0.835	0.46	0.754	1.680	0.45	1.05	.17

Table 8. Continued

Significance level	$t(\eta-3) = 11$	F	Variable or statistic	Notation
$\alpha = .1$	1.796		Income coefficient	β_2
$\alpha = .05$	2.201	3.98	Household size coefficient	β_3
$\alpha = .025$	3.016		Variance of regression coefficient	S_{b_i}
$\alpha = .01$		7.21	Significance of beta	t_i
			General significance test of model	F

[a]All regression statistics are from logarithmic functions

Table 9. Estimated parameters of Engel curves, Tehran, 1965 study: expenditures (rials) as a function of income and household size $X = f(Y, H)$

Product	β_2	S_{b_2}	T	β_3	S_{b_3}	T	F	R^2	η_{adj}
Dairy products	1.296	0.506	2.56	-0.642	1.018	-0.63	6.13	.55	1.140
Flour, macaroni, noodles, etc.	1.721	0.473	3.64	-0.595	0.951	-0.96	14.05	.74	0.985
Bread	0.261	0.076	-0.76	0.127	0.153	8.35	84.71	.94	0.186
Rice	0.676	0.302	2.24	0.385	0.607	0.63	10.83	.68	0.521
Meat	1.034	0.128	8.04	0.095	0.258	-0.37	84.67	.94	0.864
Fats	0.632	0.435	1.453	0.291	0.875	0.33	0.422	.46	0.476
Sugar	0.232	0.121	1.918	0.494	0.244	2.02	19.74	.80	0.213
Honey	1.394	0.564	2.47	-2.500	1.135	-2.20	3.12	.38	1.274
Bakery sweets	2.224	0.532	4.18	-0.206	1.070	-0.19	22.85	.82	0.750
Other sweets	1.333	0.431	3.09	-0.027	0.867	-0.03	13.24	.73	1.212
Fruit	1.200	0.330	3.63	0.340	0.664	0.51	23.16	.82	0.750
Vegetables	0.767	0.093	8.27	0.474	0.186	2.54	153.04	.97	0.608
Prepared food (away from home)	2.077	0.755	3.53	-1.476	1.519	-0.97	11.13	.69	1.635
Tea & coffee	-0.100	0.268	-0.37	1.046	0.538	1.94	3.88	.44	0.350
Non-alcoholic beverages	2.606	0.323	6.28	-1.703	1.052	-1.62	36.30	.88	2.023
Alcoholic beverages	3.917	1.188	3.30	-2.826	2.390	-1.18	8.45	.63	2.101
Dried fruits & nuts	2.435	0.645	3.78	-1.103	1.297	-0.85	13.83	.73	2.137
Pulses	0.529	0.273	0.23	1.163	0.549	2.12	7.53	.60	0.479

Table 9. Continued

Product	β_2	S_{b_2}	T	β_3	S_{b_3}	T	F	R^2	η_{adj}
Pickles	1.645	0.645	2.55	-0.327	1.297	-0.25	7.80	.61	1.330
Spices	0.511	0.158	3.24	1.111	0.650	1.71	1.72	.26	0.356
Total food	0.751	0.102	7.36	0.184	0.205	0.89	92.20	.95	

Significance level	$t(\eta-3) = 11$	F
α = .10	1.796	
α = .05	2.201	3.98
α = .025	3.106	
α = .01		7.21

Variable or statistic	Notation
Income coefficient	β_2
Household size coefficient	β_3
Variance of regression coefficients	S_{b_i}
Significance of beta	t_i
General significance test of model	F

[a]All regression statistics are from logarithmic functions

Table 10. Estimated parameters of Engel curves, urban Iran, 1959-1965 studies: expenditures (rials) as a function of income, household size and dummy variable $X = f(Y, H, D)$

Product	$\beta 2$	S_{b_2}	T	β_3	S_{b_3}	T	F	R^2	η_{adj}
Dairy products	0.98	0.121	8.10	0.15	0.341	0.43	101.88	.93	0.880
Cheese	0.93	0.18	5.25	0.45	0.50	0.80	50.80	.87	0.862
Eggs	1.03	0.157	6.54	0.78	0.44	1.76	94.28	.93	1.008
Flour	0.81	0.393	0.206	0.11	0.11	0.99	6.61	.47	0.243
Rice	.66	0.207	3.21	1.30	0.58	2.23	42.84	.85	0.564
Bread+	25.23	8.28	3.048	27.17	6.44	4.21	89.07	.92	0.183
Mutton	0.87	0.093	9.39	0.22	0.26	0.84	145.93	.95	0.870
Beef	0.18	0.131	1.37	0.52	0.37	1.41	10.68	.59	0.370
Poultry	2.63	0.351	7.49	-0.45	1.01	0.45	71.92	.91	1.715
Fish	1.45	0.210	6.89	-0.62	0.60	-1.03	51.01	.87	1.20
Fats & oil	0.66	0.448	1.48	1.58	1.29	1.23	10.38	.59	0.564
Sugar & sweets	0.58	0.267	2.17	-0.23	0.77	-0.31	5.06	.41	0.532
Fresh fruits	1.19	0.234	5.09	0.69	0.67	1.02	51.91	.87	0.782
Fresh vegetables	0.77	0.125	6.17	0.82	0.36	2.29	96.72	.92	0.711
Canned fruit	1.35	0.384	3.41	-0.72	0.11	-0.63	12.39	.63	1.350
Dried fruit	2.06	0.282	7.27	1.96	0.89	-2.41	42.91	.85	1.366
Pulses	0.53	0.221	2.41	1.03	0.60	1.70	22.32	.75	0.479
Tea & coffee	0.36	0.091	3.99	0.68	0.25	2.74	65.39	.90	0.328
Spice & other foods	0.43	0.081	5.30	1.04	0.22	4.70	202.07	.96	0.362
Non-alcoholic beverages	1.97	0.314	6.29	0.30	0.86	0.35	63.14	.90	1.970
Alcoholic beverages	1.64	0.607	2.71	1.10	1.65	0.66	16.36	.69	1.640

Table 10. Continued

Product	β_2	S_{b_2}	T	β_3	S_{b_3}	T	F	R^2	η_{adj}
Food away from home	0.54	0.219	2.45	1.22	0.59	2.04	26.81	.79	1.635
Tobacco	0.40	0.111	3.64	0.58	0.30	1.91	43.52	.86	0.405
Total food	0.92	0.115	8.06				33.51	.74	
Household textiles	0.89	0.617	1.44	2.06	1.69	1.22	33.51	.71	0.78
Women's leather shoes	1.00	0.900	5.26	0.98	0.56	1.75	66.55	.90	0.95
Leather gloves	1.94	0.675	2.87	1.33	1.99	0.67	26.91	.79	1.80
Underwear	0.060	0.63	-0.10	5.73	1.86	3.08	13.45	.65	
" " +	1.64	0.358	4.58				11.29	.49	
Dresses	-0.28	0.70	-0.41	6.04	2.06	2.93	11.28	.61	1.21
" "+	1.51	0.391	3.85				9.51	.45	
Men's cotton shirts	-0.122	0.616	-.19	4.89	1.82	2.70	9.28	.56	1.10
" " +	1.33	0.336	3.95				8.09	.41	
Cloth & leather shoes	1.01	1.65	6.10	1.21	0.48	2.49	115.02	.95	0.96
Men's leather gloves	1.67	0.50	3.35	0.51	1.46	0.35	22.17	.80	1.52
Table linen	1.49	0.312	4.80	-.27	0.91	-.30	34.45	.86	1.45
Men's stockings	0.76	0.54	0.35	2.64	1.59	1.66	6.40	.54	0.68
Handkerchiefs	1.02	0.45	2.24	1.68	1.33	1.26	18.92	.77	1.00

Table 10. Continued

Product	β_2	S_{b_2}	T	β_3	S_{b_3}	T	F	R^2	η_{adj}
Cotton suits	0.03	0.78	0.04	4.69	0.23	2.05	7.21	.57	1.05
	1.45	0.83	2.30				28.66	.70	
Leather cases	1.46	0.44	3.33	0.36	1.29	0.28	21.13	.79	1.37

Significance level	$t(\eta-4) = 22$	F	Variable or statistic	Notation
$\alpha = .10$	1.717		Income coefficient	β_2
$\alpha = .05$	2.074	3.05	Household size coefficient	β_3
$\alpha = .025$	2.819		Coefficient	S_{b_i}
$\alpha = .01$		4.94	Significance of beta	t_i
			General significanct test of model	F

[a]Parameters of commodities marked (+) from semi-log transformation; all others are logarithmic

Table 11. Estimated parameters of Engel curves, rural Iran, 1963-1964-1965 studies: expenditures as a function of income and dummy variable $X = f(Y, D)$

Product	β_2	S_{b_2}	T	F	R^2	η_{adj}
Dairy products	1.356	0.152	8.95	63.75	.86	1.005
Cheese	1.895	0.149	12.73	68.53	.87	1.445
Eggs	1.452	0.165	8.82	63.85	.86	0.672
Fruit	1.60	0.132	12.11	69.16	.87	1.260
Vegetables	1.177	0.098	12.07	78.07	.88	0.745
Dried fruits & nuts	1.203	0.124	9.68	53.02	.83	2.306
Pulses	1.136	0.168	6.77	15.73	.60	0.692
Sugar	0.722	0.034	21.33	274.88	.96	0.612
Flour, macaroni, noodles, etc.	1.719	0.301	5.71	19.64	.65	1.139
Rice	2.030	0.208	9.76	82.50	.89	1.645
Bread	1.389	0.211	5.69	62.94	.86	0.369
Beef	2.318	0.321	7.45	36.63	.76	1.798
Lamb	2.653	0.369	7.18	30.34	.74	2.433
Poultry	2.312	0.387	5.98	29.09	.73	2.312
Fish	2.092	0.301	6.96	33.85	.76	1.842
Coffee & tea	1.186	0.184	6.45	55.54	.84	0.506
Spices	1.272	0.183	6.95	52.83	.83	0.334
Wheat flour$^+$	1.580	0.347	4.55	21.62	.67	1.470
Wheat$^+$	0.965	0.253	3.82	7.37	.41	0.855
Barley flour$^+$	0.907	0.316	2.87	6.37	.38	0.794
Barley$^+$	-0.004	0.368	-0.01	0.51	.05	0.113
Oil$^+$	1.406	0.284	4.95	14.04	.57	1.115

Table 11. Continued

Product	β_2	S_{b_2}	T	F	R^2	η_{adj}
Food away from home +	1.190	0.378	3.148	11.36	.62	2.606
Tobacco +	1.457	0.163	8.91	51.38	.83	0.877
Total food	1.711	0.179	9.55	39.65	.79	
Shoes	1.92	2.53	0.76	1.32	.23	1.77
Children clothes	1.47	5.26	0.28	0.85	.16	1.32
Women's clothes	1.78	0.26	3.79	1.95	.28	1.63
Men's and boy's clothes	1.56	1.32	1.32		.23	1.41

Significance level	$t(\eta-4) = 32$	F	Variable or statistic	Notation
$\alpha = .10$	1.690		Income coefficient	β_2
$\alpha = .05$	2.040	2.92	Variance of regression coefficients	S_{b_i}
$\alpha = .025$	2.740			
$\alpha = .01$		4.51	Significance of beta	t_i

[a]Parameters of commodities marked (+) from semi-log transformation; all others are logarithmic

Table 12. Estimated parameters of Engle curves, Tehran, 1965 study: expenditures as a semi-logarithmic function of income X = f(Y)

Product	β_2	t_2	β_o	F	R^2
Cheese	82.47	6.41	-834.42	41.18	.789
Bread	38.97	3.68	-306.64	13.56	.552
Rice	40.38	4.99	-398.68	24.92	.694
Sugar	166.87	6.84	-169.67	46.74	.809
Mutton	19.22	4.56	-163.34	20.81	.654
Citrus fruit	98.42	6.26	-1009.79	39.15	.781

at the final adjusted elasticities (ηadj), one observes that the coefficient magnitude varies considerably from commodity to commodity. Approximately 4/10 of the food items could be considered luxury commodities if the often used criteria of unity is applied to separate necessities from luxury goods. In Tehran the elasticity magnitude ranges from a high for dried fruits and nuts of 2.137 to a low of 0.186 for bread. Dried fruits and nuts are as clearly a luxury commodity as bread is a necessity. For these two extremes the coefficients merely quantifies what a priori reason would suggest. Meat is an important component of the family food basket. From the elasticity value of 0.86 we see that a large share of the future increases in family income will be spent on red meat. In Urban Iran, excluding beverages, the elasticities very from the high of 1.715 for poultry to a low again of 0.183 for bread. Poultry is also the high elasticity for rural Iran, with spices the lowest of significant results. Bread is near the low, however. Thus the extreme commodity values are in general agreement between Tehran, other urban areas and rural Iran.

Just as the extremes appear reasonable, (at least in direction), so also do the intermediate elasticities. For example, in each table pulses have a low elasticity as might be expected. This suggests that they are a necessity type food which luxury commodities will tend to supercede as income rises. On the other hand one would expect dairy products to be more of a luxury good than pulses but to be consumed in large enough quantities as to keep the elasticity considerably below say dried fruits and nuts. A value near unity is found consistently throughout

Table 10.

In a study comparing the food elasticities (All Food) of about 30 different countries, H. S. Houthakker found the range to vary from a high or 0.731 for Poland to a low of 0.344 for the middle classed British.[51] Therefore international comparison of food elasticities shows Iran to rank relatively high. For example, note that the unadjusted income elasticity (β_2) for total food in urban Iran is 0.68 while that for Tehran is 0.751. This indicates that food requirements will grow rather rapidly from Iran as national income level rises.

In Chapter III it was asserted that the elasticities for food may decrease with an increase in the general income level. This seems to be particularly true for individual food items. Comparing Iranian elasticities with those of other higher income countries suggests that the assertion holds for total food elasticities between nations. In the study just mentioned Houthakker found this thesis generally to hold. However, this brings up an interesting question. Upon comparing three 1965 levels of income (table 16-B, p. 99) we note that per capita income is highest for Tehran, (33,233 rials per annum) medium for urban Iran, (21,713 rials per annum) and lowest for rural Iran (9,801 rials per annum). Thus one would expect the income elasticity level for food to vary in an inverse order with rural Iran having a high elasticity level, then urban Iran and finally Tehran with the low. However, observation of Table 9 clearly shows this to not be the case. As expected Tehran and urban Iran both have elasticities well below the level of those for rural Iran. But the unexpected result is that elasticities for Tehran are generally higher than those for urban Iran. An expanation of the differences between these two groups of elasticities consequently seems difficult. It is conceivable, and indeed probable, that relative prices may influence the elasticities, thus it has been suggested that the income elasticity of a commodity is an increasing function of its price relative to other commodities. It is also possible that the income elasticity is determined not by the relative price of the item itself, but by the relation among its factor prices.[52] No attempt is made here to verify these ideas, but they may be fruitful areas for further research.

The elasticities for clothing are higher than those for food with the average at about 1.5. This indicates that clothing is more of a luxury good than food in Iran. This is in agreement with international comparisons and is a phenomena noted as early as the 1890's by Ernest Engel.

It is interesting and well worth noting that the elasticities in Tables 9 and 10 differ significantly from those computed by the Iranian Central Bank (Bank Markazi). The Bank computed the elasticities appearing in Table 13 from the 1959 family budget survey which it conducted in 32 Iranian cities. Since they were published, these coefficients have been widely accepted as the standard Iranian income elasticities. They represented the most complete elasticity estimates up to that time. A second survey of 32 Iranian cities was also made by the Central Bank in 1965. The writer is unaware of any elasticities which have been published from this survey. If elasticities are computed from the 1965 survey they will not be directly comparable to those estimated from the 1959 study unless an adjustment is made for a 17 percent inflation which occured between the two periods and was not taken into account when the second was conducted. In this paper the elasticities from the 1959 and 1965 surveys have been compared briefly. However, it was determined that more information could be obtained by pooling the results of both budget studies. No doubt part of the difference between the elasticities computed in this study and those published by the Bank is due to the correction of the inflation bias and pooling of the data. Yet there are also two additional steps taken in this paper which contribute considerably to the differences between Tables 9, 10, and 13. It was found that reported income was biased downward. Therefore total expenditures were used since they represented a better proxy to actual income than the reported income. One additional technique was used. Household size was found to be an important independent variable in explaining consumption. Hence regression analysis was used to estimate the income elasticities in Table 8 with income and household size as independent variables. The use of more complete data and the techniques just referred to likely account for most of the difference between the elasticities published by the Bank and those in this paper.

Many papers dealing with income elasticities for food and clothing taken from cross-sectional family budget studies stop at this point. Actually they may also compute elasticities for family housing, transportation or other expenditures. But this is merely a detail. Further analysis of expenditure patterns could be based on Tables 8, 9, 10, 11, and 12, but it is the purpose of this paper to go beyond this point

Table 13. The income elasticity of various consumer goods in urban Iran: 1959[a]

Expenditure group	Elasticity
Food at home, total	0.51
Dairy products, including cheese	0.55
Cheese	0.66
Eggs	0.67
Flour, "reshteh" and macaroni	0.33
Rice	0.51
Bread	0.27
Mutton	0.61
Beef, veal and poultry	0.53
Beef and veal	0.11
Poultry	1.54
Fish	0.62
Fats and Oils	0.67
Sugar and sweets	0.35
Fresh fruits	0.66
Fresh vegetables	0.63
Canned fruits and vegetables	0.75
Dried fruits and nuts	0.57
Pulses and cereals	0.49
Tea, coffee, cacao	0.49
Non-alcoholic beverages	1.64
Alcoholic beverages	1.53
Spices, other foods	0.50
Food and drink in restaurants and eating places	0.77
Tobacco	0.41
Household textiles, towels, draperies, etc.	0.86
Hosiery and footwear	0.66
Hats, gloves, scarves, etc. (Women)	0.74

Table 13. Continued

Expenditure group	Elasticity
Underwear, nightwear	0.67
Dresses, skirts, blouses, chadors	0.61
Shirts, underwear, nightwear	0.77
Socks and footwear	0.80
Hats and gloves, scarves, etc. (Men)	0.86
Suits, trousers, workpants	0.95

[a]Elasticities published by the Iranian Central Bank Markazi from its 1959 family budget survey.

and use the elasticities to compute future Iranian demand due to the income effect. This problem along with an interesting variation in technique is left to the remaining chapter.

CHAPTER V

PROJECTED IRANIAN DEMAND USING TWO ALTERNATIVE MODELS

In this final Chapter the forecast demand for Iranian agricultural commodities is computed. The increase in demand from 1965 to the target dates is based on the income effect and population growth, with the rather strong assumption of constant prices.[53]

Two forecasts are made in this chapter. The first one is made via a fairly standard model and technique used in many previous demand studies. This method shall be referred to as the aggregate model or Model A. The second forecast shall be made via a disaggregated model (Model D), not heretofore used in forecasting under conditions similar to the present study. The purpose of this second forecast is to determine if the disaggregated model generates results significantly different from those via the standard model. For this reason the second forecast will not be carried out for every commodity and region in Iran. Only a sample forecast of sufficient size will be made to determine how the results of Model D compare with those of Model A. Comparison between Model A and D will be at the consumer level. Then final demand, at the farm gate, will be predicted for 1970, 1975 and 1980 by converting forecast consumer demand for the respective years to raw agricultural constituents (relying on Model A).

The Aggregate Model

It is usual to estimate the percentage change in demand by multiplying the expected percentage rise in income by the elasticity coefficient. This formula assumes the cross-sectional consumption function to be linear, which is not really the case. For large increases in income it is necessary to refer directly to the consumption function best fitted to the projection of demand for the commodity concerned. Therefore, a function such as the following shall be referred to as Model A and used to forecast food consumption of commodities whose consumption function is best approximated with the logarithmic form.

$$(22) \quad \ln C_t = \left[\ln C_o + \ln \frac{Y_t}{Y_o}\right] P_t$$

where:

C_t = Aggregate consumption demand in time t,

C_o = Per capita consumption demand in time o or base year,

Y_t = Per capita income in year t,

Y_o = Per capita income in year o,

E = Elasticity coefficient

P_t = Population in year t.

Note that equation (22) assumes a constant C_o (Per capita consumption) and a constant Y_t/Y_o (change in per capita income) over the entire population. This assumption requires C_o and Y_t/Y_o to be a constant aggregate average over the whole population of Iran. Thus a forecast which weights the effects of various consumption groups is not generated. Considering the great variation of income between the different consumption groups, such a generality could lead to a considerable error. For example, a rural laborer's income is less than 1/10 the income of a well paid government employee. This problem can be alleviated somewhat by disaggregating the Iranian consumption into three groups, rural, urban and Tehran.

With consumption demand divided into three groups equation (23) can be rewritten and taken out of logs as:

$$(23) \quad C_{ti} = C_{oi} \left[\left(\frac{Y_{ti}}{Y_{oi}} \right)^{E_i} \right] P_i$$

with the subscript i denoting the subgroup rural, urban or Tehran. Now total consumption demand in time t is given by $C_A = \sum_{i=1}^{3} C_{ti}$. From equation (23) it is seen that the elasticity (E_i) is assumed constant throughout each consumption group. This assumption is valid if the elasticity was estimated with the logarithmic function. As previously stated for commodities whose elasticities are estimated with another functional form (such as bread with semi log), we must refer directly to the function form used.[54] In this case the elasticity may vary with income level.

Forecast demand in time t is obtained by inserting the necessary parameters into equation (23) and are given as follows. C_o is average per capita demand for the base year (1965) and is given for Tehran, urban and rural Iran in Tables 14-A, B and C, respectively. The elasticities (E_i) were presented in Tables 8, 9, 10, 11 and 12 of Chapter IV. Income and population parameters are given in Table 16. Final projections of per capita and aggregate consumer demand for 1970, 1975 and 1980 appear in Table 19A, B & C. Finally consumer demand is converted to its farm gate equivalent in Table 21A, B & C according to the

Table 14-A. Per capita consumption (C_o) for base year 1965[a] rural Iran (in grams)

Product		Weekly	Monthly	Yearly
Milk and Yogurt		82.18	2,465.40	29,995.70
Dry Milk and Butter		2.31	69.30	843.15
Cheese		6.12	183.60	2,233.80
Khaskrhiky		9.78	293.40	3,569.70
Eggs	No.	5.43	162.90	1,981.95
Bread		41.73	1,251.90	15,231.45
Wheat		2.79	83.70	1,018.35
Barley		0.82	24.60	299.30
Rice		78.31	2,319.30	28,583.15
Grouts		2.79	83.70	1,018.35
Other Grains		1.24	37.20	452.60
Wheat Flour		513.92	15,417.60	187,580.80
Barley Flour		41.03	1,230.90	14,975.95
Corn Flour		3.44	103.20	1,255.60
Beef and Veal		12.79	383.70	4,668.35
Mutton, Lamb,		8.55	256.50	3,120.75
Insides		2.30	69.00	839.50
Poultry	No.	3.82	114.60	1,394.30
Other Meat		3.43	102.90	1,251.95
Fish		2.4	104.0	1,251.95
Animal Oil		10.01	300.30	3,653.65
Vegetable Oil		7.20	216.00	2,628.00
Sugar		60.84	1,825.20	22,206.60
Syrup		0.39	11.70	142.35
Honey		0.06	1.800	21.90
Vegetables (All, except Potatoes and Onions)		65.20	1,956.00	23,798.00
Potatoes		33.80	1,014.00	12,337.00
Onions		2.80	84.00	1,022.00
Oranges		21.25	637.50	7,756.25
Grapes		29.35	880.50	10,712.75
Plums		1.59	117.70	580.35
Pomegranates		13.17	395.10	4,807.05
Melons		58.44	1,753.20	21,330.60

Table 14-A. Continued

Product	Weekly	Monthly	Yearly
Dried Fruit	18.24	547.20	6,657.60
Dates	5.69	170.70	2,076.85
Nuts	0.42	12.60	153.30
Pulses	14.8	444.00	5,402.00
Tea	5.15	154.50	1,879.75
Coffee and Cacoa	0.22	6.60	80.30
Spices	5.18	155.40	1,890.70
Tobacco	2.61	78.30	952.65
Alcoholic Beverages	1.36	10.80	496.40

[a]Data from Rural Family Budget Surveys and Nutritional Studies.

Table 14-B. Per capita consumption (C_o) for base year 1965[a] (in grams) urban Iran

Product	Weekly	Monthly	Yearly
Milk	148.08	592.32	7,700.16
Cream	2.96	11.84	153.92
Liquid and Dry Milk	11.61	46.44	1,942.10
Yogurt	209.05	836.20	10,870.60
Yogurt Drink	37.35	149.40	19,112.20
Condensed Whey	19.37	77.48	1,007.24
Butter	16.56	66.24	861.12
Cheese	54.74	218.96	2,846.48
Eggs	34.94	139.76	1,816.88
Wheat Flour	127.38	509.52	6,623.76
Rice Flour	5.74	22.96	298.48
Macaroni	19.11	76.44	993.72
Bread	2,730.40	10,921.60	141,980.80
Rice	415.78	1,663.12	21,620.56
Mutton	277.26	1,109.04	14,417.52
Beef and Veal	95.14	380.56	4,947.28
Poultry	39.12	156.48	2,034.24
Fish	41.02	164.08	2,133.04
Oil (Animal)	34.72	138.88	1,805.44
Vegetable Oil	122.87	491.48	6,389.24
Sugar	318.12	1,272.48	15,269.76
Honey, etc.	0.65	20.60	33.80
Bakery Sweets	45.79	183.16	2,381.08
Other Sweets	36.15	144.60	1,879.80
Citrus Fruits	183.54	734.16	9,544.08
Pit Fruits	258.01	1,032.04	13,476.52
Apple	87.53	350.12	4,551.56
Pear	8.69	34.76	451.88
Apricot	11.70	46.80	608.40
Peach	21.48	85.92	1,116.96
Cherry	12.32	49.29	640.64
Green Plums	8.91	35.64	463.64
Pomegranates	43.23	172.92	2,247.96
Quince	6.78	27.12	352.56
Banana	8.25	33.00	429.00
Dates	49.05	196.20	2,550.60

Table 14-B. Continued

Product	Weekly	Monthly	Yearly
Vine Fruit	12.27	49.08	638.04
Grapes	205.81	823.24	10,802.12
Watermelons	814.62	3,258.48	42,360.24
Cantaloupes	130.60	522.40	6,791.20
Potatoes	339.13	1,356.52	17,634.76
Onions	250.46	1,001.54	13,023.92
Vegetables (all except Potatoes and Onions)	1,659.53	6,638.12	86,295.56
Pulses	183.08	732.32	9,520.16
Food in Restaurants	16.08	64.32	836.16
Tea	26.42	105.68	1,373.84
Coffee and Cacoa	0.50	2.00	26.00
Non Alcoholic Bev.	53.10	212.40	2,761.20
Alcoholic Bev.	15.81	63.24	822.12
Pickles	27.48	109.92	1,428.96
Spices	170.55	66.82	8,868.60
Tobacco	917.90	3,671.60	4,773.80
Dry Fruit	8.42	33.68	437.84
Raisin	3.29	13.16	171.08
Nuts	17.61	70.44	915.72
Canned Fruit	1.75	7.00	91.00
Canned Juice Fruit	1.46	5.84	75.92

[a]Data taken from 1965 Family Budget Survey

Table 14-C. Per capita consumption (C_o) for base year 1965[a] (in grams) Tehran

Product	Weekly	Monthly	Yearly
Milk	197.20	788.8C	10,254.40
Cream	3.28	13.12	170.56
Liquid, Dry Milk	4.19	16.76	217.88
Yogurt	203.25	813.00	10,569.00
Yogurt Drink	11.52	46.08	599.64
Condensed Whey	8.70	34.80	452.40
Butter	20.77	83.08	1,080.04
Cheese	73.22	292.88	3,807.44
Eggs	48.02	192.08	2,497.64
Wheat Flour	5.22	20.88	271.44
Chick pea	4.17	16.68	216.84
Macaroni	10.84	43.36	563.68
Wheat	1.29	5.16	67.08
Barley	3.59	14.36	186.68
Bread	2,781.3	11,125.2	144,632.08
Rice	413.68	1,654.72	21,511.36
Mutton	296.41	1,185.64	15,413.32
Beef	89.72	358.88	4,665.44
Poultry	70.89	283.56	3,686.28
Fish	6.339	25.35	329.62
Oil	24.35	97.40	1,266.20
Vegetable Oil	182.81	731.24	9,506.12
Sugar Lump	489.47	1,957.88	25,452.44
Halva, etc.	8.12	32.48	422.24
Other Sweets	8.82	35.27	438.64
Bakery Sweets	48.31	193.24	2,512.12
Citrus Fruit	332.60	1,330.40	17,295.20
Pit Fruit	294.34	1,177.36	15,305.68
Apple	168.95	675.80	8,785.40
Pear	12.17	48.68	632.84
Apricot	6.41	25.64	333.32
Peach	49.67	198.68	2,582.84
Green Plum	1.27	5.08	66.04
Pomegranate	31.11	124.44	1,617.72
Quince	4.50	18.00	234.00
Banana	26.79	107.16	1,393.08
Dates	8.90	35.60	462.80

Table 14-C. Continued

Product	Weekly	Monthly	Yearly
Vine Fruit	1,617.84	6,471.36	841.27
Grape	358.93	1,435.72	18,664.36
Watermelon	1,062.81	4,251.24	55,266.12
Cantaloupe	195.58	782.32	10,170.16
Potato	425.59	1,702.36	22,130.68
Onions	319.22	1,276.88	16,599.44
Vegetables (all except Potatoes and Onions)	1,393.50	5,574.00	72,462.00
Dry Fruit	8.46	33.84	439.92
Raisin	5.13	20.87	266.76
Nuts	22.26	89.04	1,157.52
Pulses	191.12	765.68	9,953.84
Food in Restaurants	1.47	5.88	76.44
Non Alcoholic Beverages	83.28	333.12	4,330.56
Alcoholic Beverages	40.47	161.88	2,104.44
Pickles	36.33	145.32	1,889.11
Spices	166.81	6,674.12	8,674.12
Tea	31.37	125.48	1,631.24
Coffee and Cacoa	1.32	5.28	68.64

[a]Data from 1965 Family Budget Survey.

conversion factors, Table 20.

Table 15 contains consumption comparisons with other nations; Iran's relative deficiencies are clearly apparent.

Table 17 and 18, which were not mentioned in the above listing contain the necessary information to test Model D. The results of

Table 15. Consumption of main food items in grams per capita per day, in 1965

	Pork	Other meat	Eggs	Milk and cheese	Butter	Cereals	Potatoes	Fruits	Vegetables	Pop. (Millions)
Austria	57	47	13	457	8	349	294	135	167	7.0
Denmark	87	66	23	638	16	268	343	132	192	4.3
France	45	107	30	403	16	323	343	95	378	43.1
Western Germany	53	48	20	482	17	276	504	128	135	50.0
Italy	9	34	18	273	4	420	86	136	241	46.4
Netherlands	47	41	12	630	8	278	350	139	190	10.2
Norway	38	61	20	927	11	319	347	74	76	5.3
Sweden	69	72	28	839	33	251	318	150	69	7.1
Switzerland	50	75	24	839	16	325	228	274	217	4.7
United Kingdom	33	78	36	606	20	276	302	132	136	50.0
Teheran		74.34	6.86	46.28	2.97	473.76	60.80	322.51	249.56	
Urban Iran		64.68	4.99	69.02	2.37	471.20	48.45	446.94	272.86	
Rural Iran		39.09	5.43	100.39		686.07	33.80	147.83	68.00	

Table 16-A. Projected population of Iran[a]

	1965	1970	1975	1980
Tehran population	2,653,000	3,572,487	4,848,158	6,482,425
Rural population	16,223,966	17,422,151	18,591,358	20,125,465
Urban minus Tehran population	6,037,315	7,640,678	9,737,972	12,215,966
Total urban	8,690,315	11,213,165	14,586,130	18,698,371
Total Iranian	24,914,000	28,634,000	33,177,488	38,823,856

[a]These projections are taken from a study by Dr. Allen D. LeBaron of Utah State University, soon to be published.

Table 16-B. Projected income of Iran, per capita disposable income in rials[a]

	1965	1970	1975	1980
Tehran	33,233	39,148	45,774	47,672
Urban	21,713	25,075	28,587	30,377
Rural	9,801	10,997	13,777	14,440

[a]These projections are taken from a study by Dr. Allen D. LeBaron of Utah State University, soon to be published.

this experiment with a disaggregated model are presented prior to the final food projections.

The Disaggregated Model

The implicit assumption of Model A is that each of the parameters, C_{oi}, (Y_{ti}/Y_{oi}), E_i are a constant aggregate average over the consumption group (i). For this reason equation (22) is referred to as Model A. With (Y_{ti}/Y_{oi}) treated as a constant, Model A also assumed the distribution of income between time (o) and time (t) to be constant. Suppose that these assumptions are relaxed and let Tehran be divided into forty consumption groups. Each group is made up of families identified according to (1) occupation and (2) the working class of the household head (Table 17). The entire Tehran population is represented by an 8 x 5 matrix. Each of the forty cells represents a separate consumption group. When it comes to forecasting future consumer demand, each group has its own C_o (depending on the consumption habits and income level of the occupational group), its own (Y_t/Y_o) (depending on the future distribution of income), its own (P), and possibly its own E_i (depending on the functional form used for estimating E_i). This generates the disaggregated model. According to this model forecast demand in time t for the entire population of Tehran is given by:

$$(24) \quad C_A = \sum_{i=1}^{8} \sum_{j=1}^{5} C_{tij} = \sum_{i=1}^{8} \sum_{j=1}^{5} \left[C_{oij} (Y_{tij}/Y_{oij}) \,\eta_{ij} \right] P_i$$

Table 17-A. Total population of Tehran Shahrestan (1966) assigned to each cell, according to occupation and working class of the household head[a]

	Non-reported	Private wage earner	Government employer	Own account worker	Employer
Professors, teachers, etc.	376	36,721	124,640	17,772	4,946
Administrators & management	45	3,286	10,954	2,696	8,561
Clerical and related	844	70,956	182,731	5,352	3,658
Sales workers	4,292	89,095	6,001	290,527	54,275
Service Workers	3,150	192,596	77,301	37,810	12,066
Agricultural, etc.	1,474	31,295	3,928	38,471	5,868
Production, etc.	5,782	639,888	86,448	177,345	50,647
Workers, not classified	7,779	13,910	133,074	5,457	1,818

[a]For total population of Tehran Shahrestan, add 359,037 for unemployed persons.

Table 17-B. Employed population of Tehran Shahrestan by occupation and class of worker[a]

	Unpaid family workers apprentices and non-reported workers	Private wage earner	Government employee	Own account worker	Employer
All occupations	11,028	391,081	200,035	139,134	31,852
Professors, teachers, etc.	398	14,631	41,018	4,849	1,306
Administration & management	19	1,283	3,340	641	1,563
Clerical and related	268	26,136	54,664	1,345	781
Sales workers	1,149	31,135	1,708	70,771	10,864
Service workers	1,313	76,213	25,998	10,967	3,364
Agricultural, etc.	498	12,022	1,190	9,287	1,145
Production, etc.	1,810	223,942	26,542	49,728	12,290
Workers not classified	4,573	5,809	45,576	1,546	539

[a]From Iranian Census 1966, Table 19.

Table 17-C. Approximate average monthly income of the employed population in Tehran Shahrestan (1966) by occupation and class of worker[a]

	Non-reported	Private wage earner	Government employee	Own account worker	Employee
Professors, teachers, etc.	1,675 (421,296)	6,500 (1,380,600)	5,800 (1,139,352)	6,750 (1,097,550)	6,800 (1,278,672)
Administrators & management	600 (157,752)	1,000 (208,320)	2,200 (409,200)	5,000 (724,800)	10,000 (1,398,000)
Clerical and related	225 (40,689)	550 (111,672)	530 (95,908)	325 (49,374)	8,800 (1,387,584)
Sales Workers	375 (60,390)	450 (86,724)	430 (74,149)	475 (70,053)	780 (115,596)
Service workers	350 (80,514)	325 (68,835)	650 (118,872)	900 (149,846)	2,500 (467,136)
Agricultural, etc.	225 (47,007)	250 (51,630)	700 (125,745)	500 (73,620)	450 (66,798)
Production, etc.	225 (42,012)	250 (49,170)	400 (69,210)	1,680 (283,046)	3,000 (532,080)
Workers, not classified	125 (42,855)	180 (39,549)	175 (36,246)	150 (25,686)	340 (74,460)

[a] Parentheses denote the average family income of Tehran families classified by the occupation of the family head. Income is reported in Toman per month. 1 Toman = 10 rials ≅ $ .13.

Once again the implicit assumptions of equation (24) are that C_{oij}, (Y_{tij}/Y_{oij}) and E_{ij} are constant over each separate cell. But this now seems to be a more valid assumption in that the City of Tehran has been divided into forty individually homogeneous consumption groups instead of one. However, there is a problem when (Y_y/Y_o) is allowed to vary from cell to cell. The problem is that we have no way to forecast how the future distribution of income will vary among the forty groups. The distribution of income (Figure 18) for 1965 has been calculated by ranking the population from Table 17-A and the income from 17-B. This says nothing about future distribution and thus as in Model A we will assume the distribution of income to be constant throughout the target years.

Emperical Results of Model A and Model D

The reader may note from Table 18-A that only six experimental commodity projections have been made with Model D. Comparing these results with those of Model A (Table 18-C or 19-A) shows Model D projections consistently 6 to 12 per cent above Model A projections. Thus the weighted consumption projection of Model D are higher than the so called average of Model A. This may be partially explained by looking at the frequency distribution of income (Figure 19) or the distribution of income (Figure 18). Note that the largest group of population is clustered to the left of the mid-range level of income and thus the distribution is skewed to the right over the high income levels. When the higher income and consumption groups are weighted in by Model D,

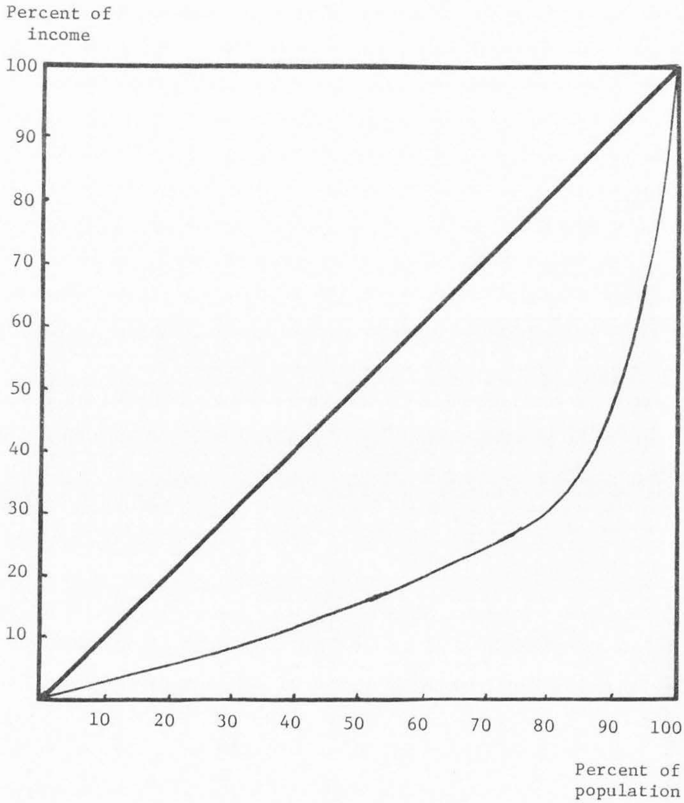


Figure 18. Distribution of income in Tehran Shahrestan (1966).

Table 18-A. Model D comparison projections of demand for Iranian food products: Tehran (η from logarithmic form)

Food product	Annual quantities in kilograms			
	1965	1970	1975	1980
Cheese	10,966,816	17,094,138	26,545,040	36,779,264
Bread	422,711,360	586,086,528	821,292,160	1,095,037,952
Rice	72,619,376	106,188,160	156,495,776	223,419,584
Sugar	73,941,312	10,235,712	142,386,624	193,875,440
Mutton	47,501,936	73,911,008	115,918,064	158,576,464
Citrus Fruit	48,809,088	74,145,504	112,922,128	155,687,648

Table 18-B. Model D comparison projections of demand for Iranian food products: Tehran (η from semi-logarithmic form)

Food product	Annual quantities in kilograms			
	1965	1970	1975	1980
Cheese	10,966,822	17,478,829	26,254,361	32,985,996
Bread	423,712,051	606,550,583	865,970,262	1,171,870,267
Rice	72,419,415	108,773,381	157,442,053	201,549,591
Mutton	47,401,982	64,843,167	88,645,418	118,389,636
Citrus Fruit	48,609,120	74,650,668	119,244,097	153,620,145

Table 18-C. Model A comparison projections of demand for Iranian food products: Tehran (η from logarithmic form)

Food product	Annual quantities in kilograms			
	1965	1970	1975	1980
Cheese	10,101,130	15,737,020	24,545,560	34,027,770
Bread	396,973,908	550,595,411	770,417,248	1,037,877,276
Rice	57,069,630	83,696,010	123,223,800	168,285,100
Mutton	40,890,990	36,497,630	98,730,040	136,759,400
Citrus fruit	45,884,160	69,864,190	106,609,800	146,956,200

the apparent resulting projections are greater than those of the aggregate Model A.

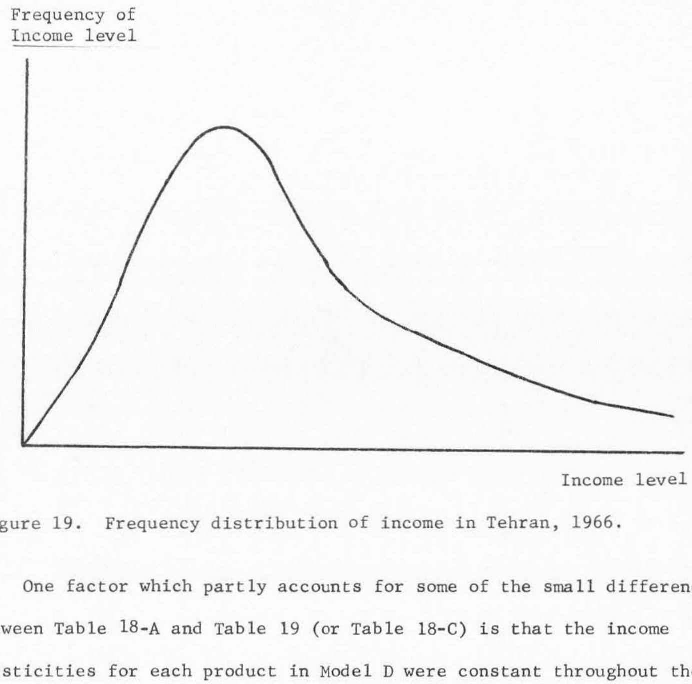


Figure 19. Frequency distribution of income in Tehran, 1966.

One factor which partly accounts for some of the small difference between Table 18-A and Table 19 (or Table 18-C) is that the income elasticities for each product in Model D were constant throughout the forty cells. Recall from Chapter III that if the income elasticity is estimated with the logarithmic form the elasticity will be constant, i.e. $\beta_2 = E$. However, if the semi-logarithmic function is used the income elasticity will vary depending on the income level of each cell since $E = \beta_2 / (\beta_o + \beta_2 \ln Y)$. In this case Model D seems particularly useful since the proper elasticity can be used for each consumption group (income level). If the semi logarithmic form (or any other form for which the elasticity varies with income), were preferable to the constant form, it is difficult to say just how much improved precision Model D might provide. More research will be necessary to answer this question. However, to get an indication of the impact that a variable elasticity may produce, projections from Model A, using the semi logarithmic elasticity, appear in Table 18-B.[55] Due to the more rapidly decreasing nature of the semi logarithmic function versus the logarithmic, the projections of Table 18-B are consistently lower than those of Table 18-A. This is as expected.

The difficulty in practice with Model D is obtaining sufficiently disaggregated data. This is particularly a common problem with developing countries. Perhaps further research in this area could determine a constant coefficient by which the more simple and rapid calculation of Model A could be corrected for a consistent bias.

The extensive empirical results obtained from Model A are presented in the series of Tables, 19-A, 19-B, and 19-C. Conversion factors used to compute farm gate equivalants appear in Table 20. Finally, Tables 21-A, 21-B, and 21-C contain the forecasts of demand for Iranian agricultural products for the target years 1970, 1975, 1980. Projections are all in annual quantities measured in kilograms.

Table 19-A. Projections of demand for Iranian food products: Tehran[a]

Food product	1965	1970	1975	1980
Milk	27,204,910.00 (10,254.40)	44,155,640.00 (12,359.92)	71,616,880.00 (14,771.98)	100,296,500.00 (15,472.07)
Cream	452,495.50 (170.56)	734,434.80 (205.58)	1,191,193.00 (245.70)	1,668,217.00 (257.34)
Liquid and dry milk	578,035.40 (217.88)	938,195.40 (262.62)	1,521,677.00 (313.87)	2,131,047.00 (328.74)
Yogurt	28,039,550.00 (10,569.00)	45,510,330.00 (12,739.12)	73,814,040.00 (15,225.18)	103,373,600.00 (15,946.75)
Yogurt drink	1,589,253.00 (599.04)	2,579,479.00 (722.04)	4,183,705.00 (862.95)	5,859,106.00 (903.85)
Condensed whey	1,200,216.00 (452.40)	1,869,874.00 (523.41)	2,916,504.00 (601.57)	4,043,181.00 (623.71)
Butter	2,865,346.00 (1,080.04)	4,464,054.00 (1,249.57)	6,962,737.00 (1,436.16)	9,652,514.00 (1,489.03)
Cheese	10,101,130.00 (3,807.44)	15,737,020.00 (4,405.06)	24,545,560.00 (5,062.87)	34,027,770.00 (5,249.24)
Eggs	6,624,645.00 (2,497.04)	10,522,290.00 (2,945.37)	16,717,630.00 (3,448.24)	23,287,180.00 (3,592.36)
Wheat flour	720,130.00 (271.44)	1,009,095.00 (282.46)	1,422,465.00 (293.40)	1,920,831.00 (296.31)
Chick peas	575,276.20 (216.84)	829,832.90 (232.28)	1,202,599.00 (248.05)	1,635,651.00 (252.32)
Macaroni	1,495,442.00 (563.68)	2,366,362.00 (662.39)	3,746,134.00 (772.69)	5,213,384.00 (804.23)

Table 19-A. Continued

Food product	1965	1970	1975	1980
Wheat	177,963.10 (67.08)	249,374.30 (69.80)	351,528.90 (72.51)	474,688.20 (73.23)
Barley	495,261.90 (186.68)	693,995.20 (194.26)	978,285.80 (201.79)	1,321,031.00 (203.79)
Bread	396,973,908.24 (144,632.08)	550,595,411.83 (154,121.04)	770,417,248.62 (158,909.27)	1,037,877,276.25 (160,106.33)
Rice	57,069,630.00 (21,511.36)	83,696,010.00 (23,427.96)	123,223,800.00 (25,416.64)	168,285,100.00 (25,960.22)
Mutton	40,890,990.00 (15,413.12)	63,497,630.00 (17,774.07)	98,730,040.00 (20,364.45)	136,759,400.00 (21,096.95)
Beef	12,377,410.00 (4,665.44)	17,708,680.00 (4,956.97)	25,463,690.00 (5,252.24)	34,562,810.00 (5,331.77)
Poultry	9,779,699.00 (3,686.28)	17,441,070.00 (4,882.05)	30,949,450.00 (6,383.76)	44,367,710.00 (6,844.31)
Fish	874,481.80 (329.62)	1,433,370.00 (401.22)	2,346,726.00 (484.04)	3,294,516.00 (508.22)
Animal oil	3,359,228.00 (1,266.20)	4,890,324.00 (1,368.89)	7,149,428.00 (1,474.67)	9,746,059.00 (1,503.46)
Vegetable oil	25,219,720.00 (9,506.12)	36,714,590.00 (10,277.04)	53,675,070.00 (11,071.23)	73,169,480.00 (11,287.37)
Sugar (granulated and lump)	67,525,310.00 (25,452.44)	94,157,260.00 (26,356.23)	132,107,000.00 (27,248.91)	178,173,700.00 (27,485.67)
Halva, etc.	1,120,202.00 (422.24)	1,562,009.00 (437.23)	2,191,571.00 (452.04)	2,955,791.00 (455.97)

Table 19-A. Continued

Food product	1965	1970	1975	1980
Other sweets	1,216,771.00 (458.64)	1,998,344.00 (559.37)	3,277,851.00 (676.10)	4,603,940.00 (710.22)
Bakery sweets	6,664,650.00 (2,512.12)	12,665,710.00 (3,545.35)	23,881,420.00 (4,925.88)	34,779,100.00 (5,365.14)
Citrus fruits	45,884,160.00 (17,295.20)	69,864,190.00 (19,556.19)	106,609,800.00 (21,989.77)	146,956,200.00 (22,669.96)
Pit fruit	40,605,950.00 (15,305.68)	61,827,530.00 (17,306.59)	94,346,140.00 (19,460.21)	130,051,400.00 (20,062.16)
Apples	23,307,640.00 (8,785.40)	35,488,750.00 (9,933.91)	54,154,330.00 (11,170.09)	74,648,970.00 (11,515.60)
Pears	1,678,924.00 (632.84)	2,446,368.00 (715.57)	3,900,908.00 (804.62)	5,377,204.00 (829.51)
Apricots	884,297.90 (333.32)	1,346,451.00 (376.89)	2,054.628.00 (423.80)	2,832,200.00 (436.90)
Peaches	6,852,272.00 (2,582.84)	10,433,420.00 (2,920.49)	15,920,950.00 (3,283.92)	21,946,240.00 (3,385.50)
Cherries	1,103,648.00 (416.00)	1,680,439.00 (470.38)	2,564,277.00 (528.92)	3,534,727.00 (545.28)
Green plums	175,204.00 (66.04)	266,769.60 (74.67)	407,078.80 (83.97)	561,137.80 (86.56)
Pomegranates	82,534.81 (31.11)	125,669.20 (35.18)	191,766.00 (39.55)	264,339.80 (40.78)
	4,291,810.00 (1,617.7)	6,534,798.40 (1,829.4)	9,971,832.00 (2.056.6)	13,745,669.60 (2,120.6)

Table 19-A. Continued

Food product	1965	1970	1975	1980
Quince	620,801.70 (234.00)	945,246.10 (264.59)	1,442,406.00 (297.52)	1,988,284.00 (306.72)
Bananas	3,695,841.00 (1,393.08)	5,627,367.00 (1,575.20)	8,587,124.00 (1,771.21)	11,836,910.00 (1,826.00)
Dates	1,227,808.00 (462.80)	2,346,398.00 (656.80)	4,447,760.00 (917.41)	6,486,339.00 (1,000.60)
Vine fruits	2,231,889.00 (841.27)	3,401,110.00 (952.03)	5,194,002.00 (1,071.34)	7,161,131.00 (1,104.70)
Grapes	49,516,540.00 (18,664.36)	75,394,960.00 (21,104.34)	115,049,400.00 (23,730.57)	158,589,900.00 (24,464.61)
Watermelon	146,620,900.00 (55,266.12)	223,248,300.00 (62,491.04)	340,667,100.00 (70,267.38)	469,592,800.00 (72,440.94)
Cantalopes	26,981,420.00 (10,170.16)	41,082.510.00 (11,499.70)	62,690,170.00 (12,930.72)	86,415,230.00 (13,330.70)
Potatoes	58,712,680.00 (22,130.68)	87,341.640.00 (24,448.44)	130,352,600.00 (26,887.05)	178,651,200.00 (27,559.32)
Onions	44,038,300.00 (16,599.44)	65,511,930.00 (18,337.91)	97,772,890.00 (20,167.02)	133,999,900.00 (20,671.27)
Vegetables	192,241,600.00 (72,462.00)	285,980,600.00 (80,050.94)	426,810,300.00 (88,035.63)	584,953,500.00 (90,236.88)
Dried apricots, peaches and plums	1,167,107.00 (439.92)	1,777,063.00 (497.43)	2,711,722.00 (559.33)	3,737,974.00 (576.63)

Table 19-A. Continued

Food product	1965	1970	1975	1980
Raisins	707,714.20 (266.76)	1,352,474.00 (378.58)	2,563,710.00 (528.80)	3,738,754.00 (576.75)
Nuts (shelled)	3,070,900.00 (1,157,52)	5,868,630.00 (1,642.73)	11,124,400.00 (2,294.56)	16,223,130.00 (2,502.63)
Pulses	26,407,520.00 (9,953.84)	38,463,700.00 (10,766.37)	56,257,040.00 (11,603.80)	76,698,540.00 (11,831.77)
Prepared food	202,795.20 (76.44)	356,955.10 (99.92)	625,548.00 (129.03)	893,847.20 (137.89)
Non-alcoholic beverages	11,488,960.00 (4,330.56)	21,549,710.00 (6,032.13)	40,127,230.00 (8,276.80)	58,248,670.00 (8,985.63)
Alcoholic beverages	5,583,077.00 (2,104.44)	9,835,253.00 (2,753.06)	17,249,310.00 (3,557.91)	24,652,590.00 (3,802.99)
Pickles	5,011,939.00 (1,889.16)	8,391,946.00 (2,349.05)	14,021,520.00 (2,892.13)	19,788,700.00 (3,052.67)
Spices	23,012,430.00 (8,674.12)	32,849,080.00 (9,195.02)	47,131,070.00 (9,721.44)	63,936,380.00 (9,863.04)
Tea	4,327,677.00 (1,631.24)	6,171,475.00 (1,727.50)	8,846,381.00 (1,824.69)	11,997,750.00 (1,850.81)
Coffee	182,101.80 (68.64)	259,685.90 (72.69)	372,241.60 (76.78)	504,846.50 (77.88)

[a] Figures within parentheses are annual per capita demands in grams. Projections are in kilograms.

Table 19-B. Projections of demand for Iranian food products: urban Iran[a]

Food products	1965	1970	1975	1980
Milk	46,488,280.00 (7,700.16)	66,778,590.00 (8,739.88)	95,518,380.00 (9,808.86)	126,399,800.00 (10,347.11)
Cream	929,263.30 (153.92)	1,334,850.00 (174.70)	1,909,337.00 (196.07)	2,526,632.00 (206.83)
Liquid and dry milk	3,644,847.00 (603.72)	5,235,679.00 (685.24)	7,488,987.00 (769.05)	9,910,198.00 (811.25)
Yogurt	65,629,230.00 (10,870.60)	94,273,790.00 (12,338.41)	134,846,900.00 (13,847.54)	178,443,300.00 (14,607.40)
Yogurt drink	11,725,670.00 (1,942.20)	16,843,450.00 (2,204.45)	24,092,460.00 (2,474.08)	31,881,640.00 (2,609.84)
Condensed whey	6,081,024.00 (1,007.24)	8,735,154.00 (1,143.24)	12,494,540.00 (1,283.07)	16,534,070.00 (1,353.48)
Butter	5,198,852.00 (861.12)	7,467,945.00 (977.39)	10,681,960.00 (1,096.94)	14,135,480.00 (1,157.13)
Cheese	17,185,080.00 (2,846.48)	24,621,840.00 (3,222.47)	35,135,440.00 (3,608.09)	46,444,080.00 (3,801.92)
Eggs	10,969,070.00 (1,816.88)	16,049,620.00 (2,100.55)	23,345,530.00 (2,397.37)	31,134,200.00 (2,548.65)
Wheat flour	39,989,720.00 (6,623.76)	52,411,370.00 (6,859.52)	68,960,380.00 (7,081.60)	87,794,170.00 (7,186.84)
Rice flour	1,802,017.00 (298.48)	2,361,762.00 (309.10)	3,107,494.00 (319.11)	3,956,181.00 (323.85)

Table 19-B. Continued

Food products	1965	1970	1975	1980
Macaroni	5,999,398.00 (993.72)	8,749,129.00 (1,145.07)	12,688,020.00 (1,302.94)	16,897,470.00 (1,383.23)
Bread	857,182,700.00 (141,980.80)	1,113,781,000.00 (145,770.00)	1,453,977,000.00 (149,310.10)	1,844,341,000.00 (150,978.00)
Mutton	87,043,070.00 (14,417.52)	124,854,100.00 (16,340.73)	178,354,200.00 (18,315.34)	235,873,500.00 (19,308.64)
Rice	130,530,000.00 (21,620.56)	179,164,600.00 (23,448.80)	245,870,800.00 (25,248.67)	319,179,700.00 (26,128.11)
Beverages	29,868,280.00 (4,947.28)	39,868,090.00 (5,217.88)	53,337,520.00 (5,477.27)	68,429,980.00 (5,601.69)
Poultry	12,281,340.00 (2,034.24)	19,894,490.00 (2,603.76)	31,749,260.00 (3,260.36)	44,198,440.00 (3,618.09)
Fish	12,877,830.00 (2,133.04)	19,370,400.00 (2,535.17)	28,894,270.00 (2,967.18)	38,985,920.00 (3,191.39)
Animal oil	10,900,000.00 (1,805.44)	14,961,270.00 (1,958.11)	20,531,600.00 (2,108.41)	26,653,340.00 (2,181.85)
Vegetable oil	38,573,840.00 (6,389.24)	52,946,160.00 (6,929.51)	72,658,890.00 (7,461.41)	94,322,940.00 (7,721.29)
Sugar	92,188,300.00 (15,269.76)	125,955,600.00 (16,484.88)	172,127,400.00 (17,675.90)	223,015,300.00 (18,256.07)
Honey, etc.	204,061.20 (33.80)	266,294.50 (34.85)	349,002.40 (35.84)	443,510.00 (36.31)

Table 19-B. Continued

Food products	1965	1970	1975	1980
Bakery sweets	14,375,320.00 (2,381.08)	24,623,930.00 (3,222.74)	41,347,900.00 (4,246.05)	58,932,640.00 (4,824.23)
Other sweets	11,348,940.00 (1,879.80)	17,100,220.00 (2,238.05)	25,548,060.00 (2,623.55)	34,496,110.00 (2,823.86)
Citrus fruits	57,620,590.00 (9,544.08)	81,610,460.00 (10,681.05)	115,243,000.00 (11,834.41)	151,597,000.00 (12,409.76)
Pit fruits	80,999,720.00 (13,416.52)	114,723,300.00 (15,014.82)	162,002,100.00 (16,636.13)	213,106,500.00 (17,444.93)
Apples	27,479,180.00 (4,551.56)	38,919,930.00 (5,093.78)	54,959,280.00 (5,643.81)	72,296,410.00 (5,918.20)
Pears	2,728,141.00 (451.88)	3,863,981.00 (505.71)	5,456,367.00 (560.32)	7,177,609.00 (587.56)
Apricots	3,673,101.00 (608.40)	5,202,366.00 (680.88)	7,346,323.00 (754.40)	9,663,754.00 (791.08)
Peaches	6,743,437.00 (1,116.96)	9,551,015.00 (1,250.02)	13,487,090.00 (1,385.00)	17,741,660.00 (1,452.34)
Cherries	3,867,744.00 (640.64)	5,478,047.00 (716.96)	7,735,615.00 (794.38)	10,175,850.00 (833.00)
Green plums	2,797,209.00 (463.32)	3,961,805.00 (518.51)	5,594,509.00 (574.50)	7,359,324.00 (602.44)

Table 19-B. Continued

Food products	1965	1970	1975	1980
Pomegranates	13,571,640.00 (2,247.96)	19,222,080.00 (2,515.76)	27,143,720.00 (2,787.41)	35,706,350.00 (2,922.93)
Quince	2,128,516.00 (352.56)	3,014,706.00 (394.56)	4,257,103.00 (437.17)	5,600,022.00 (458.42)
Bananas	2,590,008.00 (429.00)	3,668,336.00 (480.11)	5,180,100.00 (531.95)	6,814,187.00 (557.81)
Dates	15,398,770.00 (2,550.60)	23,722,380.00 (3,104.75)	36,164,670.00 (3,713.78)	49,289,790.00 (4,034.87)
Vine fruits	3,852,048.00 (638.04)	5,455,818.00 (714.05)	7,704,223.00 (791.15)	10,134,560.00 (829.62)
Grapes	64,612,060.00 (10,702.12)	91,512,750.00 (11,977.05)	129,226,300.00 (13,270.35)	169,991,200.00 (13,915.51)
Watermelons	255,742,000.00 (42,360.24)	362,218,200.00 (47,406.58)	511,492,600.00 (52,525.59)	672,845,300.00 (55,079.22)
Cantalopes	41,000,590.00 (6,791.20)	58,070,880.00 (7,600.23)	82,002,560.00 (8,420.91)	107,870,600.00 (8,830.31)
Potatoes	106,466,500.00 (17,634.76)	149,260,000.00 (19,534.92)	208,818,700.00 (21,443.76)	273,510,100.00 (22,389.58)
Onions	78,629,480.00 (13,023.92)	110,233,900.00 (14,427.26)	154,220,200.00 (15,837.01)	201,997,200.00 (16,535.53)
Vegetables	520,993,200.00 (86,295.56)	730,402,300.00 (95,593.94)	1,021,852,000.00 (104,934.80)	1,338,418,000.00 (109,563.10)
Dried apricots, peaches and plums	2,884,870.00 (437.84)	4,444,246.00 (581.66)	6,775,238.00 (695.75)	9,234,153.00 (755.91)

Table 19-B. Continued

Food products	1965	1970	1975	1980
Raisins	1,032,863.00 (171.08)	1,591,165.00 (208.25)	2,425,724.00 (249.10)	3,306,081.00 (270.64)
Nuts	5,528,485.00 (915.72)	8,516,841.00 (1,114.67)	12,983,880.00 (1,333.33)	17,696,080.00 (1,448.60)
Pulses	57,476,190.00 (9,520.16)	77,932,120.00 (10,199.64)	105,762,100.00 (10,860.81)	136,589,700.00 (11,181.26)
Prepared food	5,048,160.00 (836.16)	8,083,877.00 (1,058.01)	12,766,280.00 (1,310.98)	17,685,950.00 (1,447.78)
Tea	8,294,301.00 (1,373.84)	11,004,490.00 (1,440.25)	14,641,490.00 (1,503.55)	18,736,620.00 (1,533.78)
Coffee and cacao	156,970.10 (26.00)	208,260.60 (27.26)	277,090.80 (28.45)	354,591.60 (29.03)
Non-alcoholic beverages	16,670,230.00 (2,761.20)	28,013,550.00 (3,666.37)	46,226,360.00 (4,747.02)	65,356,090.00 (5,350.06)
Alcoholic beverages	4,963,397.00 (822.12)	7,953,862.00 (1,040.99)	12,569,200.00 (1,290.74)	17,418,200.00 (1,425.86)
Pickles	8,627,081.00 (1,428.96)	13,221,650.00 (1,730.43)	20,061,420.00 (2,060.12)	27,282,540.00 (2,233.35)
Spices	53,542,520.00 (8,868.60)	71,386,120.00 (9,342.91)	95,403,760.00 (9,797.09)	122,339,900.00 (10,014.77)

Table 19-B. Continued

Food products	1965	1970	1975	1980
Tobacco	28,816,560.00 (4,773.08)	38,658,530.00 (5,059.57)	51,957,170.00 (5,335.35)	66,800,870.00 (5,468.33)
Canned fruit	549,395.40 (91.00)	844,418.00 (110.52)	1,284,613.00 (131.92)	1,749,133.00 (143.18)
Canned juice	458,352.80 (75.92)	704,485.80 (92.20)	1,071,734.00 (110.06)	1,459,277.00 (119.46)

[a]Figures within parentheses are annual per capita demands in grams. Projections are in kilograms.

Table 19-C. Projections of demand for Iranian food products: rural Iran[a]

Food products	1965	1970	1975	1980
Milk and yogurt	486,648,800.00 (29,995.70)	586,682,300.00 (33,674.53)	785,238,200.00 (42,236.77)	891,122,100.00 (44,278.36)
Dry milk and butter	13,679,220.00 (843.15)	16,491,060.00 (946.56)	22,072,270.00 (1,187.23)	25,048,570.00 (1,244.62)
Cheese	36,241,070.00 (2,233.80)	45,960,520.00 (2,638.05)	67,929,660.00 (3,653.83)	78,699,230.00 (3,910.43)
Khaskhiky	57,914,650.00 (3,569.70)	73,446,700.00 (4,215.71)	108,554,200.00 (5,838.97)	125,764,400.00 (6,249.02)
Eggs	32,155,070.00 (1,981.95)	37,306,910.00 (2,141.35)	46,321,960.00 (2,491.59)	51,752,330.00 (2,571.49)
Bread	247,114,300.00 (15,231.45)	276,878,800.00 (15,892.36)	321,087,700.00 (17,270.83)	353,660,100.00 (17,572.78)
Wheat	16,521,670.00 (1,018.35)	19,576,810.00 (1,123.67)	25,331,180.00 (1,362.53)	29,545,080.00 (1,418.36)
Barley	4,855,828.00 (299.30)	5,282,709.00 (303.22)	5,782,679.00 (311.04)	6,293,164.00 (312.70)
Rice	463,731,700.00 (28,583.15)	601,796,300.00 (34,542.05)	930,473,400.00 (50,048.75)	1,088,164,000.00 (54,069.07)
Grout	16,521,670.00 (1,018.35)	19,576,810.00 (1,123.67)	25,331,180.00 (1,362.53)	28,545,080.00 (1,418.36)
Other grains	7,342,964.00 (452.60)	8,700,809.00 (499.41)	11,258,310.00 (605.57)	12,686,700.00 (630.38)

Table 19-C. Continued

Food products	1965	1970	1975	1980
Wheat flour	3,043,302,000.00 (187,580.80)	3,870,606,000.00 (222,165.90)	5,753,085,000.00 (309,449.90)	6,673,014,000.00 (331,570.80)
Barley flour	242,969,100.00 (14,975.95)	285,883,900.00 (16,409.23)	364,864,500.00 (19,625.51)	409,980,400.00 (20,371.24)
Corn flour	20,370,800.00 (1,255.60)	23,968,830.00 (1,375.77)	30,590,640.00 (1,645.42)	34,373,200.00 (1,707.95)
Beef and veal	75,739,080.00 (4,668.35)	100,034,900.00 (5,741.83)	160,097,500.00 (8,611.41)	188,580,300.00 (9,370.24)
Mutton, lamb and goat	50,630,910.00 (3,120.75)	60,989,230.00 (3,500.67)	81,501,610.00 (4,383.85)	92,461,130.00 (4,594.24)
Insides	13,620,010.00 (839.50)	19,353,260.00 (1,110.84)	35,739,930.00 (1,922.40)	43,372,910.00 (2,155.13)
Poultry	22,621,050.00 (1,394.30)	31,698,640.00 (1,819.45)	56,963,210.00 (3,063.97)	68,737,040.00 (3,415.43)
Other meat	20,311,580.00 (1,251.95)	26,963,400.00 (1,547.65)	43,582,840.00 (2,344.26)	51,442,810.00 (2,556.11)
Fish	20,311,580.00 (1,251.95)	26,963,400.00 (1,547.65)	43,582,840.00 (2,344.26)	51,442,810.00 (2,556.11)
Animal oil	59,276,650.00 (3,653.65)	72,371,790.00 (4,154.02)	99,297,240.00 (5,341.05)	113,270,500.00 (5,628.22)
Vegetable oil	42,636,560.00 (2,628.00)	52,055,710.00 (2,987.91)	71,422,640.00 (3,841.72)	81,473,290.00 (4,048.27)

Table 19-C. Continued.

Food products	1965	1970	1975	1980
Sugar	357,932,900.00 (22,206.20)	412,421,900.00 (23,372.30)	505,202,500.00 (27,174.10)	562,839,300.00 (27,966.50)
Syrup	2,309,480.00 (142.35)	2,661,059.00 (152.74)	3,259,704.00 (175.33)	3,631,593.00 (180.45)
Honey	355,304.40 (21.90)	409,393.30 (23.50)	501,492.60 (26.97)	558,706.30 (27.76)
Vegetables	386,097,600.00 (23,798.00)	451,633,600.00 (25,922.98)	569,816,800.00 (30,649.58)	638,743,000.00 (31,738.08)
Potatoes	200,154,900.00 (12,337.00)	234,129,100.00 (13,438.60)	295,395,500.00 (15,888.89)	331,127,500.00 (16,453.18)
Onions	16,580,880.00 (1,022.00)	19,395,310.00 (1,113.26)	24,470,650.00 (1,316.24)	27,430,680.00 (1,362.98)
Oranges	125,837,000.00 (7,756.25)	156,222,600.00 (8,966.91)	221,466,000.00 (11,912.32)	254,357,300.00 (12,638.59)
Grapes	173,803,100.00 (10,712.75)	215,771,100.00 (12,384.88)	305,883,300.00 (16,453.02)	351,312,100.00 (17,456.12)
Plums	9,415,573.00 (580.35)	11,689,130.00 (670.94)	16,570,870.00 (891.32)	19,031,900.00 (945.66)
Pomegranates	77,989,340.00 (4,807.05)	96,821,310.00 (5,557.37)	137,256,800.00 (7,382.84)	157,641,700.00 (7,832.95)
Melons	346,066,600.00 (21,330.60)	429,630,700.00 (24,660.05)	609,057,500.00 (32,760.29)	699,512,500.00 (34,757.61)
Dried fruit	108,012,600.00 (6,657.60)	151,252,400.00 (8,681.63)	271,436,500.00 (14,600.17)	327,448,300.00 (16,270.36)

Table 19-C. Continued

Food products	1965	1970	1975	1980
Dates	33,694,720.00 (2,076.85)	47,183,470.00 (2,708.25)	84,675,120.00 (4,554.55)	102,148,000.00 (5,075.57)
Nuts	2,487,132.00 (153.30)	3,482,787.00 (199.91)	6,250,184.00 (336.19)	7,539,924.00 (374.65)
Pulses	87,641,800.00 (5,402.00)	101,917,900.00 (5,849.91)	127,117,800.00 (6,837.48)	142,153,300.00 (7,063.36)
Tea	30,496,970.00 (1,879.75)	34,713,450.00 (1,992.49)	41,518,730.00 (2,233.23)	46,025,740.00 (2,286.94)
Coffee and cacao	1,299,435.04 (80.3)	1,477,093.72 (85.1)	1,769,057.05 (95.4)	1.961,096.25 (97.4)
Spices	30,674,620.00 (1,890.70)	34,246,920.00 (1,965.71)	39,438,540.00 (2,121.34)	43,376,080.00 (2,155.28)
Tobacco	15,455,750.00 (952.65)	18,360,220.00 (1,053.84)	23,875,120.00 (1,284.21)	26,932,090.00 (1,338.21)
Alcoholic beverages	8,053,571.00 (496.40)	10,445,300.00 (599.54)	16,131,920.00 (867.71)	18,861,420.00 (937.19)

[a]Figures within parentheses are annual per capita demands in grams. Projections are in kilograms.

Table 20. Conversion factors: to transpose consumer demand to farm gate equivalents

Product to be converted to raw ag. demand	Comment	Conversion factor	Raw ag. product
Pulses		1.0	Pulses
Addas (Lentils)	60 LB./Bu.		
Mosh (Lentils)			
Nokhod			
Pens			
Beans			
Other			
Dried Fruits			
Raisins	1 LB. = 4.3 Lb. Fresh Fruit	4.3	Fresh Grapes
Apricot	1 LB. = 6.0 LB. " "	6.0	Fresh Apricot
Peach	1 LB. = 6.5 LB. " "	6.5	" Peach
Apple	1 LB. = 8.0 LB. " "	8.0	" Apple
Plum	1 LB. = 3.4 LB. " "	3.4	" Plum
Dates		1.0	" Dates
Dried Fruits and Nuts			
Pistachio	1 LB. Shelled = 2.0 LB. Unshelled		Fresh Pistachio
Almonds	1 LB. " = 2.22 LB. "		Almonds
Other	1 LB. " = 2.5 LB. "		Other
Vegetable Oils		4.0	Seed (General)
Cottonseed		5.88	Ginned Seed
Olive		2.5	Seed
Sesame		2.00	Seed
Sunflower		3.571	Seed
Soybean		6.250	Seed
Ground Almond		2.857	Seed
Other		4.00	Seed

Table 20. Continued

Product to be converted to raw ag. demand	Comment	Conversion factor	Raw ag. product
Spices		1.00	Raw spice
Beverages (Non alcoholic)		0.085	Sugar
Flour		1.129	Wheat
Star Flour	19% Bran Removed	1.234	Wheat
2nd Grade	9% " "	1.098	Wheat
3rd Grade	5% " "	1.052	Wheat
Whole Wheat	2-0% " "	1.020	Wheat
Barley	21%	1.265	Barley
Rice	55% of Head Rice	2.840	Paddy Rice
Rice (Rough or Paddy)	wt. = 45 LBS./Bushel	1.0	Paddy Rice
Head Rice	64%	1.562	Paddy Rice
Bread		0.853*	Wheat
Bread		0.986	Barley
Lavash	2nd Grade Flour	0.935	Wheat
Sangak	Whole Wheat Flour	0.775	Wheat
Taftoon	50/50 2nd and 3rd Grade Flour	0.837	Wheat
Barbari	Star Flour	0.947	Wheat
Bakery Products			
(Av. % Flour)	46%	0.46	Flour
(Av. % Sugar)	29%	0.29	Sugar

Table 20. Continued

Product to be converted to raw ag. demand	Comment	Conversion factor	Raw ag. product
Sugar			
Sugar (Granulated)	7.5:1	7.5	Sugar Beets
Candy (Av. % Sugar)	72.0%	5.4	Sugar Beets
Canned Fruit			
Apple		1.0	
Peach	(1 Case of 24 No. 2 1/2 Cans = 48 Lbs of Raw Fruit)*	1.0	
Pear		1.0	
Other		1.0	
Canned Fruit		0.125	Sugar
Dairy Products			
Dried Milk	1 LB. = 7.60 LB. Milk	7.60	Milk
Yogurt		1.00	
Cheese	1 LB. = 10.0 LB. Milk	10.0	Milk
Butter	1 LB. = 21.1 LB. Milk	21.1	Milk
Cream	1 LB. = 19.0 LB. Milk	19.0	Milk
Eggs	1 Egg = 58.77 Gl. 47 LB. Eggs = 39.5 LB. Shelled Eggs	16.9578	No. Eggs

Table 20. Continued

Product to be converted to raw ag. demand	Comment	Conversion factor	Raw ag. product
Meat			
Poultry	(2 KG./Chicken) 1 LB. Live Wt., = 0.745 LB. Ready to Cook	0.5	No. Chickens
Mutton	(Av. Carcass Wt.) = 20.64 KG. Carcass = 48.2% Live Wt.	0.04849	No. Sheep
Goat	(Av. Carcass Wt.) = 14.00 KG. Carcass = 47.0% Live Wt.	0.07142	No. Goats
Beef	(Av. Carcass Wt.) = 89.31 KG. Carcass = 55.0% Live Wt.	0.0119	No. Cattle
Camel	(Av. Carcass Wt.) = 250.0 KG.	0.0040	No. Camel
Pork	(Av. Carcass Wt.) = 70.0 KG. Carcass = 57% Live Wt.	0.01428	No. Hogs
Fish	23% Live Wt. Loss with Cleaning	1.23	Wt. Fish
Game Products			
Fat and Lard (Animal)			
Sheep			
Cattle	6.6% Animals Wt. (Oleo)		
Hogs			
Rural			
Poultry	1.2 KG. Pea Chicken	0.667	No. Chickens
Sheep	Average Wt. 20 KG	0.050	No. Sheep
Goat	" " 16 KG	0.062	No. Goats
Cow	" " 10 KG.	0.010	No. Cows
Camel	" " 212 KG.	0.0047	No. Camel

Table 21-A. Projections of demand for Iranian agricultural products: Tehran

Food Product	1965	1970	1975	1980
Milk	253,673,245.00	371,771,923.00	587,073,051.00	816,525,453.00
Eggs (no.)	11,233,940.98	178,434,889.36	283,494,226.01	394,899,341.00
Wheat	345,029,101.00	478,065,585.00	676,369,605.00	912,745,542.00
Barley	55,424,566.00	76,882,016.00	107,586,047.00	144,939,944.00
Paddy Rice	93,890,826.00	137,577,630.00	202,338,626.00	276,316,953.00
Sheep (no.)	19,807,595.56	30,758,251.97	47,824,831.38	66,246,253.36
Cattle (no.)	147,291.18	210,733.29	303,017.91	411,297.44
Chickens (no.)	4,889,849.50	8,720,535.00	15,474,725.00	22,183,855.00
Fish (weight)	1,075,612.61	1,763,045.10	2,886,472.98	4,048,490.88
Animal oil (kd.)	3,359,228.00	4,890,324.00	7,149,428.00	9,746,059.00
Oil seeds (veg.)	100,878,880.00	146,858,360.00	214,700,280.00	292,677,920.00
Sugar Beets	560,670,351.00	790,015,184.00	1,153,757,121.00	1,609,236,919.00
Citrus fruit	45,884,160.00	69,864,190.00	106,609,800.00	146,956,200.00
Pit fruit	40,605,950.00	61,827,530.00	94,346,140.00	130,051,400.00
Apples	23,307,640.00	35,488,750.00	54,154,330.00	74,648,970.00
Pears	1,678,924.00	2,556,368.00	3,900,908.00	5,377,204.00
Apricots	884,297.90	1,346,451.00	2,054,628.00	2,832,200.00
Peaches	6,852,272.00	10,433,420.00	15,920,950.00	21,946,240.00
Cherries	1,103,648.00	1,680,439.00	2,564,277.00	3,534,727.00

Table 21-A. Continued

Food Product	1965	1970	1975	1980
Green plums	175,204.00	266,769.60	407,078.80	561,137.80
Pomegranates	82,534.81	125,669.20	191,766.00	264,339.80
Quince	620,801.70	945,246.10	1,442,406.00	1,988,284.00
Bananas	4,291,810.00	6,534.798.40	9,971,832.00	13,745,669.60
Dates	1,227,808.00	2,346,398.00	4,447,760.00	6,486,339.00
Vine fruit	2,231,889.00	3,401,110.00	5,194,002.00	7,161,131.00
Grapes	49,516,540.00	75,394,960.00	115,049,400.00	158,589,900.00
Watermelons	146,620,900.00	223,248,300.00	340,667,100.00	469,592,800.00
Cantalope	26,981,420.00	41,082,510.00	62,690,170.00	86,415,230.00
Potatoes	58,712,680.00	87,341,640.00	130,352,600.00	178,651,200.00
Onions	44,038,300.00	65,511,930.00	97,772,890.00	133,999,900.00
Vegetables	192,241,600.00	285,980,600.00	426,810,300.00	584,953,500.00
Fresh apricots, peaches and plums	1,167,107.00	1,777,063.00	2,711,722.00	3,737,974.00
Fresh grapes	707,714.20	1,352,474.00	2,563,710.00	3,738,754.00
Unshelled nuts	3,070,900.00	5,868,630.00	11,124,400.00	16,223,130.00
Pulses	26,407,520.00	38,462,700.00	56,257,040.00	76,698,540.00
Prepared Food	202,795.20	356,955.10	625,548.00	893,847.20
Alcoholic beverages	5,583,077.00	9,835,253.00	17,249,310.00	24,652,590.00

Table 21-A. Continued

Food products	1965	1970	1975	1980
Pickling fruits and vegetables	5,011,939.00	8,391,946.00	14,021.520.00	19,788,700.00
Spices	23,012,430.00	32,849,080.00	47,131,070.00	63,936,380.00
Tea	4,327,677.00	6,171,475.00	8,846,381.00	11,997,750.00
Coffee	182,101.80	259,685.90	372,241.60	504,846.50

Table 21-B. Projections of demand for Iranian agriculture products: urban Iran

Food products	1965	1970	1975	1980
Milk	458,871,116.00	658,510,308.00	941,446,412.00	1,244,892.721.00
Eggs (no.)	186,011,295.25	272,166,246.04	395,888,828.63	527,967,536.76
Wheat	783,728,493.00	1,020,024,054.00	1,333,755,666.00	1,693,193,967.00
Rice (paddy)	209,005,588.00	286,562,509.00	392,875,471.00	510,794,245.00
Barley	118,291,212.60	153,701,778.00	200,648,826.00	254,519,058.00
Sheep (no.)	4,216,366.31	6,047,932.60	8,639,477.45	11,425,712.34
Chickens (no.)	6,140,670.00	9,947,245.00	15,874,630.00	22,099,220.00
Fish (kg.)	15,839,730.13	23,825,592.00	35,539,952.10	47,952,681.60
Animal oil (kg.)	10,900,000.00	14,961,270.00	20,531,600.00	26,653,340.00
Oil seeds (veg.)	154,295,360.00	211,784,640.00	290,635,560.00	377,291,760.00
Sugar Beets	824,580,751.00	754,650,915.00	1,672,614,750.00	2,477,178,013.00
Citrus fruit	57,620,590.00	81,610,460.00	115,243,000.00	151,597,000.00
Pit fruits	80,999,720.00	114,723,300.00	162,002,100.00	213,106,500.00
Apples	27,479,180.00	38,919,930.00	54,959,280.00	72,296,410.00
Pears	2,728,141.00	3,863,981.00	5,456,367.00	7,177,609.00
Apricots	3,673,101.00	5,202,366.00	7,346,323.00	9,663,754.00
Peaches	6,743,437.00	9,551,015.00	13,487,090.00	17,741,660.00
Cherries	3,867,744.00	5,478,047.00	7,735,615.00	10,175,850.00

Table 21-B. Continued

Food product	1965	1970	1975	1980
Green plums	2,797,209.00	3,961,805.00	5,594,509.00	7,359,324.00
Pomegranates	13,571,640.00	19,222,080.00	27,143,720.00	35,706,350.00
Quince	2,128,516.00	3,014,706.00	4,257,103.00	5,600,022.00
Bananas	2,590,008.00	3,668,336.00	5,180,100.00	6,814,187.00
Dates	15,398,770.00	23,722,380.00	36,164,670.00	49,289,790.00
Vine fruit	3,852,048.00	5,455,818.00	7,704,223.00	10,134,560.00
Watermelons	255,742,000.00	362,218,200.00	511,492,600.00	672,845,300.00
Cantalopes	41,000,590.00	58,070,880.00	82,002,560.00	107,870,600.00
Potatoes	106,466,500.00	149,260,000.00	208,818,700.00	273,510,100.00
Onions	78,629,480.00	110,233,900.00	154,220,200.00	201,997,200.00
Vegetables	520,993,200.00	730,402,300.00	1,021,852,000.00	1,338,418,000.00
Fresh apricots, peaches and plums	15,794,663.25	24,332,246.85	37,094,428.05	50,556,987.68
Unshelled nuts	12,439,091.25	19,162,892.25	29,213,730.00	39,816,180.00
Pulses	57,476,190.00	77,932,120.00	105,762,100.00	136,589,700.00
Prepared food	5,048,160.00	8,083,877.00	12,766,280.00	17,685,950.00
Tea	8,294,301.00	11,004,490.00	14,641,490.00	18,736,620.00
Coffee and cacao	156,970.10	208,260.60	277,090.80	354,591.60
Grapes	69,053,316.00	98,354,759.00	247,656,913.00	184,207,348.00

Table 21-B. Continued

Food product	1965	1970	1975	1980
Alcoholic beverages	4,963,397.00	7,953,862.00	12,569,200.00	17,418,200.00
Fresh pickling fruits and vegetables	7,867,897.87	12,058,144.80	18,296,015.04	24,881,676.48
Spices	53,542,520.00	71,386,120.00	95,403,760.00	122,339,900.00
Tobacco	288,165,600.00	386,585,300.00	519,571,700.00	668,008,700.00
Fruit	36,682.24	363,588.64	857,387.20	1,167,421.60

Table 21-C. Projections of demand for Iranian agricultural products: rural Iran

Food product	1965	1970	1975	1980
Milk	1,670,806,966.00	2,073,223,449.00	2,941,528,508.00	3,379,983,788.00
Eggs (no.)	32,155,070.00	37,306,910.00	46,321,960.00	51,752,330.00
Wheat	3,663,198,125.00	4,625,668,600.00	6,495,232,965.00	7,864,050,951.00
Barley	346,313,512.00	405,135,116.00	561,626,373.00	573,723,463.00
Rice	463,731,700.00	601,796,300.00	930,473,400.00	1,088,164,000.00
Grout	16,521,670.00	19,576,810.00	25,331.180.00	28,545,080.00
Other grains	7,342,964.00	8,700,809.00	11,258,310.00	12,686,700.00
Wheat	3,435,887,958.00	4,369,914,174.00	6,495,232,965.00	7,533,832,806.00
Barley	307,355,911.50	361,643,133.50	461,553,592.50	518,625,206.00
Corn	25,667,208.00	30,200,725.80	38,544,206.40	43,310,232.00
Cows (no.)	757,390.00	1,000,349.00	1,600,975.00	1,885,803.00
Sheep and goats (no.)	3,139,116.42	3,781,332.26	5,053,099.82	5,732,590.06
Insides	13,620,010.00	19,353,260.00	35,739,930.00	43,372,910.00
Chickens (no.)	15,088,240.35	21,142,992.88	37,994,461.07	45,847,605.68
Other meat	20,311,580.00	26,963,400.00	43,582,840.00	51,442,810.00
Fish (kg.)	24,983,243.40	33,164,982.00	53,606,893.20	63,274,656.30
Animal oil	59,276,650.00	72,371,790.00	99,297,240.00	113,270,500.00
Oil seeds (veg.)	170.546,240.00	208,222,840.00	285,690,560.00	325,893,160.00

Table 21-C. Continued

Food product	1965	1970	1975	1980
Sugar Beets	2,809,208,670.00	3.146,861,430.00	3,965,042,760.00	4.417,400,770.00
Honey	355,304.40	490,393.30	501,492.60	558,706.30
Vegetables	386,097,600.00	451,633,600.00	569,816,800.00	638,743,000.00
Potatoes	200,154,900.00	234,129,100.00	295,395,500.00	331,127,500.00
Onions	16,580,880.00	19,395,310.00	24,470,650.00	27,430,680.00
Oranges	125,837,000.00	156,222,600.00	221,466,000.00	254,357,300.00
Grapes	173,803,100.00	215,771,100.00	305,883,300.00	351,312,100.00
Pomegranates	77,989,340.00	96,821,310.00	137,256,800.00	157,641,700.00
Melons	346,066,600.00	429,630,700.00	609,057,500.00	699,512,500.00
Fresh grapes	99,695,629.80	139,605,965.20	250,535,889.50	302,234,780.90
Fresh plums	116,681,918.00	281,912,624.00	411,782,414.00	495,796,624.00
Dates	92,237,549.00	129,162,270.00	231,793,703.00	279,624,978.00
Shelled nuts	2,487,132.00	3,482,787.00	6,250,184.00	7,539,924.00
Unshelled nuts	5,596,047.00	7,836,270.75	14,062,914.00	16,964,829.00
Pulses	87,641,800.00	101,917,900.00	127,117,800.00	142,153,300.00
Tea	30,496,970.00	34,713,450.00	41,518,730.00	46,025,740.00
Coffee and cacao	1,299,435.04	1,769,093.72	1,769,057.05	1,961,096.25
Spices	30,674,620.00	34,246,920.00	39,438,540.00	43,376,080.00
Tobacco	15,455,750.00	18,360,220.00	23,875,120.00	26,932,090.00
Alcoholic beverages	8,053,571.00	10,445,300.00	16,131.920.00	18,861,420.00

FOOTNOTES

1. Imperial Government of Iran, Plan Organization, The Fourth National Development Plan 1347-1351 (1968-1972) (English ed.: Tehran, Iran: Plan Organization, January, 1968), p. 53.

2. Ibid.

3. This adjustment will be made according to the criteria and techniques employed by Richard Stone, The Measurement of Consumer Expenditure and Behavior in the United Kingdom (Cambridge, Mass.: Harvard University Press, 1954), pp. 415-417.

4. This appears to be a realistic assumption for most food commodities; however, there are notable exceptions from time to time. For example, according to Stone's study during the late 30's, the net population of smokers in Great Britain rose by 32 percent while the adult population increased by only nine percent.

5. Since the price elasticity is given by $\frac{\partial Q}{\partial P} \frac{P}{Q}$, the slope B_1 can be obtained by multiplying the elasticity by $\frac{Q}{P}$.
$(\frac{\partial Q}{\partial P} \frac{P}{Q}) \frac{Q}{P} = \frac{\partial Q}{\partial P} = B_1$.

6. L. M. Goreux, "Long-Range Projections of Food Consumption," Monthly Bulletin of Agricultural Economics and Statistics, VI (June, 1957), 1-10.

7. These income elasticity coefficients will be similar to B_2 of equation (4). Income elasticities (denoted E) are given by $E = \frac{dQ}{dY} \frac{Y}{Q}$. $B_2 = \frac{Q}{Y}$. Therefore, $\frac{Y}{Q} B_2 = E$.

8. The 1965 data are likely to be the last collected by the Central Bank since most crop, population, and other survey functions have been turned over to the Iranian Statistical Centre.

9. Underestimation is inherent in most, if not all, surveys involving household income. The U. S. Department of Labor (Bureau of Labor Statistics) in its surveys (1941) found that cash income reported by households were underestimated by 10 to 11 percent. The Iranians are developing a very extensive income tax collection system and it is likely that income may be under reported on this account. For further references see: Sixto K. Roxas, Narciso A. Ferrer, and Andres K. Roxas, The Philippines: Long-Term Projection for Supply of and Demand for Selected Agricultural Products, Prepared for the Economic Research Service, USDA, by Mercantile Incorporated (Robot Statistics Division), Manila, Philippines (Washington, D. C.: Govermnent Printing Office, 1962).

10. For further explanation of dummy variables and their use as applied to this paper, see Appendix to this chapter.

11. Engel, Ernest, Die Productions - Und Consumptionsver Hal - Trisse De Konigreichs Sachsen, reprinted with separate pagination as an appendix to Engel's Die Lebenskosten Belgischer Arbeiter - Familien (Dresden: 1895).

12. For further information and a fine composition on Engel's law see G. J. Stigler, "The Early History of Empirical Studies of Consumer Behavior," Journal of Political Economy, LXII (February, 1954), 95-113.

13. For further explanation of the variation in consumption often resulting through time see Simon Kuznets, "Quantitative Aspects of the Economic Growth of Nations: VII. The Share and Structure of Consumption," Economic Development and Cultural Change, X (January, 1962), Part II, 1-92.

14. For a detailed discussion of time series versus cross-section data, see Lawrence R. Klein, An Introduction to Econometrics (Engelwood Cliffs, New Jersey: Prentice Hall, 1962).

15. Zvi Griliches, "Specification Bias in Estimates of Production Functions," Journal of Farm Economics, XXXIX, (February, 1957), 8-20.

16. Ibid.

17. In both regressions, the coefficients of Y are significant at the 5 percent level of probability. Although the coefficient of H is not significant at the 10 percent level, the R^2 for the true model is .94 compared to .87 for the miss-specified. According to the F test, both models will explain the total variability with a calculated F of 81.0 and 82.2 compared with a tabular of 9.4 at the 5 percent level.

18. Mordecai Ezekial and Karl A. Fox, Methods of Correlation Analysis (New York: John Wiley and Sons, Inc., 1959), p. 214.

19. The partial correlation coefficient would be written: $r_{13.2}$ = .738. This means the correlation between expenditures (1) and household size (3) holding the effect of income (2) constant is 0.738.

20. S. J. Prais, "Non-Linear Estimates of the Engel Curve," Review of Economic Studies, XX (Part 2, No. 55, 1952-53), 87. (Microfilm.)

21. United States Department of Agriculture, Department of Trade Analysis, Elasticity of Food Consumption Associated with Changes in Income in Developing Countries, by Robert D. Stevens, Foreign Agricultural Economics Report No. 23 (Washington, D. C.: Government Printing Office, March, 1965), p. 5.

22. L. M. Goreux, "Income and Food Consumption," Monthly Bulletin of Agricultural Economics and Statistics, IX (October, 1960), 1-13.

23. Ibid.

24. See Table 2.

25. The functional relationship of expenditures (X) depending on income and household size $X = F(Y,H)$ shall be referred to as Model I in this section.

26. J. Johnston, Econometric Methods (New York: McGraw-Hill Book Company, Inc., 1963), p. 202.

27. The data taken from the 1965 and 1959 Iranian survey reports average expenditures, income, and household size in 26 total groups.

28. Johnston, p. 202.

29. This can be shown mathematically by beginning with a log transformation of Model III.

$$\ln X/H = \ln \beta_o + \ln (Y/H)$$

Taking it out of logarithmic form gives: $X/H = \beta_o (Y/H)^{\beta_2}$

Multiplying both sides by H gives: $S = \beta_o Y^{\beta_2} H^{-\beta_2} H^1 = \beta_o Y^{\beta_2} H^{(1-\beta_2)}$.

30. The variance of (β_2) for these commodities (bakery products, fish, beef and dresses) is often higher than β_2 itself. (See Table 5). Apparently the magnitude of the var (β) in these regressions is amplified due to the low R^2 resulting in a high (e'e).

31. J. R. N. Stone, "The Analysis of Market Demand." In J. Johnston, Econometric Methods (New York: McGraw-Hill Book Company, Inc., 1963), 204.

32. B_2 is the income beta coefficient.

33. This can be seen from the results in Table 4.

34. This equation is derived by starting with X_t (total food expenditures) equal to the sum of all food items expenditures. That is $X_t = X_1 + X_2 + X_i$ and the partial derivative of X_t with respect to household size is:

$$\frac{\partial X_t}{\partial H} = \frac{\partial X_1}{\partial H} + \frac{\partial X_2}{\partial H} + \ldots + \frac{\partial X_i}{\partial H}$$

Multiplying both sides by H/X_t and term 2 on the right side by

$\frac{X_1}{X_1}$, $\frac{X_2}{X_2}$ and so on, we get:

$$\frac{\partial X_t}{\partial H}\frac{H}{X_t} = \frac{X_1}{X_t}\left(\frac{\partial X_1}{\partial H}\frac{H}{X_1}\right) + \frac{X_2}{X_t}\left(\frac{\partial X_2}{\partial H}\frac{H}{X_2}\right) + \ldots + \frac{\partial X_i}{\partial X_t}\left(\frac{X_i}{H}\frac{H}{X_i}\right).$$

The left side of this latter equation is equal to E_{Ht} and the right side is equal to $\Sigma\frac{X_i}{X_t}E_{Hi}$.

35. Houthakker estimated the effect of household size on total food consumption, based on 40 surveys taken from 30 different countries to be 0.28-0.35. See Hendrick S. Houthakker, "An International Comparison of Household Expenditure Patterns, Commemorating the Centenary of Engel's Law," Econometrica, XXV (October, 1957), 545. Brady and Barber arrived at a value of 0.33 for $E_H t$. See D. S. Brady, and H. A. Barber, "The Pattern of Food Expenditures," Review of Economics and Statistics, XXX (August, 1948), 198.

36. The simple correlation between income and household size from the rural data is 0.922. Obviously multicollinearity problems are to be expected.

37. Houthakker, p. 544; also, L. M. Goreux, "Income Elasticity of the Demand for Food," U. N. Economic Commission for Europe, 7/2 (New York: Agriculture working Party, June, 1959).

38. It follows from equation 21 that the quality elasticity is equal to the expenditure elasticity minus the quantity elasticity for any commodity.

39. A change in market structure is defined as a change in the proportion of food flowing through a marketing channel. Robert D. Stevens, "The Influence of Urbanization on the Income Elasticity of Demand for Retail Food in Low-Income Countries," Journal of Farm Economics, XLV (December, 1963), 1209.

40. Kuznets, p. 6.

41. United States Department of Agriculture, Department of Trade Analysis, Elasticity of Food Consumption Associated with Changes in Income in Developing Countries, By Robert D. Stevens, Foreign Agricultural Economics Report No. 23 (Washington, D. C.: Government Printing Office, March, 1965).

42. There are four levels at which E can be measured: (1) Food at Retail (the retail value of all food sold); (2) Food at Wholesale (the farm value of all food sold); (3) Supplier Food (the sum of "home produced food" and "food at wholesale"); (4) Total Food (the sum of "home produced food"and "food at retail").

43. Rex F. Daly, "Demand for Farm Products at Retail and Farm Level," Journal of American Statistics Associations, LIII (September, 1958), 656-668.

44. Goreux, "Income and Food Consumption," pp. 1-13.

45. Marguerite C. Burk, "Ramifications of the Relationship Between Income and Food," Journal of Farm Economics, XLIV (February, 1962), 115-125.

46. In another publication, Bunker and Cochrane use an approach similar to that which Stevens used with the Economics Research Service. Both studies show that the elasticities measured at the farm gate may differ as much as 6 from those measured at the retail level. E. W. Bunkers and Willard W. Cochrane, "The Income Elasticity of Food Services," Review of Economics and Statistics, XXIX (May, 1957), 211-217.

47. Hassen Ali Ronaghy, "Iran, Long-Term Projection of Demand for Supply of Major Agricultural Commodities for 1970, 1975, 1980 and 1985" (unpublished Ph.D. dissertation, University of Wisconsin, 1969). Ronaghy only had the urban 1959 survey data available for his study. He therefore had expenditure data and no purchased quantities. This led him to estimate the market margins for various commodities. His final results are considerably different from those of this paper in that he projected the real value of future demand rather than quantities demanded.

48. As previously noted, total expenditure elasticities are referred to here as income elasticities to avoid confusion of the term expenditure elasticity. Expenditure elasticities measure the percent change in family expenditures associated with a one percent change in family income. Likewise quantity elasticities refer to the percent change in the quantity of commodities consumed for each percent change in family income.

49. The complete details for this choice are given in Chapter III.

50. Stone, p. 204.

51. Houthakker, p. 541.

52. Houthakker encountered this same phenomena in the United States and between the U. S. and many European countries. Houthakker, p. 543.

53. Cf. pp. 9-11 supra.

54. In projecting the quantity of bread or any other commodity whose elasticity has been estimated with a semi-logarithmic form, the equation used in place of 22 is:

$$C_{ti} = \left(C_{oi} \left[E_i \ln \left(Y_{ti}/Y_{oi}\right)^t + 1 \right] \right) P_{ti}$$

55. Seni-logarithmic elasticities taken from parameters appearing in Table 12.

56. Johnston, pp. 221-2.

57. Stone, p. 204.

58. Lawrence R. Klein, An Introduction to Econometrics (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1962), p. 64.

59. C. E. V. Lesser, Econometric Techniques and Problems (New York: Hafner Publishing Co., 1966), pp. 27-28.

60. Klein, p. 64.

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APPENDIX

Appendix to Chapter II

Econometric research has used dummy variables fairly extensively in recent years. They are used to represent short run shifts in relationships between war-time and peace-time years, between different seasons, or different political regimes. They are also used to represent certain qualitative relationships. Sex, occupational or social status, marketal condition and age groups are a few examples.

To illustrate the use of dummy variables, take the hypothetical case shown in Figure 20 of expenditures on product K regressed against income for years A and B. Suppose consumption expenditures are linearly related to income and that in year B there is a downward shift in the function, as is the case for the consumption of vegetables between 1959 and 1965.

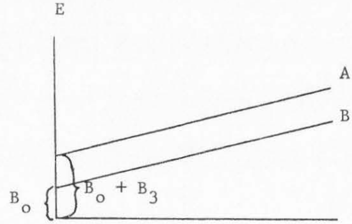

Figure 20. Expenditures on product K.

If the cross-sectional data were pooled for the two years and the following standard consumption function was used,

(7) $X_k = B_o + B_2Y + e$

where:

X_k = expenditures on product K

Y = income

e = error term

B_o and B_2 parameters to be estimated.

a large error will result due to the definite drop in expenditures between year A and B. However, suppose the following pooled consumption function is used including Z as a dummy variable.

(8) $X = B_o + B_3Z_1 + B_2Y + e$

where:

$Z = \begin{matrix} o \text{ in year B} \\ 1 \text{ in year A} \end{matrix}$

The consumption function for year B will then be written:

$$X_k = B_o + B_3\ (0) + B_2Y$$

$$= B_o + B_2Y$$

Note that B_o is of course the intercept.

The expenditure income relationship for year A is:

$$X_k = B_o + B_3(1) + B_2Y$$

Here the intercept is given by $(B_o + B_3)$.

Thus B_3 is the vertical measure between the intercepts of the two separate regressions. When equation (2) is used, the variation, due to the difference in the intercepts of year A and B, is given by B_3, which becomes part of the intercept instead of showing up in error term.

If the expenditures between year A and B did not vary equally at each income level so as to give a relationship similar to Figure 21, an additional dummy variable could be used to measure the change in slope. This change in the marginal propensity to consume can be incorporated by the following equation:

(9) $X_k = B_o + B_3 Z + B_2 Y + B_4 W + e$

where:

$W = ZY$, and

$Z = \begin{matrix} o \text{ in year B} \\ 1 \text{ in year A} \end{matrix}$

This gives a function for the year B as:

$$X_k = B_o + B_1 Y$$

and a function for year A as:

$$X_k = (B_o + B_3) + (B_1 + B_4)\ Y$$

Note that B_4 measures the change in the slope or propensity to consume for product K between year A and B.[56]

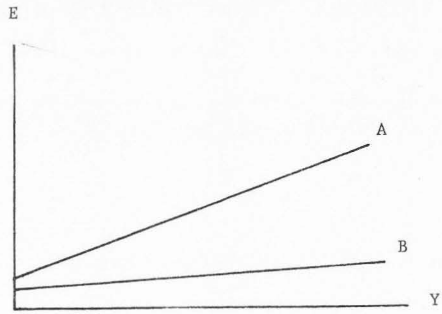

Figure 21. Expenditures on product K.

Appendix to Chapter III

The technique of depending on the var $(\hat{B})$ to determine if multicollinearity exists is not currently well defined. When the problem is not obvious noted statisticians are not always in agreement. For the interested reader the following should give some ideas and references on this matter. Stone argues that it may easily happen that var $(\hat{B})$ could be small relative to B in which case a misleading conclusion may be reached and B may be considered well determined.[57] However, Johnston insists that when multicollinearity is a problem ample warning will be given by a high standard error. Klein gives a more complete explanation for the detection of multicollinearity.

> When the explanatory variables are not perfectly correlated, but merely have a high correlation, there is a tendency towards indeterminancy, but not absolute indeterminancy, of the best-fitting plane. The warning light to the statistician that multicollinearity is serious, is that sampling errors in individual coefficients become large. The separate influences of each variable are shown by their respective coefficients in a linear equation, and these coefficients will not be very precisely estimated even though the over-all correlation for the entire equation is high. Inter-correlation of the explanatory variables is a relative matter. It is not possible to say whether separate influences can be singled out if the inter-correlation is at least .6, .7, .8, .9, or even higher. The sampling error of an individual coefficient depends on both the inter-correlation with other explanatory factors and on the over-all correlation of the whole equation. If the former is high relative to the latter, indeterminancy appears.[58]

Lester points out that multi-collinearity is serious when emphasis lies on the estimation of individual parameters in the relationship, but less serious when the objective of prediction for the dependent variable is stressed.[59] Since the logarithmic model will be used for estimating most of the income elasticity coefficients in this study, the individual income parameters are the actual elasticity coefficients. This means that if multicollinearity does exist, a direct bias will result in estimating the income elasticity coefficients.

The warning light of a large increase in the income coefficient sampling errors is not present, at least to any degree Klein suggests as significant. Yet, the high correlation between the two independent variables along with the high standard error for the household coefficient, may yet give rise to question. Further light on this matter may be offered by Klein.

> Multicollinearity is not a problem unless it is high relative to the overall degree of multiple correlation among all variables simultaneously. Production functions with overall correlations much in excess of 0.95, as often occur in practice, can be well-estimated with inter-correlations between labor and capital as high as 0.8 to 0.9. If these functions were not well estimated, we would tend to find high sampling errors of the estimated coefficients. The beta coefficient should be high multiples of sampling errors (certainly more than twice, which is the customary critical value for the five percent level of significance).[60]

For dairy products and most other food items in this study the overall multiple correlation is 0.9 or above. Since the inter-correlation between income and household size is 0.835, it seems reasonable to ignore for most commodities what bias, if any, that may exist due to multicollinearity. This is further explained in the main body of Chapter III.

Appendix to Chapter IV

Tables 22, 23, 24 and 25 contain a selection of the income, consumption and household data employed in estimating Iranian elasticity coefficients. Table contains the complete breakdown of pooled 1959-1965 urban (32 cities) household expenditure data, averaged into the income classes shown. Table 23 contains the 1965 urban consumption data in terms of quantities rather than expenditures. Together these tables provide a good indication of the general results of Bank Markazi surveys.

Tables 24 and 24 contain condensed or abbreviated examples of the Tehran and rural data. Only average 1965 expenditure values are shown for Tehran; not all commoditites are listed (table 24). Table 25 contains three rounds of pooled rural data 1963, 1964, 1965. The listings are on an expenditure rather than weight basis.

Table 22. Basic average pooled 1959-1965 income, household size, and consumption data, urban Iran (32 cities, average weekly family expenditures in Rials) Part 1.

A. Income	22,863	25,073	29,474	40,590	47,130	56,104
B. H. H. Size	2.26	2.62	2.95	3.02	3.84	4.12
C. Food items						
1. Dairy products	14.1	20.1	18.8	18.8	21.8	28.4
2. Cheese	3.1	4.5	5.1	7.5	9.4	9.9
3. Eggs	2.9	2.8	2.8	4.8	7.0	7.4
4. Flour	30.8	14.4	18.5	13.5	8.8	16.0
5. Rice	16.9	20.6	18.6	27.3	33.8	39.0
6. Bread & bakery	6.2	88.6	101.4	119.0	114.2	143.6
7. Mutton	28.6	27.7	38.6	59.6	74.1	96.8
8. Beef	7.4	13.7	16.9	17.2	14.1	14.0
9. Poultry	.1	.3	1.4	1.9	3.1	2.1
10. Fish	2.7	1.8	2.6	3.5	2.4	2.4
11. Fats & oil	9.0	27.8	21.3	46.7	35.4	50.0
12. Sugar	31.9	35.9	28.4	46.1	53.8	6.3
13. Fresh fruits	18.8	11.8	1.6	22.7	30.7	36.2
14. Fresh vegetables	12.6	13.2	18.0	22.0	28.6	35.3
15. Canned Fruit	.1	.2	5.7	.5	1.1	.8
16. Dry fruits & nuts	4.3	2.5	2.8	4.3	4.4	5.6
17. Pulses	7.6	9.0	11.6	19.0	19.1	2.7
18. Coffee & tea	21.8	11.4	23.7	34.5	35.9	41.4
19. Spices	8.7	7.4	10.6	11.7	13.0	16.7
20. Non-alcoholic beverages	.1	.1	.5	1.1	1.6	2.9
21. Alcoholic beverages	.1	.1	.5	.7	.1	1.8
22. Food away from home	242.1	617.6	1095.8	1608.0	2012.6	2696.2
23. Tobacco	1123.1	822.7	1209.5	1337.0	1604.7	1544.0
D. Material items						
24. Textiles	47.3	98.6	153.2	185.7	275.1	317.1
25. Women's leather shoes	235.6	200.4	273.6	344.3	470.9	610.8
26. Leather gloves	46.0	46.6	60.2	130.2	128.0	147.6
27. Underwear	80.3	89.0	77.2	107.2	152.8	199.8
28. Dresses	486.2	341.5	431.2	510.6	678.5	911.0
29. Men's cotton shirts	104.0	177.9	291.4	470.8	514.9	659.7

Table 22. Part 2.

A.	67,000	80,935	109,662	140,423	182,150	332,530	20,640
B.	4.45	4.63	5.14	5.45	5.47	5.71	2.26
C.							
1.	32.7	42.9	52.9	71.9	89.6	163.5	3.6
2.	15.9	17.9	22.1	29.8	37.4	47.1	1.0
3.	9.7	12.2	17.2	20.4	28.4	39.1	.6
4.	15.5	24.2	25.3	27.7	22.8	20.1	.1
5.	65.3	93.5	110.4	44.0	155.6	199.2	2.0
6.	150.9	156.3	169.2	183.6	212.6	224.9	55.7
7.	104.7	125.1	160.9	198.7	237.1	344.5	52.2
8.	14.8	14.1	12.2	12.1	14.5	21.4	8.2
9.	3.4	7.1	17.5	25.9	36.7	114.3	.1
10.	6.1	9.2	11.3	16.7	14.6	25.4	.5
11.	53.5	72.3	92.1	111.1	142.3	221.1	.1
12.	68.8	79.2	87.4	9.9	118.6	136.4	18.6
13.	41.3	51.7	78.5	93.6	131.8	223.9	7.6
14.	44.7	64.4	71.6	87.9	105.5	168.6	7.0
15.	.8	.1	1.2	2.0	1.5	5.5	.1
16.	4.9	7.1	10.4	1.9	20.1	36.7	.2
17.	27.6	30.8	40.2	52.0	52.5	50.0	2.8
18.	45.0	52.7	64.4	64.1	87.7	86.2	9.7
19.	18.3	24.2	26.6	36.4	48.2	62.3	1.3
20.	3.2	6.3	11.9	16.9	23.6	57.5	.1
21.	3.5	7.9	7.5	12.7	26.3	543.1	.1
22.	2863.1	3455.6	4386.9	5367.7	7114.0	1025.0	2436.6
23.	1678.6	2069.7	2323.1	2884.3	2859.8	3900.8	249.6
D.							
24.	452.2	542.2	730.1	988.6	1415.1	2299.7	.1
25.	688.1	872.6	1146.8	1490.5	1926.9	3276.2	20.0
26.	198.6	268.2	261.4	442.8	533.9	1342.7	.1
27.	224.9	288.8	381.6	525.4	634.0	1213.8	.1
28.	972.0	1156.7	1607.4	2104.2	2652.6	4013.1	.1
29.	818.3	973.2	1281.6	1694.0	2039.1	2816.5	.1

Table 22. Part 3.

A.	11,650	21,216	25,266	31,819	38,154	45,082
B.	1.77	2.95	3.02	4.05	4.54	4.03
C.						
1.	5.9	12.4	11.4	15.3	13.0	19.1
2.	5.8	2.1	5.3	6.0	8.1	9.8
3.	.9	.6	2.4	2.4	4.6	6.3
4.	5.6	4.3	3.4	1.6	14.9	8.9
5.	6.2	5.8	4.9	14.6	21.0	26.7
6.	37.3	90.0	83.4	116.1	152.0	144.9
7.	13.7	24.2	21.2	40.2	48.6	49.8
8.	6.3	6.5	11.4	14.6	19.6	19.4
9.	.1	.1	.1	.1	.1	.6
10.	.6	2.5	1.0	1.3	1.0	1.1
11.	12.5	6.6	20.6	23.6	24.8	32.0
12.	21.9	25.6	30.0	36.3	47.4	44.6
13.	5.4	7.4	21.6	30.6	36.2	54.6
14.	12.2	28.8	29.7	25.4	34.9	50.3
15.	.1	.1	.1	.2	.1	.5
16.	.2	.5	.6	.7	.2	3.0
17.	2.2	5.9	10.7	13.2	13.8	14.2
18.	11.4	18.1	22.4	20.6	20.1	23.0
19.	1.6	2.6	4.0	5.8	6.0	6.7
20.	.1	.4	2.0	.1	2.0	1.2
21.	.1	.1	.1	.1	1.0	1.1
22.	258.9	1929.0	1950.9	7324.7	1361.4	2277.2
23.	522.0	822.1	1070.4	872.9	952.9	1242.3
D.						
24.	36.0	.1	1.7	21.8	29.3	40.9
25.	56.5	53.8	105.4	127.8	160.2	185.1
26.	.1	.1	2.0	.8	.1	.2
27.	.1	4.5	22.1	11.3	18.2	20.6
28.	1.2	18.0	36.3	40.5	45.0	52.0
29.	29.1	47.1	72.1	83.7	195.4	153.1

Table 22. Part 4.

A.	58,225	78,682	98,404	133,080	182,008	222,666	447,026
B.	4.42	5.01	5.29	5.75	5.45	4.73	5.35
C.							
1.	26.8	5.64	48.7	77.6	94.5	124.5	195.1
2.	12.0	21.0	23.6	35.5	35.0	41.1	109.3
3.	8.1	10.2	14.9	22.9	26.4	39.1	50.3
4.	7.9	6.5	10.9	8.5	4.6	12.6	11.4
5.	43.0	52.3	77.6	105.1	57.8	125.0	111.3
6.	140.5	162.6	168.9	206.8	178.6	181.3	238.5
7.	72.2	92.2	131.3	181.7	213.7	259.6	377.1
8.	21.4	21.7	16.4	23.5	39.5	20.6	31.5
9.	4.6	9.5	5.9	20.2	33.9	94.3	109.1
10.	5.7	5.7	10.3	9.3	28.0	25.0	49.0
11.	37.5	64.4	87.4	82.0	137.5	126.0	98.3
12.	59.6	66.6	68.7	89.2	90.6	94.9	89.3
13.	60.6	101.4	139.8	228.0	300.4	436.8	557.2
14.	76.1	104.3	123.8	178.1	206.9	222.7	258.5
15.	.3	.9	1.4	.8	1.7	3.3	5.0
16.	2.4	4.8	7.5	10.0	14.3	32.8	69.7
17.	18.3	25.4	26.2	35.6	30.8	78.3	44.8
18.	38.8	39.4	39.7	52.0	50.5	45.1	72.5
19.	8.0	9.2	12.3	14.1	11.1	12.7	22.8
20.	.3	3.4	4.1	7.7	14.0	27.8	25.5
21.	.1	2.9	7.0	10.5	27.3	.1	482.1
22.	2475.5	3430.9	3878.6	4861.0	9365.1	9428.7	2324.4
23.	1543.2	1722.6	2000.8	2651.8	2643.1	1790.7	4420.9
D.							
24.	55.2	87.7	108.5	141.5	138.1	164.2	158.1
25.	323.9	492.3	577.6	914.4	1241.3	1495.8	2401.5
26.	1.6	2.9	2.2	10.1	38.4	51.8	83.4
27.	43.4	59.6	69.4	65.0	66.1	108.5	41.1
28.	98.8	108.1	136.0	185.5	140.6	133.3	90.8
29.	163.2	176.6	304.7	402.7	324.0	330.3	307.9

Table 23. Basic average 1965 in ome, household size, and consumption data, urban Iran (average weekly family purchases in grams) Part 1.

A. Income	11,650	20,640	21,216	25,266
B. H. H. size	1.85	2.40	3.17	3.24
C. Food items				
I. Dairy	62.8	24.7	62.8	58.5
2. Cheese	8.4	1.5	2.8	7.6
3. Eggs	1.4	.9	.9	3.2
4. Flour	61.7	.1	52.1	37.6
5. Rice	22.0	10.0	27.1	21.5
6. Bread	439.4	560.8	996.4	935.2
7. Mutton	18.3	70.9	31.5	30.3
8. Beef	15.7	17.2	15.0	28.8
9. Poultry	.1	.1	.1	.1
10. Prepared food	1.0	.1	1.4	2.0
11. Fish	5.0	5.0	8.3	.1
12. Fats & oils	21.4	.1	12.4	35.1
13. Sugar	71.2	48.7	85.7	96.4
14. Fruit	66.6	20.0	131.8	199.8
15. All vegs.	122.7	366.2	277.6	271.4
16. Canned fruit & veg.	.1	.1	.1	.1
17. Dry fruit	1.2	.9	1.7	.6
18. Pulses	15.2	12.9	24.8	54.5
19. Food away from home	1.0	.8	1.4	2.0
20. Coffee & tea	6.0	4.2	7.6	12.2
21. Non-alcholic bev.	.1	.1	2.6	.9
22. Alcholic bev.	.1	.1	.1	.1
23. Spices	93.9	51.4	33.6	46.7
24. Tobacco	282.4	157.8	292.6	612.9
D. Material items				
25. Cloth & leather shoes	30.0	35.5	75.4	98.4
26. Men's leather gloves	.1	1.2	.1	1.2
27. Table linen	2.0	8.5	2.0	3.6
28. Men's stockings	.1	5.7	5.3	8.7
29. Handkerchiefs	.1	.5	5.1	5.4
30. Cotton suits	.1	16.2	57.3	162.1
31. Leather cases	.1	.1	.1	.1

Table 23 Part 2.

A.	31,819	38,154	45,082	58,225	78,682
B.	4.39	4.93	4.37	4.80	5.46
C.					
I.	137.8	104.2	126.2	167.5	206.9
2.	9.0	9.9	13.1	14.1	28.4
3.	3.4	7.1	9.3	10.3	13.6
4.	24.7	186.5	91.3	73.4	80.0
5.	63.2	234.9	111.3	182.7	217.0
6.	1310.9	1639.7	1488.1	1372.1	1575.1
7.	63.0	59.2	70.9	103.3	127.3
8.	34.8	45.3	129.1	43.3	44.6
9.	1.4	1.1	.1	.4	.1
10.	4.0	11.8	14.4	15.1	5.6
11.	7.1	4.2	4.1	19.1	21.1
12.	43.0	43.0	55.8	55.1	90.7
13.	125.2	167.5	148.8	198.2	233.0
14.	345.5	500.3	464.4	563.9	819.6
15.	273.7	329.4	475.3	699.4	936.0
16.	.6	.1	1.1	.5	2.1
17.	2.6	1.5	8.1	7.9	10.7
18.	58.1	56.5	57.4	76.6	93.3
19.	4.0	11.8	14.4	15.1	5.6
20.	9.2	9.8	9.8	14.7	15.4
21.	.4	1.2	6.5	1.5	16.7
22.	.1	.1	.8	.1	2.6
23.	82.2	83.2	73.5	87.7	101.2
24.	294.7	349.1	427.2	408.7	447.2
D.					
25.	90.8	205.2	234.5	454.8	703.3
26.	1.3	1.1	4.3	5.0	11.0
27.	5.4	7.5	18.3	22.4	38.9
28.	9.4	8.3	18.7	20.4	21.4
29.	1.0	5.3	4.3	5.0	12.6
30.	185.0	210.2	181.5	236.6	256.0
31.	.1	.1	.4	1.0	1.9

Table 23 Part 3.

A.	98,404	133,080	182,008	222,666	447,026
B.	5.77	6.28	5.94	5.14	5.83
C.					
1.	247.6	346.1	380.2	509.8	632.9
2.	27.6	44.1	38.5	46.8	136.2
3.	19.9	31.4	34.7	54.8	59.8
4.	84.7	100.0	10.2	204.4	67.9
5.	314.1	400.9	212.3	416.7	285.7
6.	1586.6	1895.6	1443.6	1164.6	1603.5
7.	181.1	223.0	267.6	310.4	429.7
8.	34.1	30.0	77.3	21.1	52.6
9.	.5	.3	3.8	.1	13.1
10.	4.1	11.1	14.5	10.5	8.2
11.	29.7	24.5	57.4	63.8	48.0
12.	116.4	106.7	154.4	129.8	135.4
13.	238.3	297.6	292.0	285.7	256.5
14.	1013.3	1472.0	1701.4	2110.9	1668.0
15.	960.0	1411.0	1383.2	1567.4	1974.0
16.	1.6	1.4	3.3	5.6	8.3
17.	18.2	17.6	42.0	49.8	82.4
18.	108.2	140.6	121.0	353.5	119.9
19.	4.1	11.1	14.5	10.5	8.2
20.	15.7	19.1	16.7	15.4	26.3
21.	21.5	40.9	78.2	138.9	141.2
22.	10.1	11.2	37.9	.1	62.7
23.	118.9	105.9	88.7	136.2	86.4
24.	609.6	620.1	606.8	522.9	693.5
D.					
25.	828.3	1195.8	1332.0	1764.2	2372.1
26.	15.3	28.8	39.2	47.7	63.8
27.	58.1	87.9	118.4	106.7	255.8
28.	26.9	26.2	35.2	16.2	54.6
29.	14.4	26.0	33.8	45.5	72.6
30.	206.7	387.0	297.5	456.5	1219.3
31.	2.6	8.7	4.4	.8	13.7

Table 24. Examples of basic average 1965 income, household size and consumption data, Tehran, Iran (average weekly family expenditures in Rials). Part 1.

A. Income	13,461	29,930	31,226	34,381	52,776	54,158	55,951
B. H. H. Size	1.0	2.19	2.12	2.44	4.32	4.68	3.97
C. Food items							
1. Dairy	37.5	13.7	33.0	1.4	27.9	39.8	49.8
2. Flour products	.1	.1	.5	.1	.7	.1	.2
3. Bread	23.5	71.0	89.8	66.6	175.2	136.5	147.6
4. Rice	12.0	36.4	6.2	8.8	27.7	34.8	35.0
5. Meat	23.0	77.4	28.1	44.4	81.1	72.2	89.0
6. Animal fats	13.5	88.2	3.5	7.0	23.1	30.0	33.8
7. Sugar	17.0	45.4	24.9	29.6	45.8	41.7	38.8
8. Honey	7.5	.1	.7	2.0	.1	1.1	.6
9. Bakery	.1	2.3	.1	.1	.7	.5	3.5
10. Other sweets	.1	.1	1.1	.1	.2	.9	1.8
11. Fruit	4.5	40.3	11.7	3.2	40.7	28.5	37.2
12. Vegetables	6.0	14.3	22.3	16.8	26.8	32.0	43.6
13. Dried fruits & nuts	.1	.1	3.5	.1	.1	1.1	.3
14. Pulses	5.0	11.3	4.3	3.6	16.3	17.0	16.0

Table 24 Part 2.

A. Income	90,439	107,537	134,311	182,232	232,223	458,979
B. H. H. Size	4.11	4.56	5.34	4.53	4.24	4.92
C. Food items						
1. Dairy	90.4	90.8	123.4	135.3	191.3	327.8
2. Flour products	3.1	2.1	2.6	3.9	1.0	14.6
3. Bread	154.7	162.9	194.8	172.9	141.9	150.7
4. Rice	57.3	77.6	112.6	34.2	85.4	169.9
5. Meat	123.3	143.8	219.4	299.2	396.3	645.9
6. Animal fats	64.0	102.1	58.9	90.5	83.7	83.4
7. Sugar	54.8	70.9	82.3	96.7	63.0	65.2
8. Honey	1.3	2.6	1.0	4.0	1.9	4.5
9. Bakery	5.5	11.8	13.1	11.1	42.1	80.0
10. Other sweets	2.3	1.5	1.1	2.6	4.7	8.4
11. Fruit	58.8	95.6	132.8	118.0	289.5	344.6
12. Vegetables	59.7	66.8	92.4	102.8	99.1	171.7
13. Dried fruits & nuts	4.8	14.8	7.7	6.7	11.3	69.3
14. Pulses	21.6	32.2	41.0	17.8	8.0	32.2

Table 25. Examples of basic average pooled 1963, 64, 65, income, household size and consumption data, rural Iran (average monthly family expenditures in grams). Part 1.

A. Income	2729.06	3825.88	4499.59	6063.20	6101.08	7052.32
B. H. H. size	1.76	2.06	2.87	3.81	3.05	4.02
C. Dairy products	56.698	90.50	107.60	115.43	144.76	128.63
1. Cheese	0.30	3.93	8.96	32.30	20.50	37.03
2. Eggs	0.30	21.86	12.43	29.86	36.46	33.70
3. Fruit	36.26	9.56	19.96	25.20	25.50	36.96
4. Vegetables	19.33	37.43	42.80	67.06	67.50	80.83
5. Dry fruit	1.33	36.80	36.56	20.70	17.26	12.00
6. Pulses	214.53	28.26	40.90	54.96	63.30	76.63
7. Sugar	786.26	234.10	274.20	322.80	362.43	363.53
8. Flour, etc,	86.26	365.60	452.33	639.76	575.90	619.96
9. Rice	4.36	38.26	122.33	133.00	120.36	188.63
10. Bread	125.13	155.33	47.53	39.93	47.10	70.76
11. Beef	13.26	4.63	13.67	20.16	24.46	40.53
12. Mutton	14.026	35.56	37.30	126.83	139.93	200.50
13. Poultry	0.30	0.23	0.20	14.93	0.16	15.03
14. Fish	8.283	4.63	7.50	12.30	12.16	24.66
15. Coffee and tea	42.250	64.90	168.16	194.70	216.73	217.36
16. Spices	9.26	13.43	17.00	22.43	23.70	28.63

Table 25. Part 2.

A. Income	7617.68	8977.06	11,312.62	13,639.36	17,933.96	19,714.14
B. H. H. Size	4.73	5.16	5.71	6.64	2.78	9.02
C. Dairy products	138.7	155.20	198.56	225.40	312.36	407.16
1. Cheese	66.73	57.13	74.90	88.76	105.03	113.66
2. Eggs	30.93	35.83	56.26	66.23	98.16	76.56
3. Fruit	30.33	39.20	61.96	70.66	116.76	207.63
4. Vegetables	78.50	93.93	90.00	124.23	143.60	121.86
5. Dry fruit	14.23	12.73	11.96	25.36	30.80	38.00
6. Pulses	83.90	97.93	100.40	103.76	109.13	129.30
7. Sugar	371.12	393.30	430.70	476.76	446.10	547.26
8. Flour, etc.	681.03	681.23	680.00	601.36	455.8	555.40
9. Rice	254.23	323.03	512.70	838.13	845.8	685.96
10. Bread	70.86	72.10	69.93	91.73	157.93	69.40
11. Beef	48.83	74.23	56.13	42.16	135.33	29.26
12. Mutton	252.80	301.90	386.96	429.16	469.90	646.70
13. Poultry	21.06	41.93	68.00	88.96	165.07	156.70
14. Fish	21.43	19.40	20.30	31.36	15.03	44.66
15. Coffee and tea	213.43	228.46	220.70	253.96	255.07	267.06
16. Spices	24.86	25.53	30.60	32.50	35.7	37.86

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