FORECASTING PERSONAL CONSUMPTION EXPENDITURES FROM CROSS-SECTION AND TIME-SERIES DATA

by
Paul Devine

Dissertation submitted to the Faculty of the Graduate School
of the University of Maryland in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
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Title of Dissertation: Forecasting Personal Consumption Expenditures From Cross-Section and Time-Series Data

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Doctor of Philosophy, 1983

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ABSTRACT

Title of Dissertation: Forecasting Personal Consumption Expenditures from Cross-Section and Time-Series Data

Paul Devine, Doctor of Philosophy, 1983

Dissertation directed by: Clopper Almon, Jr.
Professor of Economics
Department of Economics

A system of equations to forecast personal consumption expenditures in 77 categories was developed for use in a long-term input-output model of the U.S. economy. The equations incorporate demographic and income distribution influences as well as the effects of relative prices. Measuring demographic and economic influences on consumption required that both a cross-section and a time-series analysis be performed.

Cross-section equations estimated on the most recent Consumer Expenditure Survey (1972-73) yield a set of adult equivalency weights, non-linear Engel curves, and demographic composition parameters for 50 consumption items. The adult equivalency weights allow each of eight age groups to contribute different amounts to the effective size of the household for a given item. This weighting scheme permits the construction of commodity specific household sizes which depend on the age distribution, and not just the number, of household members. The Engel curve is represented by a flexible linear spline which allows the curve to have different slopes for different income groups. The demographic composition parameters measure

differences in household consumption which are attributed to variances in region, family size, educational attainment, working habits of spouses, and age of the household heads.

The cross-section results were transformed into two variables -- weighted population indices and historical 'predictions' of consumption levels -- which were used in the estimation of the time-series equations. The adult equivalency weights were combined with population totals by age to produce commodity specific population indices. Consumption levels were divided by these population indices to create the dependent variable used in the time-series equation. 'Predictions' of historical consumption levels were found by combining the cross-section Engel curves and demographic composition parameters with historical income distributions and demographic population proportions. These 'predictions' were the principal non-price explanatory variables in the time-series equations.

The income portion of the cross-section 'predictions' was calculated using per capita distributions of income. These per capita distributions are not available from published sources and had to be constructed by combining the distributions of income by household size into a single yearly distribution. Equations were estimated to project this distribution into the future.

The method employed to measure the price effects in the time series equations is an extension of Clopper Almon's Symmetric Consumption Functions. The Almon System assumes that all groups of commodities are weak substitutes for one another. In the new system, groups can be either substitutes or complements and the magnitude of the group price interactions can vary among groups.

In its final form, the system of equations combine the cross-section demographic results and the additional price sensitivity. The equations were estimated for 77 detailed components of the National Income and Product Accounts' Personal Consumption Expenditures for the period of 1959 through 1979. Forecasts of consumption to 1995 were made using the estimated system of equations.

ACKNOWLEDGEMENTS

I would like to thank Professor Clopper Almon for his invaluable guidance and for the opportunity to be a part of the INFORUM Project. I would also like to thank Rosemary Nowaskey and Claudia Jackson for their expert word processing support. My greatest debt, however, is to my wife, Judith, who contributed patience, encouragement, and tireless editorial assistance.

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CHAPTER 1

INTRODUCTION

Personal consumption expenditures make up approximately two-thirds of Gross National Product in the U.S. economy. Since shifts in consumption patterns subsequently affect industry output, prices, employment, and investment, forecast of consumption are an integral part of any forecast of economic activity. This study describes the formulation and estimation of a system of equations used to forecast personal consumption expenditures in a long-term input-output forecasting model of the U.S. economy.[1] These equations utilize a nonlinear Engel curve and a flexible treatment of price substitution effects. The principal tenet of the investigation, however, is that demographic factors are important determinants of aggregate consumer demand and should be accounted for in the equations along with the economic variables. If demographically distinct households have different consumption patterns, then changes in the demographic composition of the population will affect aggregate consumption.

This study supports our prior notion that demographic characteristics influence household consumption behavior. Consider the following demographic factors and some examples of their effects on household consumption:

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1 The equations are used in the LIFT model (Long-term Interindustry Forecasting Tool) of the U.S. economy developed at the University of Maryland under the direction of Professor Clopper Almon.

Age structure: Households comprised of the same number of individuals but with different age structures can have markedly different consumption patterns. An elderly couple spends more on medical care and less on furniture than a young couple. The number of children in a household has a greater impact on household expenditures such as food and clothing than on alcohol and tobacco.

Region: Differences in climate lead households in the northeast and the north-central regions to spend more on heating than households in the west and the south. Households in the western region spend less on public transportation and more on gasoline than households in the northeast because fewer public transportation options exist in the west.

Education: Households whose heads have a college education spend more money on books and magazines and less on televisions and automobiles than do other households.

Working spouses: Households in which both the husband and the wife work spend more on services and clothing than households with just one wage earner.

Household size: Large families have the potential to realize economies of scale in the consumption of durables and services. Small families spend more on a per person basis for these items.

The composition of the population with respect to these demographic factors has significantly changed over time. As a result, these factors not only enable us to explain differences in household consumption patterns but are helpful in explaining changes in aggregate consumption as well. Consider, once again, our demographic factors and the corresponding changes in the population which have occurred since the late 1950's:

Age structure: Significant changes in the age composition of the population have resulted from such factors as the post World War II baby boom and increased longevity. In the period between 1959 and 1979, the proportion of the population under 5 years decreased from 11.35 percent to 7.14 percent while the elderly population over the age of 65 years increased from 9.14 percent to 11.17 percent. The proportion of the population between the ages of 31 and 40 roller coasted from a high of 13.83 percent in 1959 to a low of 11.09 percent in 1970 and back up to 13.62 percent in 1979.

Figure 1.1 is a graphical representation of historical and projected changes in the age structure of the population for the period 1955 to 1999. The projections are obtained from the Bureau of the Census and assume a lifetime fertility of 2.1 children per woman.

Region: The United States has experienced a migration of the population from the northeast and the north-central regions to the south and the west. Between the period of 1959 and 1979, this migration shifted a full 5 percent of the population toward warmer climates.

Education: There has been a substantial increase in the level of educational attainment by the population. In 1959, only 10 percent of all households were headed by someone with a college degree. By 1979 this figure increased dramatically to 17.5 percent.

Working spouses: In 1959, only 25 percent of all households had the benefit of two incomes. But as the result of the increased participation of women in the labor force, the proportion of two worker households reached 40 percent by 1979.

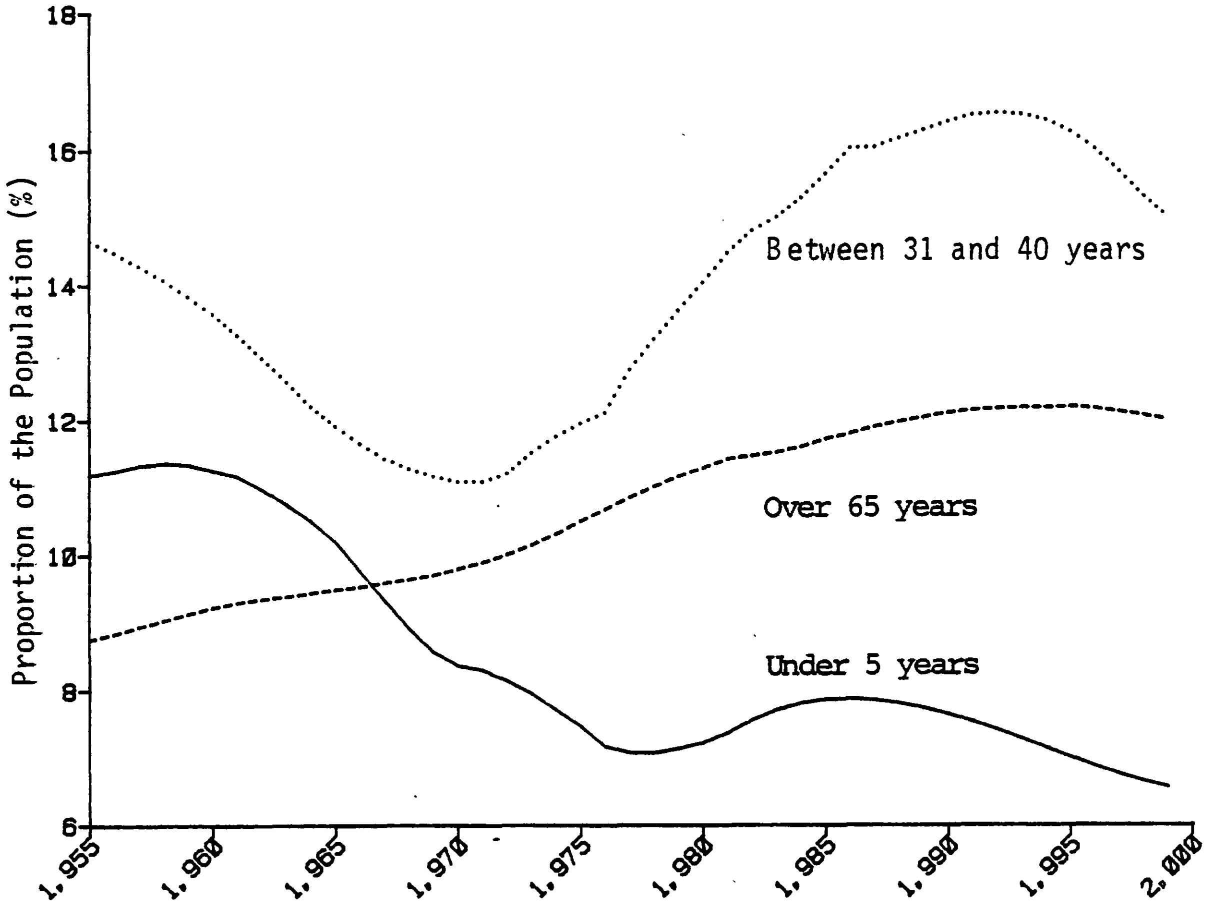
Household size: The American household has decreased in size. The trend away from large households reduced the proportion of households with 5 or more members from 22.4 percent to 14.0 percent in 1979. Conversely, the proportion of single member households increased sharply from 12.7 percent in 1959 to 22.4 percent in 1979.

Since these demographic variables are important determinants of consumer demand, it is necessary from an econometric point of view to account for them in our consumption equation. Not doing so would force variables such as income and prices to explain demographically induced changes in demand, thereby biasing all the coefficients in the equation.

Incorporating demographic factors into consumer expenditure equations is a difficult task. The procedure is complicated because no single data source is rich enough to disentangle the myriad of demographic and economic influences on consumption. Cross-section data with its wide variety of households in the sample provide a perfect environment in which to measure the effects of household composition on consumption patterns. But cross-section data, having essentially fixed

Figure 1.1

The Population Proportion of Three Selected Age Groups



prices, are not particularly useful in estimating the price effects that influence long run forecasts on consumption. In contrast, time series data are appropriate for measuring price elasticities but not for measuring the effects of slowly moving and collinear demographic variables. Since neither data source is sufficient by itself, both are used and two separate analyses are required. We first perform a cross-section analysis and then transform these results into variables for use in a time series analysis.

In the cross-section analysis, which is presented in chapter two, household consumption equations are estimated for 50 items. Each of the equations utilizes a nonlinear Engel curve and demographic composition variables to explain household consumption. The source of the data used for the estimation is the 1972-73 Consumer Expenditure Survey from the Bureau of Labor Statistics which contains detailed information on the characteristics and consumption patterns of approximately 20,000 U.S. households.

The cross-sections equations depend upon the simple notion that, in the demand for some goods, say alcohol, family members of certain ages "count" for more than do family members of other ages. To be specific, our results will show that adults "count" for more than 40 times as much as do children in the consumption of alcohol. The cross-section equations relate household consumption to the product of two components - consumption per "equivalent person" and the weighted size of the household. The household 'size' component refers to the effective size of a household relevant to a given item and is constructed using adult equivalency weights. Adult equivalency weights measure a person's consumption requirements or tendencies towards a given item relative to that of a reference group --- which in our case is adults aged 31 to 40 years. Through these weights household members in eight age groups contribute differently to the size of the household on an item-to-item basis. The commodity specific household 'size', therefore, depends upon the age distribution as well as the number of household members.

The consumption per equivalent person component is a function of household income and non-age structure variables. The nonlinear Engel curve incorporated in the equations allows households with different levels of income to spend different portions of a marginal dollar on the consumption of a given item. In addition, its form is flexible so as to allow each of the 50 consumption items to have a different income-consumption relationship. The non-age structure demographic variables are included in the equation as dummy variables that shift the Engel curve up or down depending upon the consumption patterns of the demographic group.

In chapter three, these cross section results are transformed into variables for use in a time series analysis of aggregate consumption behavior. The adult equivalency weights are used to construct commodity specific population indices from historical population figures. These indices provide a better measure of the size of the population relevant to a particular commodity than does a simple population total. Through the estimated adult equivalency weights, they combine information on the changing age structure of the population with information on age-related differences in consumption tendencies. We form the dependent variable in the time series equation by dividing aggregate consumption levels with the population indices. The parameters of the "per equivalent person" component of the cross-section equations are used to make "cross-section parameter" predictions of historical consumption levels. That is, we try to predict the time series of consumption but use only the cross-section parameters and historical information on the demographic and income distribution of the population. These predictions are the principle non-price explanatory variables in the time-series equations.

The per capita distribution of income is a critical element in the computation of the income component of the "cross-section parameter" predictions of consumption. In chapter three, we present a method of representing the distribution and develop equations which explain shifts in the distribution.

In chapter four we describe the development of annual time series equations which are estimated for 77 items of Personal Consumption Expenditure in the National Income and Product Accounts. In addition to incorporating the cross-section results, these equations allow a great deal of flexibility with regard to product complementarity and substitutability since the demand for a commodity is allowed to depend upon the price of all goods. Some simplifying assumptions are made about the structure of the Slutsky symmetry matrix to reduce the number of price parameters that need to be estimated. The 77 consumption items are combined into 10 groups where each is comprised of economically similar items. Items in one group can be substitutes or compliments of those in another group yet the magnitude and direction of the price interactions between each pair of groups are governed by a single parameter. Within each of the groups, narrow collections of closely related items are combined into subgroups. This use of subgroups increases the variety of the possible price interactions in the system by allowing complex intra-group substitution/complementarity patterns.

In summary, the system of equations developed in chapter four allows for an elaborate scheme of price interactions while incorporating the detailed demographic and Engel curve results of the cross-section analysis. In chapter five, these equations are used to make projections of consumption to the year 1995.

We do not provide a detailed review of the literature on consumer demand principally because many fine reviews already exist. Two outstanding examples include the classic Brown and Deaton article, "Models of Consumer Behavior: a Survey,"[1] and the recent comprehensive work, Economics and Consumer Behavior by Deaton and Muellbauer.[2] To attempt to add to the perspective on consumption given by these fine scholars would be presumptuous on our part. In addition, our study has a pragmatic orientation that is not typically found in the literature. The goal of our research is to develop a system of equations for long term forecasting rather than to test economic theory. Consequently, we do not feel restricted to use only equations which are derivable from utility maximization. It is our premise that noneconomic factors play a significant role in forming consumption patterns. Therefore, any utility function which fails to account explicitly for demographic attributes yields a system of demand equations inappropriate for explaining the consumption behavior of a population whose demographic composition changes over time. Our equations compromise mathematical elegance in order to include both economic and demographic influences on consumption.

We do have two specific debts to the literature--the concept of adult equivalency weights and the basic form of the time series consumption functions. Adult equivalency weights were first employed by

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[1] Brown, J.A.C. and A.S. Deaton (1972), "Models of Consumer Behavior: a Survey," Economic Journal, Vol. 82, pp.1145-1236.

[2] Deaton, A. and J. Muellbauer (1980), Economics and Consumer Behavior, Cambridge: Cambridge University Press.

Sydenstricker and King[1] and were later popularized by Prais and Houthaker in the work Analysis of Family Budgets.[2] Singh and Nagar extended the adult equivalency technique to allow for its use in conjunction with any form of Engel curve.[3] We, in turn, use the Singh and Nagar technique to include in our Engel curve demographic variables as well as income. The form of our time series consumption functions has as its basis the system of symmetric consumption functions developed by Clopper Almon.[4] Aside from differences with the Almon system in the treatment of demographic variables, our system allows for a more elaborate scheme of price interactions. Groups of items can be substitutes or complements with each other to varying degrees. In the Almon system, all groups are assumed to be weak substitutes for one another.

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1 Sydenstricker, E., and W.I. King (1921), "The Measurement of the Relative Economic Status of Families," Quarterly Publication of the American Statistical Association, Vol. 17, pp.842-57

2 Prais, S.J., and H.S. Houthaker (1955), The Analysis of Family Budgets, Cambridge: Cambridge University Press; 2nd edition, 1971.

3 Singh, B. and A.L. Nagar (1973), "Determination of Consumer Unit Scales," Econometrica, Vol. 41, pp.347-55.

4 Almon, C. (1979), "A System of Consumption Functions and its Estimation for Belgium," Southern Economic Journal, Vol. 46, pp.85-106.

CHAPTER 2

CROSS-SECTION CONSUMPTION FUNCTIONS

The objective of our cross-section analysis is to measure the effects of both income and demographic influences on household consumption. In general, a consumer's demand for a commodity depends upon his income, his demographic characteristics, and prices. However, since in a cross-sectional analysis all consumers face essentially the same prices, different patterns of consumption among consumers are the result of differences in income and demographic characteristics alone.

We specify a functional form which is flexible enough to be used as the consumption functions for many goods, specifically for those 50 categories shown in Table 2.1. The function is able to represent the demand for luxury items, necessities, and even inferior goods. It also incorporates demographic influences in a way which can later be used in conjunction with time-series data.

This chapter describes the formulation and estimation of our cross-section consumption function. Section I presents and explains the functional form used in the analysis; Section II outlines the estimation technique and describes the data used; and Section III contains the results of the analysis.

I. THE FORMULATION OF CROSS-SECTION CONSUMPTION FUNCTIONS

The form of our cross-section consumption function is as follows:

$$C_i = (a + \sum_{j=1}^{K} b_j Y_j + \sum_{j=1}^{L} d_j D_j) \cdot (\sum_{g=1}^{G} w_g n_g) \qquad (2.1)$$

TABLE 2.1

Cross-Section Consumption Categories

1	Food, off premise consumption
2	Food, on premise consumption
3	Alcohol, off premise consumption
4	Alcohol, on premise consumption
5	Tobacco products
6	Shoes and shoe repair
7	Women and childrens clothing
8	Men and boys clothing
9	Cleaning, laundering, clothing repair
10	Jewelry, watches, luggage
11	Personal care
12	Owner occupied housing
13	Tenant occupied rental housing
14	Hotels and motels
15	Furniture
16	Appliances
17	China, glasswares, tableware
18	Other durable houseufrnishings
19	Semi-durable housefurnishings
20	Telephone and telegraph
21	Domestic service
22	Other household operations
23	Gas utilities
24	Electricity
25	Fuel, coal, other
26	Water and sanitary services
27	Medical insurance
28	Physicians services
29	Hospitals
30	Dental and eye care
31	Other medical expenses
32	Life insurance
33	Other personal business
34	New automobiles
36	Tires, tubes, auto accessories
37	Auto repair, rental, storage, and tolls
38	Gasoline and oil
39	Automobile insurance
40	Local Public transportation
41	Inter-city transportation
42	Foreign travel
43	Admissions and memberships
44	TV, radio, musical instruments
45	Miscellaneous recreation equipment, repair and rental
46	Bikes, sport goods, toys
47	Books, magazines, newspapers
48	Campers, RV's, boats, etc.
49	Education (tuition)
50	Contributions to charities

where:

C_i	=	household consumption of good i
Y_j	=	the amount of per capita household income within income category j. (An expanded description follows.)
D_j	=	a zero/one dummy variable used to show inclusion in a demographic group
n_g	=	the number of household members in age category g
K	=	the number of income groups
L	=	the number of demographic categories
G	=	the number of age groups
a,b,d,w	=	parameters to be estimated.

The consumption function can be viewed as explaining household consumption as the product of two components -- the consumption per person and the "size" of the household. The consumption per person is determined by per capita income and the demographic characteristics of the household. (This consumption per person is represented by the expression within the first pair of parentheses of equation (2.1).) The "size" of the household varies by commodity, for "size" depends not only on the number of members of the household but also on their ages. (The "size" is represented as the summation inside the second pair of parenthesis.)

The consumption function (2.1) is in essence an expansion of a simple equation which relates per person consumption to per person income, such as:

$$\frac{C_i}{N} = f(Y) \quad \text{or} \quad C_i = f(Y) \cdot N \qquad (2.2)$$

where N is the number of members in the household and Y is per capita household income. To this simple form we add demographic characteristics and generalize on the size of the family, N, to make it a function of the number of members in separate age categories, say $h(n_1,\ldots,n_G)$. For convenience, the equation is then written in product form. That is, equation (2.1) can be represented as:

$$C_i = f(Y, D) \cdot h(n_1,\ldots,n_G) \tag{2.3}$$

This formulation, therefore, keeps intact the conventional notion of relating per capita expenditures to per capita income.

Equation (2.1) has three noteworthy features which will be discussed in turn: the treatment of the relationship between income and consumption, the method used to measure the effects of demographic variables, and the way in which the equation accounts for the age structure of the household.

A. Consumption as a Function of Income

Consumption has been related to income through various techniques. For example, Brown and Deaton in their fine survey of models of consumer behavior discuss the double logrithmic, the semi-logrithmic, the log-reciprocal, and the linear functional forms as possible candidates for Engel curve analysis.[1] Each form is thought to have special merit in certain circumstances. Brown and Deaton recommend the semi-logrithmic form for goods with income elasticities less than unity, the linear form

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1 Brown, J.A.C. and A.S. Deaton (1972), "Models of Consumer Behaviour: A Survey," Economic Journal, Vol. 82, pp. 1145-11236.

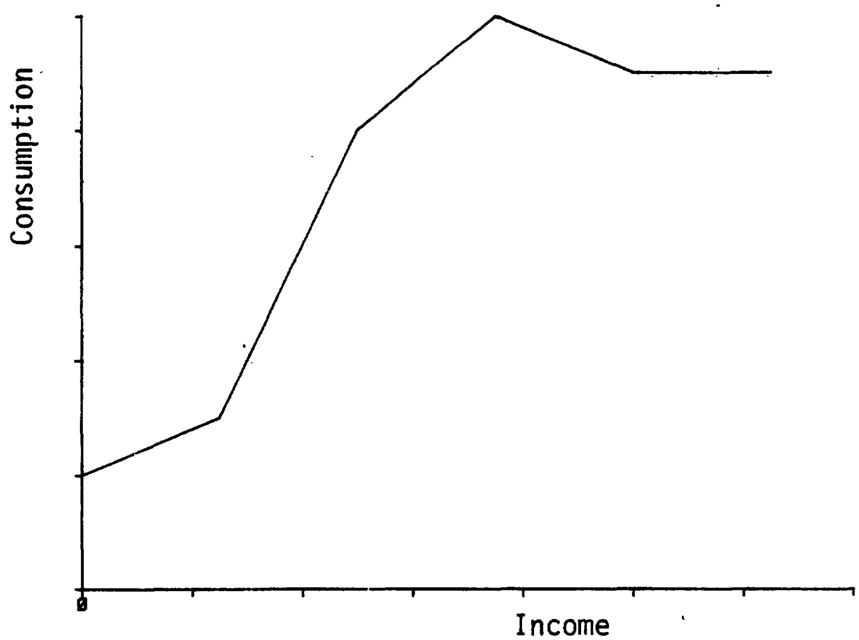
when the elasticity is close to unity, the double logrithmic form for income elasticities greater than unity, and the log-reciprocal form for goods that approach saturation levels.

The suggestions of Brown and Deaton indicate that the functional form used to relate consumption to income should be tailored to match the particular characteristics of each commodity under study. Therefore, no single form among the four discussed is flexible enough to be used in the investigation of the 50 commodities listed in Table 2.1.

There is, however, a simple form which adapts to any shape; we will call it the Piecewise Linear Engel Curve (PLEC). As the name implies, the curve is made up of linear segments over specified income ranges. The slope of the segments are allowed to differ for different income ranges with the requirement that the curve be continuous. Figure 2.1 depicts a PLEC for the case where five income brackets are considered.

Figure 2.1

A Piecewise Linear Engel Curve



The principle advantage of the PLEC is its flexibility. Like a spline or rod with flexible joints at fixed intervals, it can be transformed into a myriad of shapes and can approximate quite closely each of the four functional forms listed above.

To represent the PLEC algebraically, we first define B_j to be the upper bound for the j_{th} income bracket. For example, if we consider the lowest income bracket to be from $0 to $5,000, then B_1 would be $5,000. We can then write the PLEC for good i as:

$$C_i = a + \sum_{j=1}^{K} b_j Y_j \tag{2.4}$$

where:

$$Y_j = \begin{cases} B_j - B_{j-1} & \text{if} \quad B_j \leq Y \\ Y - B_{j-1} & \text{if} \quad B_{j-1} \leq Y < B_j \\ 0 & \text{if} \quad Y \leq B_{j-1} \end{cases}$$

and

Y = household income per capita

K = the number of income brackets

B_0 is defined to be zero and B_K as infinity.

For a household with a per capita income of Y, the Y_j variables are defined to be that amount of per capita income the household holds in each income bracket. That is, for brackets below the bracket in which the household's per capita income lies, the value of Y_j's are equal to the full range of income in the brackets. (For example, a household with an income of $12,000 would hold $5,000 in the bracket defined by $5,000 to $10,000.) Within the bracket in which its income falls, the household holds that amount by which its income exceeds the lower bound of the bracket. (The household in our previous example would hold $2,000 in the bracket defined by $10,000 to $15,000.)The amount of income held by the household in brackets above the one in which its income lies is zero. Consider the following example where there are five income brackets. Let:

$B_0 = 0$, $B_1 = 5{,}000$, $B_2 = 10{,}000$, $B_3 = 15{,}000$, $B_4 = 20{,}000$,
B_5 = infinity.

The following table gives the values of the five Y_j variables for four families with different incomes.

TABLE 2.2

The Values of the Five Y_j for Selected Income Levels

Family	Y	Y_1	Y_2	Y_3	Y_4	Y_5
1	3,000	3,000	0	0	0	0
2	12,000	5,000	5,000	2,000	0	0
3	18,000	5,000	5,000	5,000	3,000	0
4	27,000	5,000	5,000	5,000	5,000	7,000

The b_j parameters in equation (2.4) correspond to the slopes of the PLEC in the different income brackets. The slopes of these Engel curves tell us what proportion of an additional dollar of income is devoted to the consumption of good i. Let us call this proportion the Specific Propensity to Consume (SPC). The term "specific" is used since the propensity to spend will vary from good to good. For example, an additional dollar of income may lead to an increase of expenditure of ten cents on food but only an additional two cents on alcohol. (This concept should not be confused with either that of income elasticity or with that of the total marginal propensity to consume, although it is related to both.)

The advantage of the PLEC is not just that the SPC varies from good to good but also that the specific propensity to consume a particular good need not be the same for different income groups. This fact allows a low income household to devote, say, 15 cents of an additional dollar to the consumption of food while allowing a high income household to increase its expenditures out of an additional dollar by much less than 15 cents. This desirable feature is obviously the result of allowing the slope of the Engel curve to vary over income brackets.

Throughout the discussion of the PLEC we have repeatedly referred to household income. The precise form of the "income" variable used is this study, however, is per capita total expenditures for the household. That is, we make the following definition:

$$Y = \sum_{i=1}^{M} C_i/N \qquad (2.5)$$

where:

C_i = household expenditure on good i

M = the number of goods

N = the number of members in the household.

Ideally, the level of household consumption should be related to levels of current and past incomes as well as to household wealth. However, it is difficult in the cross-section to account directly for either past income or for wealth. Brown and Deaton comment that:

> "since in a cross-section of households, wealth is in general positively correlated with current income, the calculation of Engel curves without allowance for the separate influence of wealth is likely to be misleading if the relationship is used for prediction through time, since a sudden increase in income will not be matched by a similar increase in wealth."[1]

Since the purpose of this cross-section analysis is indeed to obtain Engel curves that will be used in the examination of time-series consumption patterns, we seek by using total expenditures to avoid the problems associated with using current income without accounting for either wealth or past incomes. The effect of current and past incomes, as well as the effect of wealth, jointly determines the level of total household expenditures. Suppose, for example, we observe in the cross-section a wealthy household with a history of high income but which is now experiencing a period of low income. In this case, we expect the level of total expenditures to decline to a lesser degree than current income because the household views the period of low income as transitory.

An additional difficulty with using income as the explanatory variable in the Engel curves arises when explaining the proportion of income devoted to savings. In the cross-section, there is a strong positive correlation between the level of income and the average

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1 Brown and Deaton, pp. 1172.

propensity to save. The same correlation is not evident in the historical aggregate data. Average incomes have increased substantially over time while the savings rate has remained roughly constant and even fallen slightly in recent years. Therefore, using Engel curves fitted with income, as opposed to total expenditure, would result in an overprediction of savings in periods when average incomes are high and an underprediction of savings when average incomes are low.

B. The Effect of Demographic Variables

The most general method for allowing demographic variables to influence consumption patterns is to estimate separate consumption equations for each demographic category. Each demographic group would have intercepts and specific propensities to consume out of income that are distinct from those of all the other demographic groups. However, this approach would have the obvious problem of requiring the estimation of a very large number of separate equations. Even if the cross-sectional data were sufficiently rich to allow the estimation of all the equations, severe difficulties would arise when we attempted to incorporate the results into the time-series analysis. With separate equations, we would need to know the past and future size and income distribution of each demographic group.

The procedure adopted here allows only the intercept of the PLEC to be different for different demographic groups. Zero-one dummy variables are created to indicate inclusion within various demographic categories, so that:

$$C_i = (a + \sum_{j=1}^{K} b_j Y_j + \sum_{j=1}^{L} d_j D_j) \cdot h(n_1,\ldots,n_g) \qquad (2.6)$$

where:

$$D_j = \begin{cases} 1 \text{ if the household is a member of the } j^{th} \text{ demographic group} \\ 0 \text{ otherwise} \end{cases}$$

L = the number of demographic categories

As usual, for each characteristic one group does not have a D_j. (In the region category, this group includes those households who live in the Northeast.) The households for which <u>no</u> D_j equals one form a reference type. In our case, the reference type represented by the intercept is a 3 or 4 person household living in the Northeast, spouse not working, and household head 35-54 years old and not a college graduate. The variables included are:

Region:	Three variables, one each for the South, North Central and West.
Education:	One variable, distinguishes families with college educated household heads.
Working Spouse:	One variable for households where the spouse is employed.
Family Size:	Three variables, one variable each for households with one member, two members, and five or more members.
Age of Household Heads:	Two variables, one for households with heads less than 35, and the other for households with heads over 55.

Our equation makes no provision for interaction between the variables. The effects of the different demographic variables are assumed to be additive. For example, the effect of having a college education on the consumption of tobacco is exactly the same for households in all regions. It is our judgement that this simplifying assumption is not overly restrictive and it allows us to avoid two difficulties: (1) If we were to allow for full interaction between the demographic groups, a large number of additional parameters would need to be estimated; (2) The transition from the cross-section to the time-series would be made far more difficult if interaction terms were included, because we would then have to know the historical size of many narrowly defined demographic groups. For example, we might need an historical series on two-person college-educated households with working spouses living in the North Central region. If we are content to allow the effects of the different demographic variables to be additive, obtaining the necessary historical data is a much more manageable task. Now, we need to know only the population of all household heads who have college degrees, the proportion of households with two wage earners, and the age distribution of household heads.

C. Age Structure

Age structure can be an important determinant of household expenditures. If we were to stop the development of the consumption function as it stands in equation 2.6 and estimate it in per capita form, we would be implicitly assuming that the age structure of the household holds no other useful information than the size of the household.

To utilize fully the information on the age structure of the household, a set of Adult Equivalency Weights (AEW's) are estimated in conjunction with the consumption function. These weights allow us to construct a measure of the size of the household which weights members of different ages differently. This weighted household size varies by commodity. We define the size of the household specific to good i as:

$$N_i = \sum_{g=1}^{G} w_{ig} n_g \qquad (2.7)$$

where:

N_i = weighted household size for good i

G = number of distinct age groups

n_g = number of household members in the g^{th} age group

w_{ig} = weight of the g^{th} age group in the consumption of good i.

This technique permits us to give high weights to the likely consumers of a good while giving relatively low weights to those less likely to consume the good. Consider tobacco and medical services as examples. Suppose we have three age groups -- children, adults, and the aged. Suppose further that the adult equivalency weights in the consumption of tobacco for the three age groups are 0.2, 1.0, and 0.5, respectively, while the corresponding weights for medical services are 1.5, 1.0, and 2.0. Table 2.3 shows the weighted household sizes of five separate households for both tobacco and medical services.

We can see from Table 2.3 that although each of the households has five members, the weighted household sizes differ markedly given the hypothetical adult equivalency weights. This is true when comparing all household sizes with regard to a specific good and when comparing the weighted household sizes for each particular household with regard to different goods. Note, for example, that the five member households range in "size" from 1.8 to 5.0 for tobacco and that the last household is the largest relative to tobacco but the smallest relative to medical services.

TABLE 2.3

Weighted Household Sizes for a Sample of Household Age Structures

Family	Number of: Children	Adults	Aged	Weighted Household Size of: Tobacco	Medical Services
A	3	2	0	2.6	6.5
B	0	2	3	3.5	8.0
C	4	1	0	1.8	7.0
D	1	2	2	3.2	7.5
E	0	5	0	5.0	5.0

Weights for:			
Tobacco	.2	1.0	.5
Medical	1.5	1.0	2.0

This weighting scheme generalizes on the concept of a per capita consumption function in a very natural way by relaxing the assumption that all individuals contribute equally to the size of the household regardless of their age. In addition, the weighting scheme is not required to be the same for different goods as it is under the naive "per capita" approach.

The desirability of this AEW approach is even more apparent when we consider its use in the coming time-series analysis. For example, suppose we find in the cross-section that the adult equivalency weight for the young is half the size of the weight for the adults with regard to the consumption of tobacco. We can incorporate this information into the time-series estimation in such a way that the spurt in population associated with the baby boom becomes relevant to the consumption of tobacco only when the "boomers" grow old enough to smoke. In light of shifts in the age structure of the population, it is clear that these age specific weights are useful, both in the estimation of the time-series equations and when making forecasts of consumption.

The AEW weighting scheme is sometimes extended to create a general set of weights which are used to provide a more accurate measure of per capita income. These general income weights are themselves weighted averages of the commodity specific AEW's with the weights being the share in total consumption of the different goods. This technique provides the overall impact on consumption for each age group by combining their specific influences on the different goods. (It is, therefore, possible to answer such questions as whether children are more or less expensive to maintain than the typical adult.) The income weights are defined to be:

$$w_{0g} = \sum_{i=1}^{M} s_i w_{ig}$$

where s_i is the share of good i in total consumption. The "size" of the household, for purposes of constructing per capita income, is then:

$$N_0 = \sum_{g=1}^{G} w_{0g}\, n_g$$

While this approach has merit, it has not been adopted in this study for a number of reasons. First, the added complication of the income weights makes an already nonlinear equation severely nonlinear and a difficult estimation even more difficult. Second, preliminary estimations indicated that the income weights do not differ significantly across age groups. Finally, and most importantly, the estimation of income weights would make it nearly impossible to use the Engel curves in the time-series analysis because we would need to know not just the size distribution of income but the age structure at each income level as well. Therefore, when we construct per capita income, all age groups are given identical weights. We assume that:

$$w_{01} = w_{02} = \ldots = w_{0g} = 1.0$$

One final point should be made about the Adult Equivalency Weights. The parameters are not uniquely identified in the sense that doubling the parameters of the consumption function (the a's, the b's, and the d's of equation 2.6) while halving the w's will leave the value of the product unchanged. This under-identification is avoided by setting the weight for adults ages 31 to 40 equal to 1.0. From this normalization comes the name Adult Equivalency Weights -- though "thirties equivalency weights" would be more accurate.

II. ESTIMATION AND DATA

A. The Estimation Technique

The multiplicative nature of equation (2.1) makes it nonlinear in the parameters to be estimated. However within each of its two component pieces, consumption per equivalent person and the adjusted size of the households, the equation is linear. Our iterative estimation scheme exploits this fact by first assuming that the parameters of one half of the equation are known and then estimating the parameters of the other half of the equation with ordinary least squares. These estimates are in turn fixed so that the parameters of the other half of the equation can be estimated by performing another regression. This "back and forth" estimation technique continues until the parameter estimates converge.

For exposition purposes, consider the following simplified version of equation (2.1):

$$C = (a + bY) \cdot (w_1 n_1 + w_2 n_2) \qquad (2.8)$$

We start the iterative estimation process by making the standard assumption that both w_1 and w_2 are equal to one. (In other words, we assume that the size of the household is simply N, the number of members in the household.) This assumption reduces equation (2.8) to the following linear equation:

$$C = aN + bYN$$

We are then able to obtain the parameter estimates a and b using ordinary least squares.

The parameter estimates a and b are used to calculate C_p, an estimate of consumption per equivalent person:

$$C_p = a + bY$$

Substituting C_p into equation (2.8) gives us

$$C = w_1 n_1 C_p + w_2 n_2 C_p$$

Once again, ordinary least squares is used to estimate the parameters of the equation, which at this step are w_1 and w_2.

With the estimates of w_1 and w_2, the adult equivalency weights, we calculate the adjusted size of the household in order to refine our estimates a and b. Holding the new estimates of a and b fixed allows us, in turn, to improve our estimates of the adult equivalency weights. This process continues until the parameter estimates show negligible change through one complete iteration.

Our estimation scheme is a variant of the usual "hill climbing" techniques used to estimate nonlinear equations. In this version each step taken in search of the optimum increases the amount of variation in household consumption explained by the equation. Consider, for example the first time that the weights w_1 and w_2 are estimated. If no change from the assumption that both weights equal one improves the fit of the equation, the weights will be left at one. However if assigning different weights to different age groups helps explain household consumption, as is our contention, the regression will do so thereby increasing the R^2 of the equation.[1]

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[1] It can be shown that our estimation scheme is analogous to an iterative solution of the normal equations that result from the maximum likel hood estimation of equation (2.1). (First, the block of equations for the non-AEW parameters are solved under the assumption that the AEW's are fixed. Then, the equations for the AEW's are solved holding the non-AEW parameters fixed. The processes continues until four blocks of equations are solved simultaneously.) Because of this correspondence, we claim that our scheme converges to the maximum likelihood estimates. Accordingly, we present asymtotic standard errors with our parameter estimates.

Although our estimation technique always proceeds uphill, there is no guarantee that the maximum it finds is global and not local.[1] Our choice of a starting point for the estimation may influence the final parameter estimate. To examine this possibility we re-estimated equations for Alcohol (EQ#4) and Women's clothing (EQ#7), starting each re-estimation with the final AEW estimates of the other sectors. (These two equations have starkly different adult equivalency weighting schemes.) Unfortunately, the re-estimated parameters for both equations are quite different from those in the original estimations thereby confirming our concern regarding the importance of the starting point. (The optimums reached in the re-estimation are, however, inferior to those of the original estimation.) We can only defend our choice of starting values for the AEW's by stating that equal weights is the standard assumption and that any numerical search for starting values would be intractable.[2]

Finally, it should be noted that the estimation of equation 2.1 for each of our 50 commodities with over 8,000 observations was a very computer intensive undertaking. The equations were estimated on a Prime 550 computer only at night when the computer was otherwise empty. Even under these conditions, only two full iterations could be completed per

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1 This is a problem common to most nonlinear estimation techniques.

2 An alternative to arbitrarily selecting a starting point would be to perform a grid search to find the combination of AEW's that minimize the sum of squared errors and to use these as our starting point. This would have been a problem of enormous proportions since there are seven AEW's to estimate. Suppose, for example, that 1/3, 2/3, 1, 4/3, and 5/3 are chosen as the starting values for our weights. There would be 78,125 combinations (5^7) of AEW's to compare. (Just three starting values for each weight would result in 2187 combinations.) This intractability necessitates the use of simplifying assumptions.

night so it took nearly two weeks to perform the twenty iterations that were necessary to achieve convergence.[1]

B. Data

The data on which our cross-section consumption function is estimated is the 1972-1973 Consumer Expenditure Survey conducted by the Bureau of Labor Statistics. This survey provides detailed information on household characteristics and spending patterns. It is comprised of an interview survey and a diary survey. The households which participated in the interview survey were visited by an interviewer five times. Basic information on the characteristics of the household such as household composition, employment status, and occupation was obtained on the first visit. In the subsequent four visits, which occurred over a period of a year in three month intervals, the households were interviewed to obtain detailed information on household expenditures. In contrast, the households participating in the diary survey recorded daily, for two weeks, their purchases of groceries and other "everyday" items.

We chose the interview survey to estimate our equation because of the breadth of items it covers. The 1972-1973 interview survey data contains household expenditures on approximately 500 different items as well as detailed information on household characteristics for nearly 20,000 U.S. households. For our purposes, the 500 consumption categories were aggregated into the 50 items listed in Table 2.1 so as

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1 Each iteration required reading the entire data set and estimating both portions of our equation for each of the 50 commodities.

to match the National Income and Product Account data used in the time series analysis.[1] Because our cross-section equation is not designed to measure price effects, we restricted our sample to the observations recorded for one year. The year 1972 was arbitrarily selected. Furthermore, we excluded from this pool of 10,000 households those households that failed to report key information such as income or region of residence. Our resulting sample contains 8,324 observations.

III. RESULTS OF THE CROSS-SECTION ANALYSIS

In presenting the cross-section analysis we repeat for convenience our consumption equation along with the list of income, demographic, and age group variables included in its final version.

$$C_i = (a_i + \sum_{j=1}^{5} b_{ij}Y_j + \sum_{j=1}^{10} d_{ij}D_j) \cdot (\sum_{g=1}^{8} w_{ig}n_g) \qquad (2.1)$$

where:

For defining the Y_j in the piece-wise linear Engel curves, five per capita income groups are defined such that each group contains 20 percent of the individuals in the sample. The corresponding income boundaries are as follows:

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1 We did make one further modification to the data. Some households reported gas and electric utilities as a combined total. Since our interest is in estimating separate equations for gas and electricity, we devised a logit model to split a combined utility bill into separate expenditures. The model estimates the proportion of a combined bill which is expended on electricity using as data those households which reported separate totals. The proportion expended on electricity is assumed to be a function of income, region, and the type of heating and cooling fuels use by the household.

B_0 = 0	B_3 = \$2936
B_1 = \$1566	B_4 = \$4116
B_2 = \$2243	B_5 = Infinity

Dummy variables are used to show inclusion in ten demographic groups. These ten groups fall into five broad categories: region, education, working status of spouse, family size, and age of the household head. (The preceding section on demographic influences contains the detailed list of these variables.)

Eight separate age groups are distinguished in the adult equivalence weighting scheme. (The reference group includes adults between the ages of 31 and 40.)

The age classifications are as follows:

Group 1 - 0 to 5 years old
Group 2 - 6 to 15 years old
Group 3 - 16 to 20 years old
Group 4 - 21 to 30 years old
Group 5 - 31 to 40 years old
Group 6 - 41 to 50 years old
Group 7 - 51 to 65 years old
Group 8 - 66 years and older.

Equation (2.1) is estimated for each of the fifty commodities listed in Table 2.1. A considerable volume of results are produced as a consequence of the large number of equations and variables. To present the voluminous results in a manner that is both complete and easily interpretable, three different forms of presentation are utilized: a tabular presentation of the influences of the demographic variable, a graphical representation of the Engel curves and the adult equivalency weights, and a complete listing of all the parameter estimates.

A. Influences of the Demographic Variables

In Table 2.4 the demographic variables which significantly affect the consumption of a particular good are indicated. Positive and negative signs are used to show both the direction of influence and the level of significance. (A single + or - sign denotes significance at the 10 percent level while a double ++ or -- sign denotes significance at the 5 percent level.)

Table 2.4 also presents the value of the R^2 statistic for each equation. As is typical of cross-section estimations, the values of the R^2 statistics are quite low. They range from a minimum of 0.02 for Local Public Transportation (40) to a respectable value of 0.47 for Food Off Premise (1). Although only 15 equations have an R^2 in excess of 0.2, there are just 9 equations which have values less than 0.1. The R^2's, while low, are not an indictment of our results but a comment on the difficulty in explaining the wide variability present in cross-section data.

Included in Table 2.4 is an equation-by-equation count of the number of Adult Equivalency Weights that differ significantly (at the 10

Table 2.4

INFLUENCES OF THE DEMOGRAPHIC VARIABLES

	TITLE	REGION: South	REGION: North Central	REGION: West	College Educated	Working Spouse	Household Size: 1	Household Size: 2	Household Size: 5+	Age of Household Head: 35	Age of Household Head: 55	# of AEW's Significantly Different From 1.0	R^2
1	FOOD, OFF PREMISE	--	--	--	--	--			--	--		7	0.474
2	FOOD, ON PREMISE		++		--	++	++	--	++			4	0.297
3	ALCOHOL, OFF PREMISE		--	++		--					--	4	0.104
4	ALCOHOL, ON PREMISE	+	--		--	++	++	--	++			6	0.134
5	TOBACCO PRODUCTS	--	--	--	--		++	++	--	+	--	5	0.143
6	SHOES AND SHOE REPAIR	++	++	++			+			--	++	2	0.177
7	WOMEN'S & CHILDREN'S CLOTHING			--		++	+	+		--		5	0.348
8	MEN'S & BOY'S CLOTHING			--			--	--	++			4	0.401
9	CLEANING, LAUNDRY, & REPAIR	--	--	--		++	++	++	--	+		3	0.125
10	JEWELRY, WATCHES, & LUGGAGE	+	++				--	--				4	0.113
11	PERSONAL CARE	++	++			++					--	7	0.244
12	OWNER OCCUPIED HOUSING		--	++	++	--	--	--				5	0.431
13	TENANT OCCUPIED RENT	--	--	+	++	++	++	++	--	++		7	0.202
14	HOTEL AND MOTELS	+	-	--	++	--	--	--	++	--	++	6	0.176
15	FURNITURE				--			++		++		6	0.145
16	APPLIANCES	++	++		--		--	++		++	--	1	0.107
17	CHINA, GLASSWARE, & TABLEWARE	+	++	++	+		--		+	+		3	0.061
18	OTHER DURABLE HOUSEFURNISHINGS	+					--					7	0.156
19	SEMI-DURABLE HOUSEFURNISHINGS				--		--	++		--	++	7	0.175
20	TELEPHONE & TELEGRAPH	--			++		++	++	--	++		2	0.183
21	DOMESTIC SERVICE		++	+	++	++	+	++		++	--	6	0.218
22	OTHER HOUSE OPERATION		++		++	--	-					4	0.195
23	GAS UTILITIES	++	--	--	--		++	++	--			4	0.133
24	ELECTRICITY		++	--	+		++	++	--		--	5	0.290
25	FUEL OIL AND COAL	--	--	--		+	+				+	6	0.114

Table 2.4 (cont'd)
INFLUENCES OF THE DEMOGRAPHIC VARIABLES

	TITLE	REGION South	REGION North Central	REGION West	College Educated	Working Spouse	Household Size 1	Household Size 2	Household Size 5+	Age of Household Head 35	Age of Household Head 55	# of AEW's Significantly Different From 1.0	R^2
26	WATER & SANITARY SERVICES	++	++	++	++						-	6	0.188
27	MEDICAL INSURANCE	++	++						-			6	0.139
28	PHYSICIANS SERVICES		+	++	--	--	--					2	0.045
29	HOSPITALS		++	++	--		--			++		4	0.022
30	DENTAL AND EYE CARE		--		++			--		--		2	0.149
31	OTHER MEDICAL EXPENSES		++		--	--		++		-	++	4	0.061
32	LIFE INSURANCE	+	++		++	--	--	--				4	0.267
33	OTHER PERSONAL BUSINESS			+			++				--	1	0.023
34	NEW AUTOMOBILES	++	++		--		--	--	++			4	0.211
35	USED AUTOMOBILES	++	++	++	--		--	--	++	+		5	0.100
36	TIRES, TUBES, & ACCESSORIES		++	++	--	++	--	-			--	3	0.182
37	REPAIR, RENT, STORAGE, & TOLLS	+	++	++		+	--		++	-		4	0.231
38	GASOLINE AND OIL	++	++	++	--		--			+	--	6	0.376
39	AUTOMOBILE INSURANCE	--	--	--	--			--	++	-		5	0.325
40	LOCAL PUBLIC TRANSPORT	--	--	--	+	++	++					3	0.020
41	INTERCITY TRANSPORT			++	++						++	2	0.107
42	FOREIGN TRAVEL	--	--	--	++		--					5	0.099
43	ADMISSIONS AND MEMBERSHIPS				++		--	--			--	5	0.179
44	TV, RADIO, & MUSICAL INST.	++	++	++	--	+				++	++	5	0.122
45	REPAIR & RENTAL OF REC. EQUIP.	++	++	++				++			-	3	0.053
46	BIKES, SPORT GOODS, & TOYS	++		++					++	++	--	4	0.177
47	BOOK, MAGAZINE, & NEWSPAPER	+	++	++	++			--	++			4	0.197
48	CAMPERS, RV'S, & BOATS			++	--		--		++			4	0.053
49	EDUCATION (TUITION)		--	--	++		--	--	++	--	++	6	0.206
50	CONTRIBUTIONS TO CHARITY	++	++	+	++	-	--	--	++		+	4	0.195

percent level) from the 1.0 reference group weight. Each of the 50 equations has at least 1 AEW that is different from 1.0 and 38 of the equations have 4 or more age groups with estimated weights which are statistically different from 1.0. While this tally of significant AEW's falls short of being a formal test of the weighting scheme as a whole, there can be little doubt that the flexibility imparted on the equations by the Adult Equivalency Weights is of considerable value.

The demographic results reported in Table 2.4 paint an interesting and informative picture of household consumption. Although every commodity is affected by at least one of the demographic variables, the results are not discussed on an equation by equation basis. Instead, the following discussion focuses on the impact of each demographic variable on consumption by highlighting the effect of these variables on particular commodities.

Region: For 47 of the 50 commodities, at least one of the three regional dummy variables is significant. That is, consumption of the commodity in the designated region or regions differs significantly from consumption in the Northeast. For example, after correcting for income and other influences, each of the three regions are found to spend less on Fuel Oil (25) and Tobacco (5) than is spent in the Northeast. Since Fuel Oil is a predominately Northeastern heating fuel, the Fuel Oil finding comes as no surprise. But it is less clear why tobacco expenditures are the highest in the Northeast. Yet another example of interregional differences in consumption is found with Gasoline and Oil (38) and Local Public Transportation (40). The Northeast is more densely populated and has better established mass transit systems than the rest of the country. These facts are reflected in our results by significantly lower expenditures on Local Public Transportation and higher expenditures on Gasoline and Oil for the South, North Central, and Western sections of the country.

Education: The dummy variable for households with college-educated heads is significant in 36 of the 50 equations. For example, the "educated" households spend less on food and alcohol (except for Alcohol off premise (3)) than households without college educated heads. With the exception of Dental and Eye Care (30), they spend less on medical care than other households. And perhaps not unrelated to their consumption of medical expenses is their lower expenditure on tobacco. As is expected, households with college educated heads spend more on Education (49) than other households.

Working Spouse: The dummy variable for housholds with working spouses is significant in 21 of the 50 equations. The consumption differences between households with working spouses and those without follow expected patterns. Households with working spouses spend more on Women's Clothing (7) and "service" items such as Cleaning and Laundry (9), Personal Care (11), and Domestic Service (21). They also spend significantly more on food and alcohol consumed on premise and significantly less on the same items consumed at home. (These effects are quite apart from any income related changes in consumption.)

Family Size: This demographic group captures any scale economies related to household consumption. At least one of the three family size variables is significant in 46 of the 50 commodities.[1] The importance of these "scale" economies is striking, given that the equation also accounts for the number and ages of the individual members of the household through the use of the AEW's. Tenant occupied rent (13), and Gas (23) and Electric Utilities (24) are examples of "economies of scale" in consumption. Commodities which exhibit "diseconomies" are New Automobiles (34) and Used Automobiles (35).

Age of the Household Head: At least one of the two variables which distinguish households in different life cycle stages is significant in 34 of the 50 equations. For example, young "households" (heads less than 35 years) spend more on appliances than the standard (heads aged 35 to 55) and older "households" (heads greater than 55 years), those likely to contain college-aged dependents, spend more on Education (49) than the standard.

B. Graphical Representation of the Engel Curves and the AEW's

A graphical representation of the adult equivalency weights and the income/consumption relationship appears at the end of this chapter. The 13 pages of Figure 2.2 contain a bar chart of the AEW's and a plot of the Engel curve for each of the 50 commodities.

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[1] It is interesting to note that Water and Sanitary Services (26) is one of the few items for which family size is unimportant. Since water is inexpensive and since there are few opportunities to get multiple uses from a given quantity of it, the consumption of water is strictly proportional to household size.

The AEW bar charts give the height of the weight assigned to each of the eight age groups. To facilitate the comparison of the weight structures of different commodities, a constant vertical scale is used.[1]

The Engel plots graph the estimated consumption functions against income. The level of the curve is the "per capita" portion of the equation evaluated for the reference demographic group.[2] The scale of the vertical axis used in the Engel plots was selected on an equation-by-equation basis so as to best exhibit each curve. Care should therefore be taken when comparing the Engel plots for different commodities.

The bar charts and Engel plots are used to condense the information embodied in the large number of age structure and income parameters. But even this method results in 50 pairs of graphs. Therefore, as with the discussion of the demographic variables, we avoid a point-by-point description and instead choose to highlight only the graphs of particular interest.

1. Observations on the AEW Bar Charts

Alcohol on Premise (4): Alcohol on premise (4) provides a striking example of the efficacy of the adult equivalency weighting scheme. As

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1 Space constraints require that a few bar charts be truncated at the maximum values of their vertical axes. For purposes of checking, the value of the AEW for each group is printed at the top of the group's bar.

2 Recall that the Engel curve for any other demographic group is obtained by adding to the constant term the appropriate demographic coefficients thereby shifting the base curve up or down in a parallel fashion.

expected, children and teenagers contribute almost nothing to the size of the household specific to the consumption of alcohol in restaurants and bars. And, the two groups over the age of 50 have small weights relative to those of the 3 younger adult groups -- a result which also conforms a priori expectations.

Alcohol Off Premise (3): The structure of the AEW's for Alcohol off premise (3) is quite different from the structure of the AEW's for Alcohol on premise. In the case of Alcohol consumed at home (off premise) not only are the weights for all the adult groups roughly equal but children through the age of 15 have non-negligible weights. These non-negligible weights for children may be an indication that the existence of children in a household forces adults to substitute alcohol consumption at home for alcohol consumption in bars and restaurants.

Tobacco (5): In the equation for tobacco (5), the weight for those over the age of 65 is approximately half the weight assigned to any other adult age group. Apparently, old smokers, for one reason or another, stop smoking. The non-trivial weights given to the youngest two age groups are a curious result for which we have no explanation.

Durable Household Items (15), (18), (19): The structure of the weights for Furniture (15), Other durable housefurnishings (18), and Semi-durable housefurnishings (19) show a similar pattern. The relatively high weights assigned to infants and children illustrate the effects of household expansion on purchases of durable household items.

Fuel Oil (25): The pattern of weights associated with Fuel Oil (25) possibly reflects a corollary influence on fuel oil consumption. The high weights for the older age groups may result from the fact that older people live in older houses. The weighting structure is, therefore, dictated in part by the fuel requirements of the housing stock and not just to age induced changes in preferences.

Telephone and Telegraph (20): As illustrated by the small variation of the AEW's among the various age groups, the weighting scheme did not detect notable differences in the consumption of telephone and telegraph services (20) by different age groups.

Medical Sectors (27), (28), (29), (30): The adult equivalency weights of the medical sectors - Medical Insurance (27) Physicians Services (28), and Hospitals (29), suggest a higher utilization of medical services by older individuals. It is not surprising that Dental and Eye Care (30) prove an exception to this rule. As might be expected, the largest weight is assigned to children between the ages of six and fifteen.

Other Medical Expenses (31): The equation for Other Medical Expenses (31) is the only equation that failed to converge. It exhibits a bizarre set of AEW's. (The weight assigned to children under five years old is in excess of 17.0.) Consequently, the results of this equation are not used in the time series analysis.

Education (49): The results of the AEW estimation for Education (49) are noteworthy for two reasons. First, the magnitude of the weights for the 16 to 20 year old and 21 to 30 year old age groups indicate that the equation estimation procedure had no difficulty in identifying the prime college-going years. Secondly, children under the age of five have a negative influence on the weighted size of the household specific to tuition expenditures. That is, the arrival of a newborn to a young couple substantially decreases the couple's expenditure on schooling.

Bikes, Sporting Goods, Toys (46): The AEW's for recreational items increase to a high of 1.4 for teenagers and then steadily decline with age. It takes roughly seven adults over the age of 65 to generate the same household consumption of Bikes, Sporting Goods, and Toys (46) as is supplied by a single 16-to-20-year-old teenager.

New Books, Magazines, and Newspapers (47): The structure of the Adult Equivalency Weights for Books, Magazines and Newspapers (47) presents a realistic picture of reading habits. Children under the age of five are given a very small weight. The weights increase monotonically for young people ages 6 to 30 and then drop to remain roughly constant for adults over the age of 30. This pattern seems consistant with the reading abilities of children, requirements of students, and preferences of adults.

2. Observations on the Engel Curves

Food Off Premise (1) and Food on Premise (2): The Engel curves for the food sectors depict expected differences between on and off premise consumption behavior. At all income levels, food consumed at home is shown to be a necessity while food consumed in restaurants proves to be a luxury.[1] The slope of the Engel curve for Food off Premise decreases with increases in income thus supporting the standard contention that the proportion of income spent on food declines as income rises. The slope of the Engel curve for Food on Premise remains nearly constant at

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[1] A commodity is a necessity if there is non-zero consumption at zero income. Luxury items have zero consumption until a "threshold" income is reached. Generally, a commodity is a necessity at a given level of income if the line tangent to the Engel curve at that income crosses the vertical axis at a positive level of consumption; otherwise it is a luxury.

all income levels. It is a true luxury item with increases in income leading to an increase in its share of consumption.

Tobacco (5): The Engel curve for tobacco is less steep for the high income categories than for the low income categories. That is, high income individuals spend a smaller proportion of their income on tobacco than do low income individuals. The plot also indicates that tobacco (an addictive and effectively advertised product) is a "necessity."

Clothing Expenditure (7), (8): The Engel curves for both Women's and Children's Clothing (7) and Men's and Boy's Clothing (8) are nearly straight lines. A simple linear form of the income consumption relationship would have proved serviceable for these commodities. In a sense, this result highlights the principle advantage of the Piecewise Linear Engel Curve. Since it can represent almost any shape, including a straight line, it does not force an arbitrary shape on the income consumption relationship. That is, while a linear form would have worked just as well as the PLEC in the clothing equation, it would have performed poorly in the equation for tobacco.

Jewelery, Watches, and Luggage (10): Expenditures on luxury items such as Jewelry, Watches, and Luggage (10) are insubstantial for all but the upper income bracket. Notice that the slope of the curve in the last income bracket is quite steep.

Tenant Occupied Rent (13): Tenant occupied rent (13) is an inferior good over most of the income scale where increases in income lead to decreases in expenditures on rent. However, the curve eventually turns upward at high levels of income.

Household Utilities (23), (24), (25), (26): There are significant differences in the consumption-income pattern within the broad category of utilities. The curve for Electricity (24) is the steepest of all the utility curves -- a difference which reflects the various uses of electricity. The amount of Gas (23) and Fuel Oil (25) needed to sufficiently warm a house has a natural limit but there is no end to the electrical gadgets that can be purchased as income increases. (In fact, Fuel Oil (25) reaches a level of virtual satiation for the medium and high income groups.) The curve for Water and Sanitary Services (26) is noteworthy because it depicts water as a luxury item for the poor. One possible explanation is that water and sewer service charges are often incorporated into rental expenditures thereby eliminating direct expenditures on water for most of the poor.

Local Public Transportation (40): We call attention to Local Public Transportation to note a commodity for which expenditures bear no relationship to income.

C. Listing of Parameter Estimates

Table 2.5 completes the presentation of our cross-section results with a listing of the parameter estimates of equation (2.1).[1] A glossary of variable names appears on the first page of the table. On the next ten pages of the table the estimates of all of the parameters (including the Adult Equivalency Weights), the R^2 for the estimated equation, and the average household expenditure on the item are listed

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1 The eleven pages of Table 2.5 follow the graphical presentation of our results.

for each equation. The ratio of the parameter to the standard error of the parameter is presented in parenthesis below each of the parameter estimates. (In the case of Adult Equivalency Weights, the hypothesis being tested is whether or not the coefficient differs significantly from 1.0)

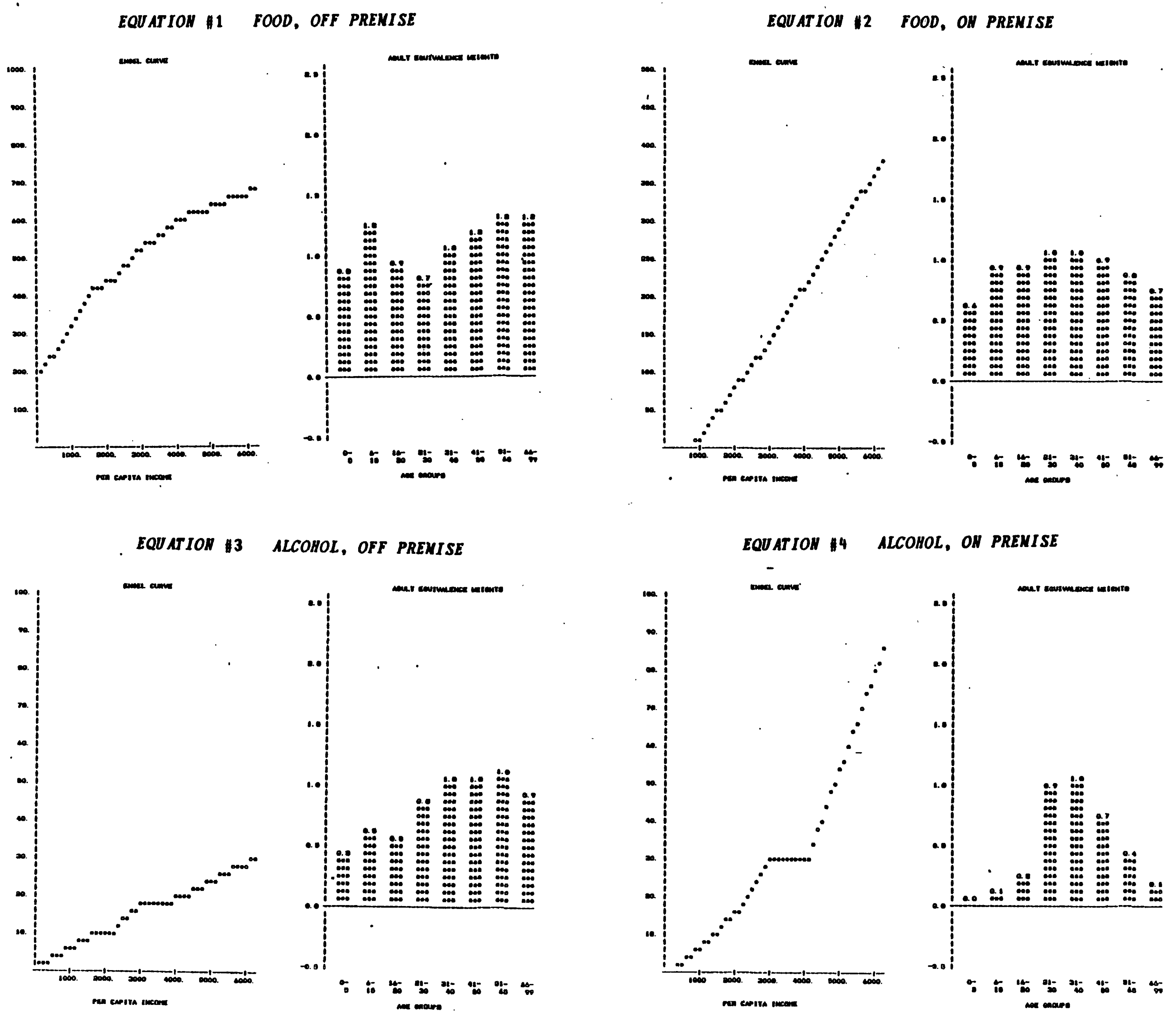
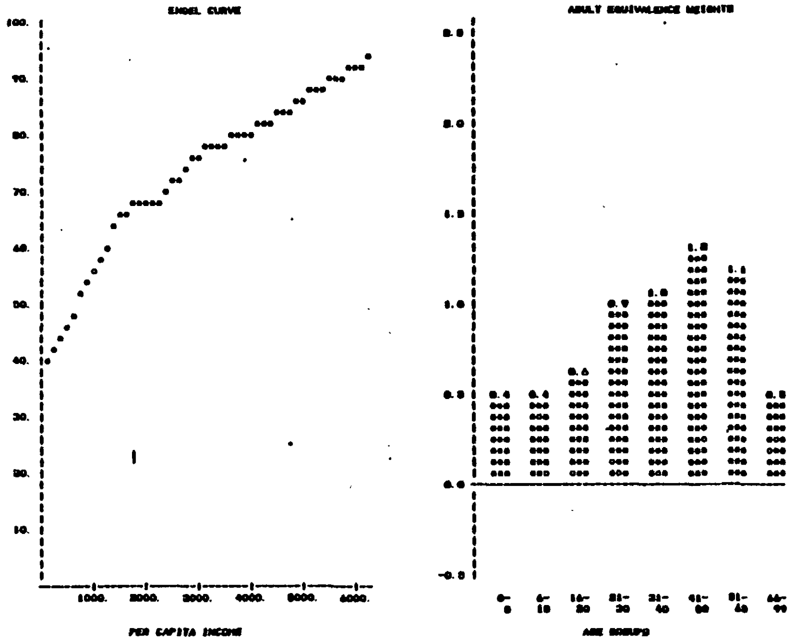


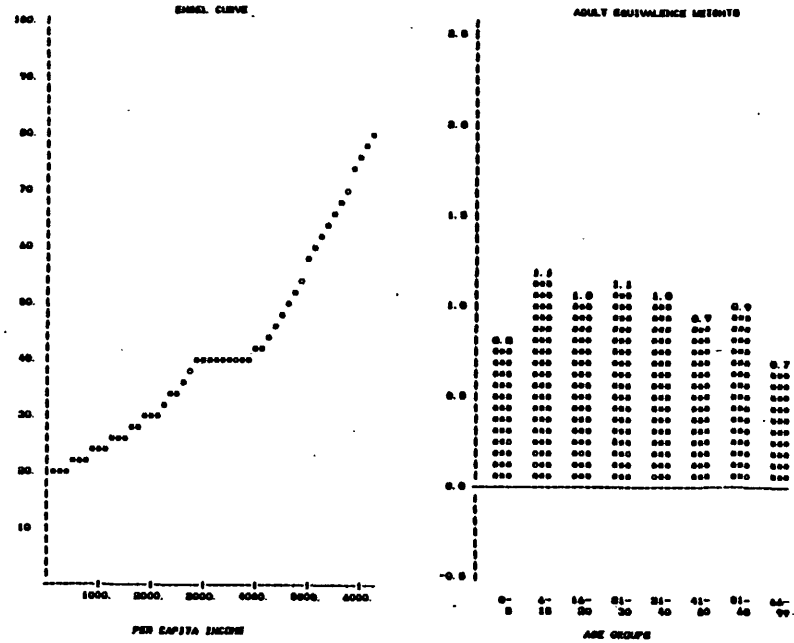
Figure 2.2
Graphical Presentation of Cross-Section Results

Figure 2.2 (cont'd)

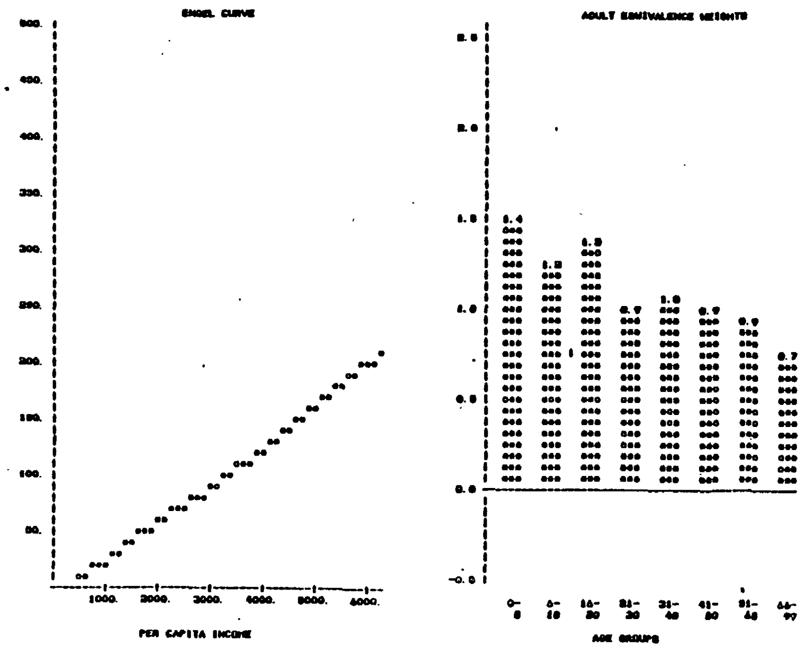
EQUATION #5 TOBACCO PRODUCTS



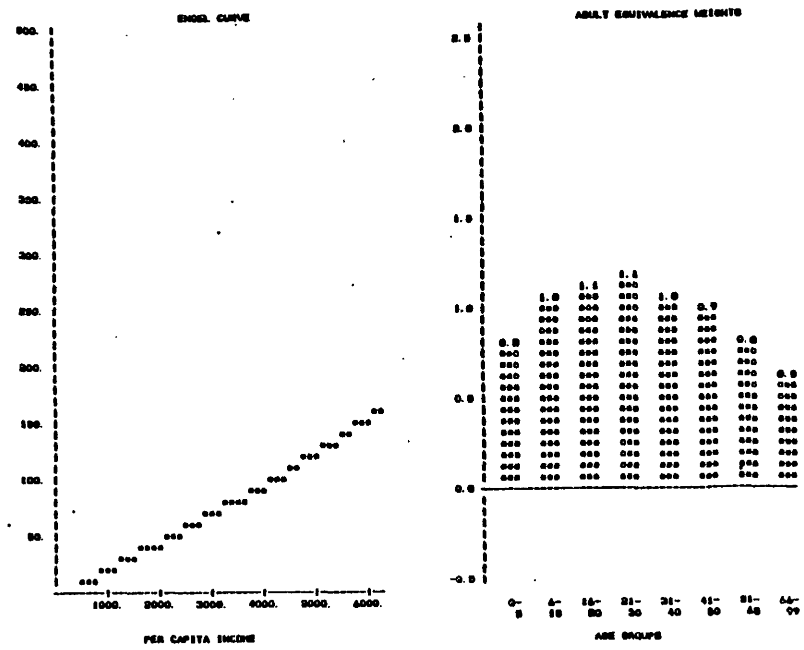
EQUATION #6 SHOES AND SHOE REPAIR



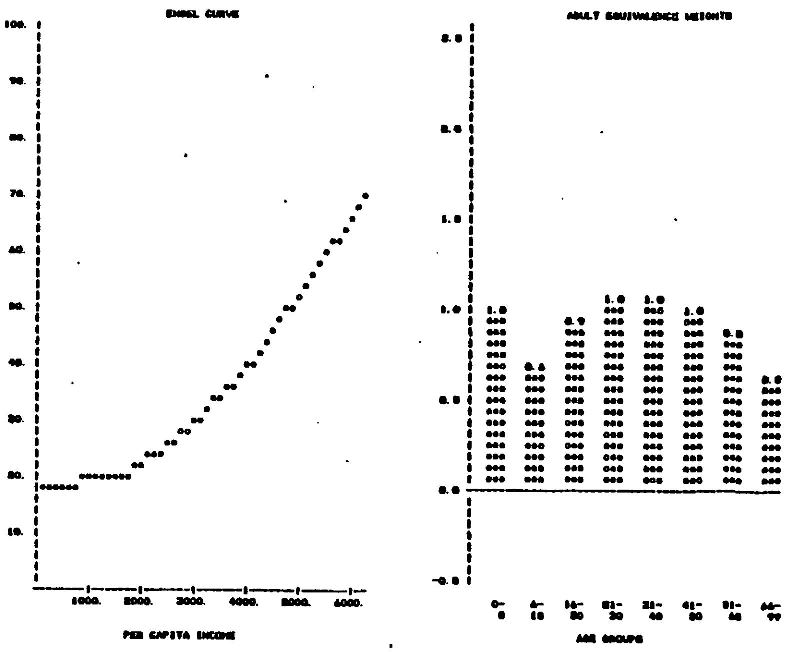
EQUATION #7 WOMEN'S & CHILDREN'S CLOTHING



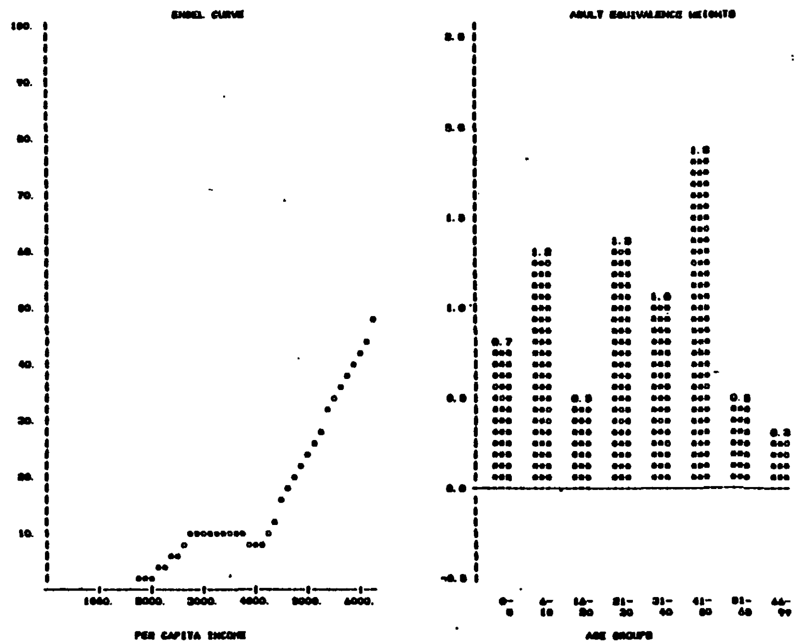
EQUATION #8 MEN'S & BOY'S CLOTHING



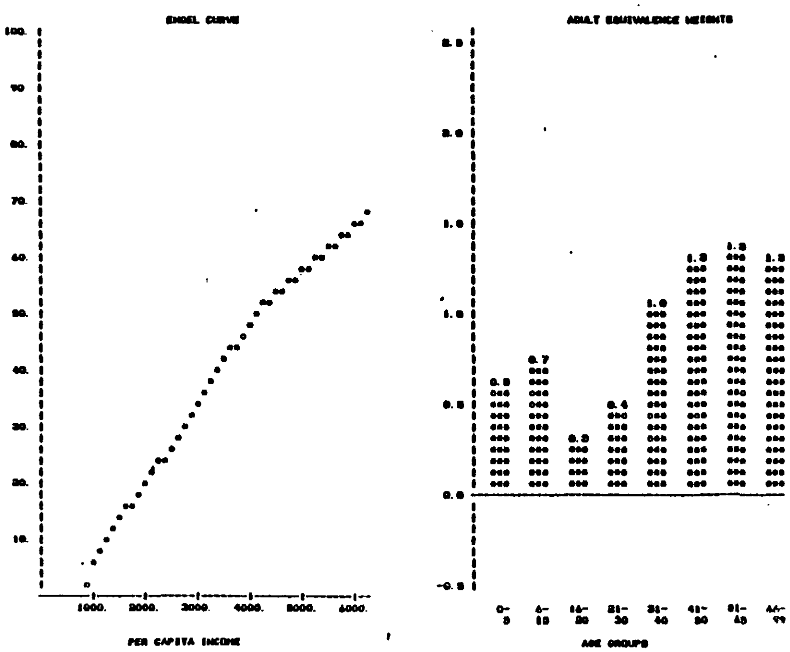
EQUATION #9 CLEANING, LAUNDRY, & REPAIR



EQUATION #10 JEWELRY, WATCHES, & LUGGAGE



EQUATION #11 PERSONAL CARE



EQUATION #12 OWNER OCCUPIED HOUSING

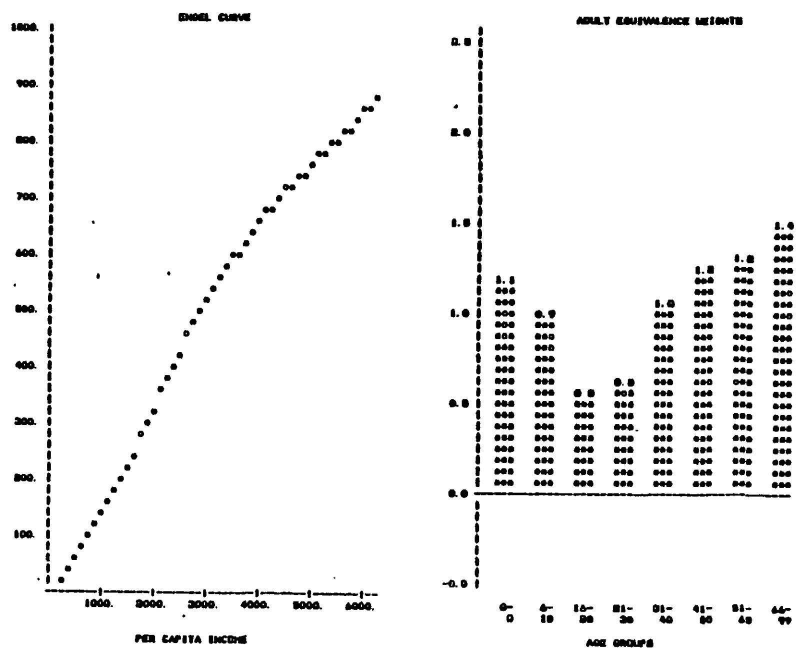
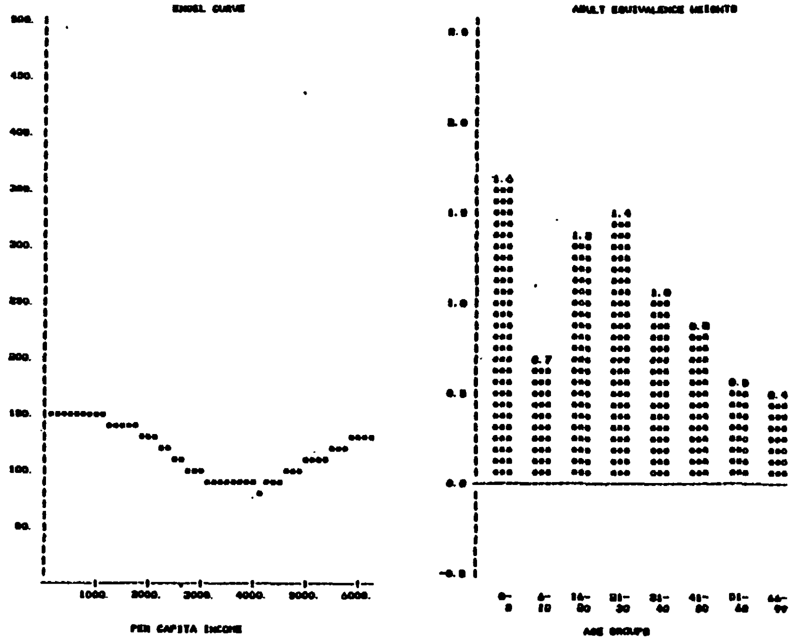
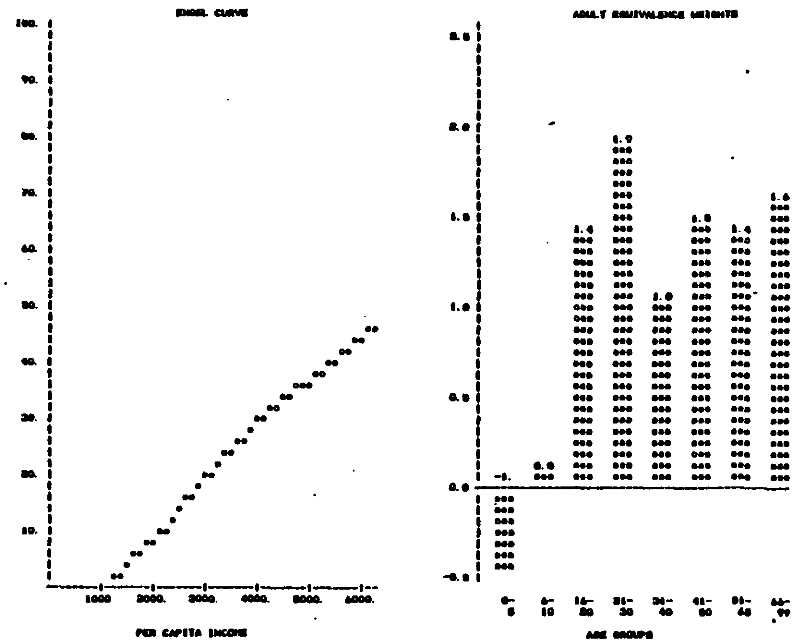


Figure 2.2 (cont'd)

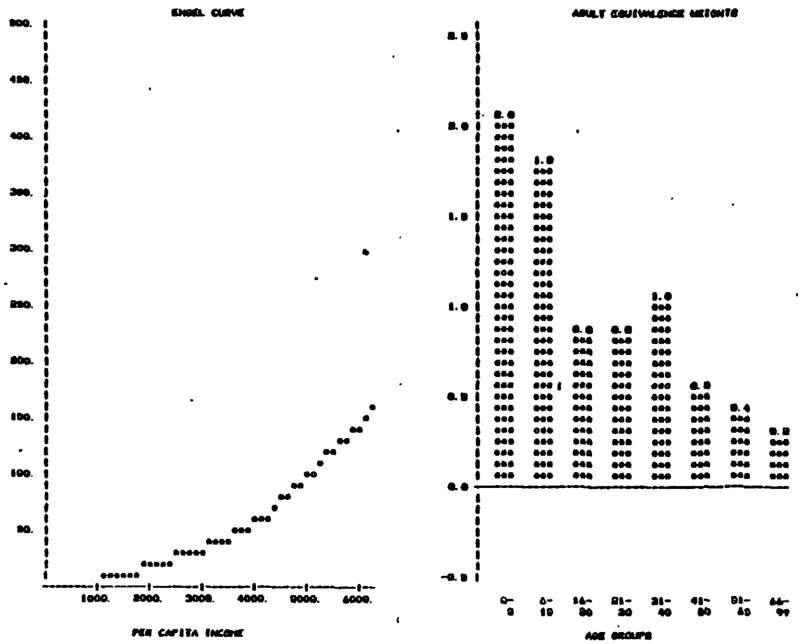
EQUATION #13 TENANT OCCUPIED RENT



EQUATION #14 HOTEL AND MOTELS



EQUATION #15 FURNITURE



EQUATION #16 APPLIANCES

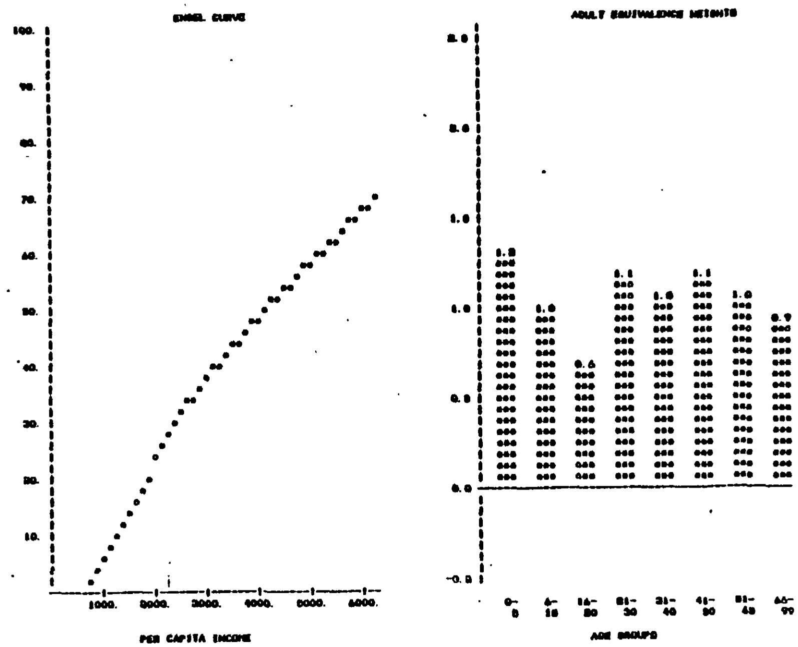
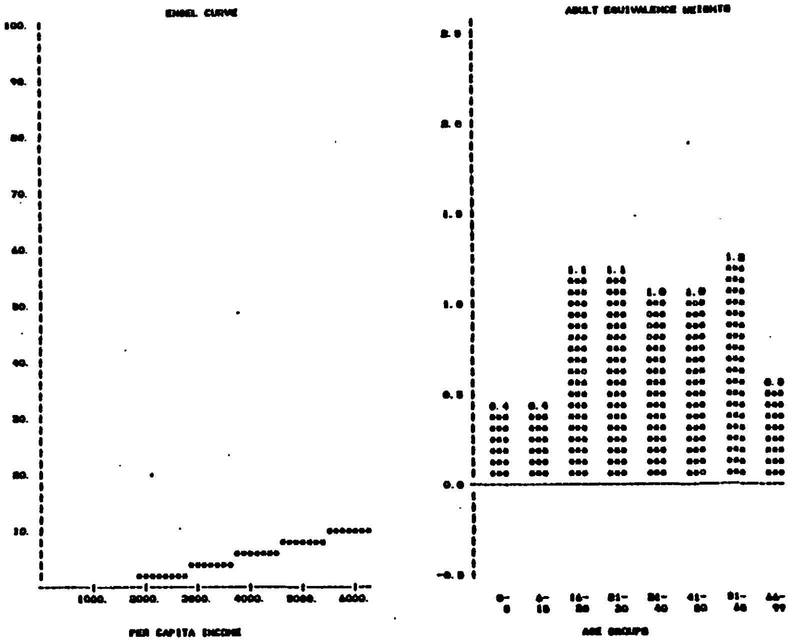
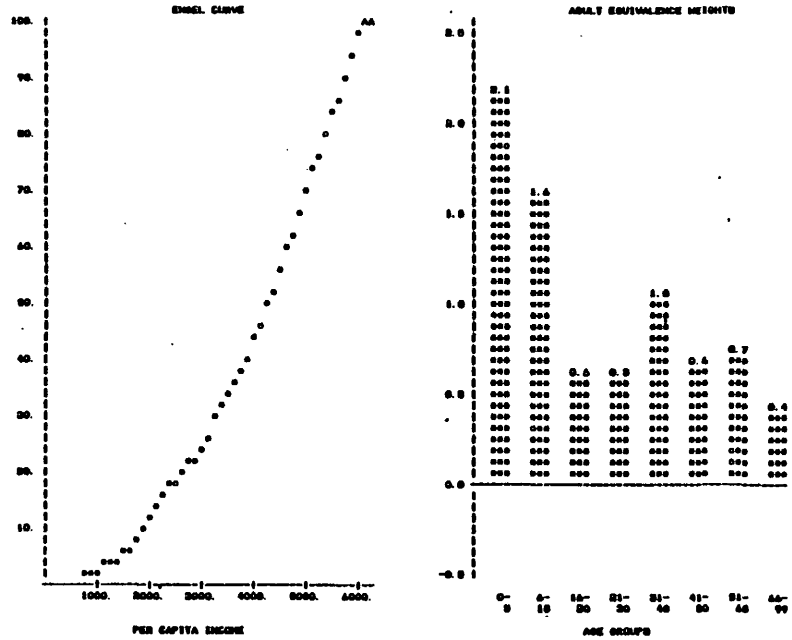


Figure 2.2 (cont'd)

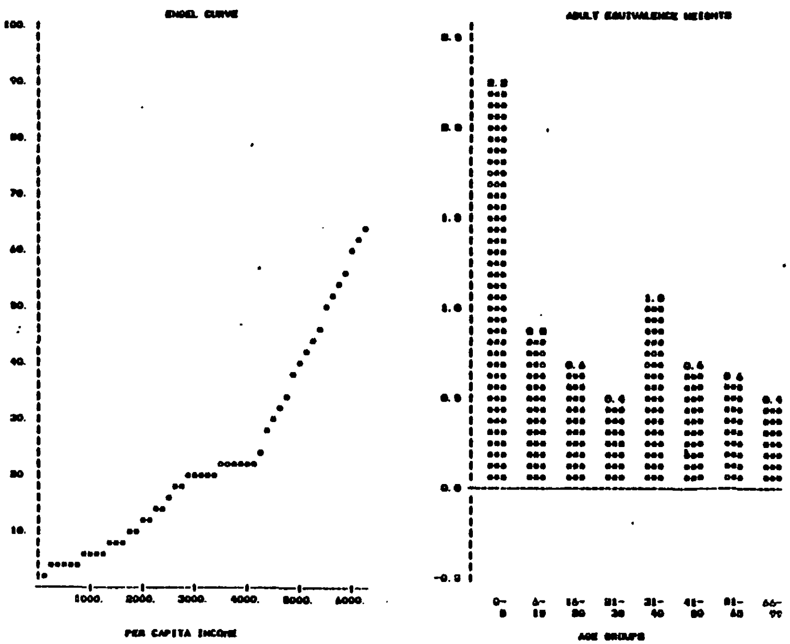
EQUATION #17 CHINA, GLASSWARE, & TABLEWARE



EQUATION #18 OTHER DURABLE HOUSEFURNISHINGS



EQUATION #19 SEMI-DURABLE HOUSEFURNISHINGS



EQUATION #20 TELEPHONE & TELEGRAPH

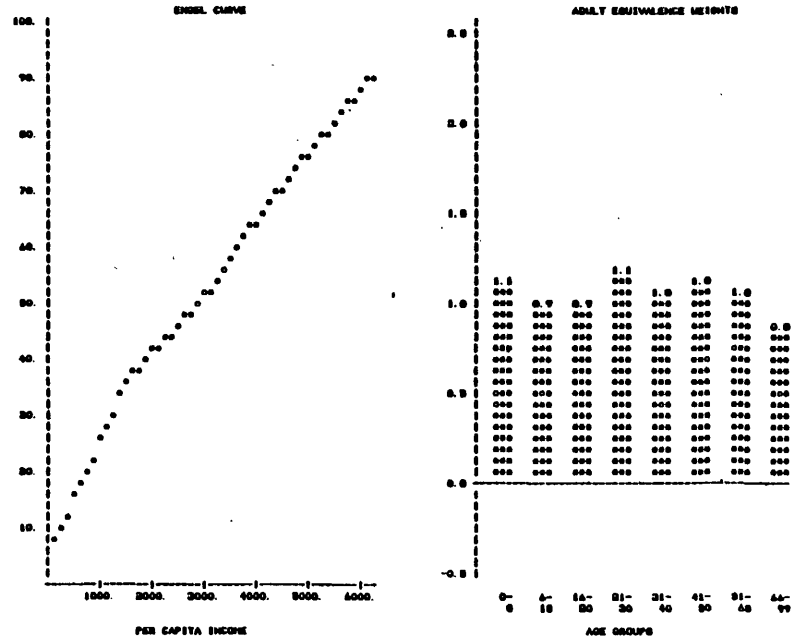
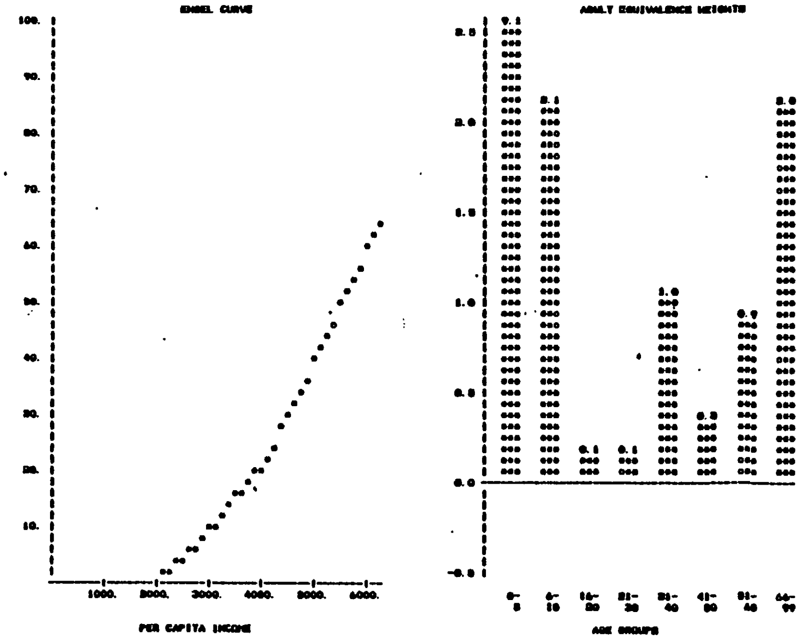
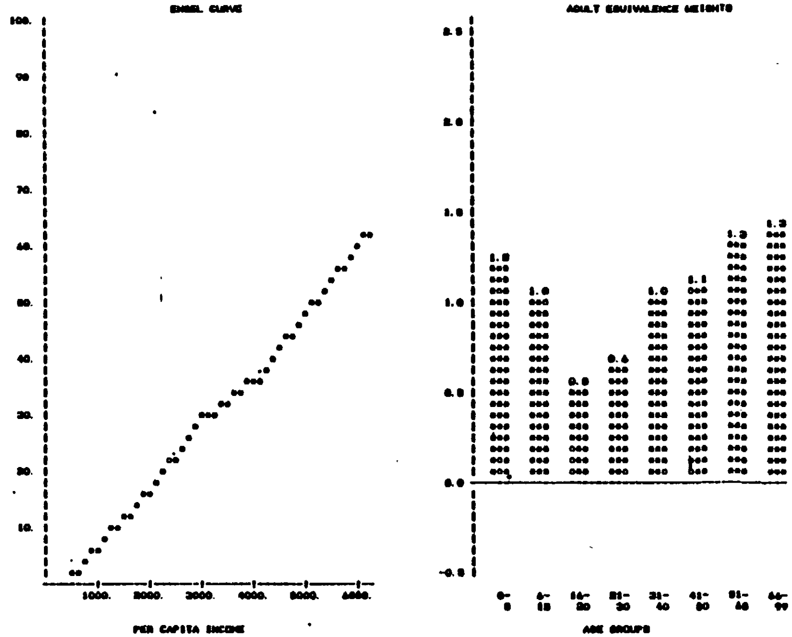


Figure 2.2 (cont'd)

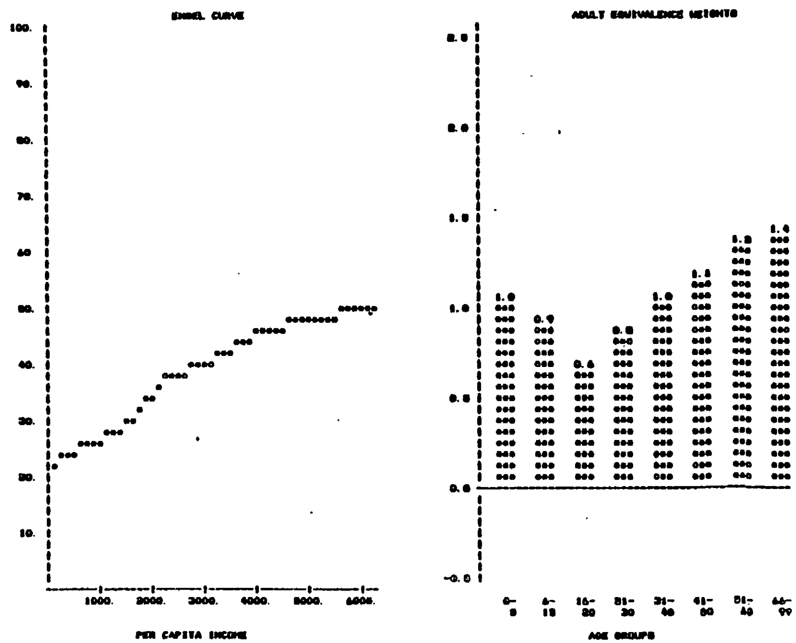
EQUATION #21 DOMESTIC SERVICE



EQUATION #22 OTHER HOUSE OPERATION



EQUATION #23 GAS UTILITIES



EQUATION #24 ELECTRICITY

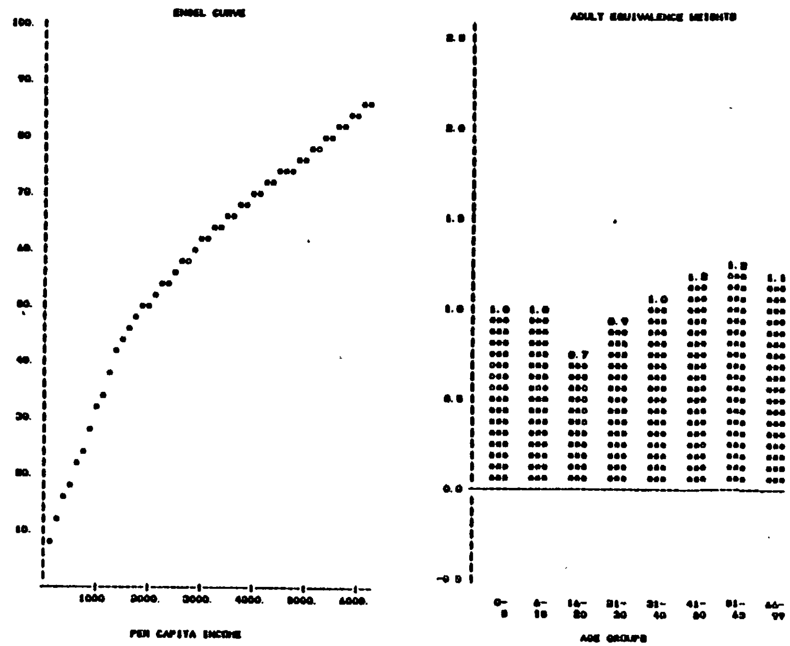
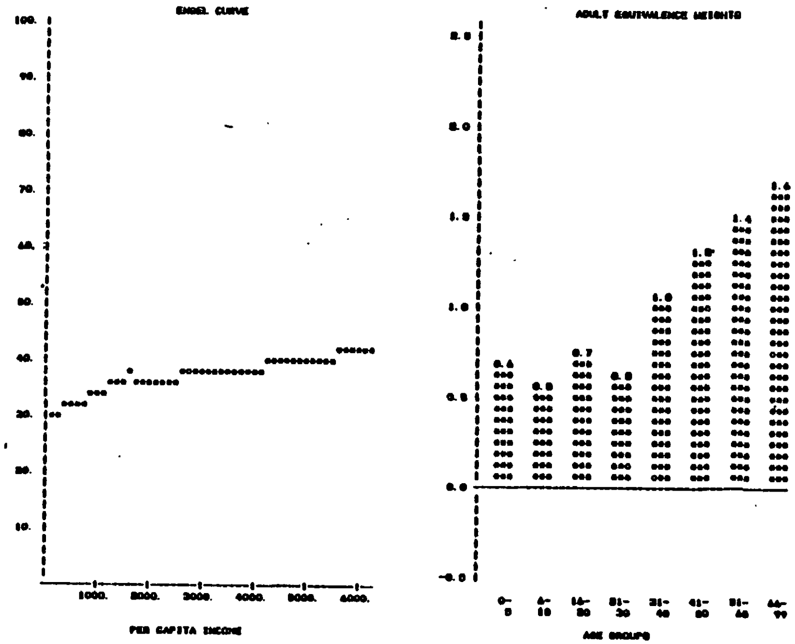
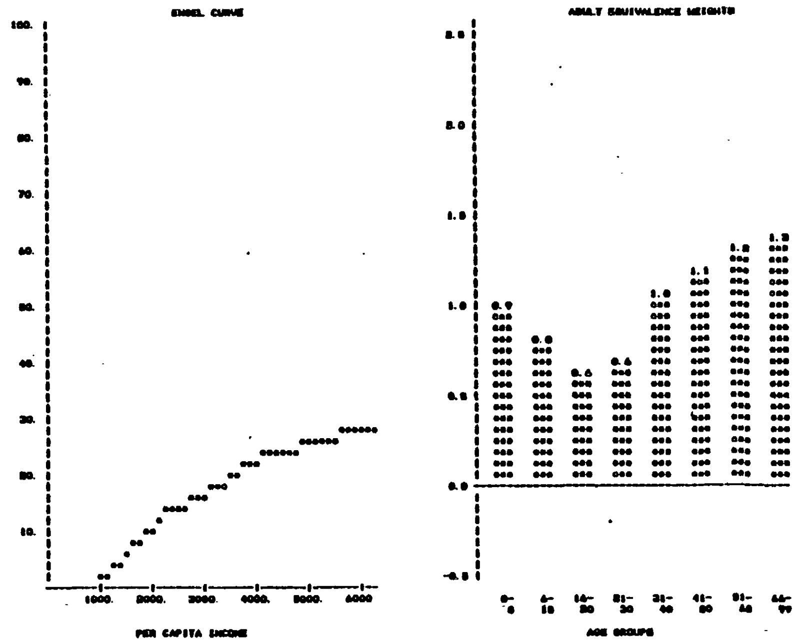


Figure 2.2 (cont'd)

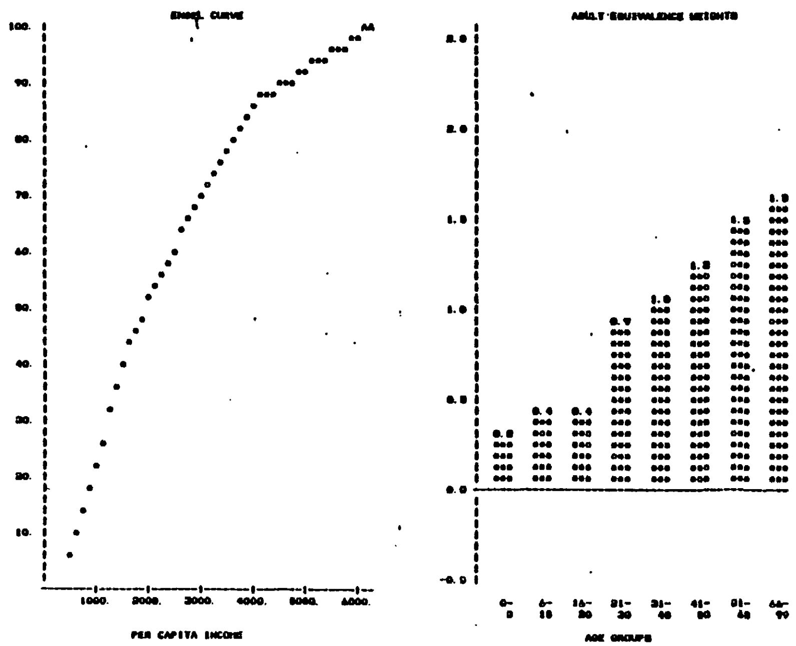
EQUATION #25 FUEL OIL AND COAL



EQUATION #26 WATER & SANITARY SERVICES



EQUATION #27 MEDICAL INSURANCE



EQUATION #28 PHYSICIANS SERVICES

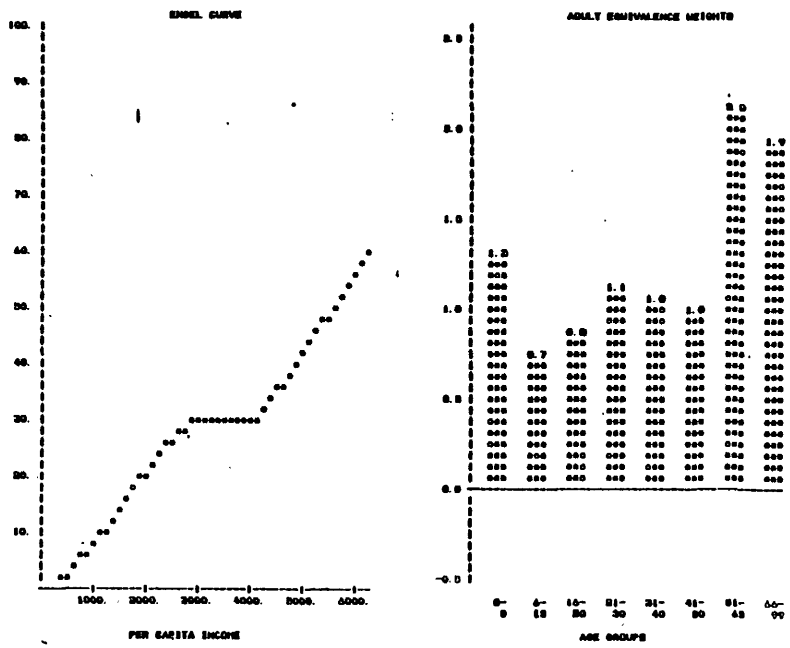
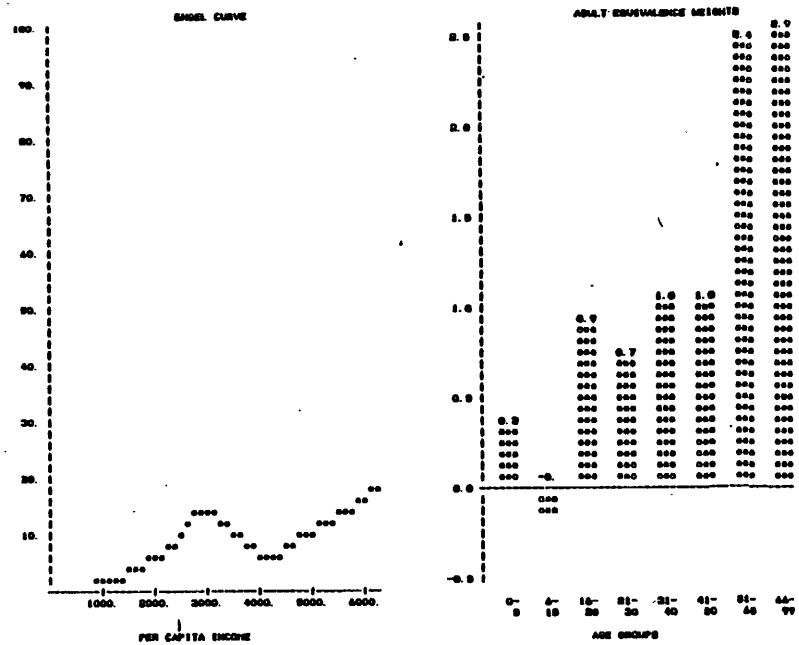


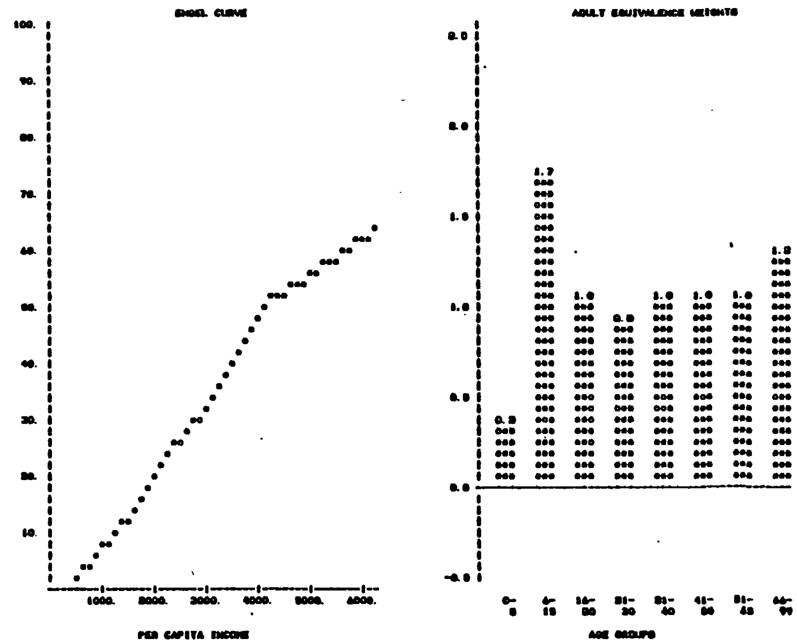
Figure 2.2 (cont'd)

Figure 2.2 (cont'd)

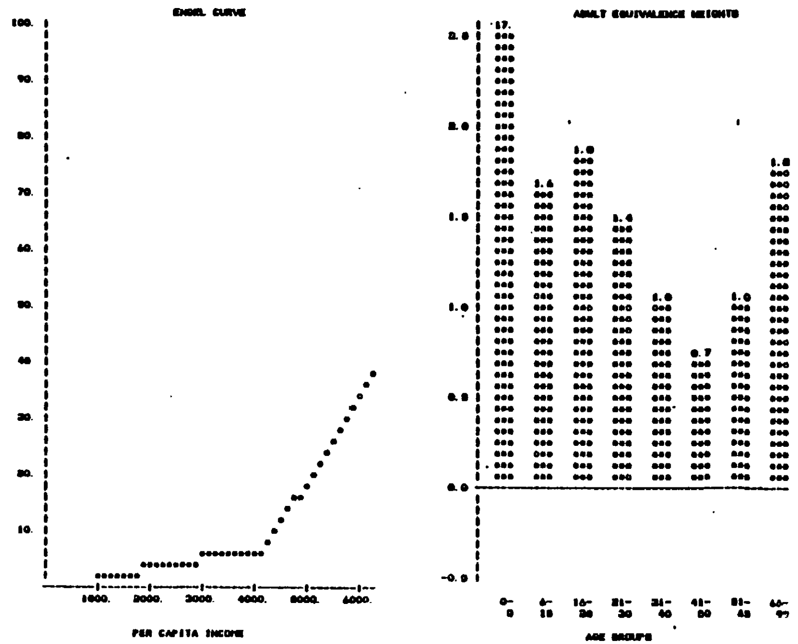
EQUATION #29 HOSPITALS



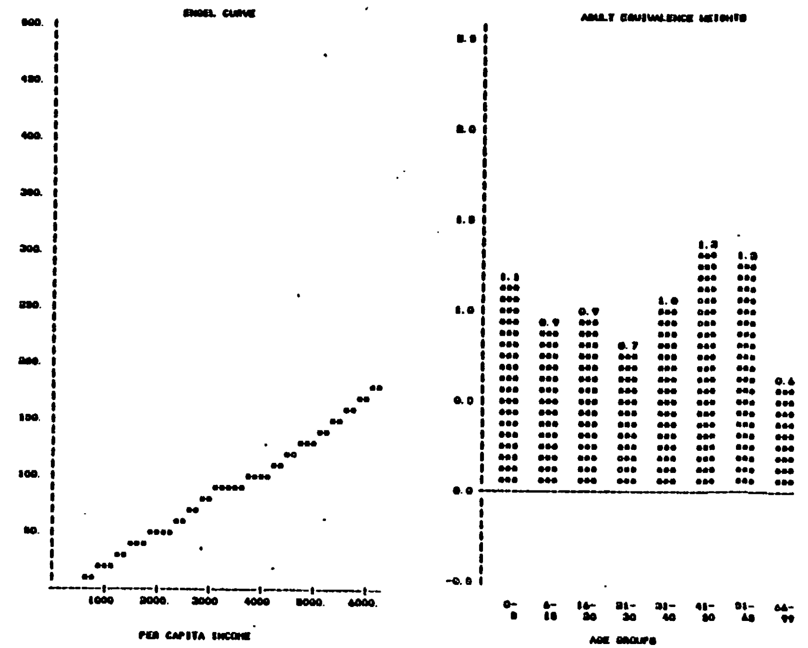
EQUATION #30 DENTAL AND EYE CARE



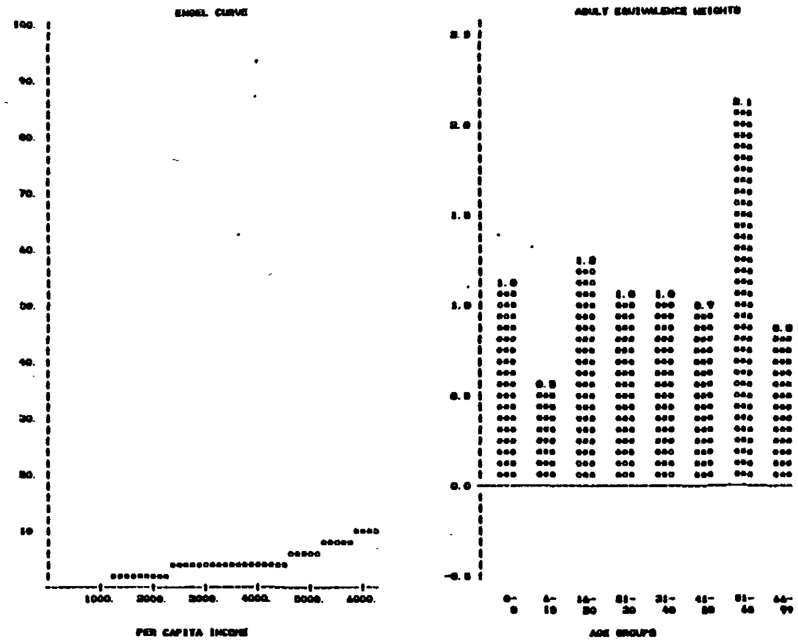
EQUATION #31 OTHER MEDICAL EXPENSES



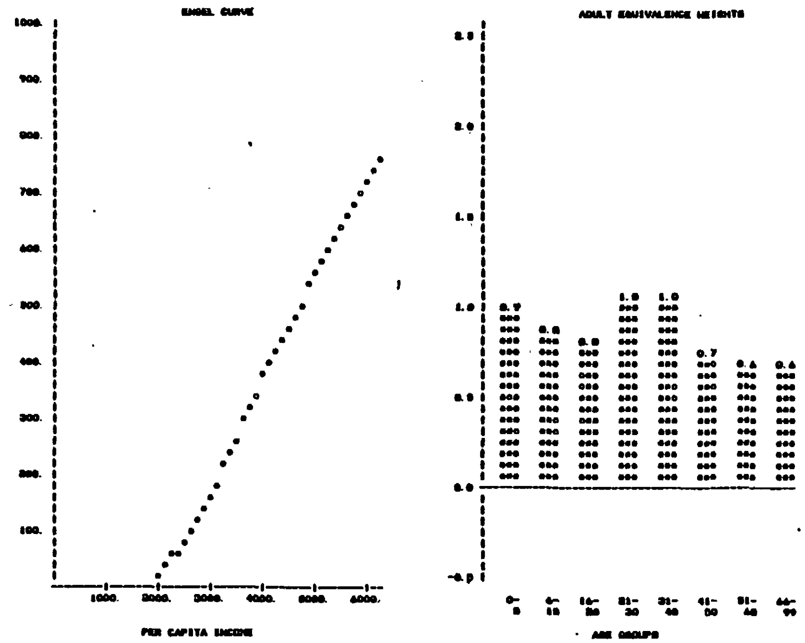
EQUATION #32 LIFE INSURANCE



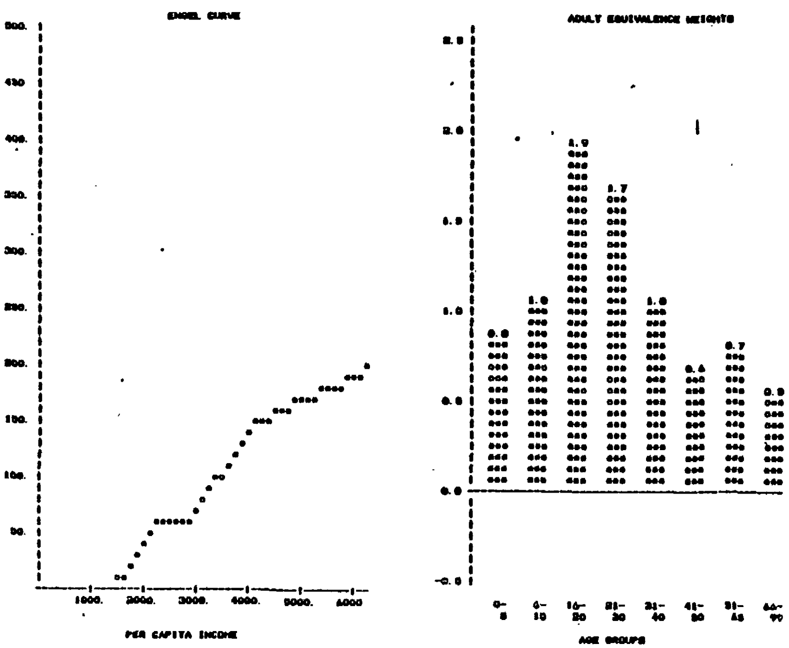
EQUATION #33 OTHER PERSONAL BUSINESS



EQUATION #34 NEW AUTOMOBILES



EQUATION #35 USED AUTOMOBILES



EQUATION #36 TIRES, TUBES, & ACCESSORIES

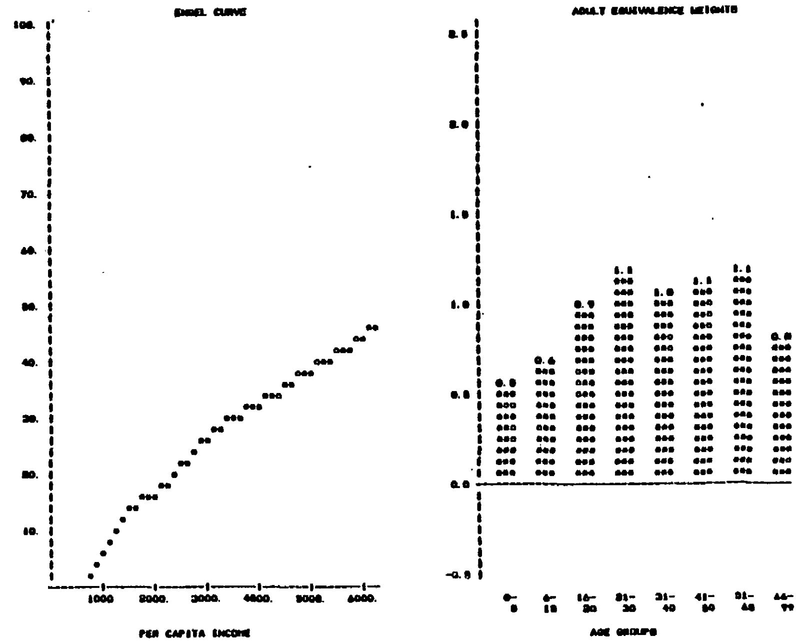
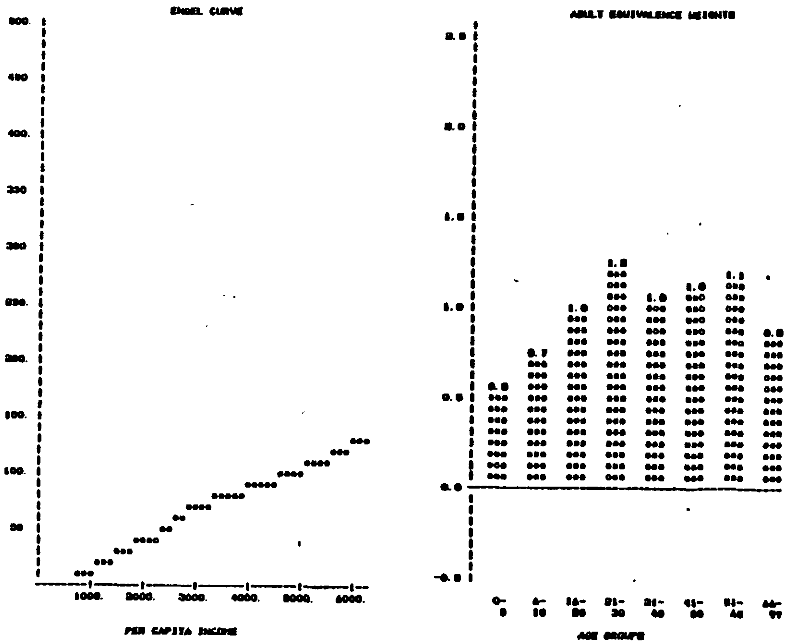


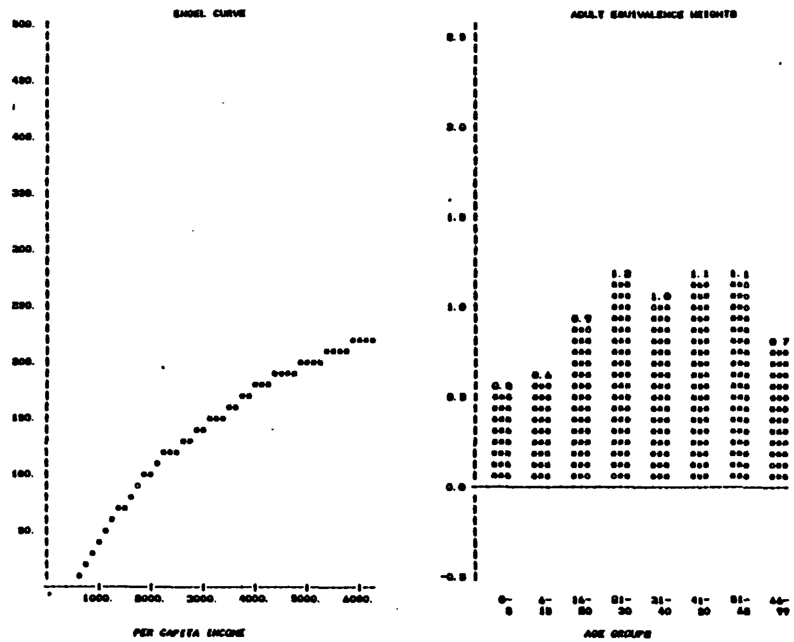
Figure 2.2 (cont'd)

Figure 2.2 (cont'd)

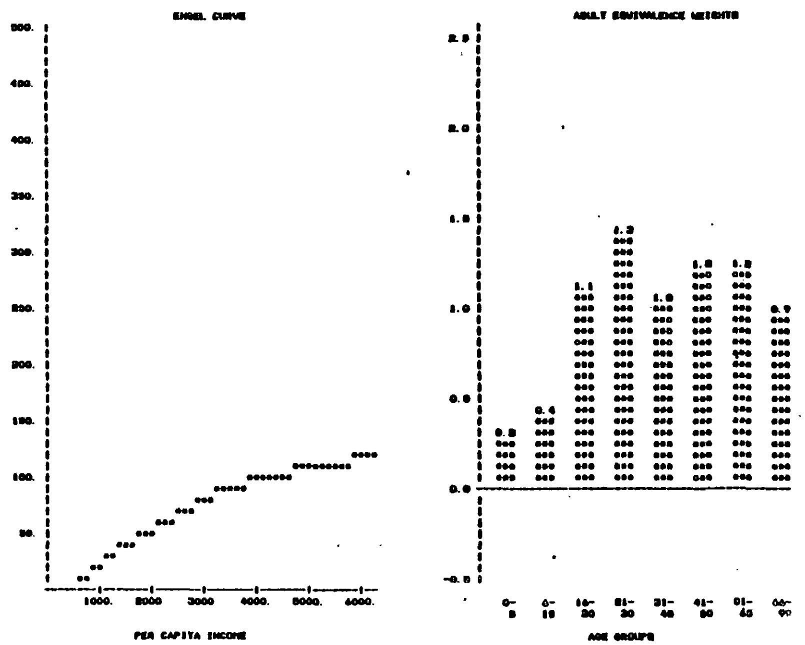
EQUATION #37 REPAIR, RENT, STORAGE, & TOLLS



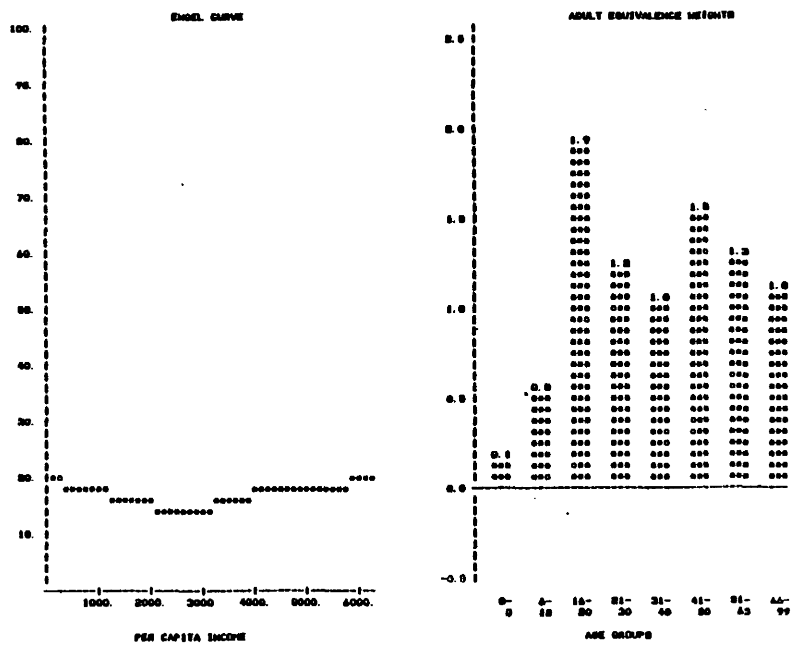
EQUATION #38 GASOLINE AND OIL



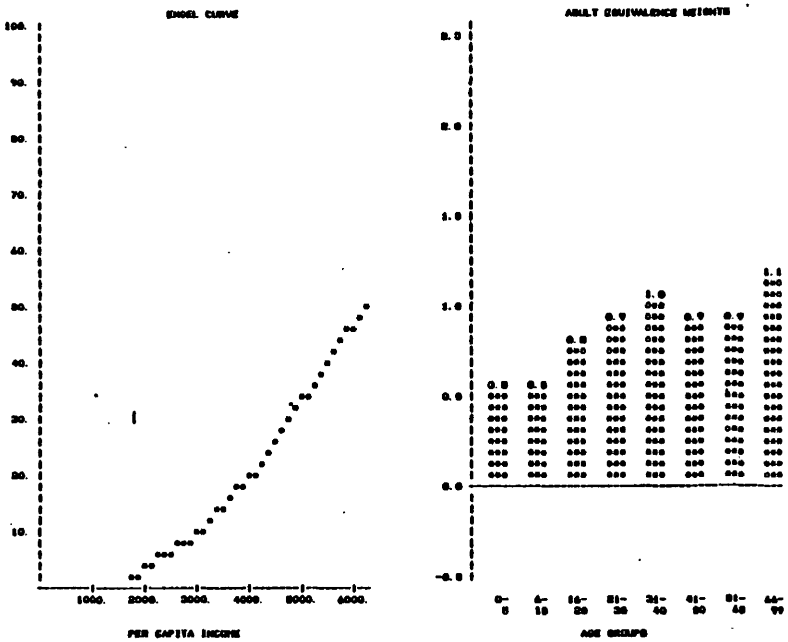
EQUATION #39 AUTOMOBILE INSURANCE



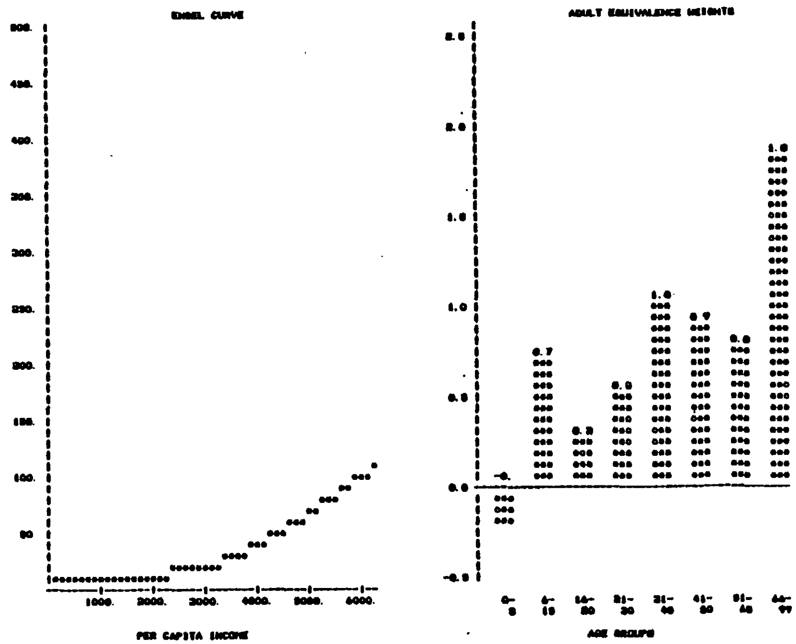
EQUATION #40 LOCAL PUBLIC TRANSPORT



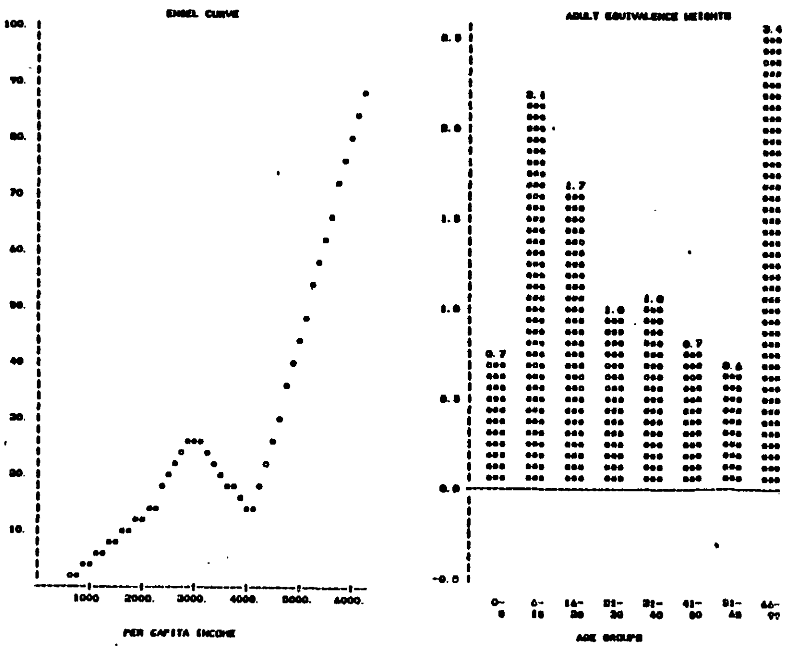
EQUATION #41 INTERCITY TRANSPORT



EQUATION #42 FOREIGN TRAVEL



EQUATION #43 ADMISSIONS AND MEMBERSHIPS



EQUATION #44 TV, RADIO, & MUSICAL INST.

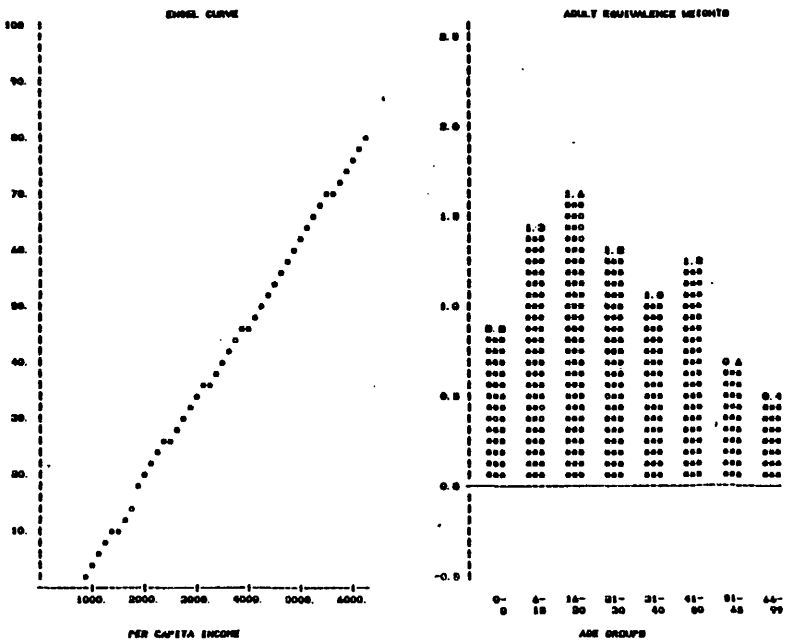
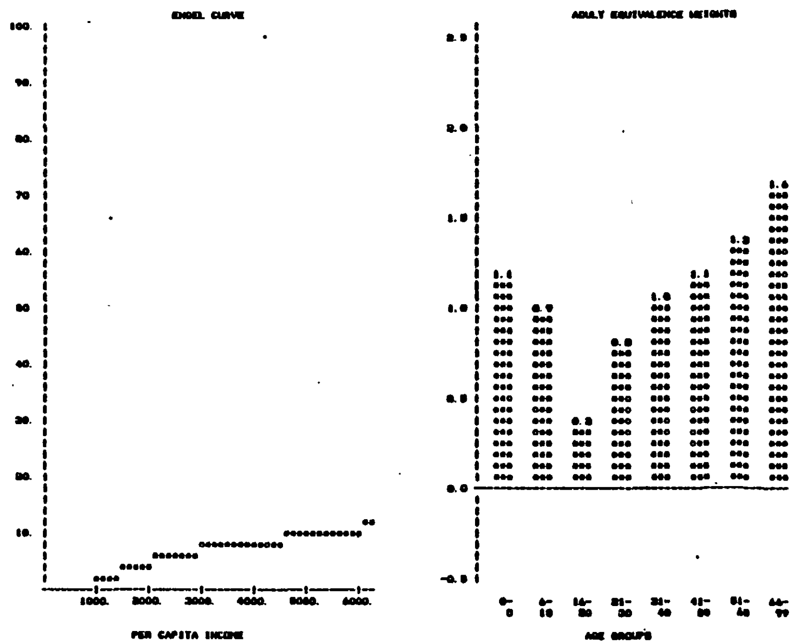
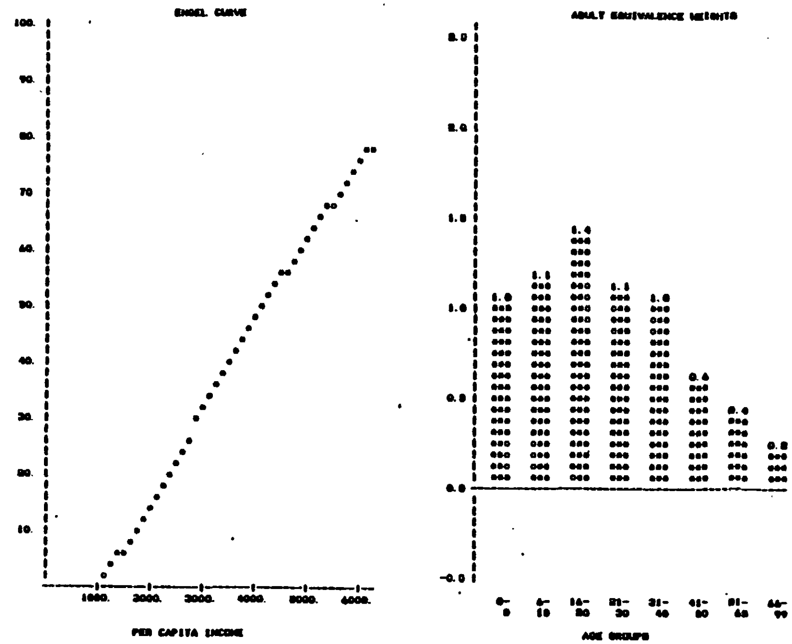


Figure 2.2 (cont'd)

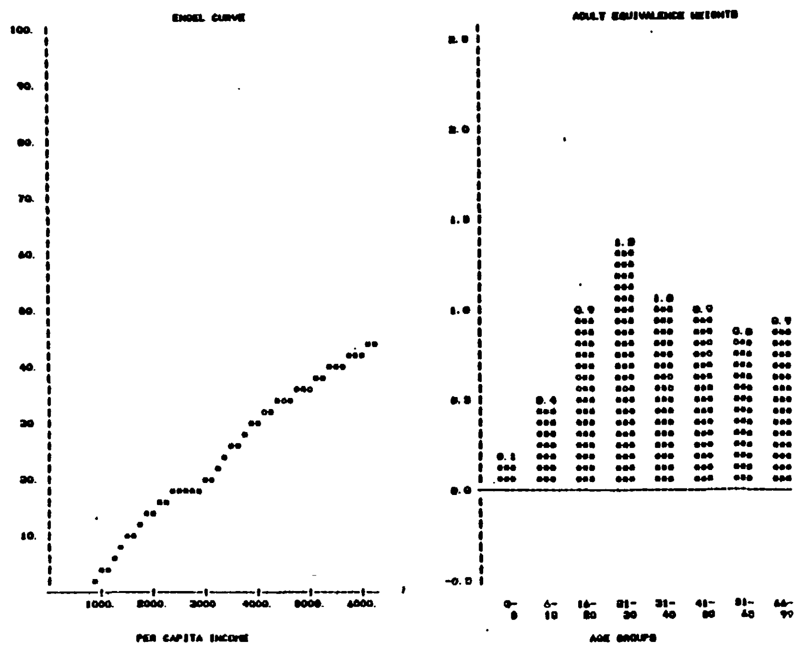
EQUATION #45 REPAIR & RENTAL OF REC. EQUIP.



EQUATION #46 BIKES, SPORT GOODS, & TOYS



EQUATION #47 BOOK, MAGAZINE, & NEWSPAPER



EQUATION #48 CAMPERS, RV'S, & BOATS

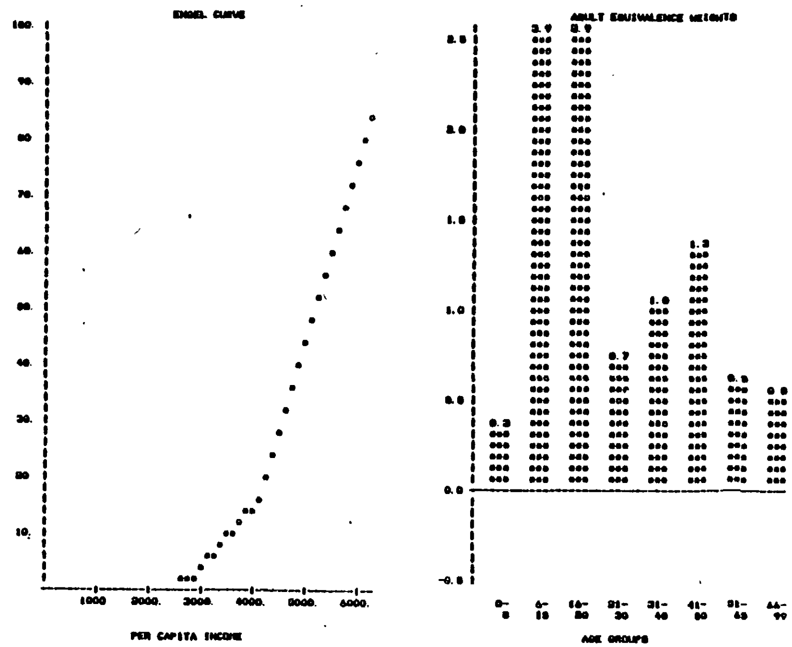
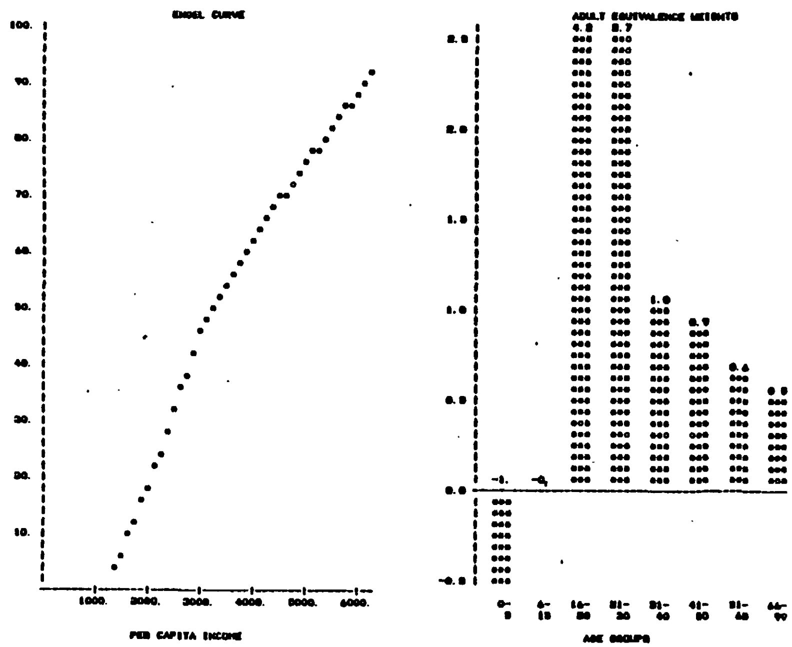


Figure 2.2 (cont'd)

Figure 2.2 (cont'd)

EQUATION #49 EDUCATION (TUITION)



EQUATION #50 CONTRIBUTIONS TO CHARITY

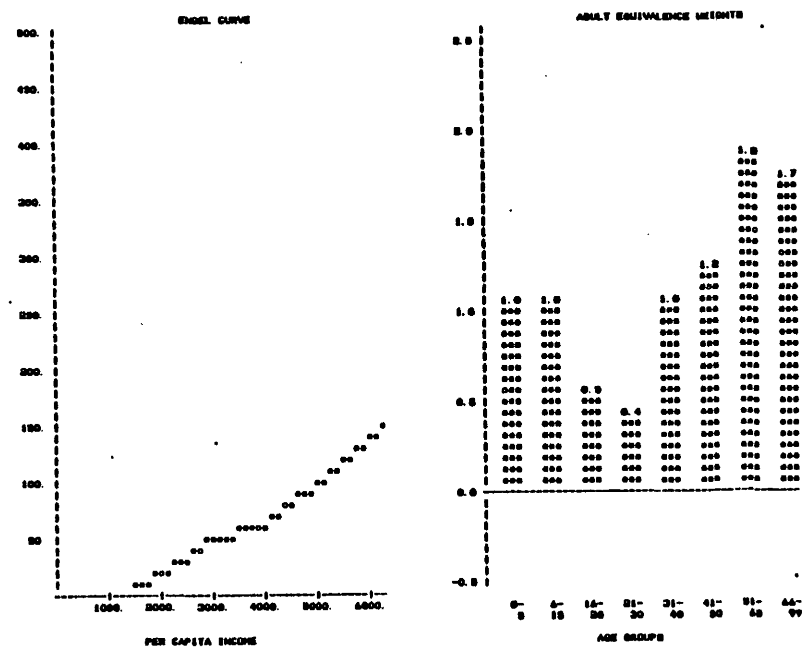


TABLE 2.5

Variable List

VAR 1	-	income between $0 and $1,565
VAR 2	-	income between $1,566 and $2,242
VAR 3	-	income between $2,243 and $2,935
VAR 4	-	income between $2,936 and $4,115
VAR 5	-	income over $4,116
VAR 6	-	household resides in the South
VAR 7	-	household resides in the North Central
VAR 8	-	household resides in the West
VAR 9	-	household has a college educated head
VAR 10	-	spouse is employed
VAR 11	-	household has one member
VAR 12	-	household has two members
VAR 13	-	household has five or more members
VAR 14	-	age of household head less than 35
VAR 15	-	age of household head greater than 55
VAR 16	-	constant

NUMBER OF OBSERVATIONS = 8,234

EQUATION # 1 FOOD, OFF PREMISE RSQ= 0.4741 MEAN= 1326.74

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.1510	0.0534	0.1023	0.0701	0.0364	-61.2961	-56.6561	-33.3560	-41.5644	-18.3640
(12.99)	(3.94)	(7.00)	(7.61)	(9.60)	(9.48)	(8.80)	(4.83)	(6.08)	(4.10)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
0.4252	-4.6033	-18.4109	-16.1337	7.8070	174.3918
(0.02)	(0.47)	(3.08)	(2.24)	(0.87)	(10.72)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.8246	1.1799	0.9028	0.7425	1.0000	1.1535	1.2189	1.2285
(2.94)	(2.84)	(1.93)	(7.93)	(0.00)	(3.64)	(4.63)	(4.16)

EQUATION # 2 FOOD, ON PREMISE RSQ= 0.2967 MEAN= 391.19

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0639	0.0612	0.0637	0.0732	0.0747	-0.3235	13.6473	3.3861	-9.8581	7.9716
(6.94)	(5.59)	(5.56)	(9.25)	(16.23)	(0.07)	(2.90)	(0.65)	(1.96)	(2.34)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
36.1191	-19.1336	14.5542	2.4290	-9.2264	-49.2560
(2.34)	(2.51)	(3.07)	(0.49)	(1.51)	(3.98)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.5880	0.8832	0.8536	0.9689	1.0000	0.9335	0.8383	0.6810
(3.89)	(1.19)	(1.75)	(0.53)	(0.00)	(1.17)	(3.14)	(5.62)

EQUATION # 3 ALCOHOL, OFF PREMISE RSQ= 0.1043 MEAN= 31.72

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0052	0.0024	0.0096	0.0015	0.0052	-0.7451	-3.9126	5.6561	-0.3454	-1.4442
(3.14)	(1.30)	(4.71)	(1.38)	(8.76)	(0.92)	(4.28)	(5.10)	(0.40)	(2.36)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
2.4199	-0.8030	0.0114	0.7942	-3.2825	0.9988
(1.17)	(0.78)	(0.01)	(0.81)	(3.26)	(0.46)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.3465	0.5491	0.4792	0.8037	1.0000	0.9812	1.0314	0.8526
(4.56)	(3.40)	(4.50)	(2.20)	(0.00)	(0.19)	(0.30)	(1.29)

EQUATION # 4 ALCOHOL, ON PREMISE RSQ= 0.1336 MEAN= 46.38

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0081	0.0097	0.0169	0.0008	0.0261	4.5904	-16.1919	0.5939	-9.2400	4.6948
(1.29)	(1.47)	(2.65)	(0.23)	(14.06)	(1.65)	(5.22)	(0.20)	(3.38)	(2.26)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
66.7313	-8.8612	8.4635	2.3578	1.1326	-1.3938
(8.87)	(2.69)	(2.98)	(0.91)	(0.31)	(0.16)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.0243	0.0683	0.1760	0.9179	1.0000	0.6589	0.3951	0.1187
(8.83)	(12.48)	(10.36)	(1.31)	(0.00)	(6.47)	(15.88)	(23.76)

EQUATION # 5 TOBACCO PRODUCTS RSQ= 0.1430 MEAN= 132.53

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0188	0.0025	0.0118	0.0041	0.0058	-13.1959	-15.6879	-26.8929	-27.0066	0.5274
(4.71)	(0.57)	(2.67)	(1.63)	(5.63)	(5.66)	(6.33)	(7.96)	(8.64)	(0.38)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
11.9300	6.3165	-7.1498	4.8237	-6.5414	37.1576
(2.34)	(2.47)	(3.93)	(1.76)	(2.51)	(5.61)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.4332	0.4428	0.5929	0.9462	1.0000	1.2345	1.1047	0.4652
(5.26)	(5.57)	(4.25)	(0.63)	(0.00)	(2.26)	(1.01)	(8.12)

EQUATION # 6 SHOES AND SHOE REPAIR RSQ= 0.1771 MEAN= 128.50

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0053	0.0067	0.0118	0.0012	0.0181	4.7469	9.0373	3.7402	-0.1897	-0.4193
(2.23)	(2.16)	(3.50)	(0.56)	(12.63)	(3.28)	(5.73)	(2.35)	(0.12)	(0.41)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
8.4538	2.1999	-0.1028	-4.4732	4.2291	18.7744
(1.69)	(0.93)	(0.08)	(3.00)	(2.06)	(4.95)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.7623	1.1330	0.9693	1.0799	1.0000	0.8929	0.9332	0.6509
(1.73)	(0.98)	(0.28)	(0.94)	(0.00)	(1.51)	(0.91)	(5.13)

EQUATION # 7 WOMEN'S & CHILDREN CLOT RSQ= 0.3479 MEAN= 277.29

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0332	0.0344	0.0252	0.0375	0.0379	1.5825	2.3859	-6.6771	-0.3345	6.6049
(8.69)	(7.20)	(5.04)	(10.14)	(17.31)	(0.77)	(1.15)	(2.86)	(0.15)	(4.31)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
13.9234	6.8497	2.1261	-5.3230	-4.3482	-8.3072
(1.68)	(1.71)	(1.08)	(2.61)	(1.45)	(1.67)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
1.4476	1.1982	1.3373	0.9318	1.0000	0.9204	0.8524	0.6842
(3.48)	(2.04)	(3.77)	(1.37)	(0.00)	(1.60)	(3.20)	(6.16)

EQUATION # 8 MEN'S & BOY'S CLOTHING RSQ= 0.4010 MEAN= 174.11

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0254	0.0221	0.0272	0.0232	0.0303	-2.2099	2.4532	-6.8769	2.0179	-1.1121
(8.27)	(6.01)	(6.85)	(8.62)	(18.17)	(1.37)	(1.52)	(3.74)	(1.15)	(0.96)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-36.2364	-16.9390	7.7380	-0.7473	-3.1497	-4.9896
(5.80)	(5.91)	(4.62)	(0.45)	(1.41)	(1.25)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.7658	1.0238	1.0544	1.1061	1.0000	0.9349	0.7611	0.5375
(2.44)	(0.27)	(0.68)	(1.79)	(0.00)	(1.28)	(5.39)	(9.14)

EQUATION # 9 CLEAN,LAUNDRY,REPAIR RSQ= 0.1247 MEAN= 89.09

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0009	0.0063	0.0068	0.0100	0.0138	-8.2646	-2.9241	-6.6642	-1.5286	4.6886
(0.39)	(2.17)	(2.25)	(5.12)	(12.53)	(5.60)	(2.23)	(4.32)	(1.11)	(4.61)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
60.7049	11.3213	-4.2291	2.4839	0.1826	18.2687
(11.02)	(5.21)	(3.61)	(1.76)	(0.10)	(5.12)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.9501	0.6232	0.8993	1.0216	1.0000	0.9532	0.8210	0.5486
(0.32)	(3.52)	(0.99)	(0.30)	(0.00)	(0.68)	(3.01)	(8.69)

EQUATION #10 JEWELRY,WATCHS,LUGGAGE RSQ= 0.1127 MEAN= 35.80

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0048	0.0051	0.0101	-0.0024	0.0182	2.0995	5.2497	1.6440	-1.8671	-0.4449
(2.19)	(1.87)	(3.25)	(1.36)	(7.25)	(1.70)	(3.36)	(1.23)	(1.49)	(0.53)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-31.8000	-6.1428	1.3973	1.7871	2.9928	-6.9085
(4.85)	(2.58)	(1.26)	(1.44)	(1.60)	(2.14)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.7244	1.2253	0.4549	1.3175	1.0000	1.7874	0.4561	0.2742
(0.76)	(0.69)	(2.55)	(1.57)	(0.00)	(3.00)	(6.34)	(6.87)

EQUATION #11 PERSONAL CARE RSQ= 0.2439 MEAN= 97.00

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0167	0.0126	0.0139	0.0151	0.0082	2.8224	7.8330	1.0180	-1.5334	6.0870
(6.56)	(4.39)	(4.85)	(8.47)	(11.52)	(2.34)	(6.10)	(0.77)	(1.14)	(6.32)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
0.9624	1.4631	1.2029	1.1085	-3.6032	-11.6717
(0.37)	(0.96)	(0.96)	(0.71)	(2.54)	(3.42)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.5313	0.6579	0.2688	0.4186	1.0000	1.2685	1.3428	1.2794
(5.07)	(3.98)	(11.47)	(15.25)	(0.00)	(3.54)	(4.12)	(3.02)

EQUATION #12 OWNER OCCUPIED HOUSING RSQ= 0.4313 MEAN= 1202.81

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.1596	0.2110	0.1968	0.1358	0.0950	-3.0112	-63.5126	29.1558	83.7641	-44.0862
(8.84)	(9.38)	(8.65)	(9.72)	(14.92)	(0.33)	(6.58)	(2.88)	(7.59)	(6.36)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-165.3755	-43.5848	11.3617	-7.2542	-5.7243	-15.1238
(6.99)	(3.34)	(1.25)	(0.72)	(0.49)	(0.66)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
1.1187	0.9454	0.5048	0.5478	1.0000	1.1598	1.2295	1.4484
(1.26)	(0.72)	(8.98)	(13.16)	(0.00)	(2.96)	(3.84)	(5.75)

EQUATION #13 TENANT OCCUPIED RENT RSQ= 0.2020 MEAN= 325.28

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
-0.0062	-0.0262	-0.0415	-0.0097	0.0234	-53.6413	-44.9284	12.8419	22.6050	21.9676
(0.52)	(1.70)	(2.51)	(0.92)	(4.81)	(6.43)	(5.60)	(1.66)	(2.94)	(4.10)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
946.7742	264.2380	-81.4293	55.9190	-12.4120	152.2530
(16.37)	(13.91)	(10.23)	(6.15)	(1.22)	(7.18)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
1.6307	0.6538	1.2955	1.4400	1.0000	0.7957	0.4765	0.4312
(2.71)	(2.45)	(2.69)	(5.03)	(0.00)	(3.26)	(13.38)	(16.05)

EQUATION #14 HOTEL AND MOTELS RSQ= 0.1764 MEAN= 50.87

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0124	0.0084	0.0121	0.0095	0.0075	2.7960	-2.4714	-6.3780	17.8285	-2.4840
(3.05)	(2.20)	(3.32)	(4.56)	(7.18)	(1.84)	(1.66)	(3.58)	(6.47)	(2.19)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-25.2244	-13.4134	11.6339	-7.2291	5.1658	-14.4376
(6.15)	(6.06)	(5.08)	(3.78)	(2.95)	(2.58)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
-0.5185	0.0351	1.3898	1.8675	1.0000	1.4664	1.3537	1.5935
(9.25)	(9.52)	(1.61)	(3.52)	(0.00)	(2.56)	(1.96)	(2.50)

EQUATION #15 FURNITURE RSQ= 0.1450 MEAN= 121.65

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0126	0.0161	0.0170	0.0205	0.0462	0.7768	3.4025	1.6677	-5.0018	0.3419
(3.66)	(3.40)	(3.12)	(4.63)	(11.33)	(0.37)	(1.57)	(0.70)	(2.09)	(0.23)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-17.6831	18.9201	2.0826	4.3019	3.8055	-9.1599
(1.15)	(3.39)	(1.04)	(2.30)	(1.03)	(1.88)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
2.0222	1.7758	0.8309	0.8206	1.0000	0.5130	0.3949	0.2497
(3.64)	(3.29)	(1.27)	(2.31)	(0.00)	(7.55)	(12.98)	(12.56)

EQUATION #16 APPLIANCES RSQ= 0.1068 MEAN= 107.94

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0161	0.0179	0.0146	0.0106	0.0091	5.2360	7.8677	2.6683	-6.7167	-2.1095
(4.56)	(4.18)	(3.32)	(3.83)	(6.64)	(2.83)	(4.04)	(1.35)	(3.27)	(1.63)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-19.3757	7.3088	1.6993	4.1332	-7.2138	-9.8284
(3.34)	(2.50)	(0.99)	(2.07)	(2.87)	(2.14)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
1.2209	0.9617	0.6111	1.0939	1.0000	1.1474	0.9741	0.8786
(0.99)	(0.22)	(2.93)	(0.79)	(0.00)	(1.20)	(0.23)	(0.91)

EQUATION #17 CHINA, GLASSWARES, TABLEW RSQ= 0.0610 MEAN= 13.25

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0016	0.0026	0.0019	0.0023	0.0023	0.9993	1.3873	2.9032	1.2089	-0.4249
(1.55)	(2.09)	(1.62)	(3.15)	(5.93)	(1.87)	(2.44)	(3.75)	(1.84)	(1.15)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-3.2489	-0.3015	1.0916	1.1308	-0.5730	-2.2918
(2.25)	(0.46)	(1.95)	(1.65)	(1.01)	(1.55)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.3965	0.3944	1.1414	1.1071	1.0000	1.0200	1.2037	0.4843
(2.32)	(2.77)	(0.48)	(0.60)	(0.00)	(0.12)	(1.09)	(3.30)

EQUATION #18 OTHER DURABLE HOUSEFURN RSQ= 0.1561 MEAN= 75.67

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0055	0.0158	0.0099	0.0188	0.0275	2.4828	-0.0387	0.8499	-2.5518	-1.2749
(2.47)	(4.61)	(2.75)	(5.98)	(11.06)	(1.72)	(0.03)	(0.53)	(1.59)	(1.24)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-32.5109	5.1035	1.0680	0.7872	0.3124	-3.0168
(3.58)	(1.53)	(0.81)	(0.64)	(0.14)	(0.94)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
2.1212	1.5760	0.5738	0.5452	1.0000	0.6146	0.7145	0.3920
(3.81)	(2.73)	(3.58)	(7.25)	(0.00)	(5.44)	(4.08)	(8.71)

EQUATION #19 SEMI DURABLE HOUSEFURNS RSQ= 0.1752 MEAN= 43.82

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0037	0.0078	0.0100	0.0016	0.0198	-0.5092	-1.3067	-0.4960	-2.1692	-0.6792
(2.84)	(4.17)	(4.78)	(1.14)	(14.10)	(0.62)	(1.57)	(0.54)	(2.42)	(1.15)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-12.3057	7.5492	-0.2258	-2.2626	3.4003	2.1720
(2.78)	(4.31)	(0.31)	(3.28)	(2.52)	(1.17)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
2.1583	0.8059	0.6050	0.4290	1.0000	0.6096	0.5710	0.4072
(4.57)	(1.65)	(4.43)	(13.77)	(0.00)	(7.64)	(9.58)	(12.65)

EQUATION #20 TELEPHONE & TELEGRAPH RSQ= 0.1827 MEAN= 171.80

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0207	0.0094	0.0098	0.0138	0.0114	-3.2128	0.3245	-1.1659	3.2967	0.8686
(9.35)	(3.67)	(3.63)	(7.82)	(13.93)	(2.78)	(0.28)	(0.91)	(2.60)	(1.05)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
64.9341	19.6922	-8.3244	4.5661	0.7707	4.6925
(14.23)	(9.72)	(7.73)	(3.52)	(0.48)	(1.63)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
1.0863	0.9365	0.9200	1.1109	1.0000	1.0474	1.0063	0.8255
(0.87)	(0.82)	(1.21)	(2.20)	(0.00)	(0.95)	(0.13)	(3.83)

EQUATION #21 DOMESTIC SERVICE RSQ= 0.2180 MEAN= 73.20

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0031	0.0073	0.0091	0.0114	0.0197	0.7317	3.6699	1.9068	2.5180	10.0330
(2.27)	(3.50)	(3.64)	(5.72)	(10.79)	(0.79)	(3.64)	(1.83)	(2.34)	(8.36)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
7.9428	10.5876	-0.7240	2.8602	-6.5109	-7.5028
(1.81)	(4.37)	(0.88)	(3.61)	(3.68)	(3.51)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
9.0516	2.0523	0.1315	0.1492	1.0000	0.2920	0.8564	2.0461
(9.24)	(3.70)	(4.99)	(12.22)	(0.00)	(7.69)	(1.48)	(4.95)

EQUATION #22 OTHER HOUSE OPERATION RSQ= 0.1953 MEAN= 86.19

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0098	0.0107	0.0133	0.0070	0.0122	1.7317	3.9273	1.1923	6.9998	-2.5495
(4.85)	(4.25)	(4.98)	(4.34)	(12.29)	(1.62)	(3.51)	(1.00)	(5.20)	(3.17)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-4.9739	1.2461	0.0307	-0.3459	1.7415	-3.2325
(1.78)	(0.78)	(0.03)	(0.30)	(1.28)	(1.19)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
1.1694	1.0281	0.5151	0.6177	1.0000	1.0663	1.2946	1.3476
(1.01)	(0.21)	(5.05)	(6.53)	(0.00)	(0.80)	(3.06)	(3.09)

EQUATION #23 GAS UTILITIES RSQ= 0.1326 MEAN= 113.81

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0052	0.0116	0.0025	0.0054	0.0022	13.0169	-8.8055	-7.2271	-2.5536	1.2444
(2.53)	(4.35)	(0.95)	(3.33)	(3.62)	(8.52)	(6.69)	(5.29)	(2.04)	(1.51)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
14.7236	3.8280	-6.8151	0.5094	-1.5740	21.7901
(4.95)	(2.37)	(6.18)	(0.38)	(1.04)	(6.61)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
1.0085	0.8554	0.6186	0.8297	1.0000	1.1025	1.3180	1.3848
(0.06)	(1.29)	(4.26)	(2.49)	(0.00)	(1.22)	(3.08)	(3.24)

EQUATION #24 ELECTRICITY RSQ= 0.2898 MEAN= 173.21

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0260	0.0104	0.0111	0.0079	0.0074	-0.0840	9.5450	-9.4343	1.9890	-0.9681
(12.00)	(4.48)	(4.58)	(5.27)	(11.48)	(0.08)	(8.50)	(7.71)	(1.76)	(1.30)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
10.5587	6.9511	-6.3621	-0.3188	-4.0706	5.4754
(3.69)	(4.35)	(6.49)	(0.27)	(2.81)	(2.11)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.9671	0.9603	0.6917	0.8926	1.0000	1.1544	1.2104	1.1345
(0.39)	(0.53)	(5.39)	(2.46)	(0.00)	(3.00)	(3.67)	(2.17)

EQUATION #25 FUEL, COAL, OTHER RSQ= 0.1141 MEAN= 52.92

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0052	-0.0031	0.0055	0.0000	0.0014	-23.5935	-27.8585	-32.3911	1.1421	1.6921
(2.02)	(1.04)	(1.88)	(0.00)	(2.37)	(6.35)	(6.49)	(6.60)	(0.82)	(1.78)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
4.4245	2.3341	0.3120	1.6705	2.9016	29.0834
(1.75)	(1.57)	(0.25)	(0.97)	(1.81)	(5.18)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.6137	0.4745	0.6960	0.5450	1.0000	1.2476	1.4121	1.5984
(2.13)	(3.72)	(1.88)	(4.55)	(0.00)	(1.37)	(1.85)	(2.28)

EQUATION #26 WATER&SANITARY SERVICES RSQ= 0.1885 MEAN= 60.84

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0083	0.0098	0.0044	0.0062	0.0024	6.2422	12.2386	11.3859	1.9437	-0.7633
(5.86)	(5.61)	(2.60)	(5.85)	(5.90)	(7.32)	(10.55)	(9.67)	(2.40)	(1.47)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-1.9503	-0.0809	0.2871	0.8723	-1.7978	-6.5442
(1.13)	(0.08)	(0.40)	(0.99)	(1.96)	(3.37)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.9133	0.7625	0.5763	0.5992	1.0000	1.1437	1.2338	1.3044
(0.70)	(2.34)	(5.16)	(7.46)	(0.00)	(1.77)	(2.51)	(2.69)

EQUATION #27 MEDICAL INSURANCE RSQ= 0.1394 MEAN= 197.18

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0345	0.0212	0.0175	0.0158	0.0060	9.6995	17.9621	4.3762	2.6346	2.8912
(6.05)	(3.53)	(3.10)	(5.04)	(5.63)	(3.89)	(6.75)	(1.63)	(0.99)	(1.61)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-1.7163	-1.5727	-4.5525	4.7703	0.6944	-12.0061
(0.37)	(0.57)	(1.79)	(1.27)	(0.24)	(1.60)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.2433	0.3720	0.3889	0.9018	1.0000	1.1598	1.4591	1.5477
(8.89)	(8.88)	(8.52)	(1.52)	(0.00)	(2.08)	(4.69)	(4.68)

EQUATION #28 PHYSICIANS SERVICES RSQ= 0.0451 MEAN= 94.86

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0108	0.0151	0.0082	-0.0003	0.0138	3.7403	4.7143	7.0844	-7.3449	-4.6956
(2.10)	(2.40)	(1.37)	(0.09)	(5.99)	(1.45)	(1.81)	(2.27)	(2.42)	(2.24)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-16.4748	-4.7290	-0.9865	5.7318	-2.9031	-2.5674
(2.85)	(1.56)	(0.40)	(1.59)	(1.08)	(0.37)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
1.2600	0.7183	0.8325	1.0717	1.0000	0.9635	2.0335	1.8894
(0.62)	(1.03)	(0.59)	(0.35)	(0.00)	(0.18)	(3.11)	(2.53)

EQUATION #29 HOSPITALS RSQ= 0.0218 MEAN= 37.07

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0032	0.0052	0.0119	-0.0083	0.0058	1.7102	7.8170	5.9378	-5.3937	-1.9627
(0.64)	(1.06)	(2.36)	(2.93)	(3.96)	(0.92)	(3.13)	(2.48)	(2.09)	(1.33)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-7.3896	-2.1666	-0.5624	14.0683	-1.5653	-1.4847
(2.39)	(1.26)	(0.27)	(2.68)	(0.85)	(0.21)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.3182	-0.1571	0.8673	0.7172	1.0000	0.9914	2.4260	2.8543
(2.49)	(7.28)	(0.37)	(1.51)	(0.00)	(0.02)	(2.40)	(2.38)

EQUATION #30 DENTAL AND EYE CARE RSQ= 0.1485 MEAN= 88.14

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0107	0.0152	0.0115	0.0158	0.0061	-1.9740	-3.9812	0.4579	6.1959	0.4667
(4.21)	(4.66)	(3.46)	(6.16)	(5.81)	(1.46)	(2.82)	(0.31)	(3.60)	(0.49)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-6.8649	-6.0156	1.6162	-2.7250	-0.4195	-3.3744
(1.58)	(2.54)	(1.20)	(1.98)	(0.24)	(1.03)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.3070	1.6766	1.0005	0.8476	1.0000	0.9787	0.9991	1.2346
(4.29)	(2.71)	(0.00)	(1.48)	(0.00)	(0.19)	(0.01)	(1.44)

EQUATION #31 OTHER MEDICAL EXPENSES RSQ= 0.0612 MEAN= 69.33

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0024	0.0030	0.0008	0.0006	0.0147	0.3546	3.0222	-0.9341	-3.1512	-1.7575
(2.46)	(2.12)	(0.50)	(0.49)	(8.52)	(0.56)	(4.01)	(1.31)	(3.99)	(3.44)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
7.3236	5.1026	-0.3088	-0.9019	6.4562	-1.3281
(1.43)	(3.09)	(0.57)	(1.77)	(4.42)	(0.95)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
16.9794	1.6101	1.8398	1.4431	1.0000	0.6656	0.9838	1.7567
(7.29)	(1.15)	(1.65)	(1.88)	(0.00)	(1.63)	(0.10)	(2.90)

EQUATION #32 LIFE INSURANCE RSQ= 0.2667 MEAN= 225.66

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0354	0.0210	0.0402	0.0165	0.0372	5.0237	10.5988	0.2407	31.0794	-5.1602
(6.06)	(3.24)	(5.67)	(3.95)	(13.30)	(1.78)	(3.63)	(0.08)	(7.32)	(2.50)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-66.8384	-18.1347	0.9988	-2.7801	0.3728	-15.3632
(6.46)	(3.84)	(0.36)	(0.91)	(0.10)	(2.09)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
1.1012	0.9053	0.9109	0.7278	1.0000	1.3279	1.2581	0.5583
(0.61)	(0.70)	(0.73)	(4.24)	(0.00)	(3.46)	(2.74)	(5.99)

EQUATION #33 OTHER PERSONAL BUSSINES RSQ= 0.0227 MEAN= 17.66

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0023	0.0013	0.0021	-0.0008	0.0035	0.6758	0.8888	1.9951	-0.1722	0.5065
(1.36)	(0.73)	(1.16)	(0.78)	(3.68)	(0.88)	(1.15)	(1.92)	(0.21)	(0.92)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
7.8750	-0.2400	-0.2028	2.0746	-2.2611	-1.7575
(3.09)	(0.27)	(0.28)	(1.37)	(2.40)	(0.79)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
1.0407	0.4867	1.1817	0.9946	1.0000	0.9121	2.0721	0.7917
(0.06)	(1.24)	(0.36)	(0.02)	(0.00)	(0.31)	(1.90)	(0.72)

EQUATION #34 NEW AUTOMOBILES RSQ= 0.2111 MEAN= 405.99

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0420	0.1393	0.1319	0.2214	0.1687	41.5347	50.1054	-4.9888	-113.3487	8.2033
(2.02)	(4.53)	(4.28)	(7.23)	(10.73)	(3.15)	(3.66)	(0.38)	(6.27)	(0.96)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-352.9384	-109.8652	51.9801	-3.4639	3.0873	-110.0641
(5.97)	(4.62)	(3.98)	(0.33)	(0.19)	(3.37)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.9161	0.8224	0.7646	1.0103	1.0000	0.6705	0.5976	0.6170
(0.41)	(1.15)	(1.82)	(0.10)	(0.00)	(4.39)	(6.14)	(4.38)

EQUATION #35 USED AUTOMOBILES RSQ= 0.0998 MEAN= 257.49

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0419	0.0687	0.0113	0.0704	0.0224	22.8052	27.0777	14.3218	-54.1030	-0.6456
(3.53)	(4.35)	(0.82)	(5.76)	(4.59)	(3.40)	(3.88)	(2.10)	(5.59)	(0.15)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-55.9972	-25.1864	16.7249	12.9054	2.5638	-54.7402
(2.41)	(2.45)	(2.67)	(1.95)	(0.31)	(3.23)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.8060	1.0023	1.8753	1.6547	1.0000	0.6331	0.7441	0.4987
(0.73)	(0.01)	(2.86)	(2.87)	(0.00)	(2.81)	(1.96)	(3.19)

EQUATION #36 TIRES, TUBES, ACCESORIES RSQ= 0.1815 MEAN= 72.82

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0158	0.0057	0.0118	0.0057	0.0059	1.5268	8.0169	4.4816	-3.3379	1.4038
(7.13)	(2.56)	(4.92)	(4.18)	(9.20)	(1.58)	(6.97)	(3.97)	(3.16)	(1.99)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-5.9260	-2.2881	0.7177	1.7234	-2.5224	-10.2535
(2.18)	(1.66)	(0.75)	(1.35)	(2.05)	(3.71)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.5021	0.6177	0.9492	1.1013	1.0000	1.0902	1.1126	0.7555
(4.19)	(3.75)	(0.45)	(1.12)	(0.00)	(1.06)	(1.22)	(2.74)

EQUATION #37 REPAIR, RENT, STORE, TOLLS RSQ= 0.2311 MEAN= 191.71

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0303	0.0183	0.0382	0.0145	0.0203	4.2113	6.3925	15.4573	1.8500	3.1692
(6.41)	(3.50)	(6.64)	(4.54)	(11.76)	(1.87)	(2.82)	(5.74)	(0.77)	(1.93)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-18.2268	-2.4351	4.5274	-4.3992	-0.1674	-16.6756
(2.92)	(0.78)	(2.01)	(1.70)	(0.06)	(2.71)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.5098	0.7001	0.9595	1.1990	1.0000	1.0339	1.1207	0.8393
(4.40)	(3.13)	(0.40)	(2.29)	(0.00)	(0.46)	(1.49)	(2.01)

EQUATION #38 GASOLINE AND OIL RSQ= 0.3758 MEAN= 377.20

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0709	0.0524	0.0363	0.0337	0.0209	17.1134	33.1261	12.6657	-21.9135	1.7947
(10.89)	(7.47)	(5.35)	(8.16)	(12.33)	(5.65)	(10.06)	(3.91)	(6.84)	(0.86)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-27.8828	-4.5476	1.5423	6.6982	-13.7201	-31.7209
(3.46)	(1.12)	(0.54)	(1.75)	(3.62)	(3.92)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.4951	0.5654	0.9008	1.1520	1.0000	1.1241	1.1294	0.7215
(7.26)	(7.23)	(1.50)	(2.65)	(0.00)	(2.35)	(2.28)	(5.35)

EQUATION #39 AUTOMOBILE INSURANCE RSQ= 0.3248 MEAN= 171.69

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0362	0.0266	0.0272	0.0171	0.0086	-4.3184	-12.9913	-12.0061	-7.8691	0.4614
(8.80)	(6.43)	(6.78)	(7.43)	(9.64)	(2.59)	(7.00)	(6.11)	(4.46)	(0.38)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-6.5901	-9.1087	8.3827	-4.0728	-1.5678	-13.6085
(1.61)	(4.30)	(4.53)	(1.86)	(0.77)	(2.74)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.2443	0.3979	1.0872	1.3441	1.0000	1.1574	1.2049	0.9142
(9.65)	(9.62)	(0.97)	(4.16)	(0.00)	(2.38)	(2.79)	(1.20)

EQUATION #40 LOCAL PUBLIC TRANSPORT RSQ= 0.0199 MEAN= 39.81

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
-0.0022	-0.0023	-0.0005	0.0025	0.0010	-8.1628	-13.1481	-10.9200	3.3421	4.0703
(0.72)	(0.66)	(0.15)	(1.22)	(1.20)	(3.50)	(4.14)	(3.83)	(1.89)	(3.02)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
26.2379	2.3027	-1.8839	0.0206	1.4759	19.7217
(3.76)	(1.12)	(1.35)	(0.01)	(0.82)	(3.28)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.1317	0.4966	1.8789	1.1875	1.0000	1.4867	1.2574	1.0427
(2.40)	(1.94)	(1.75)	(0.65)	(0.00)	(1.40)	(0.84)	(0.15)

EQUATION #41 INTER CITY TRANSPORT RSQ= 0.1068 MEAN= 42.76

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
-0.0002	0.0087	0.0040	0.0103	0.0138	-0.6445	-2.0395	12.2301	11.8359	1.0233
(0.07)	(2.24)	(1.05)	(4.12)	(7.14)	(0.40)	(1.21)	(4.45)	(3.92)	(0.87)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
0.6990	-3.6676	1.4374	-2.3079	4.6451	0.3301
(0.18)	(1.63)	(0.91)	(1.39)	(2.21)	(0.08)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.5047	0.4779	0.7623	0.8831	1.0000	0.8510	0.8772	1.1138
(1.88)	(2.76)	(1.20)	(0.90)	(0.00)	(1.22)	(0.98)	(0.67)

EQUATION #42 FORIEGN TRAVEL RSQ= 0.0990 MEAN= 54.43

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
-0.0005	0.0076	0.0049	0.0195	0.0314	-12.1627	-19.2502	-17.3074	29.7061	3.4162
(0.07)	(0.93)	(0.60)	(3.53)	(6.73)	(2.69)	(3.53)	(3.24)	(3.84)	(1.25)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-19.7496	-5.1864	3.9259	-0.9649	4.1113	10.1744
(2.72)	(1.17)	(1.08)	(0.23)	(0.99)	(1.01)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
-0.2683	0.7175	0.2671	0.5238	1.0000	0.8782	0.7551	1.8385
(5.40)	(1.03)	(4.01)	(4.75)	(0.00)	(0.85)	(2.01)	(2.91)

EQUATION #43 ADMISSIONS AND MEMBERSH RSQ= 0.1788 MEAN= 88.05

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0076	0.0092	0.0188	-0.0127	0.0357	2.4325	2.3589	0.0834	11.0854	0.2528
(2.65)	(2.49)	(4.36)	(4.39)	(10.39)	(1.44)	(1.41)	(0.04)	(4.82)	(0.21)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-19.1290	-14.6157	-1.3371	-0.0307	-6.1335	-3.4405
(4.84)	(5.28)	(0.82)	(0.02)	(2.78)	(0.85)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.6572	2.1049	1.6521	0.9634	1.0000	0.7465	0.6170	3.4340
(1.26)	(3.50)	(2.55)	(0.31)	(0.00)	(2.31)	(4.51)	(7.08)

EQUATION #44 TV, RADIO, MUSIC INST. RSQ= 0.1217 MEAN= 118.35

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0133	0.0176	0.0128	0.0134	0.0150	4.0280	5.6701	5.1034	-5.5958	2.2032
(4.08)	(4.24)	(2.99)	(4.51)	(8.27)	(2.23)	(3.03)	(2.51)	(2.86)	(1.72)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
9.7607	-1.4203	-0.8407	5.7066	5.3717	-9.1262
(1.25)	(0.41)	(0.51)	(2.78)	(2.00)	(2.04)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.8166	1.3466	1.5608	1.2483	1.0000	1.1571	0.6409	0.4193
(0.91)	(1.69)	(2.83)	(1.99)	(0.00)	(1.28)	(4.50)	(6.61)

EQUATION #45 REPAIR, RENT, REC EQUIP. RSQ= 0.0534 MEAN= 23.46

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0039	0.0027	0.0022	0.0011	0.0014	1.3226	2.1129	3.5224	-0.7032	-0.3455
(4.04)	(2.68)	(2.13)	(1.82)	(4.94)	(2.83)	(4.01)	(4.93)	(1.47)	(1.12)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
1.5780	1.3046	-0.2631	0.2999	-1.0687	-2.4331
(1.54)	(2.14)	(0.63)	(0.63)	(1.93)	(2.07)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
1.1208	0.9479	0.2894	0.7734	1.0000	1.1348	1.2879	1.6067
(0.44)	(0.22)	(5.16)	(1.87)	(0.00)	(0.84)	(1.52)	(2.38)

EQUATION #46 BIKES, SPORT GOODS, TOYS RSQ= 0.1772 MEAN= 81.89

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0122	0.0151	0.0177	0.0170	0.0134	3.6331	2.4917	12.3992	0.4916	0.6839
(4.27)	(4.11)	(4.40)	(5.68)	(8.44)	(2.25)	(1.56)	(5.46)	(0.29)	(0.61)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-10.6828	-5.1854	3.1341	4.1892	-7.0513	-11.4761
(1.34)	(1.59)	(1.97)	(2.55)	(2.88)	(2.85)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.9938	1.1344	1.3608	1.0694	1.0000	0.5531	0.4035	0.1820
(0.03)	(0.75)	(2.15)	(0.67)	(0.00)	(6.20)	(10.10)	(9.95)

EQUATION #47 BOOK, MAGAZINE, NEWSPAPER RSQ= 0.1967 MEAN= 61.31

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0120	0.0101	0.0027	0.0111	0.0057	1.9052	2.5222	4.4891	16.4145	0.4470
(4.89)	(3.89)	(1.12)	(6.73)	(8.49)	(1.76)	(2.33)	(3.51)	(7.75)	(0.58)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-0.5891	-4.4270	2.4757	-0.6350	0.1037	-8.7074
(0.22)	(2.98)	(2.12)	(0.48)	(0.08)	(2.68)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.1108	0.4398	0.9498	1.3007	1.0000	0.9306	0.8332	0.8761
(8.10)	(5.33)	(0.39)	(2.43)	(0.00)	(0.87)	(2.10)	(1.24)

EQUATION #48 CAMPERS, RV'S, BOATS, ETC RSQ= 0.0529 MEAN= 53.48

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0031	0.0042	0.0062	0.0105	0.0316	3.1177	1.3714	5.7283	-7.6499	1.1035
(1.03)	(1.01)	(1.29)	(2.41)	(5.13)	(1.51)	(0.69)	(2.25)	(2.84)	(0.78)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-47.5080	-3.0085	4.1165	0.7407	0.1396	-8.6438
(2.59)	(0.57)	(1.96)	(0.39)	(0.05)	(1.80)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.3063	3.8792	2.8874	0.6965	1.0000	1.3336	0.5385	0.4753
(1.11)	(3.13)	(2.64)	(1.34)	(0.00)	(1.12)	(3.08)	(2.55)

EQUATION #49 EDUCATION (TUITION) RSQ= 0.2056 MEAN= 113.09

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0225	0.0247	0.0281	0.0173	0.0126	4.7020	-10.6891	-24.7086	47.4337	-1.2902
(2.95)	(3.06)	(3.50)	(3.68)	(5.56)	(1.43)	(3.01)	(5.21)	(6.94)	(0.53)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-55.2971	-33.5339	27.6588	-11.7572	13.0642	-27.4220
(4.75)	(5.52)	(5.75)	(2.90)	(3.06)	(2.57)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
-0.5645	-0.0117	4.1706	2.6925	1.0000	0.8630	0.6422	0.5029
(7.31)	(8.88)	(5.65)	(4.78)	(0.00)	(0.83)	(2.39)	(2.47)

EQUATION #50 CONTRIBUTIONS TO CHARIT RSQ= 0.1951 MEAN= 199.73

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5	VAR 6	VAR 7	VAR 8	VAR 9	VAR10
0.0324	0.0229	0.0321	0.0141	0.0396	17.4986	20.8845	7.4780	49.5011	-4.9769
(4.39)	(2.71)	(3.66)	(2.79)	(10.88)	(4.41)	(5.04)	(1.86)	(7.41)	(1.92)

VAR11	VAR12	VAR13	VAR14	VAR15	VAR16
-34.1110	-17.2534	11.2858	-1.2115	6.7904	-40.2454
(4.09)	(3.63)	(2.87)	(0.30)	(1.70)	(3.82)

0- 5	6-15	16-20	21-30	31-40	41-50	51-65	66-99
0.9787	0.9744	0.4906	0.3625	1.0000	1.1746	1.7938	1.6634
(0.11)	(0.15)	(3.81)	(9.64)	(0.00)	(1.51)	(4.85)	(3.90)

CHAPTER 3

TRANSITION FROM CROSS SECTION TO TIME SERIES

I. VARIABLES CONSTRUCTED FOR USE IN THE TIME SERIES ANALYSIS

In the cross-section, we were able to quantify the extent to which household consumption is affected by demographic composition, age structure, and the distribution of income. Our present task is to combine these cross-section results with information on the composition of the population as a whole to create variables for use in time-series analysis. First, by using the adult equivalency weights, a time-series of weighted populations is created for each commodity. Then, "cross-section parameter" predictions of the consumption of each commodity are calculated using only the results of the cross-section analysis combined with historical changes in income distribution and demographic composition. The weighted populations and the predictions of consumption enter directly into the time-series consumption functions. Producing the time-series of weighted populations is the easier of the two tasks and is discussed first.

A. Weighted Populations

The Census Bureau publishes historical series on population by age. These series can be aggregated to provide separate population totals for each of our eight age groupings. Let N_{gt} represent the number of individuals in age group g in year t. We can then construct our weighted population series for commodity i (WP_{it}) as follows:

$$WP_{it} = \sum_{g=1}^{8} w_{ig} N_{gt} \qquad (3.1)$$

where w_{ig} = the cross section adult equivalency weights.

This construction is done for each of the 50 cross-section commodities giving us 50 commodity-specific weighted populations.

Through the use of the adult equivalency weighting scheme, we are in essence timing spurts in population growth, such as the one associated with the baby boom, to occur when they are most relevant to the commodities in question. For example, consider the two goods Furniture and Alcohol on Premise. In the case of Furniture, young children have a high adult equivalence weight. The weighted population for furniture, therefore, grows rapidly as the size of 0-5 age group grows. In other words, the spurt in the population specific to furniture occurs immediately after the baby boom. On the other hand, the adult equvalency weight for young children specific to Alcohol on Premise is nearly zero. Therefore, the growth in the size of the 0-5 age group contributes nothing to the weighted population size for alcohol during the baby boom years. In fact, it is not until the "boomers" reach the drinking age, some 20 years later, that they cause the weighted population for Alcohol on Premise to increase rapidly.

The benefits of the commodity specific populations are twofold. First, the fact that we can define a more relevant population size for a good should enable us to make better estimates of the price and income effects on the demand for that good. Secondly, when we use the estimated time-series functions to forecast consumption expenditures, we will have explicitly accounted for the changing age structure in the forecast.

B. Cross-Section "Predictions" of Consumption

"Predictions" of consumption per adult equivalent are made for past years using the historical time series on income distribution and demographic shifts. That is, we ask, what would consumption of good i in year t have been had only the factors considered in the cross-section affected its sales and had the parameters estimated in the cross-section equation accurately reflected those influences. This "prediction" for good i in year t is referred to as C^*_{it} and is expressed as follows:

$$C^*_{it} = a_i + \sum_{j=1}^{5} b_{ij} Y_{jt} + \sum_{j=1}^{10} d_{ij} D_{jt} \qquad (3.2)$$

where:

Y_{jt} = average amount of income received in the j^{th} income bracket in year t.

D_{jt} = population proportion falling into the j^{th} demographic category in year t.

a_i, b_{ij}, d_{ij} = the estimated cross-section parameters for good i.

Equation (3.2) can be viewed as the result of evaluating the consumption per person component of the cross-section equation (2.1) for each individual in the population and then averaging the results.

The C^*_{it} variable is used as an explanatory variable in the time-series consumption function for good i. It is valuable because it incorporates the changing population proportions of the different demographic categories together with information on the level and the distribution of income. Most importantly, this information on the make-up of the population is summarized for product i through the use of the cross-section coefficients. Consider for example the specific benefits that accrue from this C^*_{it} construction with regard to the the demographic composition variables. In the cross-section the demographic variables showed that they could be helpful in explaining household expenditures; therefore, they belong in a the time-series analysis of consumption. It would be foolish, however, to include the ten separate, slowly changing population proportions into a time-series estimation. Even if it were possible to circumvent the severe problem of collinearity and get meaningful estimates, the toll taken on the degrees of freedom would be prohibitive. In the construction of the C^*_{it}

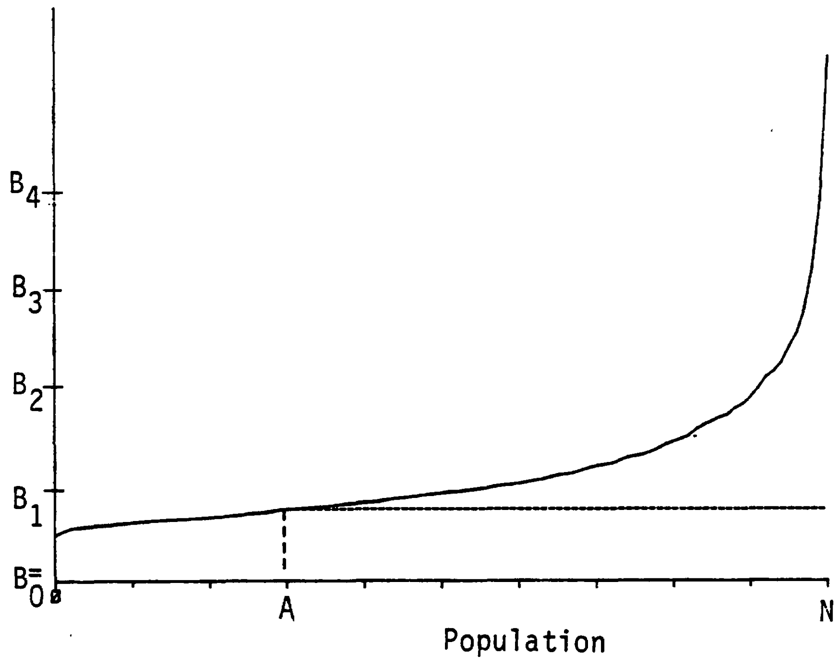
variable, however, the ten population proportions are combined in such a way that the most relevant variables to good i are given the most weight. The demographic variables are summed up into one value with the weights being the cross-section parameters (the second summation in equation (3.2)). For instance, since family size isn't particularly helpful in the cross-section equations for tobacco, the shift to smaller family size does not greatly influence the value of the C_{it}^* variable for tobacco. On the other hand, education is an important variable in the cross-section equation for tobacco. It has, as a result, a relatively large parameter and therefore the trend towards higher educational attainment significantly affects the tobacco C_{it}^* variable.

We calculate the income component of the C_{it}^* variable from the distribution of per capita total expenditures. Recall that the cross-section income variables, (Y_j) are the amount of income received by a household in a specific income bracket, with income defined to be the total household expenditures per person. The average value of these five income variables for each year is computed through the use of a distribution of per capita total expenditures. (The construction of the distribution of per capita expenditures is described in the second section of this chapter. For now, we assume that this distribution is given in order to describe the calculation of the income component of the C_{it}^* variable.)

Consider the representation of the distribution of per capita total expenditures given in Figure 3.1. Along the horizontal axis are the N individuals in the population starting with the poorest and continuing on to the richest. The curve gives the value of expenditure for each individual. Note that the area under the curve is precisely total expenditures for the population.

FIGURE 3.1

The Distribution of Per Capita Total Expenditures



The construction of the the five Y_j variables requires finding the area in the horizontal bands defined by the B_j boundaries. To understand this requirement, it is much easier to think and speak of the total expenditures as "income". Now, consider Y_1 which is the average amount of "income" received in the B_0 to B_1 range. To get the total income in this range, we must sum over all individuals that amount of income which each has in this range. For individuals to the left of A, this income is the height of the curve while individuals to the right of A receive the maximum amount, that is B_1-B_0. The total amount of income in group 1, the area of the first horizontal band, is then divided by population to give Y_1. In a similar fashion, Y_2 through Y_5 can be computed. This procedure is followed for each year of the historical data.

Using this procedure to calculate the Y_j variables requires making the key decision to define income classes in absolute rather than relative terms. That is, the B_j brackets remain fixed so that the level of income that defines the poorest class in 1972 is fixed in real terms and defines the poorest class in all other years. As the distribution of income drifts upwards, the poorest class becomes smaller and smaller. For instance, suppose that there are 100 individuals in the population, and that in the base period the 20[th] individual is in the poorest category. This person will consume along the first segment of the piecewise-linear Engel curves. If all real incomes increase at the same rate through time, this same individual will slide up into the next income bracket. He will then be assumed to consume along the second segment of the Engel curve. Thus, in this system, it is not relative but absolute real income which determines consumption patterns. Note, however, that we are not saying that absolute income determines the share of savings, for our income is, in fact, total expenditures.

With the five income variables computed, we can now combine them with the cross-section parameters to construct the expenditure on each item. (This is represented as the first summation in equation (3.2).)

II. THE CONSTRUCTION OF THE TOTAL EXPENDITURE CURVE

The distribution of per capita total expenditures is difficult to construct because it takes into account shifts in the underlying distribution of income, changes in both the overall savings rate and in the level of taxation, and increases in the average level of income. The process starts with historical distributions of money income in current dollars by family size. These are combined to create, yearly, a distribution of per capita money income. The next step is to use a tax function, estimated in the cross-section, to remove taxes from money income and to create a distribution of disposable income in current dollars. The assumption is that tax rates are roughly fixed in current dollars so that a function relating tax rates to income estimated using 1972 data can also be used for any other year. The total amount of taxes removed from the distribution by the tax function is not automatically guaranteed to be the correct amount. Therefore, the distribution of disposable income must be scaled so that it has the correct average value. The distribution of disposable income is then deflated to produce a distribution of disposable income per capita in constant dollars. The last step required in the progression to a distribution of total expenditures is to remove savings from the distribution. This transformation is accomplished through the use of a spending function, estimated in the cross-section, which relates the spending rate at each income level to the income level relative to average income. When this spending function is used to transform the distribution of income to one of total expenditures, the functional form guarantees that the distribution's average value is exactly what it should be for any level of average disposable income and average spending rate. Hence, the resulting distribution of expenditures need not be scaled to give the correct average value for total expenditures.

A. The Distribution of Income

Recall that the first step towards arriving at a time series on the distribution of per capita total expenditures is to create a distribution of per capita money income.

This section of the chapter describes a convenient representation of the distribution of per capita money income and the procedure used to forecast it into the future.

1. Representing the Distribution of Income

Consider the distribution of per capita money income as represented in Figure 3.2:

FIGURE 3.2

The Distribution of Per Capita Money Income

The vertical axis measures the level of per capita income (y) and the horizontal axis denotes the population (z), which has been ranked in ascending order of income. Let F(z) represent the relationship between population and income, that is:

$$y = F(z) \quad ; \quad 0 < z \leq N \qquad (3.3)$$

where N is the size of the population.

It is important to note that the area under F(z) between 0 and N is the total amount of income held by all individuals (Y) --- a property that all representations of the income distribution must preserve. That is:

$$Y = \int_0^N F(z)dz$$

This point can be intuitively understood by thinking of the curve in discrete terms. The height of the curve at any point is the income level of the individual corresponding to that point. The integration can be interpreted as adding the poorest individual's income to that of the next individual and to that of all subsequent individuals, giving us total income.

Since we wish, ultimately, to compare the distributions of per capita income from years with different population sizes, it is desirable to normalize the horizontal axis so that it represents the proportion of the population and not the actual level of the population. We make the following transformation:

$$x = \frac{Z}{N}$$

then:

$$Y = F(x) \quad ; \quad 0 < x \leq 1 \quad . \tag{3.4}$$

Note that:

$$\int_0^1 F(x)dx = \int_0^N F(z)(\frac{1}{N}\,dz)$$
$$= \frac{1}{N}\int_0^N F(z)dz$$
$$= \frac{Y}{N} = \overline{Y}$$

In other words, the area under the transformed curve is average per capita income $\overline{Y}$.

There is a separate distribution of income for each year in the historical period as well as for each year in the forecast period. Let $F^t(x)$ represent the distribution in year t. The objective is to find a representation of $F^t(x)$ for each year that will facilitate interperiod comparisons of distributions, and ultimately, enable us to project the sequence of distributions into the future.

One possible procedure is to approximate $F^t(x)$ each year with a specific functional form such as the lognormal[1]. Changes from year to year in the $F^t(x)$ would then be manifested as changes in the parameters of the general functional form. By modeling the changes in these parameters we could then project the specific functional form, and therefore $F^t(x)$, into the future. The advantage of this technique is that having a general functional form gives us an exact representation of the entire curve. However, this exact representation is of an approximation to the distribution and not of the actual distribution

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1 Note that if Figure 3.2 is rotated to lie on its vertical axis the function has a range of 0 to 1 and would look very much like a cumulative distribution function.

itself. A further disadvantage is that the parameters of the approximating function would almost certainly lack any obvious interpretation, making the attempt to model changes in these parameters difficult.

An alternative to the procedure of using a specific functional form has been adopted. Our alternative method represents $F^t(x)$ by specifying the value of the function for selected values of x and assumes that a polynomial can describe intervening points along the curve. Obviously, if the number of points selected to represent the curve is small the intervening polynomial approximations to $F^t(x)$ will be poor. On the other hand, if we select a large number of points the polynomial approximations to the remainder of the curve will be quite good since $F^t(x)$, the distribution of money income, is probably quite smooth. The principle advantage of this technique, however, is that the representation of the curve lends itself to economic interpretation making the modeling of changes in the curve straightforward.

The distribution of income is defined by the income levels at the 20 'ventile' points. More precisely, it is defined by the income levels of the first 19 ventiles (i.e., x = .05, .1, ..., .95) and by the amount of income held by individuals comprising the top ventile. Call these ventile values y_i where i = 1, ..., 20. That is:

$$
\begin{aligned}
y_1 &= F^t(.05) \\
y_2 &= F^t(.10) \\
&\vdots \\
y_{19} &= F^t(.95)
\end{aligned}
\qquad (3.5)
$$

and

$$y_{20} = \int_{.95}^{1.0} F^t(x)dx$$

To approximate any point on $F^t(x)$ between 0 and 0.1 we use the quadrative polynomial defined by 0, y_1, and y_2. For points between 0.1 and 0.2 we approximate $F^t(x)$ with the quadratic defined by y_2, y_3, and y_4. This pattern continues in similar fashion for the remainder of the curve up to 0.95[1]. The last portion of curve is approximated by a function that approaches the vertical asymptote defined by x = 1.0 in such a way that the area under the curve is exactly y_{20}.[2]

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1 The segment of the curve between 0.9 and .95 is approximated by a straight line. The number of points used to approximate $F^t(x)$ required that one linear segment be used. The portion of the curve between .9 and .95 was selected as the linear segment based upon comparisons of relative curvature.

2 See the technical appendix to this chapter for the details on this function.

2. Isolating the Effect of Shifts in the Distribution of Income

Any interpretation of interperiod comparisons of the income distribution as represented by $F^t(x)$ must be made with care. The economic well being of individuals at a given percentile can be examined over time by comparing the appropriate value of y_i from the different distributions. This direct comparison will tell us the income levels associated with the given percentile in the different years but it will do little to identify the independent effects of the sources of the differences.

A change in the distribution may arise from proportional shifts in the entire distribution of income and gains (or losses) made relative to the rest of the distribution. Our objective is to represent and explain the shifts in the distribution of real per capita money income and not to explain the macroeconomic influences on the distribution. To factor out the influences due to general increases in average income, each ventile point is divided by average money income. That is, our new representation of the income distribution in year t is:

$$r_i = \frac{y_i}{\overline{Y}} \tag{3.6}$$

Each ventile point on the distribution is described by the ratio of the income level of the ventile to average income. For instance, the income level of the first ventile might be 10% of average income while the 19th ventile is 200% of average income. Given the definition of y_{20}, r_{20} can be interpreted as that proportion of total income held be the richest 5% of the population. The r_i values therefore provide a dimensionless representation of the distribution which facilitates the inter and intra year comparisons of income distributions.

Table 3.1 gives the actual values in percentage terms of r_i for selected years. The r_i values describing the distribution of per capita money income are obtained, indirectly, from the Bureau of the Census publications on household income. The distribution of per person income can be constructed using the distributions of household income by different household sizes. (The details of the procedure are given in the technical appendix of this chapter.)

Table 3.1 indicates that in 1955 the income level of the poorest category was 11% of the average income while the income level of the 90th percentile was 200% of the average income. In 1978, however, the income levels of the same two groups were respectively 17% and 192% of average income. This comparison shows that there is a great deal of inequality in the distribution of U.S. per capita income and indicates that the gap between rich and poor is narrowing only slightly.

TABLE 3.1

Ventile Points of the Distribution of

Income Relative to Average Income for Selected Years

VENTILE	1955	1960	1965	1970	1975	1978
5%	11.12	11.79	14.18	18.96	18.30	17.29
10%	21.30	22.18	25.37	28.26	26.81	26.64
15%	30.55	31.19	33.82	34.56	34.88	34.86
20%	38.86	38.93	40.48	41.22	42.06	41.89
25%	46.33	45.76	46.36	47.82	48.77	48.19
30%	53.17	52.06	52.37	54.00	55.18	54.31
35%	59.62	58.23	58.70	59.93	61.36	60.41
40%	65.89	64.58	65.35	65.90	67.29	66.38
45%	72.23	71.30	72.26	72.11	73.32	72.78
50%	78.87	78.52	79.47	78.73	79.85	79.80
55%	86.17	86.39	87.11	85.94	86.78	87.06
60%	94.47	95.07	95.32	93.91	94.43	95.02
65%	104.14	104.92	104.39	102.91	103.42	103.81
70%	115.54	116.34	115.00	113.46	113.77	113.96
75%	129.09	129.82	127.93	126.03	126.30	125.87
80%	145.26	146.18	144.23	141.41	140.79	141.11
85%	166.32	166.76	166.07	162.21	160.30	161.99
90%	200.03	196.36	197.52	192.31	190.67	191.88
95%	252.00	256.02	255.25	247.04	247.47	245.56
100%*	17.88	17.88	17.41	17.88	17.63	17.74

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* Proportion of total income held by the richest 5% of the population.

Notice that the median income is approximately 80% of average income which illustrates the skewed nature of the income distribution. Indeed, average income is not attained until the 60th to 65th percentile. The last row in Table 3.1 gives the percentage of total income held by the richest 5% of the population. The roughly 17.5% value is notable both for its magnitude and its constancy.

3. Forecasting the Distribution of Income

In order to project the distribution of per capita money income, an econometric analysis of the r_i values is performed. The projections of the r_i for a future year can be combined with an independent estimate of the level of average income forecasted in a macroeconomic framework to provide a prediction of the entire distribution. This division of labor is appropriate since a model of the distribution of income should not dictate the level of total income unless it has accounted for all the influences on income built into a well-constructed macroeconomic model.

The econometric investigation is performed at the r_i level of representation rather than the y_i level because the r_i values provide insight into the underlying structure of the distribution. The r_i values represent the relative positions of the twenty income groups so that any change in their values over time signifies a shift in the distribution of income. Prior reasoning as to the causes of such a shift lead us to choose the following explanatory variables for our model: the unemployment rate, the share of national income devoted to transfer programs, the percentage of household with two incomes, and the ratio of the income earning population to the dependent population.

Given the nature of transfer programs, increases in the share of transfer income are expected to benefit lower income groups at the expense of the higher income groups. However, we would expect increases in the unemployment rate to have the opposite effect. The adverse effect on the poor from increased joblessness has two components: the marginally employed (and therefore already poor) are the first to lose their jobs and the increased number of people without jobs swell the ranks of the poor, thereby lowering the level of income which defines "poor."[1]

The proportion of households with two earners has increased dramatically over the period of investigation[2]. It is conceivable that this increase has had its impact on the distribution of income but it is difficult to predict the effect of the variable on the different income ranges because it is not evident from which households come the additional working spouses. If change in the proportion of two income households can be attributed to the increased labor force participation of spouses in low-income homes, we would expect the lower end of the income scale to gain vis-a-vis the rest of the income scale. Obviously, if the increase comes from the middle ranges we would expect this group to gain.

Changes in the relative sizes of the 'dependent' and 'income earning' segments of the population may alter the shape of the distribution. (Recall that the distribution we are trying to explain is

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[1] Consider a population of one hundred individuals where the poorest individual has an income of $1, the next individual has an income of $2, and so on until the richest person in the population has an income of $100. Suppose the tenth individual loses his job, changing his income from $10 to $2. This has the effect of lowering the income which defines the poorest ventile from $5 to $4.

[2] The percentage of households with two incomes in 1955 was 22.8%, rose to a level of 40.6% by 1980 and is projected by Chase Econometrics to reach a value of 46.5% by 1990.

that of per capita and not household money income.) We would expect that increasing the ratio of potential income earners to dependent individuals in a household would improve the per capita income of that household but it is less clear what the effect of changes in the aggregate version of this ratio will have on the shape of the overall distribution.

To ascertain the magnitude of these external influences on the distribution of per capita money income, the following model is specified:

$$r_i = a_{i0} + a_{i1}UNEMPL + a_{i2}TRANS + a_{i3}EARN2 + a_{i4}POPRATIO + u_i$$

$$i = 1,\ldots,20 \qquad (3.7)$$

where:

r_i = the income level of the ith ventile relative to average income.

UNEMPL = the aggregate unemployment rate.

TRANS = the percentage of national income devoted to transfer payments.

EARN2 = the percentage of households with two incomes.

POPRATIO = the ratio of the income earning population (20-65) to the dependent population (0-19, 66+).

The twenty equations represented by expression (3.7) are estimated over the period from 1955 through 1978 and the results are presented in Table 3.2. The results of the estimation are, in general, quite good.

The closeness of fit as measured by the R^2 is less than impressive for the equations in the middle ranges of income but the corresponding AAPE's indicate that the average percentage errors of these equations are less than 1% in an absolute sense. (The AAPE is the Average Absolute Percentage Error. That is: AAPE = $\frac{1}{N} \sum \left| \frac{r-\hat{r}}{r} \right| * 100$) . The low R^2's merely indicate that there is little variation to explain. The Durbin-Watson statistics give no strong indication of serial correlation.

The performance of the unemployment and the transfer payment variables conforms closely to prior expectations. An examination of the signs that the unemployment variable takes on in the different equations illustrates that the 'poor' are hurt (negative signs) and that the 'rich' benefit (positive signs) relative to average income when the unemployment rate goes up. The sign pattern associated with the transfer payment variable indicates exactly the opposite effects. Both variables are usually significant except in the equations for the middle ranges of income where the variable is switching from positive to negative and therefore has a neutral effect.

Increases in the ratio of income earners relative to the dependent population has a positive effect on most of the income scale with an offsetting negative effect concentrated in the lowest five income ventiles. One possible explanation for this result might be that different degrees of 'constancy' in family structure hold for different income levels. If low income level households maintain a roughly constant family structure while other households reduce the proportion of dependent individuals, we would expect individuals from poor households to become even poorer, relative to average income.

With the exception of the second and third ventiles, increases in the proportion of two income households have had a detrimental effect on the lower half of the income scale. Therefore, the increase in the proportion of two income households from 22% in 1955 to 39% in 1978 (the period of estimation) must be the result of increased employment of spouses from middle and upper portions of the income scale. These increases allowed the middle and upper income groups to gain at the expense of the lower income groups who might have temporarily benefited as the first of the two income households.

The rationale given for the performance of the two-income variable suggests that the effect of the variable might well be non-linear.[1] That is, initial increases in the proportion of two income households would help poor individuals if the initial increases in the proportion were the result of low income spouses going to work. The gains they would achieve (relative to the average individual) would disappear as soon as households of higher incomes followed the same strategy of acquiring two incomes. The effect of increases in the proportion of two income households on the income distribution may, in essence, depend on the level of that proportion.

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1 See Bergman, et. al., Journal of Human Resources, 1980.

TABLE 3.2

Results of the Estimation of Equation 3.7

EQ	CONS	UNEMPL	TRANS	EARN2	POPRATIO	R^2	AAPE+	DW
1	28.78**	-1.697**	1.557**	-0.040	-14.82**	.922	4.51	1.42
2	34.21**	-0.999**	0.497	0.297	-14.81**	.911	2.43	1.37
3	40.17**	-0.647**	0.490	0.112	-9.45**	.876	1.32	1.41
4	47.68**	-0.728**	0.863**	-0.174	-4.57*	.806	0.94	1.56
5	54.79**	-0.978**	1.205**	-0.383**	-0.93	.761	0.84	1.50
6	60.35**	-1.151**	1.335**	-0.463**	1.59	.763	0.76	1.55
7	64.62**	-1.114**	1.227**	-0.427**	2.89	.754	0.67	1.67
8	69.51**	-0.954**	1.029**	-0.352**	2.78	.702	0.60	1.77
9	73.69**	-0.691**	0.732**	-0.235	2.64	.621	0.53	1.90
10	76.96**	-0.356	0.366	-0.089	3.12	.515	0.47	2.11
11	81.86**	-0.053	0.055	0.015	3.45	.325	0.49	2.31
12	87.75**	0.241	-0.263	0.103	4.17	.160	0.49	2.44
13	95.64**	0.484*	-0.520	0.148	5.00*	.360	0.44	2.41
14	107.23**	0.576**	-0.623	0.122	5.32*	.626	0.41	2.39
15	124.09**	0.591*	-0.615	0.036	3.88	.782	0.38	2.46
16	140.83**	0.903**	-1.036**	0.129	2.24	.846	0.38	2.37
17	152.55**	1.640**	-2.130**	0.514**	4.81	.895	0.39	2.26
18	173.98**	2.433**	-3.137**	0.776**	9.84	.875	0.53	1.85
19	230.91**	4.430**	-4.145**	0.918	3.44	.868	0.63	2.58
20	18.41**	0.034	0.029	-0.024	-0.32	.091	1.13	1.84

+Average absolute percentage error.
*Indicates significance at the 5% level.
**Indicates significance at the 10% level.

To allow for this possible non-linearity, equation (3.7) is extended to include the square of the proportion of two income households. The derivative of the equation with respect to this proportion is linear in the proportion thereby allowing the effect to change in magnitude and in sign.

The results of this extended model, given in Table 3.3, indicate that the squared proportion is significant in only one of the twenty equations and that its inclusion causes the simple proportion variable to become much less significant. In addition, our once-well behaved and reasonably significant 'POPRATIO' variable is now significant in only one equation and has become generally uninterpretable.

The equations containing the squared proportion variable were tried in forecasting the distribution of income to 1990 using census population projections and projections of the number of two income households provided by Chase Econometrics. Future unemployment rates and the shares of transfer payments are assumed to remain constant at their 1978 levels. For comparison purposes Table 3.4 presents the 1990 distribution forecasted by both the model with the square term and the model without the square term. The historical values for 1955, 1970, and 1978 are included for reference.

It is clear from Table 3.4 that including the square of the proportion of two-income households leads to unrealiable forecasts. The most notable irregularity is in the forecast of the first ventile which falls from a value of 17.29 in 1978 to 2.12 in 1990. In contrast, the forecast for the same ventile using the simpler equation (16.38) is in line with the historical figures. Note that the equation for the first ventile is the only equation where the squared proportion variable enters significantly. The poor forecasting performance of the extended model is caused by an explosion of the 'squared' term as the projected proportions become large relative to the historical values.

TABLE 3.3

Results of the Estimation of the Expanded Version of Equation 3.7

EQ	CONS	UNEMPL	TRANS	EARN2	POPRATIO	$(EARN2)^2$	R^2	AAPE+	DW
1	-158.9**	-0.612	0.181	3.593**	36.269**	-0.133**	.946	3.98	1.65
2	-33.6	-0.612	0.000	3.417	3.654	0.048	.915	2.35	1.39
3	59.9	-0.761*	0.634	-0.795	-14.812	0.014	.877	1.33	1.40
4	44.9	-0.712*	0.842*	-0.046	-3.817	-0.002	.806	0.95	1.57
5	18.3	-0.767**	0.937*	1.294	8.998	-0.026	.769	0.85	1.60
6	10.1	-0.860**	0.967*	1.847	15.263	-0.036	.776	0.80	1.61
7	17.1	-0.840**	0.879*	1.758	15.811	-0.034	.766	0.68	1.69
8	31.4	-0.733*	0.750	1.401	13.149	-0.027	.712	0.61	1.79
9	55.7	-0.587	0.601	0.591	7.533	-0.013	.623	0.54	1.91
10	85.6*	-0.406	0.430	-0.487	0.770	0.006	.516	0.47	2.11
11	110.0**	-0.216	0.262	-1.281	-4.223	0.020	.338	0.47	2.36
12	138.6**	-0.053	0.110	-2.235	-9.674	0.036	.207	0.46	2.60
13	145.6**	0.195	-0.153	-2.152	-8.612	0.035	.394	0.43	2.61
14	150.5**	0.326	-0.306	-1.869	-6.461	0.031	.641	0.41	2.66
15	155.7**	0.408	-0.383	-1.420	-4.739	0.022	.786	0.37	2.64
16	218.3**	0.455	-0.468	-3.437	-18.864	0.055	.858	0.35	2.59
17	261.9**	1.007*	-1.328*	-4.518	-24.965	0.078	.908	0.37	2.46
18	254.2**	1.969**	-2.549**	-2.916	-12.011	0.057	.878	0.51	1.87
19	278.5	4.154**	-3.796**	-1.271	-9.508	0.034	.868	0.62	2.64
20	16.5	0.045	0.015	0.062	0.186	-0.011	.091	1.13	1.85

+ Average absolute percentage error.
* Indicates significance of the 5% level.
** Indicates significance of the 10% level.

The lackluster performance of the squared proportion in the estimations coupled with the resulting unreasonable forecasts argues strongly against including this additional variable into the model of the distribution of income.[1] If there is a non-linear relationship between the proportion of two income households and the distribution of income it will probably be found outside the framework of time-series data.

Our final model -- the system of equations as represented (3.7) -- possesses the desirable property that changes in any of the variables balance out so that the mean of the distribution is unaffected. That is, the variables take on positive signs in the equations for some ventiles and negative signs for others. Intuitively stated, any gains made by one group, as the result of a change a variable, must be offset by losses to some other group. Consequently, when the system of equations is used to forecast future distributions of income, the forecasted distributions will be consistent with the estimate of average income supplied by the 'macro' side of the model.[2] This convenient property results from the fact that the equations represented in (3.7) are, by design, linearly dependent.

---

1 Experiments with other non-linear formulations gave similar results. Among the other formulations tested were the square root and log of the proportion of two income households.

2 In this regard, the method used to forecast the distribution of income has the same principle advantage that would have accrued had we used the alternate approach of forecasting the parameters of some specified distribution function, that is, the area under the distribution is always consistent with the independent estimate of average income used to drive the forecast.

TABLE 3.4

Two Forecasts of the 1990 Income Distribution

VENTILE	1955	1970	1978	1990*	1990**
5%	11.12	18.96	17.29	16.38	2.12
10%	21.30	28.26	26.64	27.89	22.73
15%	30.55	34.56	34.86	34.72	36.22
20%	38.86	41.22	41.89	40.08	39.87
25%	46.33	47.82	48.19	45.47	42.70
30%	53.17	54.00	54.31	51.47	47.66
35%	59.02	59.93	60.41	58.05	54.44
40%	65.89	65.90	66.38	64.64	61.74
45%	72.32	72.11	72.78	71.80	70.43
50%	78.87	78.73	79.80	79.75	80.40
55%	86.71	85.94	87.06	87.80	89.94
60%	94.47	93.91	95.02	96.39	100.26
65%	104.14	102.91	103.81	105.63	109.43
70%	115.54	113.46	113.96	115.67	118.95
75%	129.09	126.03	125.87	126.72	129.12
80%	145.26	141.41	141.11	141.90	147.79
85%	166.32	162.21	161.99	165.33	173.64
90%	200.03	192.31	191.88	197.60	203.70
95%	252.00	247.04	245.56	251.12	254.73
100%+	17.88	17.88	17.74	17.43	17.29

* Forecasted using results from Table 3.2 (without square of two-earner share).
** Forecasted using results from Table 3.3 (with square of two-earner share).
\+ Proportion of total income held by the richest 5% of the population.

To demonstrate our assertions, we must first recall the method of representing the distribution of per capita income. The distribution is defined by 20 values, y_1, through y_{20}, which give the income level of the distribution at the first 19 ventile points and the area under the distribution for the top ventile. In addition, the intervening points are assumed to lie on quadratic polynomials. The area under this curve can be found by using Simpson's Rule, an approximate integration technique. Simpson's rule estimates the area under a curve by approximating the curve with a series of quadratic polynomials (defined by points on the curve) and then calculating the area under these polynomials. The resulting estimate of the area is a specific linear combination of the height of the points used to define the polynomials. The area under the distribution through the 19th ventile can be expressed as:

$$\int_0^{.95} F(x)dx = \alpha_1 y_1 + \alpha_2 y_2 + \dots + \alpha_{19} y_{19} \;. \qquad (3.8)$$

The values of the α's are given by Simpson's rule but depend upon the distance between the x coordinates of the points used to approximate the curve. Because we are assuming that the distribution between ventile points lies on the approximating quadratic polynomials, Simpson's rule actually gives the exact area under the first 95% of the distribution. Since the area under the entire distribution equals $\overline{Y}$, and since Y_{20} is defined to be the area under the distribution from .95 to 1.0, we can then extend (3.8) and write:

$$\overline{Y} = \alpha_1 y_1 + \alpha_2 y_2 + \ldots + \alpha_{19} y_{19} + \alpha_{20} Y_{20} \qquad (3.9)$$

where $\alpha_{20} = 1.0$. Hence, the area under the entire distribution, $\overline{Y}$, can be written as a linear combination of the y_i's. Note that if we divide both sides of equation (3.9) by $\overline{Y}$ we get:

$$1' = \alpha_1 r_1 + \alpha_2 r_2 + \ldots + \alpha_{20} r_{20}$$

since

$$r_i = \frac{y_i}{\overline{Y}}$$

Therefore, the expression:

$$\sum_{i=1}^{20} \alpha_i r_i = \sum_{i=1}^{20} \alpha_i a_{i0} + \sum_{i=1}^{20} \alpha_i a_{i1} \text{UNEMPL} + \ldots + \sum_{i=1}^{20} \alpha_i a_{i4} \text{POPRATIO} = 1$$

is true for all possible values of the independent variables if and only if:

$$\sum_{i=1}^{20} \alpha_i a_{i0} = 1$$

and

$$\sum_{i=1}^{20} \alpha_i a_{ij} \quad ; \quad j=1,\ldots,4 \ .$$

That is, a weighted sum of the coefficient for each variable will be zero with the weights given by Simpson's rule. Because these weights are all positive, it follows that some coefficients will be positive and some will be negative. (The existence of this dependency among the equations makes one of them redundant; however, for convenience all are estimated.)

In summation, the system of equations represented by (3.7) provide a method for explaining past changes in, and projections of, the distribution of per capita money income. By virtue of the method used to represent the distribution and the linear nature of the equations used to model it, we are assured that our projected distributions are consistent with independent projections of their mean values. This property is preserved even though the equations used to model the distribution are simple in form and contain clearly relevant economic and demographic variables.

The remainder of the chapter describes in detail the tax and spending equations which are used to transform the distribution of per capita money income into the distribution of per capita total expenditures. It is required that these functions be applied to every point along the distribution of income and not just evaluated at average income. In other words, we need a function that will tell us the spending rate for each individual in a given year; a function which predicts just the overall spending rate would not be sufficient because it is not reasonable to assume that all individuals spend the same proportion of their income. This consideration shapes the selection of functional form and data environment.

B. The Tax Function

The progression from money income to total expenditures involves the removal of taxes before the removal of savings. Taxes are removed from the yearly distributions of money income to create the distributions of disposable income by using a relatively simple function estimated in the cross-section. This task of removing taxes is complicated by the per capita nature of the distribution of money income. Had the distribution of income been at the household level, IRS compilations of tax returns by income category could have been utilized. Instead, a function relating the tax rate faced by a household to the per capita household income is specified and then is estimated using the 1972 Bureau of Labor Statistics Consumer Expenditure Survey - the same data used to obtain the results described in Chapter 2. The form of the equation is also borrowed from the cross section analysis in that tax rates are related to per capita income using a piecewise linear curve.

The equation is allowed to have eight segments and is specified as follows:

$$t_i = a + \sum_{j=1}^{8} b_j ym_{ij} \tag{3.10}$$

where:

t_i = the average tax rate in percent of household i. This includes Federal, State, and Local taxes.

$$ym_{ij} = \begin{cases} 0 & \text{if } ym_i < B_j \\ ym_i - B_j & \text{if } B_j \leq ym_i < B_{j+1} \\ B_{j+1} - B_j & \text{if } B_{j+1} \leq ym_i \end{cases}$$

and

ym_i = the per capita money income of household i.

The prespecified boundaries are:

B_1 = \$0.	B_5 = \$4000.
B_2 = \$1000.	B_6 = \$5000.
B_3 = \$2000.	B_7 = \$7500.
B_4 = \$3000.	B_8 = \$10,000.

The slope parameter of the segment for incomes greater than 10,000 (b_8) is constrained to be zero. This constraint insures that the average tax rate associated with very high income is neither very large nor very small. The unconstrained estimate of b_8 is near zero in magnitue (.014 x 10^{-3}) but it is significantly different from zero with a 't' value of 2.05.

The results of the estimation are:

		PARAMETER	t value	
a	=	1.765	1.86	
b_1	=	1.318×10^{-3}	1.21	R^2 = .3155
b_2	=	3.814×10^{-3}	8.55	N = 8009

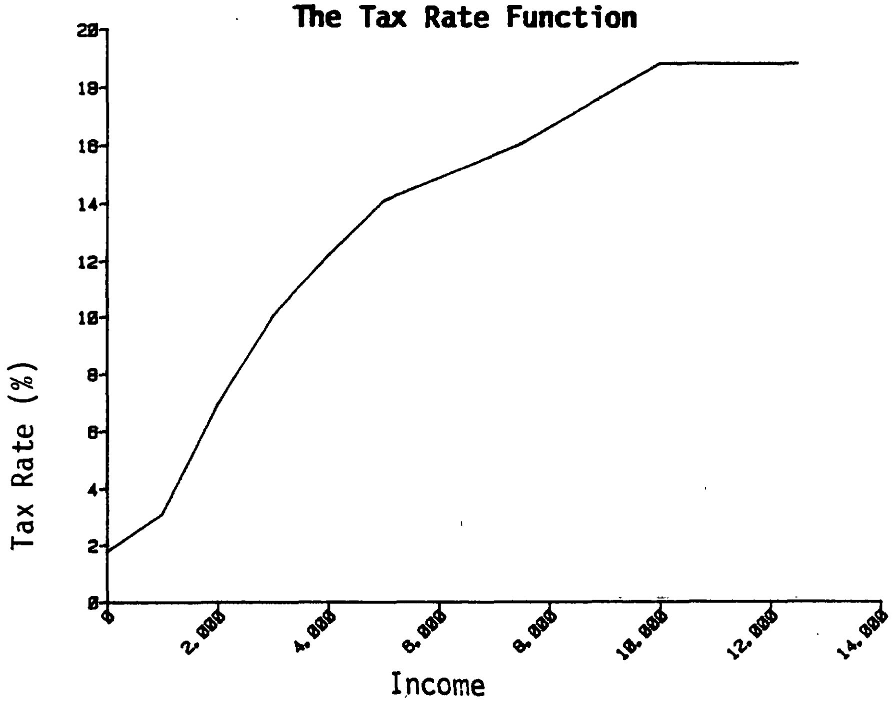
b_3	=	3.119×10^{-3}	8.25
b_4	=	2.174×10^{-3}	5.51
b_5	=	1.862×10^{-3}	4.74
b_6	=	0.794×10^{-3}	4.53
b_7	=	1.102×10^{-3}	6.67
b_8	=	0.0	--

Given the simple form of the equation and the fact that taxes are not levied on a per capita basis, the tax function fits the cross-section data quite well. A sketch of the estimated function is shown in Figure 3.3.

Since historical tax schedules are nearly invariant in current dollars, the tax function estimated using 1972 data is used to remove taxes from the income distributions of other years. Any remaining discrepancy between the computed level of total disposable income and its historical value is removed by proportionally scaling the entire distribution. (The actual mechanics of using the tax function are quite simple -- except in case of removing taxes in 20th ventile. The details of the procedure are given in the appendix to this chapter.)

FIGURE 3.3

The Tax Rate Function



C. The Spending Function

The progression to the desired distribution of per capita total expenditures is completed with the removal of savings from disposable income. As with the removal of taxes from money income, the task of removing savings from disposable income is accomplished with the use of a function that is estimated with cross-section data.

1. Properties of the Spending Function

We begin with strong prior notions on the properties a candidate function should possess. The first property is that the proportion of income spent by an individual should depend upon the individual's relative, as opposed to his absolute, income level. A poor person today is better off, in terms of real disposable income, than a poor person in 1955; but their corresponding savings rates are very similar. If it were the case that savings rates increase with increases in real income levels, we would have experienced increased aggregate savings rates over time. The second desirable property of a spending/savings function is to have the total amount of savings removed be consistent with the assumed (or actual) aggregate savings rate.

To this point, the terms 'savings' and 'spending' have been used somewhat interchangably. Since one concept is the mirror image of the other, we have arbitrarily chosen to explain 'spending'. Let $\overline{s}$ be the aggregate spending rate and let s_i be the spending rate of the i^{th} individual. Similarly, let YD and E be the aggregate values for disposable income and total expenditures and let yd_i and e_i be the corresponding values for the i^{th} individual.

We want to specify a function which relates s_i to yd_i, say $g(yd_i)$, so that the following condition holds:

$$\sum_{i=1}^{N} yd_i s_i = \sum_{i=1}^{N} yd_i g(yd_i) = E$$

That is, if we apply our spending function to all individuals and sum the results, we should arrive at the actual total for expenditures. The following spending function meets both of the prior requirements:

$$s_i = g(yd_i) = \overline{s} + b\,\overline{s}\left(\frac{\overline{yd}}{yd_i} - 1\right) \qquad (3.11)$$

Consider the requirement that the total amount of savings removed be consistent with the actual savings rate. Applying the spending function to all individuals and summing yields E, the aggregate value for total expenditures:

$$\begin{aligned}\sum_i yd_i\ g(yd_i) &= \sum yd_i(\bar{s} + b\bar{s}\,\frac{\overline{yd}}{yd_i} - 1)) \\ &= \bar{s} \sum yd_i + b\,\bar{s} \sum yd_i(\frac{\overline{yd}}{yd} - 1) \\ &= \bar{s}\ YD + b\bar{s} \sum \overline{yd} - b\bar{s} \sum yd_i \\ &= E\end{aligned}$$

since:

$$\sum yd_i = \sum \overline{yd} = YD\ .$$

Note that this property holds no matter what the values s and $\overline{YD}$ take on. It is the unusual form of equation (3.11) which guarantees that the 'summing up' property be met. In fact, any function which satisfies this criteria will be similar in form and must include the ratio of YD to yd_i. (One exception is the trivial function which assigns $\bar{s}$ to all individuals.) Notice also that the spending rate for individual i is related to the ratio of average income to the individual's income. The requirement that the spending rate be a function of relative income is clearly met.

Further properties of equation (3.11) are illustrated when evaluating the function at some special values:

$$\lim_{yd_i \to 0} g(yd_i) = \infty$$

$$\lim_{yd_i \to \infty} g(yd_i) = \bar{s} + b\bar{s}(-1) = \bar{s}(1-b)$$

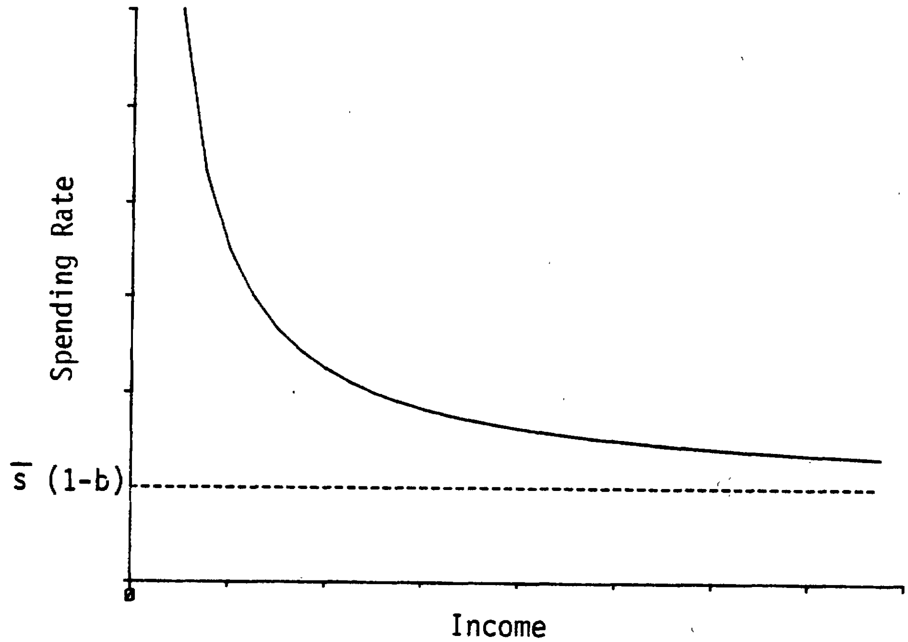
and

$$g(\overline{yd}) = \bar{s} \ .$$

In other words, the spending function implies that the spending rate of the very poor approaches infinity, the spending rate of the very rich levels off at some level, and that the spending rate of the individual with average income is precisely the average spending rate. The spending function implies non-zero expenditures for zero income individuals and infinite expenditures for those fortunate enough to have infinite incomes. These seem to be reasonable or at least acceptable properties for a spending rate function. A sketch of the function is shown in Figure 3.4. The speed of convergence to the horizontal asymptote is dictated by the parameter b. The higher the value of b, the slower the convergence to the asymptote.

FIGURE 3.4

The Spending Rate Function



2. Estimation of the Spending Function

The parameter b in the spending function (3.11) is estimated using the BLS Consumer Expenditure data. The results of the estimation are:

		Parameter	t value		
b	=	.41168	128.0	R^2	= 0.668
				N	= 8009

These results are truly remarkable, given the nature of cross-section estimations, but it is hardly surprising that an individual's relative income is found to be helpful in explaining his spending rate.

It is possible to extend Equation (3.11) to include the age of the household head in an attempt to capture a 'life cycle' effect. (However, the results are not useful for our purposes because utilizing the function would require a data source which is not available). Specifically, dummy variables are introduced into the equation which allow the 'slope' coefficient b to vary among four distinct age categories. The expanded spending function is:

$$s_i = g(yd_i,A_i) = \bar{s}(1 + \sum_{j=1}^{4} b_j(\frac{\overline{yd}}{yd_i}A_{ij} - \frac{N_j}{N})) \qquad (3.12)$$

where:

$$A_{ij} = \begin{cases} 1 & \text{if the household head is in the jth age group} \\ 0 & \text{otherwise} \end{cases}$$

N_j = the number of households in the j^{th} age group

N = the total number of households.

The four age groups are :

1 age < 30

2 30 ≤ age < 45

3 45 ≤ age < 65

4 65 ≤ age.

The rather peculiar form of (3.12) guarantees that the "summing up" property still holds. That is:

$$\sum_{i=1}^{N} yd_i g(yd_i A_i) = \sum_{i=1}^{N} yd_i(\bar{s} + \bar{s} \sum_{j=1}^{4} b_j(\frac{\overline{yd}}{yd_i}A_{ij} - \frac{N_j}{N}))$$

$$= \bar{s} \sum_{i=1}^{N} yd_i + \bar{s}(\sum_{j=1}^{4} b_j(\sum_{i=1}^{N} \overline{yd}\ A_{ij} - \sum_{i=1}^{N} \frac{N_j}{N}\ yd_i))$$

$$= \bar{s}\ YD + \bar{s}(\sum_{j=1}^{4} b_j(\overline{yd} \quad \sum_{i=1}^{4} A_{ij} - \frac{N_j}{N} \quad \sum_{i=1}^{N} yd_i))$$

$$= E + 0 = E$$

since:

$$\sum_{i=1}^{N} A_{ij} = N_j \quad .$$

Hence, the expanded spending function combines adherence to our initial requirements with a flexibility that allows different saving/spending patterns for individuals at different stages in their lives.

Consider the function relevant to an individual in the first age category. Equation (3.12) reduces to:

$$\bar{s}(1 + b_1(\frac{\overline{yd}}{yd_i} - \frac{N_1}{N}) + \sum_{j=2}^{4} b_j(0 - \frac{N_j}{N})) \qquad (3.13)$$

$$= \bar{s}(1 + b_1 \frac{\overline{yd}}{yd_1} - b_1 \frac{N_1}{N} - \sum_{j=2}^{4} b_j \frac{N_j}{N})$$

$$= \bar{s}\ (1-K) + \bar{s}\ b_1 \frac{\overline{yd}}{yd_i}$$

where:

$$K = \sum_{j=1}^{4} b_1 \frac{N_j}{N} \ .$$

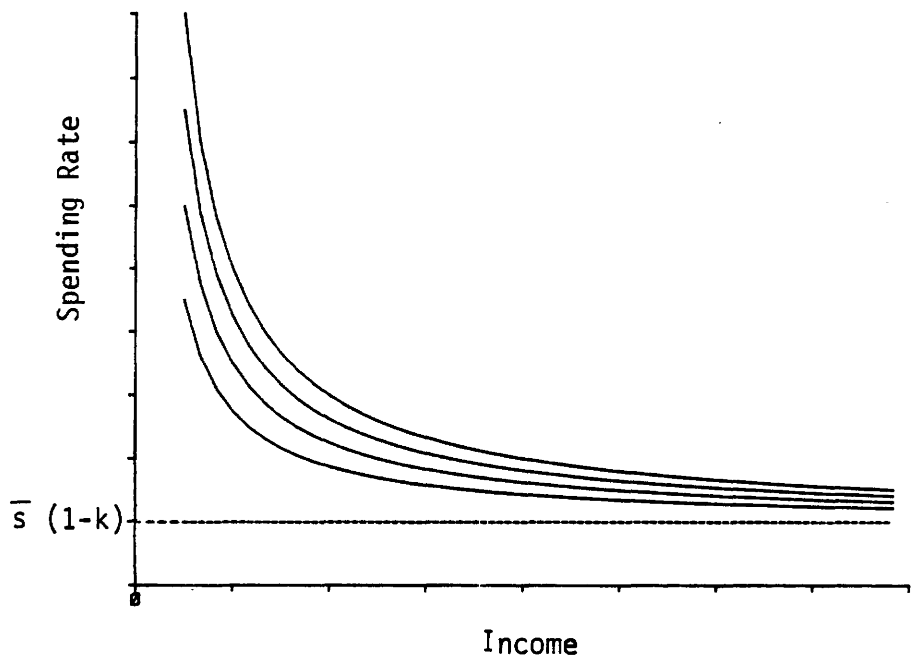
Taking the limit of (3.13), as income goes to infinity gives:

$$\lim_{yd_i \to \infty} (\bar{s}(1-K) + \bar{s}\ b_1 \frac{\overline{yd}}{yd_i}) = \bar{s}(1-K) \tag{3.14}$$

The function for the first age category, equation (3.13), differs from the equations for the other age groups only by the appearance of the b_1 term. Therefore, the four spending curves all converge to (3.14) as income goes to infinity. This implies that at higher levels of income age induced differences in spending rates are minor. A graphical representation of the four spending curves that comprise our extended spending functions is given in Figure 3.5.

FIGURE 3.5

Age Specific Spending Curves



Although the spending function can be collapsed for each of the four groups into the curves shown in Figure 5, these curves are not what results from stratifying the data set and then estimating spending functions of the original specification for each group. Instead, only one equation is estimated and its functional form insures that the spending patterns of the four separate age groups are consistent with the aggregate spending rate.

Equation (3.12), which is linear in the b_i parameters, is estimated using ordinary least squares. The results of the estimation are:

	Parameter	t value	
b_1	= 0.26124	62.4	
b_2	= 0.45221	108.7	R^2 = 0.763
b_3	= 0.68971	46.3	N = 8009
b_4	= 0.68564	96.7	

The inclusion of the age group variables makes a striking improvement in the fit of the spending equation, lifting an already high value of the R^2 from 0.668 to 0.763. (A statistical comparison of the two equations yields an F value of 1069.6. The approximate critical value for the appropriate F test at the 1% level of significance is only 3.78.)

The individual b_i parameters show a good deal of variation among the four different age groups but the resulting spending pattern does not conform to conventional wisdom. The results of our estimation show a monotonic increase in spending rates as age increases from low to high and not the usual pattern of high spending rates for young and old with low spending rates for the middle age group. One possible explanation for the non-standard results may be the arbitrarily selected age groupings but further experimentation with this specification of the spending function seems unwarranted for reasons given below.[1]

Although the age group expanded spending function is both statistically and intuitively preferable to the simple version, it is

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[1] An interesting alternative would be to specify more narrowly defined groups, say 5 year spans, with the requirement that the larger number of b_i parameters lie on a 2nd or 3rd degree polynomial.

not helpful in performing the original task. Recall that we want a function to transform the yearly distributions of per capita disposable income into the distributions of per capita total expenditures. This transformation requires that we evaluate the spending function at each level of income and multiply the resulting spending rate times income to get the level of total expenditures. To use the expanded version of the spending function we need to know the proportion of individuals in each of our four age groups at each income level. Since the distribution data available does not allow construction of per capita distributions differentiated by the age of household head, we would be forced to assume that each income level had the same age distribution. This assumption is clearly not correct, thus we cannot use a spending function which includes age group variables. In general, we can extend the spending function only with variables which we do not think vary with the level of income. In other words, we can extend the spending function only with variables not likely to affect spending!

Having specified and estimated tax and spending functions it is now possible to construct yearly distributions of per capita total expenditures. From these distributions we can calculate our Y_j variables and obtain our C^*_{it} "predictions" of consumption. These C^*_{it} "predictions together with the weighed population series enter directly into the time-series equations described in the next chapter.

CHAPTER 4

TIME-SERIES CONSUMPTION FUNCTIONS

In this culminating chapter we formulate and estimate a system of time series consumption functions. These consumption functions incorporate through the C^*_{ij} and weighted population variables the demographic and Engel curve results of the previous two chapters while allowing for a flexible pattern of price interactions. The equations are used in the latter part of this chapter to explain and, subsequently in Chapter 5, to forecast consumption on the 77 detailed components of the NIPA Personal Consumption Expenditures listed in Table 4.1.

The system of Symmetric Consumption functions developed by Clopper Almon in "A System of Consumption Functions and its Estimation for Belgium" provides the foundation for our time series consumption functions.[1] The hallmark of Almon's functional form is its ability to express either substitution or complementarity among goods. Our equations are extended to allow even greater flexibility in price interactions by making less restrictive assumptions about the structure of the Slutsky symmetry matrix. In addition, our system is able to account for shifts in the demographic makeup of the population as a result of replacing the simple income terms and the population totals used in the Almon system with the C^*_{it} and weighted population variables.

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1 Almon, C. (1979), "A System of Consumption Functions and its Estimation for Belgium," Southern Economic Journal, Vol. 46, pp. 85-106.

TABLE 4.1

Time-Series Consumption Items

1	New cars and trucks
2	Net purchases of used cars
3	Tires and tubes
4	Accessories and parts (auto)
5	Furniture, mattresses, and bedsprings
6	Kitchen and other household appliances
7	China, glassware, tableware, and utensils
8	Radio, TV, records, and musical instruments
9	Floor coverings
10	Durable housefurnishings nec
11	Writing equipment
12	Hand tooks
13	Jewelry
14	Opthalmic and orthopedic appliances
15	Books and maps
16	Wheel goods and durable toys
17	Boats, recreational vehicles, and aircraft
18	Food, off premise
19	Food, on premise
20	Alcohol, off premise
21	Alcohol, on premise
22	Shoes and footware
23	Womens clothing
24	Mens Clothing
25	Luggage
26	Casoline and oil
27	Fuel oil and coal
28	Tobacco
29	Semidurable housefurnishings
30	Drug preparations and sundries
31	Toilet articles and preparations
32	Stationery and writing supplies
33	Nondurable toys and sport supplies
34	Flowers, seeds, and potted plants
35	Cleaning preparations
36	Lighting supplies
37	Household paper products
38	Magazines and newspaper
39	Other nondurables -- identity
40	Owner occupied space rent
41	Tenant occupied space rent
42	Hotels and motels
43	Other housing -- educational housing
44	Electricity
45	Natural gas
46	Water and other sanitary services

TABLE 4.1

Time-Series Consumption Items (Continued)

47	Telephone and telegraph
48	Domestic services
49	Household insurance
50	Other household operations - repair
51	Postage
52	Auto repair
53	Bridge, tolls, etc.
54	Auto insurance
55	Taxicabs
56	Local public transport
57	Intercity railroad
58	Intercity buses
59	Airlines
60	Travel agents and other transportation services
61	Cleaning, laundering and shoe repair
62	Barbershops and beauty shops
63	Physicians
64	Dentists and other professional services
65	Private hospitals and sanitariums
66	Health insurance
67	Brokerage and investment counseling
68	Bank service charges and services w/o payment
69	Life insurance
70	Legal services
71	Funeral expenses and other personal business
72	Radio and television repair
73	Movies, legitimate theatre, spectator sports
74	Other recreational services
75	Education
76	Religious and welfare services
77	Foreign travel

In the following section we derive a general system of consumption functions using Almon's Symmetric Consumption functions as a guide. We then modify this general system to incorporate our demographic variables.

I. A SYSTEM OF CONSUMPTION FUNCTIONS

A. Derivation of the System

In his Symmetric Consumption function paper, Almon presents a list of attributes that a functional form for consumption should possess. Chief among these attributes are: homogeneity of degree zero in prices and income, constant-price adding up, approximate Slutsky symmetry, and flexibility in expressing price interactions. In addition, Almon maintains that price changes should alter the effects of income and nonincome determinants of demand in roughly equal fashion. These properties shape the development of both Almon's Symmetric Consumption functions and the extention of that system which is presented here.[1]

To meet the requirement that price changes have an equi-proportional effect on the income and nonincome influences on demand, a multiplicative relationship between prices and the other determinants of demand is adopted. Specifically, we have the following equation:

$$q_i = (a_i(t) + b_i\, Y/_{\overline{P}})\prod p_j^{c_{ij}} \tag{4.1}$$

1 Since our system is an extension of Almon's system, the derivation of its general form closely follows Almon's presentation.

where q, P, and Y represent quantity, price, and income respectively.[1] The $a_i(t)$ depicts a constant term and other nonprice, nonincome factors and $\bar{P}$ is an index of average prices.

To insure that doubling all prices and income leads to no changes in consumption behavior we impose the restriction that:

$$\sum_{j=1}^{N} c_{ij} = 0 \tag{4.2}$$

We thereby quarantee homogeneity of degree zero in income and prices.

Although it is desirable for consumption to exhaust income at all prices, the imposition of restrictions on equation (4.1) can at best result in constant price adding up -- that is, the exhaustion of income at base prices. In order for equation (4.1) to possess the property of constant price adding up, the following two conditions must hold:

$$\sum_{i=1}^{N} b_i = 1 \quad \text{and} \quad \sum_{i=1}^{N} a_i(t) = 0 \tag{4.3}$$

For consumption to exhaust income at prices other than base prices, a "spreader" must be employed. The "spreader" technique is an after the fact method of achieving consistency between the sum of consumption on all individual items and income. It accomplishes this task by taking the difference between income and the sum of consumption as given by

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1 As was the case in the previous chapters, our concept of income is actually that of total expenditures.

(4.1) and spreading this difference among all the consumption items. In essence, equation (4.1) is assumed to give close first guesses at consumption and the spreader insures that the guesses add to income.[1]

The Slutsky symmetry requirement is used to impose constraints on the c_{ij} parameters in equation (4.1). These constraints enable us to reduce the number of parameters to be estimated. The Slutsky equation states that the income-compensated partial derivative of the demand for good i with respect to the price of good j is equal to the income-compensated partial derivative of the demand for good j with respect to the price of good i.

In equation (4.1) the derivative of q_i with respect to P_j holding $Y/\overline{P}$ constant can be considered the "income compensated" price derivative of the demand for q_i if we assume that $\overline{P}$ is an adequately good price index. Thus:

$$\left(\frac{dq_i}{dP_j}\right)_{Y/\overline{P} = \text{constant}} = \frac{c_{ij}\, q_i}{P_j} \tag{4.4}$$

By making use of the Slutsky symmetry condition it follows that:

$$\frac{c_{ij}\, q_i}{P_j} = \frac{c_{ji}\, q_j}{P_i}$$

or

---

1 Since the first guesses are expected to be close, the spreader is not considered further in the development of the equation and its estimation. The real value of the spreader is to give consistency in the forecasts. Exact details on the form of the spreader are given in Chapter 5.

$$\frac{c_{ij}}{p_j q_j} = \frac{c_{ji}}{p_i q_i}$$

or

$$\frac{c_{ij}}{s_j} = \frac{c_{ji}}{s_i}$$

where s_i denotes the budget share of good i in a given year. If we define $\lambda_{ij} = \frac{c_{ij}}{s_j}$ we have the symmetric condition that $\lambda_{ij} = \lambda_{ji}$. Since it is the λ_{ij} and not the c_{ij} that are symmetric, we use the λ_{ij} as the parameters of our system so that symmetry can easily be imposed. Rewriting equation (4.1) with this substitution gives:

$$q_i = (a_i(t) + b_i \, {}^{Y}/_{\overline{P}}) \, P_i^{\,c_{ii}} \prod_{j \neq i} P_j^{\,s_j \lambda_{ik}} \tag{4.5}$$

By utilizing the constraints implied by homogeneity $(\sum_{j=1}^{N} c_{ij} = 0)$ and symmetry $(\lambda_{ij} = \lambda_{ji})$ we have reduced the number of price parameters from N^2 of the c_{ij}'s in (4.1) to $(N^2 - N)/2$ of the λ_{ij}'s in (4.5). However, with 77 commodities under investigation there still remains 2926 price parameters. We need to make some additional assumptions to proceed. Specifically, we assume that the 77 commodities can be combined into economically relevant groups and that a less ambitious scheme of λ_{ij}'s is sufficient to capture all price interactions. We use this concept of groups to partition the λ_{ij} substitution matrix into blocks and, to hold down the number of λ's, every λ within each of the blocks is assumed to take on a single value. While this technique is restrictive in that a change in the price of a good in one group affects each member of another group equally, it does allow these interactions to vary from group to group. Thus, the commodities in one group can be complements for the goods in another group while being substitutes for those in yet a third group. Within each group a single λ dictates the degree of complementarity/substitutability between each member of the group. (Later we make the treatment of intra-group price interactions more flexible through the use of subgroups.)

Partitioning and simplifying the λ_{ij} substitution matrix greatly reduces the number of price parameters to be estimated. By combining our 77 commodities into 10 groups, the number of λ's to be estimated decreases from 2926 to 55. And since the groups are comprised of commodities with similar characteristics, the restrictions imposed to achieve these reductions do not seem unreasonable.

We proceed with our derivation by modifying the consumption function as expressed by equation (4.5) to reflect the group structure. We adopt the following notational convention: capital letters used as subscripts refer to groups while lower case subscripts denote individual commodities. Let the 77 commodities be combined into M groups, G_1 through G_M. If $i \in G_I$ then for every $j \in G_J$ we can replace the corresponding λ_{ij}'s in equation (4.5) with λ_{IJ}. Continuing in this fashion for each of the M groups, the entire product of price elements in (4.5) can be segregated into M separate products each of which uses the appropriate λ_{IJ}. Rewriting (4.5) in this group notation we have:

(4.6)

$$q_i = (a_i(t) + b_i \, Y/\bar{P}) \, P_i^{\,c_{ii}} \prod_{j \in G_1} P_j^{\,s_j \lambda_{I1}} \cdots \prod_{\substack{j \in G_I \\ j \neq i}} P_j^{\,s_j \lambda_{II}} \cdots \prod_{j \in G_M} P_j^{\,s_j \lambda_{IM}}$$

To simplify (4.6) define

$$\bar{P}_L = \Big(\prod_{j \in G_L} P_j^{\,s_j}\Big)^{\frac{1}{S_L}} \qquad \text{where } S_L = \sum_{j \in G_L} s_j \tag{4.7}$$

Using $\bar{P}_L$, the harmonic mean of prices in group G_L, equation (4.6) reduces to:

$$q_i(a_i(t) + b_i \, Y/\bar{P}) \, P_i^{\,c_{ii} - s_i \lambda_{II}} \prod_{L=1}^{M} \bar{P}_L^{\,S_L \lambda_{IL}} \tag{4.8}$$

since

$$\prod_{\substack{j \, G_I \\ j \neq i}} P_j^{\,s_j \lambda_{II}} = \frac{\bar{P}_I^{\,S_I \lambda_{II}}}{P_i^{\,s_i \lambda_{II}}}$$

When the restriction of homogeneity of degree zero in income and prices is rewritten in terms of our λ_{ij}'s, it can be used to further simplify equation (4.8):

$$\sum_{j=1}^{N} c_{ij} = c_{ii} + \sum_{j=1}^{N} s_j \lambda_{ij}$$

$$= c_{ii} + \sum_{L=1}^{M} S_L \lambda_{IL} - s_i \lambda_{ii}$$

and since $\sum c_{ij} = 0$, we have

$$c_{ii} - s_i \lambda_{ii} = - \sum_{L=1}^{M} s_L \lambda_{IL} \tag{4.9}$$

Substituting (4.8) into (4.9) we arrive at the final representation of our consumption function:

$$q_i = (a_i(t) + b_i \, {}^{Y}/_{\overline{P}}) \prod_{L=1}^{M} (\frac{P_i}{\overline{P}_L})^{-S_L \lambda_{IL}} \tag{4.10}$$

where $i \epsilon G_I$. It is clear that the demand for commodity i depends upon its price relative to each of the M group specific average prices and upon income.[1]

As it stands, equation (4.10) makes no provision for subgroups. Since the option of defining narrow collections of commodities within groups is desirable, we modify (4.10) to allow for this possibility. Each of the λ_{II} blocks in the substitution matrix is replaced with a

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1 It should be noted that equation (4.10) satisfies the Slutsky condition only at base prices. For Slutsky symmetry to hold in every period, we would need to use contemporaneous as opposed to fixed budget shares. However, doing so would also impart a degree of simultaneity into the equations since we could not know the contemporaneous budget shares before we knew the demand for each of the products -- and vice versa.

matrix that has a block structure defined by the subgroups.[1] This modification captures the complex price interactions within and among subgroups. Suppose, for example, that a group is split into three subgroups. A particular subgroup may be comprised of either complementary or substitutable items independently of the other subgroups. And it is possible for the goods in the first subgroup to substitute with the goods in the second subgroup while complimenting those in the third. Although this increase in complexity requires additional parameters, the potential for more flexible price interactions offsets the loss to degrees of freedom.

The derivation of the subgroup extended consumption function is notationally awkward and not substantively different from (4.10). Therefore, the exact formulation of the extended equation and its rationalization are relegated to the appendix of this chapter.

Our consumption function as expressed by equation (4.10), though based on the Almon requirements, differs from Almon's system of Symmetric Consumption functions with regard to the treatment of price interactions. We achieve greater flexibility in this area by allowing the Slutsky symmetry matrix to have a more elaborate block structure. The difference in the substitution matrices can best be illustrated by example. Suppose we have twelve commodities that are combined into three groups. Suppose further that the first group has three subgroups and that the second and third groups have none. Figures 4.1 and 4.2 depict the substitution matrices under the Almon system (4.1) and our

---

1 Recall that, for a given group, λ_{II} is that portion of the substitution matrix which governs intra-group price interactions. Heretofore, each element in λ_{II} (excluding the diagonal elements) was assumed to take on the same value.

own (4.2).

An examination of the two figures indicates that the systems differ in their treatment of price interactions between groups and between subgroups within the same group. However, the two systems represent intra-group and intra-subgroup price relationships in the same fashion. Notice that the μ_G^1, μ_G^2, μ_G^3, μ_B, and μ_C parameters in Almon's system, which depict intra-subgroup and intra-group price relations, correspond exactly to the γ_{11}, γ_{22}, γ_{33}, λ_{22}, and λ_{33} parameters in our system. But with regard to group interactions, the Almon system uses just one parameter, μ_0 which implies that all groups must substitute (or complement) each of the other groups to the same degree. In our system the interactions between groups are dictated by the three parameters λ_{12}, λ_{13}, λ_{23} --- one for each distinct paring of two groups. This distinction allows for any pattern of substitutability and complementarity to exist between groups. The differences between the two systems in the treatment of subgroups is analogous to that of groups. The inter-subgroup price relationships in the Almon system are fixed with a single parameter (μ_G) while our system has three (γ_{12}, γ_{13}, and γ_{23}).[1] It should be noted that the increase in flexibilities of our system over the Almon system is achieved through significantly higher computational costs.

Before completing the development of our system of consumption functions by including the cross-section variables it is convenient to derive the formulas for own and cross-price elasticities.

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1 Obviously, if a group has just two subgroups there is no difference between the two systems.

Figure 4.1
The Almon Grouping Scheme

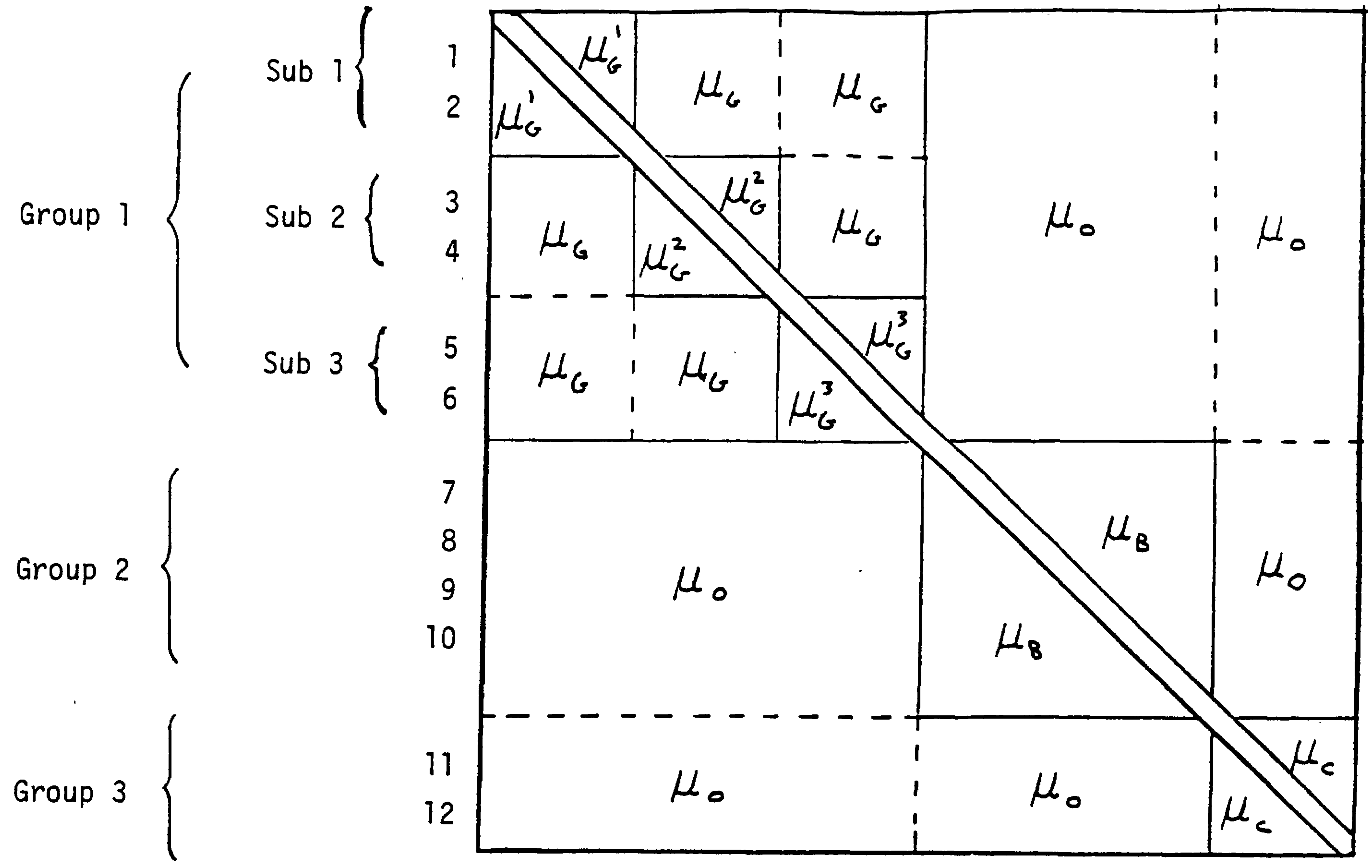
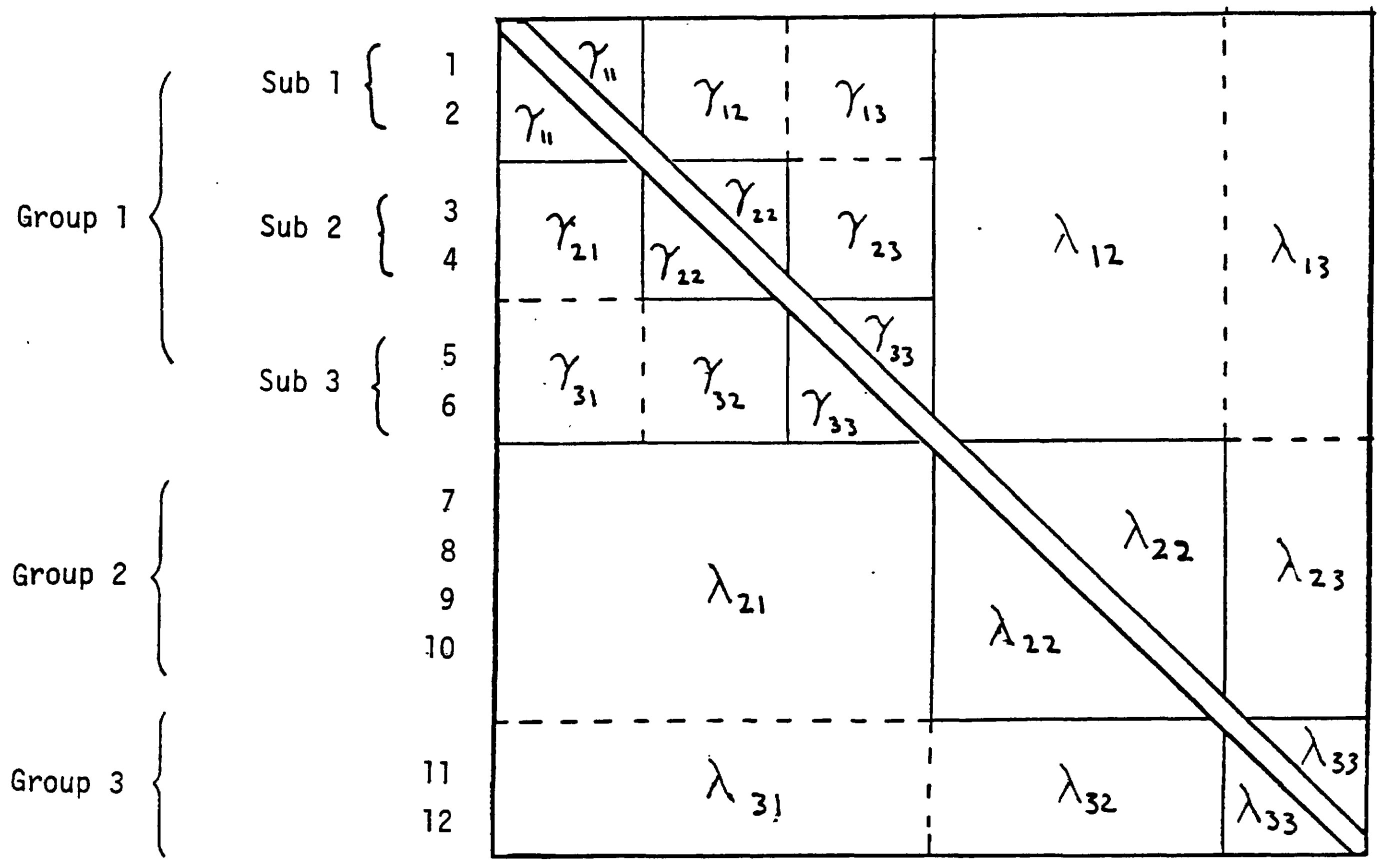


Figure 4.2
Our Own Grouping Scheme



B. Price Elasticities

To obtain own and cross-price elasticities for equation (4.10), the best measures of price interactions, we make use of the following definition of elasticity.

$$\eta = \frac{P_j}{q_i} \frac{dq_i}{dP_j}$$

$$= P_j \frac{d}{dP_j} (\log q_i)$$

where η_{ij} represents the elasticity of demand for good i with respect to the price of good j. We utilize the log form of this definition by noting that:

$$\log q_i = \log (a_i(t) + b_i \, {}^{Y}/_{\overline{P}}) - \sum_L S_L \lambda_{IL} (\log P_i - \log \overline{P}_L)$$

$$= \log (a_i(t) + b_i \, {}^{Y}/_{\overline{P}}) + \sum_L \lambda_{IL} \log \overline{P}_L^{S_L} - (\log P_i) \cdot \sum_L S_L \lambda_{IL}$$

The formulas presented in the following sections are for income-compensated price elasticities. These are obtained by assuming that $^{Y}/_{\overline{P}}$ is unaffected by small changes in any given price.[1]

1. Own Price Elasticities

To find the own-price elasticity of demand, we begin by evaluating the derivative of the log of q_i with respect to P_i.

$$\frac{d}{dP_i}(\log q_i) = \lambda_{II} \frac{1}{\overline{P}_I^S} \frac{d}{dP_i}(\overline{P}_I^{S_I}) - \frac{1}{P_i} \sum_L S_L \lambda_{IL} \tag{4.11}$$

We can simplify (4.11) by using the definition of $\overline{P}_I^{S_I}$ as given by equation (4.7):

$$\overline{P}_I^{S_I} = \left[\left(\prod_{j \in G_I} Pj^{s_j} \right)^{\frac{1}{S_I}} \right]^{S_I} \tag{4.7}$$

---

[1] The formulas presented are applicable (with slight notational changes) to the subgroups extended version of the consumption function found in the appendix.

Therefore:

$$\frac{d}{dP_i} \bar{P}_I^{\,S_I} = s_i \frac{\prod P_j^{\,s_j}}{P_i} = \frac{s_i}{P_i} \bar{P}_I^{\,S_I}$$

Substituting this relationship into (4.11) gives:

$$\frac{d}{dP_i} (\log q_i) = \lambda_{II} \cdot \frac{s_i}{P_i} - \frac{1}{P_i} \sum_L s_L \lambda_{IL}$$

We arrive at the own-price elasticity of demand for good i by multiplying the last expression by P_i.

$$\begin{aligned} \eta_{ii} &= P_i \frac{d}{dP_i} (\log q_i) \\ &= s_i \lambda_{II} - \sum_{L=1}^{M} S_L \lambda_{IL} \end{aligned} \qquad (4.12)$$

If we rearrange (4.12) we can see that the own price elasticity for good i is the budget share weighted sum of the λ_{IL}'s corresponding to each of the other goods.

That is:

$$\eta_{ii} = - \sum_{\substack{j=1 \\ j \neq i}}^{N} s_j \lambda_{IJ} \tag{4.13}$$

where $j \in G_J$

2. Cross-Price Elasticities

To find the cros-price elasticity of demand we begin as before but now the derivative of the log of q_i is taken with respect to P_j.

$$\frac{d}{dP_j} (\log q_i) = \lambda_{IJ} \frac{1}{\bar{P}_J} S_J \frac{d}{dP_j} (\bar{P}_J^{\,S_J}) \tag{4.14}$$

where $j \in G_J$.

Once again we simplify, by substituting into (4.14) the following expression:

$$\frac{d}{dP_j} \bar{P}_J^{\,S_J} = \frac{s_j}{P_j} \bar{P}^{S_J}$$

Multiplying through by P_j gives us the elasticity of demand for good i with respect to the change in the price of good j.

$$\eta_{ij} = s_j \lambda_{IJ} \tag{4.15}$$

Thus, the cross-price elasticity of demand is merely the budget share of j multiplied by the $(i,j)^{th}$ entry in the substitution matrix. As a result, any goods that are members of the same group or subgroups (and are therefore represented by the same λ) will be equally affected by a change in the price of good j.

C. Modifications to Include the Cross-Section Variables

To complete the development of the system of consumption functions we introduce into equation (4.10) the time-series counterparts of the cross-section Engel curve and demographic variables (C^*_{it} and WP_{it}). Our new equation is:

$$\frac{q_{it}}{WP_{it}} = (a_i + b_i C^*_{it} + c_i \Delta C^*_{it} + d_i t) \prod_L \left(\frac{P_{it}}{\bar{P}_{Lt}}\right)^{S_L \lambda_{IL}} \qquad (4.16)$$

where

q_{it} - quantity of good i consumed during year t

WP_{it} - weighted population size, relevant to good i, in year t

C^*_{it} - cross-section "prediction" of consumption i in year t

t - time trend

P_{it} - price of good i in year t

$\bar{P}_{Lt}$ - average price for group L in year t

S_L - share in total consumption of group L in the base period (1972).

a_i, b_i, c_i, d_i, λ_{IL} - parameters to be estimated

Both the C^*_{it} and the WP_{it} variables in equation (4.16) have clear advantages over the income and population variables typically used in demand systems. Consider WP_{it}, the weighted population relevant to good i, which is used to create per capita consumption of good i, the dependent variable in our equation. WP_{it} incorporates information on the changing distribution of the population by using the Adult Equivalency Weights. Simple population totals, unlike WP_{it}, cannot take into account the fact that the age distribution shifts through time and that different age groups can have different consumption tendencies.

Similarly, the C^*_{it} variable is less restrictive than a simple income term which uses just the average value of income. In the case of the latter, a single slope parameter forces the income response of individuals at all income levels to be the same. The C^*_{it} variable, in contrast, utilizes the cross-section Engel curves thereby allowing a differential income response for five income groups. In addition, C^*_{it} accounts for the effects on consumption of shifts in the demographic makeup of the population by including trends in the proportion of households by region, educational attainment, labor force participation of spouse, household size, and age of the household head.

The $a_i(t)$ term in equation (4.10) is replaced in equation (4.16) by a constant, a cyclical variable, and a time trend. The variable ΔC^*_{it} is used to capture cyclical patterns in consumption. Since the demographic factors in C^*_{it} move gradually over time, abrupt changes in C^*_{it} from year to year are attributed in our system to changes in income. The time trend is used to capture secular changes in consumption resulting from changes in tastes and preferences that have not been accounted for by the demographic and the age and income distribution information included in the equation.

The parameter b on the variable C^*_{it} is constrained to preserve the cross-section results. Attempts to freely estimate the parameter b had produced negative values which imply a negative income elasticity for those items, an aberration not observed in the cross-section. And, since the time-series data is subject to the usual multicollinearity, the cross-section data provide more reliable estimates of the income and demographic effects on consumption.

The fact that C^*_{it} is by construction a prediction of (q_{it}/WP_{it}), the dependent variable in the equation, suggests that the constraint be set to one. However, to correct for any discrepancies between the definitions used to define the items or any differences in the apparent shares in the consumption[1] between the two data sources, the value of b is chosen so that the elasticity of consumption with respect to C^*_{it} is equal to unity.

Consider the elasticity of equation (4.16) with respect to C^*_{it} evaluated in 1972[2] the year of the cross-section data:

$$\eta_{C*} = C^*_i \frac{d}{dC^*_i} \ln \left(\frac{q_i}{WP_i}\right)$$

$$= C^*_i \frac{d_i}{dC^*_i} \ln (a + bC^*_i + c \Delta C^*_i + dt)$$

---

1 For example, based on the National Income Accounts in 1972, the share of the consumption of alcohol on premise in total consumption was 1.59 percent. The cross-section data for the same year puts the share of alcohol on premise at 0.37 percent. This discrepancy may be the result of households being reluctant to report their true consumption in the interviews used to collect the cross-section data.

2 In 1972 all prices are equal 1.0, therefore, the price portion of equation (4.16) can be disregarded.

$$= \frac{bC^*_i}{a + bC^*_i + c \quad C^*_i + dt}$$

$$= b \frac{C^*_i}{(q_i/WP_i)}$$

setting this last expression equal to one give us

$$b = \frac{(q_i/WP_i)}{C^*_i} \tag{4.17}$$

We can see from equation (4.17) that b will be set equal to one if the correspondence in terms of shares in consumption between the two data sources is exact.

II. ESTIMATION AND DATA

A. Estimation Technique

Our system of equations represented by (4.16) possess features which make it difficult to estimate. The principle difficulty lies in the magnitude of the estimation required. The system includes approximately 400 parameters which, because of the interdependence of the equations dictated by Slutsky symmetry, require joint estimation.[1] This joint estimation, in turn, creates the problem of

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1 Slutsky symmetry requires that λ_{IJ} be equal to λ_{JI}. To insure this equality, all the equations which use either of these parameters must be estimated together. Since the symmetry is required for every combination of groups, and not just for commodities in groups I and J, the system of equations must be estiamted as a whole.

heteroscedasticity. Furthermore, the equations are nonlinear in the parameters to be estimated. We begin the discussion by describing the scheme used to estimate these nonlinear equations, follow with an explanation of how we estimate the large number of parameters, and conclude with the discussion on the procedure used to correct for heteroscedasticity.

The scheme used to estimate our nonlinear equations involves the iterative estimation of linearlized versions of the equations. For purposes of illustrating this technique, suppose we have the following general nonlinear equation:

$$y_i = F(x_i, B) + U_i \tag{4.17}$$

where y_i and x_i are, respectively, the observations on the dependent variable and the vector of independent variables in the i^{th} period; u_i is the disturbance term in the i^{th} period; and B is the vector of parameters to be estimated.

We select estimates of B so as to minimize the following expression:

$$\sum_{i=1}^{N} (y_i - F(x_i, B))^2 \tag{4.18}$$

The Gauss-Newton method is used to iteratively estimate the value of B by performing ordinary least squares regressions.[1] Consider the linear terms of the Taylor series expansion of F( ) around B_0, an estimate of B. We have

$$F(x_i, B) = F(x_i, B_0) + F'(x_i, B_0)(B - B_0)$$

$$= F(x_i, B_0) - F'(x_i, B_0) B_0 + F'(x_i, B_0) B \qquad (4.19)$$

where $F'(x_i, B_0)$ is the vector of first derivatives of F( ) with respect to B, evaluated at B_0. If we substitute this last expression into 4.18 we get

$$\sum_{i=1}^{N} \left(\left[y_i - F(x_i, B_0) + F'(x_i, B_0) B_0\right] - F'(x_i, B_0)B\right)^2 \qquad (4.20)$$

The expression within the brackets contains no unknown parameters. Likewise, $F'(x_i, B_0)$ is a vector which can be calculated for a given value of B_o. It follows that the value of B which minimizes expression (4.19) is the same as that which results from performing an ordinary least squares regression of the expression in brackets on $F'(x, B_0)$. That is:

$$y_i - F(x_i, B_0) + F'(x_i, B_0) = F(x_i, B_0)B \qquad (4.21)$$

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1 Our description of the Gauss Newton method is a slight variant of the presentation found in Maddala, Econometrics, pp. 174-175. McGraw-Hill Company, New York, 1977.

The estimate of B obtained from this regression is used to re-linearize equation (4.17). Another regression is then performed to obtain a second estimate of B. This iterative procedure continues until no further reductions are made in the sum of squared errors. Because our consumption functions are nearly linear, convergence is achieved within five or six iterations.

Having reduced our nonlinear estimation problem to one of iteratively estimating a large linear equation, we are faced with the problem of storing and inverting a 400 by 400 cross-product (X'X) matrix. While it might be possible to store the matrix using conventional FORTRAN data structures, the errors that would accumulate when inverting a matrix this large would impede such an attempt. We are able to circumvent this problem because our cross-product (X'X) matrix can be constructed in such a way that it is nearly block diagonal. This allows us to separate out the block diagonal portion of the matrix and to form the inverse from the partitioned matrix. Since the inverse of the block diagonal portion of the matrix can be found by inverting each of the blocks separately, we avoid the need to store and invert a single large matrix. (A detailed description of this procedure has been relegated to the appendix of this chapter.)

We face one final difficulty in the estimation of our system of equations, namely, the heteroscedasticity that results from grouping equations into a single estimation. Since the level of consumption for the different items in the system vary greatly, we can expect that the variances of the error terms will also vary, thereby violating the assumption of homoscedasticity. We correct for this heteroscedasticity by dividing the data for each consumption item by an estimate of the standard deviation of the error term in the equation for that item prior to estimation. The estimates of these standard deviations are obtained by performing separate regressions of a linear version of the consumption function for each of the 76 commodities.[1]

B. Data

We estimate equation (4.16) for the period 1959 through 1979 using annual data from the Personal Consumption Expenditure (PCE) component of the National Income and Product Accounts. The PCE accounts present annual U.S. consumption expenditures in current and in constant 1972 dollars. The constant 1972 dollar PCE is the source for q_{it} our dependent variable. The data on the price indices (P_i) are obtained by taking the ratio of current dollar PCE to constant 1972 dollar PCE.

The variables C^*_{it} and WP_{it} are taken from the cross-section equation whose sector definition most closely matches that of the time-series sector. Table 4.3 lists the 77 time-series sectors and the corresponding cross-section sectors. Some of the 50 cross-section sectors are used in multiple time-series equations and some of the time-series sectors have no corresponding sector from the cross-section. For those unmatched sectors, the C^*_{it} and WP_{it} variables are replaced by a single average per capita income term and an unweighted population total.

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1 The complexity of the equation precludes any consideration of contemporaneous correlations between the errors of the different equations.

TABLE 4.2

The Correspondence Between the Cross-Section and Time Series Sectors

Time Series		Cross-Section	
1	New Cars and Trucks	34	Automobiles
2	Net Purchases of Used Cars	35	Used Automobiles
3	Tires and Tubes	36	Tires, Tubes & Accessories
4	Accessories and Parts (Auto)	36	Tires, Tubes & Accessories
5	Furniture, Mattresses, & Bedsprings	15	Furniture
6	Kitchen and Other Household Applicances	16	Appliances
7	China, Glassware, Tableware & Utensils	17	China, Glassware, & Tableware
8	Radio, TV, Records, & Musical Instruments	44	TV, Radio, & Musical Instruments
9	Floor Coverings	18	Other Durable Housefurnishings
10	Durable Housefurnishings NEC	18	Other Durable Housefurnishings
11	Writing Equipment	*	
12	Hand Tools	*	
13	Jewelry	10	Jewelry, Watches, & Luggage
14	Opthalmic & Orthopedic Appliances	30	Dental and Eye Care
15	Books and Maps	47	Books, Magazines, and Newspapers
16	Wheel Goods and Durable Toys	46	Bikes, Sport Goods, and Toys
17	Boats, Recreational Vehicle, & Aircraft	48	Campers, RV's, and Boats
18	Food, Off Premise	1	Food, Off Premise
19	Food, On Premise	2	Food, On Premise
20	Alcohol, Off Premise	3	Alcohol, Off Premise
21	Alcohol, On Premise	4	Alcohol, On Premise
22	Shoes and Footware	6	Shoes and Shoe Repair
23	Womens Clothing	7	Womens & Childrens Clothing
24	Mens Clothing	8	Mens and Boys Clothing
25	Luggage	10	Jewelry, Watches, & Luggage
26	Gasoline and Oil	38	Gasoline and Oil
27	Fuel Oil and Coal	25	Fuel Oil and Coal
28	Tobacco	5	Tobacco Products
29	Semidurable Housefurnishings	19	Semidurable Housefurnishings
30	Drug Preparations and Sundries	*	
31	Toilet Articles and Preparations	*	
32	Stationery and Writing Supplies	*	
33	Nondurable Toys and Sport Supplies	*	
34	Flowers, Seeds, and Potted Plants	*	
35	Cleaning Preparations	*	
36	Lighting Supplies	*	
37	Household Paper Products	*	
38	Magazines and Newspapers	47	Books, Magazines, & Newspapers
39	Other Nondurables -- Identity	*	
40	Owner Occupied Space Rent	12	Owner Occupied Housing
41	Tenant Occupied Space Rent	13	Tenant Occupied Rent
42	Hotels and Motels	14	Hotels and Motels
43	Other Housing -- Educational Housing	14	Hotels and Motels

TABLE 4.2

The Correspondence Between the Cross-Section and Time Series Sectors (Cont'd)

Time-Series		Cross-Section	
44	Electricity	24	Electricity
45	Natural Gas	23	Gas Utilities
46	Water and Other Sanitary Services	26	Water and Sanitary Services
47	Telephone and Telegraph	20	Telephone and Telegraph
48	Domestic Services	21	Domestic Services
49	Household Insurance	22	Other House Operation
50	Other Household Operations	22	Other House Operation
51	Postage	22	Other House Operation
52	Auto Repair	37	Repair, Rent, Storage, and Tolls
53	Bridge, Tolls, Etc.	37	Repair, Rent, Storage, and Tolls
54	Auto Insurance	39	Automobile Insurance
55	Taxicabs	40	Local Public Transport
56	Local Public Transport	40	Local Public Transport
57	Intercity Railroad	41	Intercity Transport
58	Intercity Buses	41	Intercity Transport
59	Airlines	41	Intercity Transport
60	Travel Agents & Other Trans. Services	41	Intercity Transport
61	Cleaning, Laundering, & Shoe Repair	9	Cleaning, Laundry, and Repair
62	Barbershops and Beauty Shops	11	Personal Care
63	Physicians	38	Physicians Services
64	Dentists & Other Professional Services	30	Dental and Eye Care
65	Private Hospitals & Sanitariums	29	Hospitals
66	Health Insurance	27	Medical Insurance
67	Brokerage and Investment Counseling	33	Other Personal Business
68	Bank Service Charges & Services w/o Pay	33	Other Personal Business
69	Life Insurance	32	Life Insurance
70	Legal Services	33	Other Personal Business
71	Funeral Expen. & Other Personal Business	33	Other Personal Business
72	Radio and Television Repair	45	Repair & Rental of Rec. Equipment
73	Movies, and Legitimate Theatre, Spectator Sports	43	Admissions and Membership
74	Other Recreational Services	43	Admissions and Membership
75	Education	49	Education (Tuition)
76	Religious and Welfare Services	50	Contributions to Charity
77	Foreign Travel	42	Foreign Travel

* Indicates no corresponding cross-section sector.

We end our discussion on the data with a comment on the grouping scheme used to estimate equation (4.16). We recognize that our definitions of groups and subgroups, like the actual data, influences the parameter estimates. For the most part, the 77 commodities were formed into ten economically relevant groups and 27 subgroups on an a priori basis. (Some experimentation has been done with forming groups comprised of a single item but this led to systems with very erratic forecasting properties.) Our grouping scheme is presented in Table (4.4) of the results section.

III. RESULTS

The estmation of equation 4.16 represents the culmination of a study which involves a complete cross-section analysis, an intricate transition to the time-series, and the formulation of an elaborate scheme of price interactions. The results from this process are presented in three tables. Price and income elasticies are given in Table 4.3 and Table 4.4 and the parameter estimates of the non-price variables as well as the summary information on the estimation are contained in Table 4.5. In general, these results are very gratifying. The equations, unique in their incorporation of demographic factors, all fit well and, more importantly, the price and income elasticities generally make intuitive sense.

A. Table 4.3 - Price Elasticities

Table 4.3 presents the estimates of the income compensated own and cross price elasticities for each of our 77 commodities. The commodities are arranged in groups and are discussed on this group basis. Each item within a group is identified by its equation number

(EQ#), subgroup (SUBGRP), and title. The item's income elasticity (YELAS)[1], own price elasticity (OWN), and cross price elasticities (SG#1, SG#2, etc.) follow. The cross price elasticities, designated by subgroup numbers, measure the effect of an increase in the price of the item on the consumption of the items in the designated subgroups. (The titles for these subgroups follow the listing of the items in the group.) The intergroup price effects are presented under the heading of GROUP PRICE ELASTICITIES and are found on the fourth page of the table.

GROUP 1: FOOD, ALCOHOL, AND TOBACCO

The estimates of the own and cross price elasticities for the commodities in the food, alcohol, and tobacco group provide a strong testimonial for our approach. All the estimated elasticities have signs and magnitudes that conform to intuitive expectations regarding the behavior of consumers towards the items in the group.

The own price elasticities which are all much less than one in

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1 Income elasticities are included in Table (4.4) for reference purposes only. The are presented for discussion in Table (4.4).

Table 4.3
Price Elasticities

GROUP 1: FOOD, ALCOHOL, AND TOBACCO

EQ #	SUBGRP	TITLE	SHARE	YELAS	OWN	SG #1	SG #2	SG #3
18	1	FOOD, OFF PREMISE	11.94	0.462	-0.390	-0.279	0.398	0.207
20	1	ALCOHOL, OFF PREMISE	1.59	0.823	-0.149	-0.037	0.053	0.028
19	2	FOOD, ON PREMISE	3.74	0.851	-0.532	0.125	-0.488	-0.084
21	2	ALCOHOL, ON PREMISE	1.00	0.539	-0.174	0.033	-0.131	-0.023
28	3	TOBACCO	1.48	0.331	-0.372	0.026	-0.033	0.000

SUBGROUP: 1 FOOD AND ALCOHOL, OFF PREMISE
2 FOOD AND ALCOHOL, ON PREMISE
3 TOBACCO

GROUP 2: CLOTHING, ACCESSORIES & PERSONAL CARE

EQ #	SUBGRP	TITLE	SHARE	YELAS	OWN	SG #1	SG #2	SG #3
23	1	WOMENS CLOTHING	4.63	1.223	-1.164	0.500	-0.002	0.213
24	1	MENS CLOTHING	2.30	1.320	-1.416	0.249	-0.001	0.106
22	2	SHOES AND FOOTWARE	1.21	1.217	-0.760	-0.000	-0.028	-0.033
25	2	LUGGAGE	0.13	2.473	-0.735	-0.000	-0.003	-0.004
13	2	JEWELRY	0.79	2.752	-0.750	-0.000	-0.019	-0.022
31	3	TOILET ARTICLES AND PREPARATIONS	0.93	0.977	-0.092	0.043	-0.026	-1.084
62	3	BARBERSHOPS AND BEAUTY SHOPS	0.36	0.717	0.573	0.017	-0.010	-0.420
61	3	CLEANING, LAUNDERING AND SHOE REPAIR	0.50	0.739	0.410	0.023	-0.014	-0.583

SUBGROUP: 1 CLOTHING
2 ACCESSORIES
3 PERSONAL CARE

GROUP 3: HOUSEHOLD DURABLES

EQ #	SUBGRP	TITLE	SHARE	YELAS	OWN	SG #1	SG #2
5	1	FURNITURE, MATTRESSES, AND BEDSPRINGS	1.40	1.987	-0.863	-0.334	0.024
6	1	KITCHEN AND OTHER HOUSEHOLD APPLIANCES	1.14	1.062	-0.801	-0.272	0.020
8	1	RADIO, TV, RECORDS, AND MUSICAL INSTRUME	2.06	1.282	-1.021	-0.492	0.036
7	2	CHINA, GLASSWARE, TABLEWARE, AND UTENSIL	0.53	1.305	-1.240	0.009	-0.102
9	2	FLOOR COVERINGS	0.73	2.240	-1.279	0.013	-0.141
10	2	DURABLE HOUSEFURNISHINGS NEC	0.63	2.016	-1.259	0.011	-0.122
29	2	SEMIDURABLE HOUSEFURNISHINGS	0.82	1.385	-1.296	0.014	-0.158

SUBGROUP: 1 MAJOR DURABLES
2 MINOR DURABLES

Table 4.3 (cont'd)
Price Elasticities

GROUP 4: HOUSEHOLD OPERATION

EQ #	SUBGRP	TITLE	SHARE	YELAS	OWN	SG #1	SG #2	SG #3
35	1	CLEANING PREPARATIONS	0.08	1.041	-0.974	-0.023	-0.020	0.007
36	1	LIGHTING SUPPLIES	0.59	0.386	-1.122	-0.171	-0.145	0.050
37	1	HOUSEHOLD PAPER PRODUCTS	0.28	1.143	-1.032	-0.081	-0.069	0.024
46	2	WATER AND OTHER SANITARY SERVICES	0.44	0.501	-0.426	-0.108	-0.041	-0.109
48	2	DOMESTIC SERVICES	0.44	1.417	-0.426	-0.108	-0.041	-0.109
49	2	HOUSEHOLD INSURANCE	0.13	1.340	-0.398	-0.032	-0.012	-0.032
50	2	OTHER HOUSEHOLD OPERATIONS -- REPAIR	0.44	1.164	-0.426	-0.108	-0.041	-0.109
72	2	RADIO AND TELEVISION REPAIR	0.17	0.661	-0.401	-0.042	-0.016	-0.042
51	3	POSTAGE	0.21	0.845	-1.057	0.018	-0.052	-0.002
47	3	TELEPHONE AND TELEGRAPH	2.36	0.668	-1.081	0.202	-0.584	-0.026

SUBGROUP: 1 CLEANING AND PAPER PRODUCTS
2 SERVICES AND INSURANCE
3 COMMUNICATION

GROUP 5: HOUSING & HOUSEHOLD UTILITES

EQ #	SUBGRP	TITLE	SHARE	YELAS	OWN	SG #1	SG #2
40	1	OWNER OCCUPIED SPACE RENT	12.26	1.084	1.489	-4.726	0.006
41	1	TENANT OCCUPIED SPACE RENT	4.49	0.010	4.484	-1.731	0.002
44	2	ELECTRICITY	1.87	0.472	-0.464	0.001	0.312
45	2	NATURAL GAS	0.73	0.289	-0.654	0.000	0.122
27	2	FUEL OIL AND COAL	0.56	0.166	-0.682	0.000	0.093

SUBGROUP: 1 HOUSING
2 HOUSEHOLD UTILITES

GROUP 6: MEDICAL SERVICES

EQ #	SUBGRP	TITLE	SHARE	YELAS	OWN	SG #1	SG #2
63	1	PHYSICIANS	2.09	1.015	-0.330	0.028	-0.174
64	1	DENTISTS AND OTHER PROFESSIONAL SERVICES	1.27	1.234	-0.341	0.017	-0.106
65	1	PRIVATE HOSPITALS AND SANITARIUMS	3.32	0.753	-0.314	0.044	-0.277
66	1	HEALTH INSURANCE	0.83	0.495	-0.347	0.011	-0.069
14	2	OPHTHALMIC AND ORTHOPEDIC APPLIANCES	0.18	0.905	-2.572	-0.015	0.491
30	2	DRUG PREPARATIONS AND SUNDRIES	1.04	0.968	-0.228	-0.087	2.835

SUBGROUP: 1 PHYSICIANS AND HOSPITALS
2 DRUGS AND EQUIPMENT

Table 4.3 (cont'd)
Price Elasticities

GROUP 7: PERSONAL BUSINESS SERVICES

EQ #	SUBGRP	TITLE	SHARE	YELAS	OWN	SG #1	SG #2
67	1	BROKERAGE AND INVESTMENT COUNSELING	0.82	1.666	-0.354	0.012	0.039
68	1	BANK SERVICE CHARGES AND SERVICES W/O PA	2.37	0.963	-0.331	0.035	0.111
69	2	LIFE INSURANCE	0.88	0.973	-0.396	0.041	0.023
70	2	LEGAL SERVICES	0.81	0.976	-0.398	0.038	0.021
71	2	FUNERAL EXPENCES AND OTHER PERSONAL BUSI	0.69	1.109	-0.401	0.032	0.018

SUBGROUP: 1 BANKING SERVICES
2 OTHER PERSONAL BUSINESS

GROUP 8: TRANSPORTION

EQ #	SUBGRP	TITLE	SHARE	YELAS	OWN	SG #1	SG #2	SG #3	SG #4
1	1	NEW CARS & TRUCKS	4.40	2.102	0.133	0.694	-0.576	-0.145	-0.310
2	1	NET PURCHASES OF USED CARS	0.95	1.212	-0.411	0.150	-0.124	-0.031	-0.067
3	2	TIRES AND TUBES	0.69	0.808	-0.012	-0.090	0.019	0.070	0.041
4	2	ACCESSORIES AND PARTS (AUTO)	0.23	0.711	-0.024	-0.030	0.006	0.023	0.014
52	2	AUTO REPAIR	2.05	1.000	0.025	-0.268	0.056	0.208	0.122
54	2	AUTO INSURANCE	0.70	0.800	-0.011	-0.092	0.019	0.071	0.042
53	2	BRIDGE, TOLLS, ETC	0.10	0.964	-0.028	-0.013	0.003	0.010	0.006
55	3	TAXICABS	0.09	0.209	-0.960	-0.003	0.009	0.051	0.006
56	3	LOCAL PUBLIC TRANSPORT	0.24	0.289	-0.875	-0.008	0.024	0.136	0.016
26	4	GASOLINE AND OIL	2.89	0.555	-0.293	-0.204	0.172	0.197	0.000

SUBGROUP: 1 DURABLE PURCHASES
2 MAINTENCE EXPENCES EXP. GASOLINE
3 PUBLIC TRANSPORTION
4 GASOLINE

GROUP 9: RECREATION AND TRAVEL

EQ #	SUBGRP	TITLE	SHARE	YELAS	OWN	SG #1	SG #2	SG #3	SG #4
73	1	MOVIES, LEGITIMATE THEATRE, SPECTATOR SP	0.71	2.092	-0.238	-1.174	0.133	0.150	-0.229
74	1	OTHER RECREATIONAL SERVICES	1.16	0.862	-0.982	-1.919	0.218	0.245	-0.374
17	2	BOATS, RECREATIONAL VECH., AND AIRCRAFT	0.21	2.726	-1.937	0.039	-0.001	-0.010	-0.012
16	2	WHEEL GOODS AND DURABLE TOYS	1.16	1.655	-1.943	0.218	-0.008	-0.055	-0.069
33	2	NONDURABLE TOYS AND SPORT SUPPLIES	1.11	0.686	-1.943	0.208	-0.008	-0.053	-0.066
34	2	FLOWERS, SEEDS, AND POTTED PLANTS	0.40	1.132	-1.938	0.075	-0.003	-0.019	-0.024
12	2	HAND TOOLS	0.21	0.867	-1.937	0.039	-0.001	-0.010	-0.012
57	3	INTERCITY RAILROAD	0.02	2.466	-1.640	0.004	-0.001	-0.010	-0.001
58	3	INTERCITY BUSES	0.05	0.864	-1.655	0.011	-0.002	-0.026	-0.002
59	3	AIRLINES	0.42	1.786	-1.847	0.089	-0.020	-0.218	-0.019
60	4	TRAVEL AGENTS AND OTHER TRANSPORTATION S	0.02	1.095	-0.635	-0.006	-0.001	-0.001	-0.008
77	4	FOREIGN TRAVEL	0.20	0.817	-0.706	-0.064	-0.012	-0.009	-0.080
42	4	HOTELS AND MOTELS	0.34	1.280	-0.762	-0.110	-0.020	-0.015	-0.135

SUBGROUP: 1 ADMISSIONS
2 RECREATIONAL NONDURABLES AND DUR
3 TRAVEL EXPENCES
4 HOTELS ETC.

Table 4.3 (cont'd)
Price Elasticities

GROUP 10: READING AND EDUCATION

EQ #	SUBGRP	TITLE	SHARE	YELAS	OWN	SG #1	SG #2
15	1	BOOKS AND MAPS	0.45	0.884	-0.597	-0.170	0.076
38	1	MAGAZINES AND NEWSPAPERS	0.67	0.710	-0.680	-0.253	0.113
11	1	WRITING EQUIPMENT	0.14	0.078	-0.480	-0.053	0.024
32	1	STATIONERY AND WRITING SUPPLIES	0.31	0.990	-0.544	-0.117	0.052
75	2	EDUCATION	1.42	1.141	-0.410	0.239	-0.446
76	2	RELIGIOUS AND WELFARE SERVICES	1.15	0.977	-0.325	0.193	-0.361
43	2	OTHER HOUSING -- EDUCATIONAL HOUSING	0.17	0.968	-0.017	0.029	-0.053

SUBGROUP: 1 READING
2 EDUCATION AND RELIGIOUS

GROUP PRICE ELASTICITIES

	GROUP										
1	FOOD, ALCOHOL, & TOBACCO	0.000	0.002	0.014	0.009	0.002	0.001	-0.006	-0.004	0.008	-0.003
2	CLOTHIHG, ACCESSORIES, & CARE	0.006	0.000	0.096	-0.007	0.031	-0.014	0.002	-0.023	0.018	0.018
3	HOUSEHOLD DURABLES	0.051	0.125	0.000	0.032	-0.063	-0.078	-0.059	-0.024	0.045	0.105
4	HOUSEHOLD OPERATION	0.069	-0.020	0.065	0.000	0.012	0.029	0.004	0.016	0.048	-0.039
5	HOUSING & HOUSEHOLD UTILITIES	0.002	0.011	-0.017	0.002	0.000	0.026	-0.030	0.022	-0.005	0.012
6	MEDICAL SERVICES	0.004	-0.013	-0.056	0.010	0.072	0.000	0.039	0.014	0.004	-0.002
7	PERSONAL BUSINESS SERVICES	-0.020	0.002	-0.055	0.002	-0.108	0.051	0.000	0.013	0.024	0.064
8	TRANSPORTATION	-0.013	-0.026	-0.020	0.007	0.070	0.016	0.011	0.000	0.021	-0.002
9	RECREATION AND TRAVEL	0.072	0.052	0.102	0.053	-0.042	0.013	0.058	0.057	0.000	-0.154
10	READING AND EDUCATION	-0.017	0.040	0.179	-0.033	0.078	-0.004	0.116	-0.004	-0.116	0.000
	GROUP:	1	2	3	4	5	6	7	8	9	10

absolute value indicate that food, alcohol, and tobacco are price inelastic commodities. They also show that on premise consumption of food or alcohol is more price sensitive than the consumption of the same items at home. Curiously, alcohol is less price sensitive than food, both for on and off premise consumption.

The negative cross price elasticities within the on premise and the off premise subgroups indicate that food and alcohol are complementary items. (Goods are complements when an increase in the price of one decreases the consumption of both.) This complementarity is stronger when the items are consumed in restaurants and bars rather than at home. As expected, the consumption of food or alcohol on premise is a substitute for the consumption of either good off premise.

Finally, tobacco with an own price elasticity of -.372 is shown to be quite price inelastic. It substitutes with "grocery" purchases (SG#1 = .026) while complementing bar and restaurant consumption (SG#2 = -.033).

GROUP 2: CLOTHING, ACCESSORIES, AND PERSONAL CARE

The own price elasticities for men's clothing (-1.416) and for women's clothing (-1.164) indicate that both are price elastic items. The cross price elasticities show a fairly strong substitution between the two items.

The own and cross price elasticities for the accessories subgroup do not conform to a priori expectations. One would expect the items in this subgroup to be price sensitive but the own price elasticities for accessories are all less than 1.0 in absolute value. There is little price interaction between the items in this subgroup and there is virtually no complementary or substitutability between the accessories and the clothing subgroups.

The near zero and the positive own price elasticities for the personal care subgroup are suspicious results since they contradict the conventional notion of a downward sloping demand curve.

GROUP 3: HOUSEHOLD DURABLES

With the exception of radio and television, the items in the major durables subgroup are price inelastic. (Radio and television's larger price elasticity may reflect the fact that they are substitutable with various entertainment activities.) The minor durables, in contrast, are all price elastic having own price elasticites of about 1.25 in absolute value. The difference in price responsiveness between the minor and major durables may be attributed to the fact that the purchase of minor durables are more easily postponed.

The near zero values for the cross price elasticities between the major and the minor durables reveal very weak substitution between the two subgroups.

GROUP 4: HOUSEHOLD OPERATION

The elasticities for the varied items in the household operations subgroup do not lend themselves to any broad generalizations. (The same is true for GROUP 7: PERSONAL BUSINESS SERVICES and for GROUP 10: READING AND EDUCATION.)

GROUP 5: HOUSING AND HOUSEHOLD UTILITIES

Our estimates of the own price elasticities for owner and for tenant occupied space rent are positive and large. However, these perverse results are not likely caused by the specific formulation of our system since a single linear equation for the demand for owner occupied housing also produces a positive price elasticity if the equation contains the price of renting.

The perverse own price elasticities affect the interpretation of the cross price elasticities. The negative effect of a change in the price of owner occupied housing on the consumption of rental housing (or vice versa) does not imply that the two goods are compliments. Our estimates imply, rather, that the two goods are substitutes since an increase in the price of owner occupied housing results in an increase in its consumption (according to the positive own price elasticity) and consequently a decrease in the consumption of rental housing.

Fortunately, the own and cross price elasticities within the household utility subgroup are well behaved. The own price elasticities are all less than one in absolute value and the items are substitutes.

There is virtually no price interaction between the two subgroups.

GROUP 6: MEDICAL SERVICES

The own price elasticities for nearly all the medical service items are in the vicinity of -0.3 which supports the conventional wisdom that the demand for these items is price inelastic. Opthalmic and orthopedic appliances are a notable exception with a large own price elasticity of -2.57. The price sensitivity of this sector may be related to the fact that eyeglasses are one of the few medical products that most consumers pay for directly.

The signs of the cross price elasticities show that the two subgroups (Physicians - Hospitals and Drugs - Equipment) are complementary and that the items within each of the groups substitute with one another.

GROUP 8: TRANSPORTATION

New cars and trucks are another example of an item with a positive own price elasticity[1] albeit in this case the elasticity is very near zero. (This probably results from the poor deflator for new cars.) Fortunately, the other items in this group have reasonable own price elasticities. For example, gasoline has an own price elasticity of a modest -0.29. And the estimated cross price elasticities between gasoline and the items in the other subgroups conform to a priori expectations. An increase in the price of gasoline leads to a decrease in the purchases of new and used cars, increased expenditures on car maintenance (such as tune ups), and an increase in expenditures on public transportation.

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1 Of the 76 unconstrained estimates of own price elasticities presented in Table 4.4 only 6 have positive signs.

GROUP 9: RECREATION AND TRAVEL

Our expectations for great price sensitivity in the recreation and travel group are fulfilled by the high own price elasticities of the recreational nondurables - durables subgroup (approximately -1.94) and travel expenses subgroup (approximately -1.65). The own price elasticities for the hotel and the admissions subgroups are much lower. The elasticity results for movies, etc. within the admission subgroup are particularly puzzling. The own price elasticity of -0.238 indicates that movies are very price inelastic. Yet a one percent change in the price of the other items in the admissions subgroup leads to nearly a two percent decrease in the consumption of movies (SG#1 = -1.919).

GROUP PRICE ELASTICITIES

The group price elasticities presented at the end of Table 4.3 give the estimated inter-group cross price elasticities. Specifically, the $(i,j)^{th}$ entry in the table shows the effect on the i^{th} group of a one percent increase in the price of an item in the j^{th} group. (This effect is the average over all the items in the j^{th} group.)

The group cross price elasticities range in value from a negative 0.154 to a positive 0.125 indicating that groups can be either complements or substitutes for one another. The rather weak price interactions among the groups should not be surprising since the items that are close substitutes or complements hve been put into the same group.

B. Table 4.4 - Income Elasticities

Since our equation incorporates a nonlinear Engel curve, there is no single income elasticity for a commodity. Consumption is sensitive to changes in the distribution of income as well as to changes in average income. For this reason, we derive income elasticities under four varying assumptions concerning the nature of the shifts in the distribution of income brought about by a one percent change in average income. In Table 4.4 we present four sets of "income" elasticities, each of which is produced under a different assumption regarding the distributional effects of a change in average income.

The four cases are presented in decreasing order of the benefit they bestow upon the poor. In the first case, the increase in average income is obtained by increasing the income of only the poorest individuals in the population and in the fourth case the increase is obtained by giving the income to the richest individuals. In case two each individual is given the same dollar amount (one percent of average income) and in case three all incomes are increased by one percent. (For individuals whose income is below average income, case two is clearly preferred to case three.)

While all four assumptions increase average income by the same amount, our results show that the differential effects on individual consumption items can be quite striking. For example,[1] increasing the incomes of only the poorest segment of the population leads to an

1 Since the time series equations utilize the cross-section Engel curves with no modifications, we will not repeat the full discussion of these results presented in Chapter 2.

Table 4.4
Income Elasticities

INCOME ELASTICITIES

		CASE 1	CASE 2	CASE 3	CASE 4	SHARE
1	NEW CARS & TRUCKS	0.521	2.044	2.102	2.091	4.400
2	NET PURCHASES OF USED CARS	1.373	1.331	1.212	0.734	0.950
3	TIRES AND TUBES	1.830	0.864	0.808	0.683	0.690
4	ACCESSORIES AND PARTS (AUTO)	1.610	0.760	0.711	0.601	0.230
5	FURNITURE, MATTRESSES, AND BEDSPRINGS	0.777	1.711	1.987	2.848	1.400
6	KITCHEN AND OTHER HOUSEHOLD APPLIANCES	1.523	1.151	1.062	0.861	1.140
7	CHINA, GLASSWARE, TABLEWARE, AND UTENSIL	0.929	1.294	1.305	1.335	0.530
8	RADIO, TV, RECORDS, AND MUSICAL INSTRUME	1.177	1.278	1.282	1.328	2.060
9	FLOOR COVERINGS	0.581	2.008	2.240	2.904	0.730
10	DURABLE HOUSEFURNISHINGS NEC	0.523	1.807	2.016	2.613	0.630
11	WRITING EQUIPMENT	0.078	0.078	0.078	0.078	0.140
12	HAND TOOLS	0.867	0.867	0.867	0.867	0.210
13	JEWELRY	1.251	2.248	2.752	4.743	0.790
14	OPHTHALMIC AND ORTHOPEDIC APPLIANCES	0.956	1.004	0.905	0.545	0.180
15	BOOKS AND MAPS	1.483	0.928	0.884	0.705	0.450
16	WHEEL GOODS AND DURABLE TOYS	1.348	1.697	1.655	1.480	1.160
17	BOATS, RECREATIONAL VECH., AND AIRCRAFT	0.430	2.185	2.726	4.381	0.210
18	FOOD, OFF PREMISE	1.186	0.521	0.462	0.286	11.940
19	FOOD, ON PREMISE	0.763	0.832	0.851	0.892	3.740
20	ALCOHOL, OFF PREMISE	0.912	0.818	0.823	0.912	1.590
21	ALCOHOL, ON PREMISE	0.261	0.462	0.539	0.840	1.000
22	SHOES AND FOOTWARE	0.548	1.047	1.217	1.871	1.210
23	WOMENS CLOTHING	1.142	1.191	1.223	1.304	4.630
24	MENS CLOTHING	1.229	1.277	1.320	1.466	2.300
25	LUGGAGE	1.124	2.020	2.473	4.262	0.130
26	GASOLINE AND OIL	1.292	0.625	0.555	0.381	2.890
27	FUEL OIL AND COAL	0.631	0.166	0.166	0.170	0.560
28	TOBACCO	0.981	0.349	0.331	0.303	1.480
29	SEMIDURABLE HOUSEFURNISHINGS	0.410	1.169	1.385	2.192	0.820
30	DRUG PREPARATIONS AND SUNDRIES	0.968	0.968	0.968	0.968	1.040
31	TOILET ARTICLES AND PREPARATIONS	0.977	0.977	0.977	0.977	0.930
32	STATIONERY AND WRITING SUPPLIES	0.990	0.990	0.990	0.990	0.310
33	NONDURABLE TOYS AND SPORT SUPPLIES	0.686	0.686	0.686	0.686	1.110
34	FLOWERS, SEEDS, AND POTTED PLANTS	1.132	1.132	1.132	1.132	0.400
35	CLEANING PREPARATIONS	1.041	1.041	1.041	1.041	0.080
36	LIGHTING SUPPLIES	0.386	0.386	0.386	0.386	0.590
37	HOUSEHOLD PAPER PRODUCTS	1.144	1.143	1.143	1.144	0.280
38	MAGAZINES AND NEWSPAPERS	1.193	0.746	0.710	0.567	0.670
39	OTHER NONDURABLES -- IDENTITY	0.000	0.000	0.000	0.000	0.060
40	OWNER OCCUPIED SPACE RENT	1.317	1.199	1.084	0.784	12.260

Table 4.4 (cont'd)
Income Elasticities

INCOME ELASTICITIES

		CASE 1	CASE 2	CASE 3	CASE 4	SHARE
41	TENANT OCCUPIED SPACE RENT	-0.062	-0.064	0.010	0.234	4.490
42	HOTELS AND MOTELS	1.791	1.342	1.280	1.083	0.340
43	OTHER HOUSING -- EDUCATIONAL HOUSING	1.354	1.015	0.968	0.819	0.170
44	ELECTRICITY	1.381	0.511	0.472	0.393	1.870
45	NATURAL GAS	0.383	0.339	0.289	0.162	0.730
46	WATER AND OTHER SANITARY SERVICES	0.940	0.583	0.501	0.272	0.440
47	TELEPHONE AND TELEGRAPH	1.166	0.672	0.668	0.642	2.360
48	DOMESTIC SERVICES	0.301	1.246	1.417	1.911	0.440
49	HOUSEHOLD INSURANCE	1.204	1.314	1.340	1.499	0.130
50	OTHER HOUSEHOLD OPERATIONS -- REPAIR	1.046	1.141	1.164	1.302	0.440
51	POSTAGE	0.759	0.828	0.845	0.945	0.210
52	AUTO REPAIR	1.404	1.039	1.000	0.941	2.050
53	BRIDGE, TOLLS, ETC	1.353	1.001	0.964	0.906	0.100
54	AUTO INSURANCE	1.844	0.937	0.800	0.438	0.700
55	TAXICABS	-0.608	0.131	0.209	0.276	0.090
56	LOCAL PUBLIC TRANSPORT	-0.841	0.181	0.289	0.382	0.240
57	INTERCITY RAILROAD	-0.046	2.201	2.466	3.182	0.020
58	INTERCITY BUSES	-0.016	0.771	0.864	1.115	0.050
59	AIRLINES	-0.033	1.594	1.786	2.304	0.420
60	TRAVEL AGENTS AND OTHER TRANSPORTATION SERV	-0.020	0.977	1.095	1.413	0.020
61	CLEANING, LAUNDERING AND SHOE REPAIR	0.061	0.662	0.739	0.940	0.500
62	BARBERSHOPS AND BEAUTY SHOPS	1.059	0.773	0.717	0.520	0.360
63	PHYSICIANS	1.136	0.948	1.015	1.451	2.090
64	DENTISTS AND OTHER PROFESSIONAL SERVICES	1.304	1.370	1.234	0.743	1.270
65	PRIVATE HOSPITALS AND SANITARIUMS	0.763	0.718	0.753	1.383	3.320
66	HEALTH INSURANCE	1.402	0.586	0.495	0.244	0.830
67	BROKERAGE AND INVESTMENT COUNSELING	1.876	1.399	1.666	2.855	0.820
68	BANK SERVICE CHARGES AND SERVICES W/O PA	1.084	0.809	0.963	1.650	2.370
69	LIFE INSURANCE	1.104	0.932	0.973	1.161	0.880
70	LEGAL SERVICES	1.099	0.820	0.976	1.673	0.810
71	FUNERAL EXPENCES AND OTHER PERSONAL BUSI	1.249	0.931	1.109	1.900	0.690
72	RADIO AND TELEVISION REPAIR	1.579	0.724	0.661	0.567	0.170
73	MOVIES, LEGITIMATE THEATRE, SPECTATOR SPORT	0.858	1.626	2.092	4.031	0.710
74	OTHER RECREATIONAL SERVICES	0.354	0.670	0.862	1.661	1.160
75	EDUCATION	1.485	1.258	1.141	0.832	1.420
76	RELIGIOUS AND WELFARE SERVICES	1.030	0.910	0.977	1.259	1.150
77	FOREIGN TRAVEL	-0.019	0.682	0.817	1.182	0.200

increase of 1.186 percent in the consumption of food off premise (EQ18) but increasing the income of the rich leads to an increase of only .286 percent in its consumption. Not surprisingly, domestic services (EQ#48) shows a strikingly different consumption pattern. The consumption of domestic services increases by a mere .301 percent if the increase in income is given to the poor, however, it increases by 1.911 percent if the rich are the recipients of the increased income.

Consumption is invariant to shifts in the distribution of income for the equations without a corresponding cross-section Engel curve. Hand tools (EQ#12) are one example where a simple linear income term must be used instead of C^{*}_{it} . As a result, the income elasticity for hand tools is constant across the four cases. (The other sectors with constant income elasticities are 11 and 30 through 37.)

C. Table 4.5 - Estimates of the Non-Price Parameters

Table (4.5) contains estimates of the non-price parameters (a, b, c, d, and e) and such summary measures of fit as average absolute percentage error (AAPE) and R^2 from the estimation of the system of equations represented by equation (4.16). These results are presented for each equation on a group-by-group basis.

The nonprice parameters a and b warrant little discussion. The parameter a is our constant term, and as previously explained, the parameter b is constrained (except in those few equations for which there exists no cross-section results).

The parameter c on the ΔC^{*}_{it} term measures the equation's response to cyclical changes in the economy. The ΔC^{*}_{it} term is positive when incomes are rising and negative when incomes are falling. Therefore,

Table 4.5

Estimates Of Non-Price Parameters

GROUP 1: FOOD, ALCOHOL, AND TOBACCO

EQ	SG	TITLE	A	B	C	D	E	AAPE	RSQ	TIME %	SHARE
18	1	FOOD, OFF PREMISE	15.374	0.963	-0.269	-0.774		1.6%	0.884	-0.17%	11.9
20	1	ALCOHOL, OFF PREMISE	17.820	3.791	-3.040	-0.025		1.3%	0.978	-0.04%	1.6
19	2	FOOD, ON PREMISE	50.956	0.526	0.426	0.096		1.8%	0.942	0.06%	3.7
21	2	ALCOHOL, ON PREMISE	65.706	0.719	0.198	-0.151		2.7%	0.458	-0.19%	1.0
28	3	TOBACCO	33.058	0.932	0.082	-0.378		1.1%	0.593	-0.51%	1.5

OVERALL RESULTS. AAPE= 1.7%

GROUP 2: CLOTHING AND ACCESSORIES

EQ	SG	TITLE	A	B	C	D	E	AAPE	RSQ	TIME %	SHARE
23	1	WOMENS CLOTHING	-22.636	1.405	-0.390	0.015		1.5%	0.991	0.01%	4.6
24	1	MENS CLOTHING	-16.979	1.214	-0.364	0.202		1.2%	0.991	0.25%	2.3
22	2	SHOES AND FOOTWARE	-26.510	1.357	-0.388	0.049		1.7%	0.954	0.11%	1.2
25	2	LUGGAGE	-2.052	0.385	-0.230	0.040		3.2%	0.983	0.87%	0.1
13	2	JEWELRY	5.013	2.287	-0.904	-0.035		2.6%	0.992	-0.15%	0.8
31	3	TOILET ARTICLES AND PREPARATIO	-62.404	1.222	-0.657	0.811		3.0%	0.975	2.15%	0.9
62	3	BARBERSHOPS AND BEAUTY SHOPS	56.867	0.302	0.226	-0.681		5.5%	0.730	-3.08%	0.4
61	3	CLEANING, LAUNDERING AND SHOE	62.287	0.473	0.679	-0.744		3.6%	0.881	-2.62%	0.5

OVERALL RESULTS. AAPE= 2.8%

GROUP 3: HOUSEHOLD DURABLES

EQ	SG	TITLE	A	B	C	D	E	AAPE	RSQ	TIME %	SHARE
5	1	FURNITURE, MATTRESSES, AND BED	90.065	0.841	0.072	-1.227		2.8%	0.975	-2.47%	1.4
6	1	KITCHEN AND OTHER HOUSEHOLD AP	33.435	0.973	-0.173	-0.499		2.9%	0.982	-1.20%	1.1
8	1	RADIO, TV, RECORDS, AND MUSICA	-48.895	1.425	0.256	0.415		3.2%	0.997	0.84%	2.1
7	2	CHINA, GLASSWARE, TABLEWARE, A	-7.473	4.644	-0.425	0.141		2.9%	0.955	0.57%	0.5
9	2	FLOOR COVERINGS	0.332	0.883	-0.183	-0.000		4.5%	0.983	-0.01%	0.7
10	2	DURABLE HOUSEFURNISHINGS NEC	2.713	0.731	-0.219	0.011		1.8%	0.996	0.06%	0.6
29	2	SEMIDURABLE HOUSEFURNISHINGS	-20.526	1.494	-0.499	0.424		2.2%	0.990	0.98%	0.8

OVERALL RESULTS. AAPE= 2.9%

Table 4.5 (cont'd)

Estimates of Non-Price Parameters

GROUP 4: HOUSEHOLD OPERATION

EQ	SG	TITLE	A	B	C	D	E	AAPE	RSQ	TIME %	SHARE
35	1	CLEANING PREPARATIONS	-4.376	0.138	-0.053	0.053		1.8%	0.989	1.26%	0.1
36	1	LIGHTING SUPPLIES	-42.214	0.332	-0.085	0.816		0.7%	0.999	2.94%	0.6
37	1	HOUSEHOLD PAPER PRODUCTS	-17.427	0.582	-0.347	0.185		2.1%	0.977	1.22%	0.3
46	2	WATER AND OTHER SANITARY SERVI	-9.086	0.585	0.177	0.166		3.8%	0.901	0.89%	0.4
48	2	DOMESTIC SERVICES	51.988	0.315	0.249	-0.619		3.5%	0.914	-3.95%	0.4
49	2	HOUSEHOLD INSURANCE	-5.106	0.137	0.240	0.049		7.4%	0.949	1.40%	0.1
50	2	OTHER HOUSEHOLD OPERATIONS --	0.522	0.464	-0.039	-0.021		3.4%	0.940	-0.13%	0.4
72	2	RADIO AND TELEVISION REPAIR	2.991	0.578	0.809	-0.051		2.4%	0.977	-0.87%	0.2
51	3	POSTAGE	-9.984	0.202	0.199	0.156		2.1%	0.924	1.79%	0.2
47	3	TELEPHONE AND TELEGRAPH	-94.621	1.045	0.161	0.922		2.5%	0.995	1.54%	2.4

OVERALL RESULTS. AAPE= 3.0%

GROUP 5: HOUSING & HOUSEHOLD UTILITIES

EQ	SG	TITLE	A	B	C	D	E	AAPE	RSQ	TIME %	SHARE
40	1	OWNER OCCUPIED SPACE RENT	-181.516	0.915	-0.397	-2.301	271.532	1.5%	0.996	-0.60%	12.3
41	1	TENANT OCCUPIED SPACE RENT	-251.236	0.501	-0.191	3.764	-31.521	0.7%	0.999	2.35%	4.5
44	2	ELECTRICITY	-80.370	0.896	0.040	0.929	2.202	2.3%	0.993	1.59%	1.9
45	2	NATURAL GAS	-12.339	0.602	0.787	0.235	-1.706	2.7%	0.915	0.76%	0.7
27	2	FUEL OIL AND COAL	-2.138	0.994	3.214	0.136	2.689	3.2%	0.707	0.42%	0.6

OVERALL RESULTS. AAPE= 2.1%

GROUP 6: MEDICAL SERVICES

EQ	SG	TITLE	A	B	C	D	E	AAPE	RSQ	TIME %	SHARE
63	1	PHYSICIANS	10.957	1.802	-0.116	-0.069		2.7%	0.966	-0.11%	2.1
64	1	DENTISTS AND OTHER PROFESSIONA	32.032	1.287	0.928	-0.482		5.8%	0.887	-1.39%	1.3
65	1	PRIVATE HOSPITALS AND SANITARI	-136.591	7.350	0.604	1.823		3.1%	0.982	1.73%	3.3
66	1	HEALTH INSURANCE	-13.531	0.349	0.021	0.156		2.1%	0.978	0.52%	0.8
14	2	OPHTHALMIC AND ORTHOPEDIC APPL	-12.287	0.187	0.049	0.175		4.8%	0.595	2.98%	0.2
30	2	DRUG PREPARATIONS AND SUNDRIES	-17.894	1.086	-1.126	0.256		2.6%	0.985	0.69%	1.0

OVERALL RESULTS. AAPE= 3.5%

GROUP 7: PERSONAL BUSINESS SERVICES

EQ	SG	TITLE	A	B	C	D	E	AAPE	RSQ	TIME %	SHARE
67	1	BROKERAGE AND INVESTMENT COUNS	51.531	3.686	4.076	-0.854		15.9%	0.447	-5.54%	0.8
68	1	BANK SERVICE CHARGES AND SERVI	14.640	10.116	-7.486	-0.221		1.4%	0.996	-0.29%	2.4
69	2	LIFE INSURANCE	60.243	0.301	-0.274	-0.659		3.3%	0.809	-1.69%	0.9
70	2	LEGAL SERVICES	22.759	3.388	-1.670	-0.307		2.6%	0.968	-1.22%	0.8
71	2	FUNERAL EXPENCES AND OTHER PER	32.389	3.070	-0.511	-0.639	1.536	1.9%	0.938	-2.73%	0.7

OVERALL RESULTS. AAPE= 5.0%

Table 4.5 (cont'd)

Estimates of Non-Price Parameters

GROUP 8: TRANSPORTATION

EQ	SG	TITLE	A	B	C	D	E	AAPE	RSQ	TIME %	SHARE
1	1	NEW CARS & TRUCKS	185.686	0.728	1.229	-1.194		5.8%	0.953	-0.55%	4.4
2	1	NET PURCHASES OF USED CARS	6.334	0.330	0.098	-0.207	0.075	8.9%	-1.920	-0.62%	1.0
3	2	TIRES AND TUBES	-18.460	0.757	-0.118	0.184		5.5%	0.964	0.87%	0.7
4	2	ACCESSORIES AND PARTS (AUTO)	8.169	0.228	0.244	-0.106		5.9%	0.690	-1.18%	0.2
52	2	AUTO REPAIR	16.905	0.911	0.065	-0.298		1.4%	0.994	-0.42%	2.1
54	2	AUTO INSURANCE	12.161	0.342	-0.267	-0.193		3.1%	0.940	-0.71%	0.7
53	2	BRIDGE, TOLLS, ETC	-1.240	0.046	0.026	0.013		3.4%	0.975	0.34%	0.1
55	3	TAXICABS	10.182	0.215	0.554	-0.131		3.0%	0.958	-3.40%	0.1
56	3	LOCAL PUBLIC TRANSPORT	28.167	0.589	0.090	-0.391		1.4%	0.996	-4.85%	0.2
26	4	GASOLINE AND OIL	-12.498	0.653	-0.623	0.401		1.8%	0.984	0.30%	2.9

OVERALL RESULTS. AAPE= 4.0%

GROUP 9: RECREATION AND TRAVEL

EQ	SG	TITLE	A	B	C	D	E	AAPE	RSQ	TIME %	SHARE
73	1	MOVIES, LEGITIMATE THEATRE, SP	2.344	0.654	-0.270	-0.001		2.3%	0.915	-0.05%	0.7
74	1	OTHER RECTIONAL SERVICES	-65.166	0.469	-0.379	1.162		1.8%	0.984	4.02%	1.2
17	2	BOATS, RECREATIONAL VECH., AND	-5.142	0.333	0.454	0.117		10.4%	0.948	1.46%	0.2
16	2	WHEEL GOODS AND DURABLE TOYS	-28.121	1.305	-0.710	0.243		3.7%	0.993	0.67%	1.2
33	2	NONDURABLE TOYS AND SPORT SUPP	-36.000	0.647	-0.259	0.615		1.6%	0.995	1.93%	1.1
34	2	FLOWERS, SEEDS, AND POTTED PLA	-23.802	0.472	0.009	0.272		2.2%	0.994	2.14%	0.4
12	2	HAND TOOLS	-7.883	0.154	0.033	0.112		3.6%	0.991	2.14%	0.2
57	3	INTERCITY RAILROAD	9.683	0.051	0.008	-0.125		17.6%	0.827	-11.85%	0.0
58	3	INTERCITY BUSES	-0.046	0.075	-0.101	0.030		5.8%	0.836	1.37%	0.0
59	3	AIRLINES	-17.511	1.029	-0.540	0.269		2.6%	0.993	1.66%	0.4
60	4	TRAVEL AGENTS AND OTHER TRANSP	-2.034	0.035	-0.089	0.035		15.4%	0.750	3.81%	0.0
77	4	FOREIGN TRAVEL	-17.398	0.220	-0.572	0.453		17.7%	0.236	1.80%	0.2
42	4	HOTELS AND MOTELS	-12.742	0.537	-0.187	0.197		2.8%	0.934	1.75%	0.3

OVERALL RESULTS. AAPE= 6.7%

GROUP 10: READING AND EDUCATION

EQ	SG	TITLE	A	B	C	D	E	AAPE	RSQ	TIME %	SHARE
15	1	BOOKS AND MAPS	-11.583	0.606	0.113	0.122		5.2%	0.867	0.83%	0.4
38	1	MAGAZINES AND NEWSPAPER	-20.232	0.889	-0.861	0.321		5.7%	0.733	1.17%	0.7
11	1	WRITING EQUIPMENT	-11.355	0.011	0.006	0.213		2.1%	0.995	4.87%	0.1
32	1	STATIONERY AND WRITING SUPPLIE	-4.965	0.323	0.178	0.063		3.6%	0.865	0.57%	0.3
75	2	EDUCATION	-16.711	0.957	-0.455	0.440		1.4%	0.983	0.90%	1.4
76	2	RELIGIOUS AND WELFARE SERVICES	-22.456	0.432	0.008	0.472		1.3%	0.969	1.02%	1.2
43	2	OTHER HOUSING -- EDUCATIONAL H	-10.597	0.235	-0.141	0.178		3.7%	0.951	2.80%	0.2

OVERALL RESULTS. AAPE= 3.3%

sectors with a positive value for the parameter c, such as New Cars (EQ#1) and Brokerage Services (EQ#67), move pro cyclically. These sectors experience a surge in consumer demand when the economy is expanding. In contrast, the negative value of the parameter c for a sector such a Alcohol, Off Premise (EQ#20) indicates that the demand for the item moves counter cyclically. The consumption of alcohol off premise increases with a downturn in the economy.

The parameter d is the coefficient of a simple time trend that is included in the equation to explain secular changes in demand which are not accounted for by changes in the income, price, and demographic variables. To facilitate the interpretation of the parameter d, we present it as a dimensionless measure in the "time %" column. This measure indicates the percent by which consumption would change if a year had passed and no other variables changed (measured at the year 1972).

The entries in the "time %" column are in general small; only 19 equations have time trends that would change consumption by more than two percent a year. The most notable exception is intercity railroads (EQ#57) with a value of 11.45 percent. (This equation's heavy relianced upon a time trend implies that changes in our economic and demographic variables cannot by themselves account for the decreased ridership of intercity railroads.) The time trend is less important in the equations which include the cross-section results than in the equations which do not. Only one out of five equations with cross-section variables have substantital time trends. In contrast, one out of two of the equations without the benefit of the cross-section variables have a heavy reliance on a time trend.[1]

The parameter e is the coefficient on the equation specific variables. An extra linear term has been included in seven of the 76 equations in the form of one of the following four variables:

(1) A proxy for the speculative demand for housing - This variable is formulated as the ratio of the current price of owner-occupied housing to a three year moving average of its price. This variable is included in the equations for owner occupied housing (EQ#40) and tenant occupied housing (EQ#41). As expected, it has a positive influence on owner occupied housing and an offsetting negative impact on rental housing.

(2) A dummy variable for natural gas supply constraints - The dummy variable is given a value of one during the period 1974 through 1976 and zero otherwise in the equations for natural gas (EQ#45), electricity (EQ#44), and fuel oil (EQ#46). It has a negative impact on natural gas consumption and a postive influence on its competing fuels.

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1 Of the 19 equations with time trends greater than 2 percent of consumption, 12 contain cross-section results and 5 do not. This means that significant time trends are found in 12 of the 66 equations with cross-section results and in 5 of the 10 equations without cross-section results.

(3) The mortality rate - To capture the negative impact in per person funeral expenses of increased longevity, the mortality rate is included in equation #71.

(4) A proxy for the potential stock of cars for the used car market - This variable is included in the equation for used cars (EQ#2) as a three year moving average of new car purchases lagged three years.

The summary statistics indicate that the estimated equations fit quite well. Of the 76 equations, 61 have AAPE's less than 5 percent and only 5 have AAPE's greater than 10 percent. The value of the R^2 for 57 of the equations exceeds 0.90, indeed, 45 of the equations have an R^2 greater than 0.95. The unweighted average of the group AAPE, which is presented below each group's listing, can be considered an overall measure of fit for the group. Its value ranges from 1.7 percent for Food, Alcohol, and Tobacco (Group #1), indicating a good fit, to a modest 6.7 percent for Recreation and Travel (Group #9).

CHAPTER 5

FORECASTS OF PERSONAL CONSUMPTION EXPENDITURES

Our final chapter contains forecasts of personal consumption expenditures made with the system of consumption functions developed in the previous three chapters. These forecasts are preceeded by a description of the projections of demographic and economic factors used in the forecasts. The chapter also includes a description of the linkages between our system of consumption equations and the LIFT model of the U.S. economy. For purposes of comparison, the forecasts are checked against recent data on consumption which was not used in the estimation of the equations and are contrasted with an alternative forecast made under the assumption that the age structure and other demographic characteristics of the population remain fixed at their 1979 values. The chapter ends with some concluding remarks and suggestions for further research.

I. THE FORECASTING PROCESS

Our consumption equations are an integral part of the LIFT model of the U.S. economy. Personal consumption expenditures make up 65 percent of total GNP and, as such, are an important determinant of the structure of the economy. Shifts in consumption patterns cause shifts in industry output, prices, employment, investment, and ultimately the level of income. Prices and income, on the other hand, are the driving factors of consumer behavior, and changes in these variables significantly affect consumption patterns. Consequently, there is a degree of simultaneity between consumption as projected by our equations and the determination of prices and income in the LIFT model.

We can best illustrate the linkages between our system of equations and the LIFT model as a whole by describing the steps necessary to make a forecast of consumption. At the beginning of each simulated year in a forecast, the consumption block of the model takes as data preliminary projections of average personal and disposable income, the unemployment and savings rates, and the share of transfer payments in the economy. Projections of the size distribution of income and ultimately of the distribution of total expenditures are obtained by employing this data and the techniques and equations developed in Chapter 3. The distribution of total expenditures, in turn, is combined with projections of the demographic variables to construct the C^*_{it} variables for each of the commodities. It is the C^*_{it} variables along with the projections of prices which are used to evaluate the system of consumption equations developed in Chapter 4. These equations provide projections of personal consumption expenditures on a per equivalent person basis for each of the 77 sectors of consumption. Finally, economy wide forecasts of detailed consumption expenditures are computed by multiplying each per equivalent person consumption expenditure by the appropriate weighted population size.[1] These projections represent only a first pass at a forecast because they are made with preliminary estimates of prices and income.

A final forecast of personal consumption expenditures is arrived at through an iterative process. The preliminary projections of consumption are combined with forecasts of the other components of final

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1 The weighted population sizes are calculated using the adult equivalency weights from Chapter 2 and Census forecasts of population growth.

demand to determine, in input-output fashion, industry output and employment---variables which in turn allow the model to estimate prices and income. Since the forecasts of prices and income differ from the values used to compute the initial estimates of consumption, the forecasting process begins again taking the new forecasts of prices and income as data. This iterative scheme for solving the model continues until convergence, defined in terms of industry output, is reached.

Our system of consumption functions does not guarantee that the sum of predicted consumption will match projected total expenditures at all price levels unless a "spreader" term is employed. The spreader technique, as explained in Chapter 4, insures consistency in the forecast by spreading any discrepancy between the sum of consumption and total expenditures among all the consumption items in relation to the magnitude of the slope of their Engel curve. Only a minor modification to the individual forecasts was necessary since the difference between the sum of our forecasts and total expenditures was small.[1]

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1 This difference was never greater than 0.78 percent of total expenditures and it averaged only .50 percent of total expenditures in the forecast period. It was on average 0.30 percent of total expenditures in the estimation period.

II. A FORECAST OF PERSONAL CONSUMPTION EXPENDITURES

A. Assumptions

The projections of economic and demographic variables used in the consumption forecasts are taken from several sources. The Bureau of the Census provides both the projections of population growth and the basic data used in our own linear trend extrapolations of the demographic composition variables.[1] The projections of the economic variables are obtained from the LIFT model's December 1982 forecasts.[2]

In Table 5.1 we present, for selected years, the projected values of the demographic variables, the population proportions by age group, disposable income, and the unemployment rate which underlie the forecast of consumption. (The values for 1960 and 1970 are included for reference.) A detailed listing of the structure of the price projections is excluded because of the large number of prices involved. The most significant feature of the price forecast is an increase, in real terms, in the price of petroleum and petroleum based products. Additional omissions from Table 5.1 include the share of transfer payments which is projected by the LIFT model to remain nearly constant at 13.5 percent and the savings rate which is assumed to be constant at its 1982 value. The assumption of a constant savings rate

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1 U.S. Bureau of the Census, Current Population Reports, series P-60, various reports.

2 Our consumption forecasts were made outside the LIFT model taking the final economic estimates as given rather than iteratively determining consumption and the economic variables simulataneously as discussed in the previous section. This was done to narrow the focus of the discussion to the properties of our consumption equations and not the model as a whole.

Table 5.1
List of Assumptions

	1960	1970	1980	1985	1990	1995
Per Capita Disposable Income(72$)	2709.00	3665.00	4471.75	5025.30	5500.13	5840.46
Unemployment Rate (%)	5.50	4.90	7.17	5.51	4.28	3.89
Demographic Variables (% of Total Population)						
Households resiging in:						
The Northeast Region	24.89	24.12	22.13	21.61	21.05	20.47
The North Central Region	28.73	27.81	26.53	26.00	25.47	24.93
The South	30.66	30.93	32.60	33.01	33.44	33.88
The West	15.72	17.15	18.73	19.36	20.03	20.71
Households with:						
College Educated Household Heads	10.33	13.10	17.83	19.54	21.31	23.11
Two Incomes	26.43	33.82	40.88	44.52	48.17	51.81
One Member	13.10	17.00	22.74	24.65	26.78	29.60
Two Members	27.80	28.80	30.91	31.49	32.12	32.78
Three or Four Members	36.50	33.10	32.44	30.75	29.18	27.69
Five or More Members	22.60	21.10	13.77	12.54	11.23	9.85
Heads Less than 35	24.32	25.30	30.81	32.44	34.17	35.95
Heads Between 35 and 55	41.59	38.10	32.96	36.92	37.47	37.95
Heads Greater than 55	34.08	36.50	36.26	36.92	37.47	37.95
Population by Age Group (% of Total Population)*						
Ages 0 to 5	11.23	8.37	7.23	8.10	8.01	7.45
Ages 6 to 15	19.78	19.88	15.23	14.07	14.66	15.48
Ages 16 to 20	7.44	9.43	9.26	7.72	6.87	6.68
Ages 21 to 30	12.22	15.08	17.89	17.60	15.62	13.57
Ages 31 to 40	13.57	11.09	14.06	15.67	16.48	16.35
Ages 41 to 50	12.51	11.78	10.21	10.99	12.80	14.36
Ages 51 to 65	14.00	14.56	14.85	14.08	13.26	13.64
Ages 66 and over	9.23	9.80	11.26	11.76	12.29	12.46

* Assumes a lifetime fertility of 2.1 children per woman.

facilities comparisons between the growth of income and the growth in consumption of specific items.

The following table contains additional detail on the unemployment rate and disposable income that highlights the short term assumptions underlying the forecasts:

	1981	1982	1983	1984
Per Capita Disposable Income in 1972 Dollars	4537.75	4547.25	4776.78	4943.51
Growth in Per Capita Income (%)	1.48	0.21	5.05	3.49
Unemployment Rate (%)	7.62	9.20	8.42	6.16

These figures indicate that our forecasts of consumption are based on optimistic projections of an economic upturn during 1983 and 1984.

B. Forecasts to 1995

Table 5.2 contains our forecasts of personal consumption expenditures, in constant 1972 dollars, from the year 1979 through the year 1995. These forecasts are the unadulterated output of the estimated equations and do not reflect any ex post constant term adjustments. As such, the forecasts look reasonable with the exception of Intercity Railroad (EQ#57) where negative consumption is projected for the latter years of the forecast. (It is this equation's very large time trend which is responsible for the negative forecasts of consumption.) This is one instance where modification to the forecast or a reformulation of the equation is appropriate and necessary.

The growth rates of the forecast presented in Table 5.3 give the percentage rate of change in consumption (on an annual basis) for the

Table 5.2

Forecasts of Consumption
(Millions of 1972 Dollars)

		1979	1981	1982	1983	1984	1985	1988	1990	1993	1995
1	NEW CARS & TRUCKS	43199	40447	39174	44478	49373	48334	54569	59811	61982	64525
2	NET PURCHASES OF USED CARS	8041	7704	7698	8106	8572	8744	9355	9999	10207	10398
3	TIRES AND TUBES	6206	6746	6863	7111	7403	7605	8310	8828	9421	9819
4	ACCESSORIES AND PARTS (AUTO)	2102	2198	2162	2256	2326	2305	2401	2469	2488	2514
5	FURNITURE, MATTRESSES, AND BED	12371	11574	11540	11875	12493	12705	13621	14373	15138	15590
6	KITCHEN AND OTHER HOUSEHOLD AP	10086	9538	9463	9606	9978	10174	10575	10902	11192	11339
7	CHINA, GLASSWARE, TABLEWARE, A	4510	4383	4448	4599	4809	4951	5340	5591	5998	6286
8	RADIO, TV, RECORDS, AND MUSICA	18898	18353	18367	19039	20076	20594	22659	24174	26140	27536
9	FLOOR COVERINGS	6425	6393	6613	6992	7545	7970	9105	10097	11144	11771
10	DURABLE HOUSEFURNISHINGS NEC	5724	5636	5806	6078	6497	6826	7670	8338	9173	9664
11	WRITING EQUIPMENT	1382	1484	1546	1638	1720	1806	2068	2221	2452	2607
12	HAND TOOLS	1874	1877	1888	1961	2035	2060	2183	2257	2451	2584
13	JEWELRY	7315	7155	7433	7869	8510	9052	10548	11900	13398	14315
14	OPHTHALMIC AND ORTHOPEDIC APPL	1827	2162	2213	2375	2538	2632	3089	3501	3848	4082
15	BOOKS AND MAPS	3783	3871	3923	4146	4381	4538	5005	5302	5635	5870
16	WHEEL GOODS AND DURABLE TOYS	10230	10048	10159	10442	10920	11288	12124	12936	14015	14682
17	BOATS, RECREATIONAL VECH., AND	2155	2052	2030	2229	2420	2367	2691	2945	3285	3574
18	FOOD, OFF PREMISE	107954	108394	109324	111286	114077	116243	122028	126831	132217	135519
19	FOOD, ON PREMISE	34246	35055	35182	36819	38498	38906	41854	44291	46657	48393
20	ALCOHOL, OFF PREMISE	14867	15098	15442	15720	16265	16874	18095	19158	20452	21213
21	ALCOHOL, ON PREMISE	9510	9913	10088	10386	10716	10903	11527	12015	12511	12799
22	SHOES AND FOOTWARE	11080	11194	11399	11742	12228	12589	13662	14701	15916	16690
23	WOMENS CLOTHING	42852	43744	44782	46448	48743	50517	55358	59879	64190	66993
24	MENS CLOTHING	21550	22059	22585	23427	24603	25481	27907	30234	32444	33851
25	LUGGAGE	1183	1191	1237	1289	1376	1459	1661	1861	2107	2256
26	GASOLINE AND OIL	27637	25626	25976	26194	26762	27475	28832	29894	31411	32345
27	FUEL OIL AND COAL	4823	4384	4425	4620	4757	4812	5091	5235	5474	5657
28	TOBACCO	13707	13845	13918	14168	14437	14577	15038	15427	15784	16007
29	SEMIDURABLE HOUSEFURNISHINGS	7805	8052	8359	8745	9240	9645	10796	11734	12867	13550
30	DRUG PREPARATIONS AND SUNDRIES	9996	10013	10291	10362	10697	11079	11799	12680	13707	14318
31	TOILET ARTICLES AND PREPARATIO	8326	8581	8841	9115	9545	9968	10912	11619	12732	13447
32	STATIONERY AND WRITING SUPPLIE	2759	2777	2798	2980	3163	3257	3622	3860	4117	4300
33	NONDURABLE TOYS AND SPORT SUPP	10136	10047	10152	10505	10827	11015	11835	12597	13683	14389
34	FLOWERS, SEEDS, AND POTTED PLA	3746	3969	4045	4254	4491	4605	5047	5547	6074	6430
35	CLEANING PREPARATIONS	790	799	814	844	888	917	1001	1077	1170	1229
36	LIGHTING SUPPLIES	5413	5444	5595	5795	5982	6137	6629	7009	7642	8061
37	HOUSEHOLD PAPER PRODUCTS	2556	2509	2560	2616	2714	2804	2995	3181	3465	3643
38	MAGAZINES AND NEWSPAPERS	6470	6670	6852	7077	7382	7755	8499	8969	9601	9998
39	OTHER NONDURABLES -- IDENTITY	555	561	568	587	614	630	679	721	765	794
40	OWNER OCCUPIED SPACE RENT	111579	114391	116959	120703	126618	131690	143539	151963	160713	165706

Table 5.2 (cont'd)
Forecasts of Consumption
(Millions of 1972 Dollars)

		1979	1981	1982	1983	1984	1985	1988	1990	1993	1995
41	TENANT OCCUPIED SPACE RENT	41433	45808	46233	46784	47768	49114	51254	52922	57162	60024
42	HOTELS AND MOTELS	2930	3005	3029	3113	3268	3346	3522	3740	4031	4236
43	OTHER HOUSING -- EDUCATIONAL H	1748	1753	1813	1862	1956	2041	2219	2410	2618	2762
44	ELECTRICITY	17569	18873	19351	20071	20937	21660	23841	25405	27396	28701
45	NATURAL GAS	6852	7234	7228	7482	7736	7881	8504	8883	9372	9703
46	WATER AND OTHER SANITARY SERVI	4515	4762	4886	5023	5251	5478	5978	6373	6799	7080
47	TELEPHONE AND TELEGRAPH	22468	25366	26653	27576	29260	31265	35326	38134	41323	43474
48	DOMESTIC SERVICES	4458	4347	4279	4351	4483	4386	4273	4241	3972	3797
49	HOUSEHOLD INSURANCE	1058	1151	1172	1295	1422	1459	1693	1877	2033	2157
50	OTHER HOUSEHOLD OPERATIONS --	4150	4338	4472	4623	4892	5146	5668	6137	6596	6885
51	POSTAGE	2050	2152	2219	2351	2497	2521	2751	3096	3370	3562
52	AUTO REPAIR	19202	20423	20533	21273	22127	22498	24184	25497	26708	27539
53	BRIDGE, TOLLS, ETC	1023	1102	1107	1167	1224	1240	1355	1442	1525	1586
54	AUTO INSURANCE	6661	7047	7121	7154	7314	7498	7820	8084	8306	8434
55	TAXICABS	813	824	810	795	783	763	719	691	620	582
56	LOCAL PUBLIC TRANSPORT	2101	2051	1981	1909	1832	1750	1508	1353	1057	862
57	INTERCITY RAILROAD	131	94	82	75	70	58	27	9	-32	-60
58	INTERCITY BUSES	447	444	455	458	468	483	498	531	574	599
59	AIRLINES	3876	3577	3552	3659	3901	4023	4380	4844	5407	5766
60	TRAVEL AGENTS AND OTHER TRANSP	211	231	246	249	260	280	306	336	381	407
61	CLEANING, LAUNDERING AND SHOE	4216	3860	3808	3916	4021	3974	4033	4068	3990	3970
62	BARBERSHOPS AND BEAUTY SHOPS	3196	2842	2755	2795	2832	2778	2682	2624	2443	2319
63	PHYSICIANS	20442	20567	20761	21419	22275	22689	24324	25915	27443	28444
64	DENTISTS AND OTHER PROFESSIONA	11111	10745	10477	11047	11631	11567	12257	13033	13453	13786
65	PRIVATE HOSPITALS AND SANITARI	32718	34213	34974	36616	38417	39511	43821	47428	51824	54919
66	HEALTH INSURANCE	7707	8126	8278	8592	8928	9166	9954	10559	11161	11555
67	BROKERAGE AND INVESTMENT COUNS	6236	6017	5745	6078	6350	6185	6415	6595	6510	6541
68	BANK SERVICE CHARGES AND SERVI	22327	23380	23903	24362	25238	26308	28456	29996	32353	33881
69	LIFE INSURANCE	9104	9107	9142	9105	9270	9562	9855	10102	10406	10535
70	LEGAL SERVICES	7498	7801	7932	8177	8510	8821	9460	9528	10104	10480
71	FUNERAL EXPENCES AND OTHER PER	6100	5967	5872	5923	6043	6088	6185	6244	6382	6473
72	RADIO AND TELEVISION REPAIR	1572	1632	1626	1702	1782	1804	1906	1982	2033	2071
73	MOVIES, LEGITIMATE THEATRE, SP	6535	6838	7054	7340	7875	8243	9189	10160	11392	12170
74	OTHER RECREATIONAL SERVICES	11000	12115	12656	13149	13947	14622	16329	18007	20264	21713
75	EDUCATION	13033	12551	12695	12822	13314	13699	14235	14957	15481	16018
76	RELIGIOUS AND WELFARE SERVICES	10579	10460	10708	11108	11689	12042	13207	14437	15800	16699
77	FOREIGN TRAVEL	3155	3244	3361	3422	3574	3792	4222	4694	5303	5643

Table 5.3
Growth Rates
(Percent)

		79-81	81-82	82-83	83-84	84-85	85-88	88-90	90-93	93-95	82-95
1	NEW CARS & TRUCKS	-3.24	-3.15	13.54	11.01	-2.10	4.13	4.69	1.20	2.03	3.91
2	NET PURCHASES OF USED CARS	-2.12	-0.08	5.30	5.75	2.01	2.28	3.38	0.69	0.93	2.34
3	TIRES AND TUBES	4.26	1.73	3.61	4.11	2.73	3.00	3.07	2.19	2.09	2.79
4	ACCESSORIES AND PARTS (AUTO)	2.26	-1.64	4.35	3.10	-0.90	1.37	1.41	0.26	0.52	1.17
5	FURNITURE, MATTRESSES, AND BED	-3.27	-0.29	2.90	5.20	1.70	2.35	2.72	1.74	1.48	2.34
6	KITCHEN AND OTHER HOUSEHOLD AP	-2.75	-0.79	1.51	3.87	1.96	1.30	1.53	0.88	0.65	1.40
7	CHINA, GLASSWARE, TABLEWARE, A	-1.42	1.48	3.39	4.57	2.95	2.55	2.32	2.37	2.37	2.70
8	RADIO, TV, RECORDS, AND MUSICA	-1.45	0.08	3.66	5.45	2.58	3.24	3.29	2.64	2.64	3.16
9	FLOOR COVERINGS	-0.25	3.44	5.73	7.91	5.63	4.54	5.31	3.34	2.77	4.54
10	DURABLE HOUSEFURNISHINGS NEC	-0.77	3.02	4.68	6.89	5.06	3.96	4.26	3.23	2.64	4.00
11	WRITING EQUIPMENT	3.62	4.18	5.95	5.01	5.00	4.62	3.63	3.35	3.11	4.10
12	HAND TOOLS	0.08	0.59	3.87	3.77	1.23	1.95	1.68	2.79	2.68	2.44
13	JEWELRY	-1.10	3.89	5.87	8.15	6.37	5.23	6.22	4.03	3.37	5.17
14	OPHTHALMIC AND ORTHOPEDIC APPL	8.78	2.36	7.32	6.86	3.70	5.48	6.46	3.20	3.00	4.82
15	BOOKS AND MAPS	1.16	1.34	5.68	5.67	3.58	3.32	2.92	2.05	2.06	3.15
16	WHEEL GOODS AND DURABLE TOYS	-0.89	1.10	2.79	4.58	3.37	2.41	3.29	2.71	2.35	2.87
17	BOATS, RECREATIONAL VECH., AND	-2.42	-1.07	9.80	8.57	-2.19	4.37	4.61	3.71	4.31	4.45
18	FOOD, OFF PREMISE	0.20	0.86	1.79	2.51	1.90	1.63	1.95	1.40	1.24	1.67
19	FOOD, ON PREMISE	1.17	0.36	4.65	4.56	1.06	2.46	2.87	1.75	1.84	2.48
20	ALCOHOL, OFF PREMISE	0.77	2.28	1.80	3.47	3.74	2.36	2.90	2.20	1.84	2.47
21	ALCOHOL, ON PREMISE	2.10	1.77	2.95	3.18	1.75	1.87	2.09	1.36	1.14	1.85
22	SHOES AND FOOTWARE	0.51	1.83	3.01	4.14	2.95	2.76	3.73	2.68	2.40	2.98
23	WOMENS CLOTHING	1.04	2.37	3.72	4.94	3.64	3.10	4.00	2.34	2.16	3.15
24	MENS CLOTHING	1.17	2.38	3.73	5.02	3.57	3.08	4.09	2.38	2.15	3.16
25	LUGGAGE	0.34	3.86	4.20	6.75	6.03	4.42	5.85	4.23	3.48	4.73
26	GASOLINE AND OIL	-3.71	1.37	0.84	2.17	2.66	1.62	1.83	1.66	1.48	1.70
27	FUEL OIL AND COAL	-4.66	0.94	4.41	2.97	1.16	1.90	1.40	1.50	1.66	1.91
28	TOBACCO	0.50	0.53	1.80	1.90	0.97	1.04	1.29	0.77	0.70	1.08
29	SEMIDURABLE HOUSEFURNISHINGS	1.57	3.81	4.62	5.66	4.38	3.83	4.25	3.12	2.62	3.79
30	DRUG PREPARATIONS AND SUNDRIES	0.08	2.78	0.69	3.23	3.57	2.12	3.67	2.63	2.20	2.57
31	TOILET ARTICLES AND PREPARATIO	1.52	3.03	3.10	4.72	4.43	3.06	3.19	3.10	2.77	3.28
32	STATIONERY AND WRITING SUPPLIE	0.33	0.76	6.50	6.14	2.97	3.60	3.23	2.17	2.20	3.36
33	NONDURABLE TOYS AND SPORT SUPP	-0.44	1.05	3.48	3.07	1.74	2.42	3.17	2.79	2.55	2.72
34	FLOWERS, SEEDS, AND POTTED PLA	2.93	1.91	5.17	5.57	2.54	3.10	4.84	3.07	2.89	3.63
35	CLEANING PREPARATIONS	0.57	1.88	3.69	5.21	3.27	2.96	3.73	2.80	2.49	3.22
36	LIGHTING SUPPLIES	0.29	2.77	3.57	3.23	2.59	2.60	2.83	2.92	2.70	2.85
37	HOUSEHOLD PAPER PRODUCTS	-0.92	2.03	2.19	3.75	3.32	2.22	3.06	2.89	2.54	2.75
38	MAGAZINES AND NEWSPAPERS	1.53	2.73	3.28	4.31	5.05	3.10	2.73	2.30	2.05	2.95
39	OTHER NONDURABLES -- IDENTITY	0.54	1.25	3.35	4.60	2.61	2.53	3.05	1.99	1.88	2.61
40	OWNER OCCUPIED SPACE RENT	1.25	2.24	3.20	4.90	4.01	2.91	2.89	1.88	1.54	2.72

Table 5.3 (cont'd)
Growth Rates
(Percent)

		79-81	81-82	82-83	83-84	84-85	85-88	88-90	90-93	93-95	82-95
41	TENANT OCCUPIED SPACE RENT	5.15	0.93	1.19	2.10	2.82	1.43	1.61	2.60	2.47	2.03
42	HOTELS AND MOTELS	1.27	0.80	2.77	4.98	2.39	1.72	3.05	2.53	2.51	2.61
43	OTHER HOUSING -- EDUCATIONAL H	0.14	3.42	2.70	5.05	4.35	2.83	4.21	2.80	2.71	3.29
44	ELECTRICITY	3.64	2.53	3.72	4.31	3.45	3.25	3.23	2.55	2.35	3.08
45	NATURAL GAS	2.75	-0.08	3.51	3.39	1.87	2.57	2.20	1.80	1.75	2.29
46	WATER AND OTHER SANITARY SERVI	2.70	2.60	2.80	4.54	4.32	2.95	3.25	2.18	2.05	2.89
47	TELEPHONE AND TELEGRAPH	6.25	5.07	3.46	6.11	6.85	4.15	3.90	2.71	2.57	3.84
48	DOMESTIC SERVICES	-1.25	-1.56	1.68	3.03	-2.16	-0.87	-0.38	-2.16	-2.23	-0.92
49	HOUSEHOLD INSURANCE	4.30	1.82	10.49	9.81	2.60	5.08	5.29	2.70	3.00	4.80
50	OTHER HOUSEHOLD OPERATIONS --	2.24	3.09	3.38	5.82	5.19	3.27	4.06	2.43	2.17	3.37
51	POSTAGE	2.46	3.11	5.95	6.21	0.96	2.95	6.09	2.87	2.81	3.71
52	AUTO REPAIR	3.13	0.54	3.60	4.01	1.68	2.44	2.68	1.56	1.54	2.28
53	BRIDGE, TOLLS, ETC	3.79	0.45	5.42	4.88	1.31	3.00	3.16	1.88	1.98	2.80
54	AUTO INSURANCE	2.86	1.05	0.46	2.24	2.52	1.41	1.67	0.91	0.77	1.31
55	TAXICABS	0.67	-1.70	-1.85	-1.51	-2.55	-1.96	-1.97	-3.55	-3.11	-2.51
56	LOCAL PUBLIC TRANSPORT	-1.20	-3.41	-3.63	-4.03	-4.48	-4.84	-5.28	-7.90	-9.69	-6.20
57	INTERCITY RAILROAD	-15.29	-12.77	-8.54	-6.67	-17.14	-22.50	-42.26	NA	NA	NA
58	INTERCITY BUSES	-0.34	2.48	0.66	2.18	3.21	1.02	3.26	2.63	2.15	2.14
59	AIRLINES	-3.93	-0.70	3.01	6.61	3.13	2.87	5.16	3.73	3.27	3.80
60	TRAVEL AGENTS AND OTHER TRANSP	4.63	6.49	1.22	4.42	7.69	3.00	4.79	4.28	3.36	3.95
61	CLEANING, LAUNDERING AND SHOE	-4.32	-1.35	2.84	2.68	-1.17	0.49	0.43	-0.64	-0.25	0.32
62	BARBERSHOPS AND BEAUTY SHOPS	-5.70	-3.06	1.45	1.32	-1.91	-1.17	-1.09	-2.35	-2.57	-1.32
63	PHYSICIANS	0.31	0.94	3.17	4.00	1.86	2.35	3.22	1.93	1.81	2.45
64	DENTISTS AND OTHER PROFESSIONA	-1.66	-2.49	5.44	5.29	-0.55	1.95	3.12	1.06	1.23	2.13
65	PRIVATE HOSPITALS AND SANITARI	2.26	2.22	4.69	4.92	2.85	3.51	4.03	3.00	2.94	3.53
66	HEALTH INSURANCE	2.68	1.87	3.79	3.91	2.67	2.79	2.99	1.87	1.75	2.60
67	BROKERAGE AND INVESTMENT COUNS	-1.77	-4.52	5.80	4.48	-2.60	1.22	1.39	-0.43	0.24	1.00
68	BANK SERVICE CHARGES AND SERVI	2.33	2.24	1.92	3.60	4.24	2.65	2.67	2.55	2.33	2.72
69	LIFE INSURANCE	0.02	0.38	-0.40	1.81	3.15	1.01	1.25	0.99	0.62	1.10
70	LEGAL SERVICES	2.00	1.68	3.09	4.07	3.65	2.36	0.36	1.98	1.84	2.17
71	FUNERAL EXPENCES AND OTHER PER	-1.10	-1.59	0.87	2.03	0.74	0.53	0.48	0.73	0.71	0.75
72	RADIO AND TELEVISION REPAIR	1.89	-0.37	4.67	4.70	1.23	1.85	1.97	0.85	0.93	1.88
73	MOVIES, LEGITIMATE THEATRE, SP	2.29	3.16	4.05	7.29	4.67	3.69	5.15	3.89	3.36	4.28
74	OTHER RECREATIONAL SERVICES	4.95	4.47	3.90	6.07	4.84	3.75	5.01	4.01	3.51	4.24
75	EDUCATION	-1.87	1.15	1.00	3.84	2.89	1.29	2.50	1.15	1.72	1.80
76	RELIGIOUS AND WELFARE SERVICES	-0.56	2.37	3.74	5.23	3.02	3.13	4.55	3.05	2.81	3.48
77	FOREIGN TRAVEL	1.40	3.61	1.81	4.44	6.10	3.65	5.44	4.15	3.16	4.07

designated time periods. For example, the figures in the third column give the forecasted rate of growth in each of our consumption items for the 1982-83 period. The forecast is based on the assumption of a strong recovery in 1983 and, therefore, contains predictions of high rates of growth for cyclical sectors such as New Cars (EQ#1) and Boats and RV's (EQ#17). The growth rates in the 1982-1995 column provide a summary of the forecast and are useful in determining which of the goods will increase or decrease their share in the consumer's budget. Total expenditures on personal consumption is projected to grow by 2.6 percent per year. Under this scenario, consumption items with growth rates in excess of 2.6 percent will increase their share and those with growth rates less than 2.6 percent will decrease their share in the consumer's budget over the forecast period.

Although it is difficult to explain with certainty the reason a particular item has a given growth rate, in the following section we present examples of sectors whose forecast seem to be dominated by one of the four principle influences on consumption incorporated in our equations. These four determinants include income, prices, taste and preferences, and demographic influences. In the section on demographic influences, we go beyond presenting examples of effected sectors to providing an analysis on the magnitude of the demographic influences. This analysis is based on an alternative forecast performed under a different set of assumptions regarding the demographic composition of the population.

1. Income

Sectors which are income elastic will increase their share in total expenditures as income increases unless one of the other factors of consumption provides an offsetting influence. Examples of income elastic consumption items which are forecasted to increase their share in consumption by 1995 include: New Cars & Trucks (EQ#1), Jewelry (EQ#13), Radios & TVs (EQ#8), Movies (EQ#73), Other Recreational Services (EQ#74), and Foreign Travel (EQ#77). Conversely, consumption items with low income elasticities such as the food and alcohol sectors (EQ's 18, 19, 20, and 21), Tobacco (EQ#28), and Local Public Transportation (EQ#56) are forecasted to constitute a smaller share of the 1995 consumer budget than they did in the 1982 budget.

2. Tastes and Preferences

In the estimation period, sectors such as Domestic Services (EQ#48), Cleaning and Shoe Repair (EQ#61), and Barbershops (EQ#62) showed a secular decline in consumption that cannot be attributed to changes in income, prices, or demographic factors. Our weak projection of the consumption of these items is a continuation of this trend.

3. Prices

The role prices play in shaping the forecast is particularly evident in the energy sectors. The increasing real price of energy results in low growth rates for Gasoline (EQ#26), Fuel oil (EQ#28), and Natural Gas (EQ#45). Electricity alone has a growth rate greater than 2.6 percent. This exception can be attributed to electricity's relative price advantage and its comparatively higher income elasticity.

4. Demographic Effects

To ascertain the effect that the changing demographic composition of the population has on the forecast, we performed an alternate forecast made under the assumption of no demographic change in the population. That is, we assumed that the age structure, regional distribution, educational attainment, labor force characteristics, family size, and the age of the household remained fixed at their 1979 levels and that the structure of the income distribution remained unchanged as well.[1] In essence, performing this alternate forecast of consumption required turning off the special demographic and income features of our equation. The results are presented in Table 5.4.

The percentage differences between the base forecast and the alternate forecast are presented in Table 5.5. They provide a measure of the net effects of the changing demographic composition of the population.[2] As the figures indicate, these effects can be quite substantial. For example, in 1995 the base forecast for Education (EQ#75) is 22 percent lower than the alternate forecast. We can attribute this difference to failure on the part of the alternate forecast to recognize that between 1980 and 1995 there is a 25 percent decrease in the proportion of the population between the ages of 16 and 30 --- ages which were shown in the cross section to be associated with high expenditures on education. Another example of a substantial

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[1] While the age structure of the population is fixed in the alternate forecast, the size of the population is the same as in our base forecast.

[2] The entries in Table 5.5 are computed as 100 x ((BASE-ALTERNATE)/BASE).

Table 5.4

An Alternate Forecast

(Millions of 1972 Dollars)

		1979	1981	1982	1983	1984	1985	1988	1990	1993	1995
1	NEW CARS & TRUCKS	43199	40484	39066	45123	50408	49504	56826	62875	66423	70013
2	NET PURCHASES OF USED CARS	8041	7802	7876	8341	8856	9093	9986	10848	11374	11736
3	TIRES AND TUBES	6206	6760	6897	7143	7424	7627	8363	8898	9514	9914
4	ACCESSORIES AND PARTS (AUTO)	2102	2202	2180	2261	2326	2309	2415	2487	2513	2539
5	FURNITURE, MATTRESSES, AND BED	12371	11521	11375	11784	12513	12758	13681	14502	15310	15882
6	KITCHEN AND OTHER HOUSEHOLD AP	10086	9576	9529	9666	10016	10214	10672	11015	11376	11590
7	CHINA, GLASSWARE, TABLEWARE, A	4510	4388	4453	4617	4845	5002	5440	5738	6204	6511
8	RADIO, TV, RECORDS, AND MUSICA	18898	18425	18461	19168	20245	20783	22861	24397	26375	27731
9	FLOOR COVERINGS	6425	6390	6572	6972	7581	8042	9210	10246	11340	12061
10	DURABLE HOUSEFURNISHINGS NEC	5724	5635	5778	6059	6519	6877	7743	8443	9311	9875
11	WRITING EQUIPMENT	1382	1484	1546	1638	1720	1806	2068	2221	2452	2607
12	HAND TOOLS	1874	1877	1888	1961	2035	2060	2183	2257	2451	2584
13	JEWELRY	7315	7185	7433	7884	8640	9294	10857	12316	13915	14949
14	OPHTHALMIC AND ORTHOPEDIC APPL	1827	2184	2252	2418	2582	2681	3142	3541	3867	4089
15	BOOKS AND MAPS	3783	3851	3903	4119	4345	4497	4974	5284	5641	5883
16	WHEEL GOODS AND DURABLE TOYS	10230	10117	10267	10599	11111	11508	12483	13397	14667	15457
17	BOATS, RECREATIONAL VECH., AND	2155	2084	2025	2355	2644	2593	2960	3252	3597	3895
18	FOOD, OFF PREMISE	107954	108943	110209	112209	114833	116908	122383	126647	131297	134136
19	FOOD, ON PREMISE	34246	35015	35097	36774	38476	38869	41788	44199	46509	48223
20	ALCOHOL, OFF PREMISE	14867	15035	15351	15607	16114	16687	17825	18809	19966	20653
21	ALCOHOL, ON PREMISE	9510	9701	9766	10010	10291	10423	10972	11441	11942	12284
22	SHOES AND FOOTWARE	11080	11154	11323	11673	12209	12604	13670	14742	15933	16707
23	WOMENS CLOTHING	42852	43761	44775	46466	48826	50630	55468	60074	64463	67275
24	MENS CLOTHING	21550	22172	22749	23669	24950	25925	28611	31157	33666	35278
25	LUGGAGE	1183	1196	1241	1289	1391	1491	1701	1913	2172	2335
26	GASOLINE AND OIL	27637	25655	26024	26319	26872	27555	29053	30189	31830	32806
27	FUEL OIL AND COAL	4823	4348	4390	4547	4673	4718	4946	5052	5239	5375
28	TOBACCO	13707	13822	13897	14110	14352	14488	14942	15317	15649	15851
29	SEMIDURABLE HOUSEFURNISHINGS	7805	7970	8202	8551	9050	9451	10529	11479	12626	13375
30	DRUG PREPARATIONS AND SUNDRIES	9996	10013	10291	10362	10697	11079	11799	12680	13707	14318
31	TOILET ARTICLES AND PREPARATIO	8326	8581	8841	9115	9545	9968	10912	11619	12732	13447
32	STATIONERY AND WRITING SUPPLIE	2759	2777	2798	2980	3163	3257	3622	3860	4117	4300
33	NONDURABLE TOYS AND SPORT SUPP	10136	10047	10152	10505	10827	11015	11835	12597	13683	14389
34	FLOWERS, SEEDS, AND POTTED PLA	3746	3969	4045	4254	4491	4605	5047	5547	6074	6430
35	CLEANING PREPARATIONS	790	799	814	844	888	917	1001	1077	1170	1229
36	LIGHTING SUPPLIES	5413	5444	5595	5795	5982	6137	6629	7009	7642	8061
37	HOUSEHOLD PAPER PRODUCTS	2556	2509	2560	2616	2714	2804	2995	3181	3465	3643
38	MAGAZINES AND NEWSPAPERS	6470	6640	6815	7042	7340	7702	8468	8962	9639	10052
39	OTHER NONDURABLES -- IDENTITY	555	561	568	587	614	630	679	721	765	794
40	OWNER OCCUPIED SPACE RENT	111579	114740	117494	121160	126567	131205	142348	149760	157532	162162

Table 5.4 (cont'd)
An Alternate Forecast
(Millions of 1972 Dollars)

		1979	1981	1982	1983	1984	1985	1988	1990	1993	1995
41	TENANT OCCUPIED SPACE RENT	41433	44625	44496	44586	45183	46118	47309	48565	52120	54479
42	HOTELS AND MOTELS	2930	3029	3073	3176	3344	3438	3686	3958	4335	4579
43	OTHER HOUSING -- EDUCATIONAL H	1748	1763	1832	1890	1992	2084	2302	2525	2780	2945
44	ELECTRICITY	17569	18851	19333	19986	20775	21458	23498	24927	26725	27918
45	NATURAL GAS	6852	7216	7207	7418	7636	7768	8329	8658	9080	9370
46	WATER AND OTHER SANITARY SERVI	4515	4755	4882	4993	5192	5401	5845	6190	6551	6791
47	TELEPHONE AND TELEGRAPH	22468	25152	26319	27101	28641	30491	34141	36664	39440	41308
48	DOMESTIC SERVICES	4458	4223	4048	4107	4215	4074	3879	3824	3532	3373
49	HOUSEHOLD INSURANCE	1058	1149	1165	1287	1412	1446	1667	1838	1975	2090
50	OTHER HOUSEHOLD OPERATIONS --	4150	4328	4452	4592	4852	5097	5576	6007	6406	6668
51	POSTAGE	2050	2147	2208	2336	2477	2496	2705	3029	3272	3448
52	AUTO REPAIR	19202	20464	20635	21370	22213	22614	24432	25819	27135	28006
53	BRIDGE, TOLLS, ETC	1023	1104	1113	1171	1228	1246	1368	1459	1548	1612
54	AUTO INSURANCE	6661	7082	7181	7255	7411	7587	7994	8303	8602	8758
55	TAXICABS	813	809	780	771	758	725	652	606	505	439
56	LOCAL PUBLIC TRANSPORT	2101	1998	1893	1803	1709	1598	1253	1025	613	328
57	INTERCITY RAILROAD	131	92	78	71	67	55	22	4	-38	-66
58	INTERCITY BUSES	447	441	451	452	460	476	489	522	565	590
59	AIRLINES	3876	3522	3471	3559	3805	3929	4254	4712	5254	5599
60	TRAVEL AGENTS AND OTHER TRANSP	211	229	244	243	253	274	299	329	373	398
61	CLEANING, LAUNDERING AND SHOE	4216	3807	3702	3818	3915	3837	3830	3830	3689	3623
62	BARBERSHOPS AND BEAUTY SHOPS	3196	2830	2742	2761	2778	2715	2582	2492	2280	2141
63	PHYSICIANS	20442	20559	20748	21442	22374	22861	24695	26507	28216	29348
64	DENTISTS AND OTHER PROFESSIONA	11111	10876	10718	11271	11830	11794	12503	13214	13589	13889
65	PRIVATE HOSPITALS AND SANITARI	32718	34003	34753	36277	38021	39087	43202	46811	50831	53552
66	HEALTH INSURANCE	7707	8086	8241	8509	8791	9000	9727	10265	10784	11120
67	BROKERAGE AND INVESTMENT COUNS	6236	5862	5490	5807	6128	5905	5956	6089	5762	5649
68	BANK SERVICE CHARGES AND SERVI	22327	23077	23476	23811	24645	25733	27703	29255	31302	32534
69	LIFE INSURANCE	9104	9141	9184	9147	9323	9635	9934	10193	10491	10614
70	LEGAL SERVICES	7498	7696	7780	7985	8307	8617	9182	9258	9715	9988
71	FUNERAL EXPENCES AND OTHER PER	6100	5872	5732	5754	5875	5912	5930	5977	5996	5996
72	RADIO AND TELEVISION REPAIR	1572	1626	1626	1680	1745	1764	1845	1905	1935	1964
73	MOVIES, LEGITIMATE THEATRE, SP	6535	6825	7012	7310	7932	8363	9258	10267	11459	12229
74	OTHER RECREATIONAL SERVICES	11000	12153	12720	13209	14066	14799	16432	18093	20279	21690
75	EDUCATION	13033	12814	13160	13497	14167	14716	15933	17281	18675	19552
76	RELIGIOUS AND WELFARE SERVICES	10579	10433	10651	11037	11614	11954	12994	14126	15270	16040
77	FOREIGN TRAVEL	3155	3228	3355	3356	3492	3723	4084	4502	5030	5327

Table 5.5

Percentage Differences From the Base Forecast

		1979	1981	1982	1983	1984	1985	1988	1990	1993	1995
1	NEW CARS & TRUCKS	0.00	-0.09	0.28	-1.45	-2.10	-2.42	-4.14	-5.12	-7.16	-8.51
2	NET PURCHASES OF USED CARS	0.00	-1.27	-2.31	-2.90	-3.31	-3.99	-6.75	-8.49	-11.43	-12.87
3	TIRES AND TUBES	0.00	-0.21	-0.50	-0.45	-0.28	-0.29	-0.64	-0.79	-0.99	-0.97
4	ACCESSORIES AND PARTS (AUTO)	0.00	-0.18	-0.83	-0.22	0.00	-0.17	-0.58	-0.73	-1.00	-0.99
5	FURNITURE, MATTRESSES, AND BED	0.00	0.46	1.43	0.77	-0.16	-0.42	-0.44	-0.90	-1.14	-1.87
6	KITCHEN AND OTHER HOUSEHOLD AP	0.00	-0.40	-0.70	-0.62	-0.38	-0.39	-0.92	-1.04	-1.64	-2.21
7	CHINA, GLASSWARE, TABLEWARE, A	0.00	-0.11	-0.11	-0.39	-0.75	-1.03	-1.87	-2.63	-3.43	-3.58
8	RADIO, TV, RECORDS, AND MUSICA	0.00	-0.39	-0.51	-0.68	-0.84	-0.92	-0.89	-0.92	-0.90	-0.71
9	FLOOR COVERINGS	0.00	0.05	0.62	0.29	-0.48	-0.90	-1.15	-1.48	-1.76	-2.46
10	DURABLE HOUSEFURNISHINGS NEC	0.00	0.02	0.48	0.31	-0.34	-0.75	-0.95	-1.26	-1.50	-2.18
11	WRITING EQUIPMENT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	HAND TOOLS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	JEWELRY	0.00	-0.42	0.00	-0.19	-1.53	-2.67	-2.93	-3.50	-3.86	-4.43
14	OPHTHALMIC AND ORTHOPEDIC APPL	0.00	-1.02	-1.76	-1.81	-1.73	-1.86	-1.72	-1.14	-0.49	-0.17
15	BOOKS AND MAPS	0.00	0.52	0.51	0.65	0.82	0.90	0.62	0.34	-0.11	-0.22
16	WHEEL GOODS AND DURABLE TOYS	0.00	-0.69	-1.06	-1.50	-1.75	-1.95	-2.96	-3.56	-4.65	-5.28
17	BOATS, RECREATIONAL VECH., AND	0.00	-1.56	0.25	-5.65	-9.26	-9.55	-10.00	-10.42	-9.50	-8.98
18	FOOD, OFF PREMISE	0.00	-0.51	-0.81	-0.83	-0.66	-0.57	-0.29	0.15	0.70	1.02
19	FOOD, ON PREMISE	0.00	0.11	0.24	0.12	0.06	0.10	0.16	0.21	0.32	0.35
20	ALCOHOL, OFF PREMISE	0.00	0.42	0.59	0.72	0.93	1.11	1.49	1.82	2.38	2.64
21	ALCOHOL, ON PREMISE	0.00	2.14	3.19	3.62	3.97	4.40	4.81	4.78	4.55	4.02
22	SHOES AND FOOTWARE	0.00	0.36	0.67	0.59	0.16	-0.12	-0.06	-0.28	-0.11	-0.10
23	WOMENS CLOTHING	0.00	-0.04	0.02	-0.04	-0.17	-0.22	-0.20	-0.33	-0.43	-0.42
24	MENS CLOTHING	0.00	-0.51	-0.73	-1.03	-1.41	-1.74	-2.52	-3.05	-3.77	-4.22
25	LUGGAGE	0.00	-0.42	-0.32	0.00	-1.09	-2.19	-2.41	-2.79	-3.08	-3.50
26	GASOLINE AND OIL	0.00	-0.11	-0.18	-0.48	-0.41	-0.29	-0.77	-0.99	-1.33	-1.43
27	FUEL OIL AND COAL	0.00	0.82	0.79	1.58	1.77	1.95	2.85	3.50	4.29	4.98
28	TOBACCO	0.00	0.17	0.15	0.41	0.59	0.61	0.64	0.71	0.86	0.97
29	SEMIDURABLE HOUSEFURNISHINGS	0.00	1.02	1.88	2.22	2.06	2.01	2.47	2.17	1.87	1.29
30	DRUG PREPARATIONS AND SUNDRIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	TOILET ARTICLES AND PREPARATIO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
32	STATIONERY AND WRITING SUPPLIE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
33	NONDURABLE TOYS AND SPORT SUPP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
34	FLOWERS, SEEDS, AND POTTED PLA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
35	CLEANING PREPARATIONS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
36	LIGHTING SUPPLIES	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
37	HOUSEHOLD PAPER PRODUCTS	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
38	MAGAZINES AND NEWSPAPERS	0.00	0.45	0.54	0.49	0.57	0.68	0.36	0.08	-0.40	-0.54
39	OTHER NONDURABLES -- IDENTITY	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
40	OWNER OCCUPIED SPACE RENT	0.00	-0.31	-0.46	-0.38	0.04	0.37	0.83	1.45	1.98	2.14

Table 5.5 (cont'd)

Percentage Differences From the Base Forecast

		1979	1981	1982	1983	1984	1985	1988	1990	1993	1995
41	TENANT OCCUPIED SPACE RENT	0.00	2.58	3.76	4.70	5.41	6.10	7.70	8.23	8.82	9.24
42	HOTELS AND MOTELS	0.00	-0.80	-1.45	-2.02	-2.33	-2.75	-4.66	-5.83	-7.54	-8.10
43	OTHER HOUSING -- EDUCATIONAL H	0.00	-0.57	-1.05	-1.50	-1.84	-2.11	-3.74	-4.77	-6.19	-6.63
44	ELECTRICITY	0.00	0.12	0.09	0.42	0.77	0.93	1.44	1.88	2.45	2.73
45	NATURAL GAS	0.00	0.25	0.29	0.86	1.29	1.43	2.06	2.53	3.12	3.43
46	WATER AND OTHER SANITARY SERVI	0.00	0.15	0.08	0.60	1.12	1.41	2.22	2.87	3.65	4.08
47	TELEPHONE AND TELEGRAPH	0.00	0.84	1.25	1.72	2.12	2.48	3.35	3.85	4.56	4.98
48	DOMESTIC SERVICES	0.00	2.85	5.40	5.61	5.98	7.11	9.22	9.83	11.08	11.17
49	HOUSEHOLD INSURANCE	0.00	0.17	0.60	0.62	0.70	0.89	1.54	2.08	2.85	3.11
50	OTHER HOUSEHOLD OPERATIONS --	0.00	0.23	0.45	0.67	0.82	0.95	1.62	2.12	2.88	3.15
51	POSTAGE	0.00	0.23	0.50	0.64	0.80	0.99	1.67	2.16	2.91	3.20
52	AUTO REPAIR	0.00	-0.20	-0.50	-0.46	-0.39	-0.52	-1.03	-1.26	-1.60	-1.70
53	BRIDGE, TOLLS, ETC	0.00	-0.18	-0.54	-0.34	-0.33	-0.48	-0.96	-1.18	-1.51	-1.64
54	AUTO INSURANCE	0.00	-0.50	-0.84	-1.41	-1.33	-1.19	-2.23	-2.71	-3.56	-3.84
55	TAXICABS	0.00	1.82	3.70	3.02	3.19	4.98	9.32	12.30	18.55	24.57
56	LOCAL PUBLIC TRANSPORT	0.00	2.58	4.44	5.55	6.71	8.69	16.91	24.24	42.01	61.95
57	INTERCITY RAILROAD	0.00	2.13	4.88	5.33	4.29	5.17	18.52	55.56	-18.75	-10.00
58	INTERCITY BUSES	0.00	0.68	0.88	1.31	1.71	1.45	1.81	1.69	1.57	1.50
59	AIRLINES	0.00	1.54	2.28	2.73	2.46	2.34	2.88	2.73	2.83	2.90
60	TRAVEL AGENTS AND OTHER TRANSP	0.00	0.87	0.81	2.41	2.69	2.14	2.29	2.08	2.10	2.21
61	CLEANING, LAUNDERING AND SHOE	0.00	1.37	2.78	2.50	2.64	3.45	5.03	5.85	7.54	8.74
62	BARBERSHOPS AND BEAUTY SHOPS	0.00	0.42	0.47	1.22	1.91	2.27	3.73	5.03	6.67	7.68
63	PHYSICIANS	0.00	0.04	0.06	-0.11	-0.44	-0.76	-1.53	-2.28	-2.82	-3.18
64	DENTISTS AND OTHER PROFESSIONA	0.00	-1.22	-2.30	-2.03	-1.71	-1.96	-2.01	-1.39	-1.01	-0.75
65	PRIVATE HOSPITALS AND SANITARI	0.00	0.61	0.63	0.93	1.03	1.07	1.41	1.30	1.92	2.49
66	HEALTH INSURANCE	0.00	0.49	0.45	0.97	1.53	1.81	2.28	2.78	3.38	3.76
67	BROKERAGE AND INVESTMENT COUNS	0.00	2.58	4.44	4.46	3.50	4.53	7.16	7.67	11.49	13.64
68	BANK SERVICE CHARGES AND SERVI	0.00	1.30	1.79	2.26	2.35	2.19	2.65	2.47	3.25	3.98
69	LIFE INSURANCE	0.00	-0.37	-0.46	-0.46	-0.57	-0.76	-0.80	-0.90	-0.82	-0.75
70	LEGAL SERVICES	0.00	1.35	1.92	2.35	2.39	2.31	2.94	2.83	3.85	4.69
71	FUNERAL EXPENCES AND OTHER PER	0.00	1.59	2.38	2.85	2.78	2.89	4.12	4.28	6.05	7.37
72	RADIO AND TELEVISION REPAIR	0.00	0.37	0.00	1.29	2.08	2.22	3.20	3.88	4.82	5.17
73	MOVIES, LEGITIMATE THEATRE, SP	0.00	0.19	0.60	0.41	-0.72	-1.46	-0.75	-1.05	-0.59	-0.48
74	OTHER RECREATIONAL SERVICES	0.00	-0.31	-0.51	-0.46	-0.85	-1.21	-0.63	-0.48	-0.07	0.11
75	EDUCATION	0.00	-2.10	-3.66	-5.26	-6.41	-7.42	-11.93	-15.54	-20.63	-22.06
76	RELIGIOUS AND WELFARE SERVICES	0.00	0.26	0.53	0.64	0.64	0.73	1.61	2.15	3.35	3.95
77	FOREIGN TRAVEL	0.00	0.49	0.18	1.93	2.29	1.82	3.27	4.09	5.15	5.60

difference can be found in the forecasts for Domestic Services (EQ#48). The base forecast, which incorporates increasing labor force participation of women, is eleven percent higher than the alternate forecast. Equations without the benefit of demographic variables (e.g., EQ#29 through EQ#36) are invariant to even these drastic changes in the assumptions regarding the demographic composition of the population.

C. Plots of the Forecasts

A plot for each of the 77 sectors of consumption for both the estimation and forecast periods can be found in the appendix to this chapter. In the estimation portion of the plot (1959-1979), actual consumption is represented by a '*' and the predicted value of consumption from the estimated equation is represented by a '+'. For each year in the forecast period (1980 - 1995), three numbers are plotted. The basic forecast is represented by a '+'; the alternate forecast made under the assumption of no demographic change in the population is represented by a '#'; and a naive forecast made under the assumption of constant budget shares in consumption is represented by a '.'. The naive forecast is included for reference.

Each plot of consumption is accompanied by summary information on the estimation of the equation. This information includes the R^2, the average absolute percentage error (AAPE), the autocorrelation coefficient (RHO), and the average error term in the estimation (UBAR)[1].

[1] Since we estimate our equations with a joint nonlinear technique there is no guarantee that the error term in a given sector will sum to zero.

D. Comparison with Actual Data

Since the first years of our forecast overlap the historical period, we have the opportunity to verify the short run projections. At present, data is available for the years 1980 and 1981 at the same level of detail as our equations. We use this data as a check in the forecasting performance of our estimated equations for the corresponding years. Table 5.6 contains the differences, expressed as a percentage of actual consumption, between our forecast and the actual data. This comparison should be considered with the understanding that it is not the goal of this study to provide a system of equations for short term forecasting.

In general, our equations do a satisfactory job of forecasting the years 1980 and 1981. With the exception of the used car sector, the average absolute percentage miss by our equations is only 4.7 percent for 1980 and 6.6 percent for 1981.[1] Eleven of the equations for 1980 have forecast errors less than 1.0 percent and 52 have errors less than 5.0 percent. Similarly, 12 of the 1981 equations have forecast errors less than 1.0 percent and 41 have errors less than 5.0 percent. The overall performance of the equations is especially impressive given the fact that the forecasts are made with projected and not actual prices.

[1] The equation for used cars (EQ#2) misses actual consumption by 55 percent in 1980 and by 68 percent in 1981. There seems to have been a fundamental change in the market for used cars in 1980. Between 1979 and 1980 net purchase of used cars fell by 40 percent.

Table 5.6

Comparison With Actual Data

(Percentage Difference)

	TITLE	1980	1981
1	NEW CARS & TRUCKS	-9.32	6.79
2	NET PURCHASES OF USED CARS	54.71	67.54
3	TIRES AND TUBES	3.49	5.34
4	ACCESSORIES AND PARTS (AUTO)	-3.31	-3.59
5	FURNITURE, MATTRESSES, AND BEDSPRINGS	-1.27	-1.00
6	KITCHEN AND OTHER HOUSEHOLD APPLIANCES	-4.70	-7.78
7	CHINA, GLASSWARE, TABLEWARE, AND UTENSILS	-2.53	-3.61
8	RADIO, TV, RECORDS, AND MUSICAL INSTRUMENTS	-7.29	-11.40
9	FLOOR COVERINGS	3.19	9.97
10	DURABLE HOUSEFURNISHINGS NEC	-0.79	-3.55
11	WRITING EQUIPMENT	4.01	11.69
12	HAND TOOLS	-0.08	-1.51
13	JEWELRY	2.84	-5.83
14	OPHTHALMIC AND ORTHOPEDIC APPLIANCES	6.81	20.04
15	BOOKS AND MAPS	-3.01	-0.20
16	WHEEL GOODS AND DURABLE TOYS	1.12	-2.86
17	BOATS, RECREATIONAL VECH., AND AIRCRAFT	7.01	31.15
18	FOOD, OFF PREMISE	-3.42	-3.71
19	FOOD, ON PREMISE	-1.60	3.34
20	ALCOHOL, OFF PREMISE	-1.57	0.54
21	ALCOHOL, ON PREMISE	-3.48	-0.70
22	SHOES AND FOOTWARE	0.72	-2.61
23	WOMENS CLOTHING	-3.27	-8.45
24	MENS CLOTHING	-0.55	0.01
25	LUGGAGE	10.91	0.71
26	GASOLINE AND OIL	2.95	-1.10
27	FUEL OIL AND COAL	7.37	23.50
28	TOBACCO	-0.06	-2.18
29	SEMIDURABLE HOUSEFURNISHINGS	1.49	-0.29
30	DRUG PREPARATIONS AND SUNDRIES	1.65	2.54
31	TOILET ARTICLES AND PREPARATIONS	2.24	4.67
32	STATIONERY AND WRITING SUPPLIES	-9.81	-9.12
33	NONDURABLE TOYS AND SPORT SUPPLIES	-6.29	-9.14
34	FLOWERS, SEEDS, AND POTTED PLANTS	4.52	16.40
35	CLEANING PREPARATIONS	2.74	6.70
36	LIGHTING SUPPLIES	0.56	2.62
37	HOUSEHOLD PAPER PRODUCTS	-0.64	-3.45
38	MAGAZINES AND NEWSPAPER	4.93	5.94
39	OTHER NONDURABLES -- IDENTITY	0.18	-14.52
40	OWNER OCCUPIED SPACE RENT	-2.46	-3.03

Table 5.6 (cont'd)

Comparison With Actual Data

(Percentage Difference)

	TITLE	1980	1981
41	TENANT OCCUPIED SPACE RENT	3.93	4.36
42	HOTELS AND MOTELS	6.11	8.96
43	OTHER HOUSING -- EDUCATIONAL HOUSING	-0.39	-0.45
44	ELECTRICITY	0.98	-1.00
45	NATURAL GAS	2.60	9.39
46	WATER AND OTHER SANITARY SERVICES	-0.15	5.58
47	TELEPHONE AND TELEGRAPH	1.85	0.97
48	DOMESTIC SERVICES	-1.95	2.44
49	HOUSEHOLD INSURANCE	12.59	23.19
50	OTHER HOUSEHOLD OPERATIONS -- REPAIR	1.08	2.14
51	POSTAGE	-10.53	-0.55
52	AUTO REPAIR	3.31	14.48
53	BRIDGE, TOLLS, ETC	3.41	8.28
54	AUTO INSURANCE	3.86	4.99
55	TAXICABS	-2.04	3.95
56	LOCAL PUBLIC TRANSPORT	4.12	6.94
57	INTERCITY RAILROAD	-20.97	-22.88
58	INTERCITY BUSES	-5.70	-1.34
59	AIRLINES	3.31	17.01
60	TRAVEL AGENTS AND OTHER TRANSPORTATION SERV	17.90	23.15
61	CLEANING, LAUNDERING AND SHOE REPAIR	-7.11	-2.38
62	BARBERSHOPS AND BEAUTY SHOPS	-9.32	-7.74
63	PHYSICIANS	-7.33	-10.44
64	DENTISTS AND OTHER PROFESSIONAL SERVICES	-8.78	-9.71
65	PRIVATE HOSPITALS AND SANITARIUMS	-3.90	-5.62
66	HEALTH INSURANCE	-2.62	2.42
67	BROKERAGE AND INVESTMENT COUNSELING	-26.76	-8.40
68	BANK SERVICE CHARGES AND SERVICES W/O PAYME	1.60	3.64
69	LIFE INSURANCE	-6.68	-13.90
70	LEGAL SERVICES	8.27	2.47
71	FUNERAL EXPENCES AND OTHER PERSONAL BUSINES	-2.46	-1.25
72	RADIO AND TELEVISION REPAIR	-6.08	-2.76
73	MOVIES, LEGITIMATE THEATRE, SPECTATOR SPORT	1.66	6.02
74	OTHER RECTIONAL SERVICES	0.62	-0.31
75	EDUCATION	-2.70	-4.17
76	RELIGIOUS AND WELFARE SERVICES	-3.48	-0.42
77	FOREIGN TRAVEL	14.81	17.78

III. CONCLUSIONS AND SUGGESTIONS FOR FURTHER RESEARCH

The goal of this dissertation is to develop a system of equations for forecasting personal consumption expenditures which incorporate both economic and noneconomic influences on consumer behavior. We have accomplished our objective through the use of a cross section and time series analysis. The reasonable forecasts presented in this chapter and the generally intuitive parameter and elasticity estimates discussed in the previous three chapters indicate that the effort has been successful.

The systems ability to incorporate demographic factors and its special income and price features impart flexibility as well as credence to the forecasting process. The framework exists for evaluating the effect on consumption of alternative demographic assumptions such as changes in the fertility rate of women, tax policies that redistribute income[1], or shifts in relative prices. These studies will be undertaken in later research.

While our system of equations incorporate many demographic and income distribution factors not typically found in equations designed for forecasting, they are not beyond improvement. In particular, the cyclical behavior of the equations for automobile and other durable items would benefit from the inclusion of interest rate and other stock term variables. Our equation for gasoline consumption should take into account the fact that fuel efficiency, on average, has increased in

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1 The equations, through the use of a nonlinear Engel curve, are sensitive to shifts in the size distribution of income.

recent years.[1] Futhermore, the system of equations as a whole would benefit from a reestimation that included the newly available 1980-81 data. These improvements will be implemented in the further development of our system of equations.

[1] This change in efficiency affects consumer spending patterns since the demand for gasolilne is derived from total miles driven.

APPENDIX TO CHAPTER 3

Constructing the Distribution of Per Person Income

The distribution of per capita income is constructed from household information published by the U.S. Bureau of the Census. The Census bureau provides income distributions by household size which range from one to seven and over.[1]

The procedure begins by transforming the seven household income distributions provided by the Census into corresponding per capita income distributions. This involves dividing the income levels which define an income range by the size of the household to define the income ranges on a per capita basis and multiplying the number of households by the household size to obtain the number of individuals. For example, assume that there are 600 households of size 4 with income levels from \$10,000 to \$20,000. Transforming this household data to a per capita basis results in 2,400 individuals with per capita incomes greater than \$2,500 but less than \$5,000.

We proceed with the construction using the following notation: Let Y_i, where i=1 to M-1, be the upper bounds of M-1 of the M income classes. Let s_j, j=1, ..., 7 represent the household size. (Recall that $s_j=j$, j=1, ..., 6 but $s_7 > 7$.) Let h_{ij} be the number of households of size j in income group i. That is, there are $s_j h_{ij}$ people between the income ranges of Y_{i-1}/s_j and Y_i/s_j from the j size category.

The per capita distributions derived from the various size categories are combined into a single per capita distribution in the

[1] U.S. Bureau of the Census, Current Population Reports, series P-60, "Household Income" volumes.

following manner: First, we construct the cumulative per capita income distribution for each size category. Note that there are $\sum_{K=1}^{i} s_j h_{Kj}$ people with incomes less than or equal to Y_i/s_j. Therefore, the points on the cumulative income distribution ($c_j(y)$) for size j are (Y_i/s_j, $\sum_{K=1}^{i} s_j h_{Kj}$) where i=1, ..., m-1. Using these points, the remainder of the curve through the first M-1 income groups can be arrived at by interpolation.[1] The cumulative distribution in the last income group (M) is assumed to approach the horizontal asymptote, given by the total number of individuals in family size category j, in an exponential fashion. That is, the difference between the cumulative distribution and the asymptote declines exponentially.[2] Second, these cumulative per capita income distributions for different household sizes are summed vertically to give a single cumulative distribution. Since the height of the curve $c_j(y)$ tells us the number of people with income less than y who live in the households of size j, $\sum_j c_j(y)$ gives us the overall cumulative per capita income distribution.

Removing Taxes From the 20th Ventile

In the case of the first 19 ventiles converting money income into disposable income is simply a matter of evaluating the tax function at

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1 A cubic spline interpolation technique is used. Successive points are joined with cubic polynomials which possess the property that when two polynomials meet at a point they have the same slope and the same second derivative at that point. This technique results in an interpolation having a very smooth appearance.

2 The speed of the convergence to the asymptote is determined such that the total income implied by the cumulative distribution matches the data.

the income level of the ventiles and then removing the specified amount of tax. Things become more complicated in the case of the 20th ventile since this ventile is not represented by a single income level but by the total amount of income held by the richest five percent of the population. If the tax rate faced by everyone in the top five percent bracket is the same, total disposable income for the group is found by applying this tax rate to the total income in the ventile. However, if individuals with different income levels face different tax rates, calculation of the total disposable income for the 20th ventile is more involved.

We first need to specify the function describing the income distribution in this top ventile. To do so, we first rank all the individuals in the population in order of increasing income. We will write the income of the z^{th} individual as $y = F(z)$. We now assume that $F(z)$ has the form

$$y = F(z) = y^* - \frac{1}{r} \log \left(\frac{N-z}{K}\right)$$

where y - money income

y^* - the income level at the 95th percentile

N - the total number of people in the population

K - the number of people in the 20th percentile

The parameter r is chosen to insure that the total income implied by this function is consistent with the total income in the 20th ventile. That is

$$\int_{N-K}^{N} F(z)dz = y_{20}$$

and

$$r = (y_{20} - y^{*}K)/K.$$

(Since N is large, we treat z as a continuous variable.)

Recall that the tax rate is a function of money income and is represented by a piecewise linear spline. Suppose that the individuals between z_1 and z_2 face the same linear segment of the tax function. We can then write the tax function as

$$t(y) = a + by$$

where, for convenience t(y) represents one minus the tax rate.

Finally, we define g(z) as the disposable income of the z^{th} individual. Clearly, g(z) is found by evaluating t(y) at F(z) to find the ratio of disposable income to money income and then multiplying this proportion by income, F(z). That is

$$\begin{aligned} g(z) &= F(z) \,.\, t(F(z)) \\ &= (y^* - \frac{1}{r} \log (\frac{N-z}{K}) (a + b (y^* - \frac{1}{r} \log (\frac{N-z}{K})) \\ &= ay^* + b(y^*)^2 - (a + 2by^*) (\frac{1}{r} \log (\frac{N-z}{K})) + b(\frac{1}{r} \log (\frac{N-z}{K}))^2 \end{aligned}$$

To compute the amount of disposable income held by individuals between z_1 and z_2, we must evaluate the integral

$$\int_{z_1}^{z_2} g(z)\, dz$$

This integration is not difficult (it requires integration by parts and the use of L' Hospital's rule) but is long and notationally awkward and is therefore not presented in detail. The result of the integration is:

$$\int_{z_1}^{z_2} g(z)dz = \alpha(z_2 - z_1)$$

$$- \frac{\beta}{r}\, (n-z_2)\log\left(\frac{N-z_2}{K}\right) - (n-z_1)\log\left(\frac{N-z_1}{K}\right) + (z_1+z_2)$$

$$+ \frac{b}{r^2}\,(N-z_2)\quad \left(\log\left(\frac{N-z_2}{K}\right)\right)^2 - 2\log\left(\frac{N-z_2}{K}\right) + 2$$

$$- \frac{b}{r^2}(N-z_1)\quad \left(\log\left(\frac{N-z_1}{K}\right)\right)^2 - 2\log\left(\frac{N-z_1}{K}\right) + 2$$

where:

$$\alpha = ay^* - b(y^*)^2$$

$$\beta = 2by^* - a$$

To find the total amount of disposable income in the top ventile, we evaluate each of the integrals corresponding to the relevant segments of the tax function and then total the results.

APPENDIX TO CHAPTER 4

Technique for Estimating the Large System of Equations

Consider the X matrix for the linearized system of consumption functions discussed in Chapter 4.

$$X = \begin{pmatrix} X_1 & 0 & 0 & \cdots & 0 & P_1 \\ 0 & X_2 & 0 & \cdots & 0 & P_2 \\ 0 & 0 & & \cdots & 0 & P_3 \\ \vdots & \vdots & \vdots & & \vdots & \vdots \\ 0 & 0 & 0 & \cdots & X_m & P_m \end{pmatrix} \qquad Y = \begin{pmatrix} Y_1 \\ Y_2 \\ Y_3 \\ \vdots \\ Y_m \end{pmatrix}$$

Where X_i - those variables corresponding to parameters in group i only

P_i - those variables corresponding to parameters in other groups (group price interactions).

Now

$$X'X = \begin{pmatrix} X_1'X_1 & 0 & \cdots & 0 & X_1'P_1 \\ 0 & X_2'X_2 & \cdots & 0 & X_2'P_2 \\ \vdots & \vdots & & \vdots & \vdots \\ 0 & 0 & \cdots & X_m'X_m & X_m'P_m \\ P_1'X_1 & P_2'X_2 & \cdots & P_m'X_m & \Sigma P_i'P_i \end{pmatrix}$$

$$X'Y = \begin{pmatrix} X_1'Y_1 \\ X_2'Y_2 \\ \vdots \\ X_m'Y_m \\ \Sigma P_i'Y_i \end{pmatrix}$$

Because the X'X matrix is so large, it would be difficult to store and invert in standard fashion. Instead, we will take advantage of the structure of the matrix and make use of the formulae for inverting a partitioned matrix. For notational convenience we will make the following substitutions:

$$Z_i = X_i'X_i$$

$$R_i = X_i'P_i \qquad (\therefore R_i' = P_i'X_i)$$

$$S_i = X_i'Y_i$$

$$W = \Sigma P_i'P_i$$

$$T = \Sigma P_i'Y_i$$

to get

$$X'X = \begin{pmatrix} Z_1 & 0 & \cdots & 0 & R_1 \\ 0 & Z_2 & \cdots & 0 & R_2 \\ \vdots & \vdots & & & \\ 0 & 0 & \cdots & Z_m & R_m \\ R_1' & R_2' & \cdots & R_m' & W \end{pmatrix} = \begin{pmatrix} Z & R \\ R' & W \end{pmatrix}$$

and

$$X'Y = \begin{pmatrix} S_1 \\ S_2 \\ \vdots \\ S_m \\ T \end{pmatrix}$$

The inverse of the partitioned matrix X'X is:

$$\begin{pmatrix} Z & R \\ R' & W \end{pmatrix}^{-1} = \begin{pmatrix} Z^{-1}+Z^{-1}RQ^{-1}R'Z^{-1} & -Z^{-1}RQ^{-1} \\ -Q^{-1}R'Z^{-1} & Q^{-1} \end{pmatrix}$$

where $Q = W-R'Z^{-1}R$

The advantages of this approach comes from the ease in computing Z^{-1} which is block diagonal.

We now complete the component parts of $(X'X)^{-1}$:

$\underline{Z}$:

$$Z = \begin{pmatrix} Z_1 & 0 & \cdots & 0 \\ 0 & Z_2 & \cdots & 0 \\ \vdots & \vdots & & \vdots \\ 0 & 0 & \cdots & Z_m \end{pmatrix} \qquad \text{Denote: } Z^{-1} = \begin{pmatrix} Z^1 & 0 & \cdots & 0 \\ 0 & Z^2 & \cdots & 0 \\ \vdots & \vdots & & \vdots \\ 0 & 0 & \cdots & Z^m \end{pmatrix}$$

where $Z^i = (Z_i)^{-1}$.

$\underline{Q}$:

$$R'Z^{-1} = (R_1' \ \ldots \ R_m') \begin{pmatrix} Z^1 & 0 & \cdots & 0 \\ 0 & Z^2 & \cdots & 0 \\ \vdots & \vdots & & \vdots \\ 0 & 0 & \cdots & Z^m \end{pmatrix} = (R_1'Z^1 \ \ldots R_m'Z^m)$$

$$R'Z^{-1}R = (R_1'Z^1 \ \ldots \ R_m'Z^m) \begin{pmatrix} R_1 \\ \vdots \\ R_m \end{pmatrix} = \sum_{i=1}^{m} R_i'Z^iR_i$$

Therefore,

$$Q = W - \sum_{i=1}^{m} R_i' Z^i R_i = \Sigma \, (P_i' P_i - R_i' Z^i R_i)$$

<u>$Z^{-1}RQ^{-1}$</u>

$$RQ^{-1} = \begin{bmatrix} R_1 \\ \vdots \\ R_m \end{bmatrix} Q^{-1} = \begin{bmatrix} R_1 Q^{-1} \\ \vdots \\ R_m Q^{-1} \end{bmatrix}$$

$$Z^{-1}RQ^{-1} = \begin{bmatrix} Z^1 & 0 & \dots & 0 \\ 0 & Z^2 & \dots & 0 \\ \vdots & \vdots & & \vdots \\ 0 & 0 & \dots & Z^m \end{bmatrix} \begin{bmatrix} R_1 Q^{-1} \\ \vdots \\ R_m Q^{-1} \end{bmatrix}$$

$$= \begin{bmatrix} Z^1 R_1 Q^{-1} \\ Z^2 R_2 Q^{-1} \\ \vdots \\ Z^m R_m Q^{-1} \end{bmatrix}$$

$\underline{Z^{-1}RQ^{-1}R'Z^{-1}}$

$$\begin{bmatrix} Z^1R_1Q^{-1} \\ \vdots \\ Z^m R_mQ^{-1} \end{bmatrix} (R_1'Z^1 \ \dots \ R_m'Z^m)$$

$$= \begin{pmatrix} Z^1R_1Q^{-1}R_1'Z^1 & Z^1R_1Q^{-1}R_2Z^2 & \dots & Z^1R_1Q^{-1}R_m'Z^m \\ Z^2R_2Q^{-1}R_1'Z^1 & Z^2R_2Q^{-1}R_2Z^2 & \dots & Z^2R_2Q^{-1}R_m'Z^m \\ \vdots & \vdots & & \vdots \\ Z^mR_mQ^{-1}R_1'Z^1 & Z^mR_mQ^{-1}R_2'Z^2 & \dots & Z^mR_mQ^{-1}R_m'Z^m \end{pmatrix}$$

We can now write $(X'X)^{-1}$

$$(X'X)^{-1} = \begin{pmatrix} Z^1 + Z^2R_2Q^{-1}R_1'Z^1 & Z^1R_2Q^{-1}R_1'Z^2 & \dots & Z^1R_2Q^{-1}R_m'Z^m & -Z^1R_2Q^{-1} \\ Z^2R_2Q^{-1}R_1'Z^1 & Z^2+Z^2R_2Q^{-1}R_1'Z^2 & \dots & Z^2R_2Q^{-1}R_m'Z^m & -Z^2R_2Q^{-1} \\ \vdots & \vdots & & \vdots & \vdots \\ Z^mR_mQ^{-1}R_1'Z^1 & Z^mR_mQ^{-1}R_2'Z^2 & \dots & Z^m+Z^mR_mQ^{-1}R_m'Z^m & -Z^mR_mQ^{-1} \\ -Q^{-1}R_1'Z^1 & -Q^{-1}R_2'Z^2 & \dots & -Q^{-1}R_m'Z^m & Q^{-1} \end{pmatrix}$$

Now

$$\beta = \begin{bmatrix} \beta_1 \\ \beta_2 \\ \vdots \\ \beta_m \\ \pi \end{bmatrix} = (X'X)^{-1} X'Y \quad \text{Recall that } X'Y = \begin{bmatrix} S_1 \\ S_2 \\ \vdots \\ S_m \\ T \end{bmatrix}$$

Therefore

$$\beta = \begin{bmatrix} \beta_1 \\ \vdots \\ \beta_m \\ \pi \end{bmatrix} = \begin{bmatrix} Z^1 S_1 + \sum_K Z^1 R_1 Q^{-1} R_K' Z^K S_K - Z^1 R_1 Q^{-1} T \\ Z^2 S_2 + \sum_K Z^2 R_2 Q^{-1} R_K' Z^K S_K - Z^2 R_2 Q^{-1} T \\ \vdots \\ Z^m S_m + \sum_K Z^m R_m Q^{-1} R_K' Z^K S_K - Z^m R_m Q^{-1} T \\ - \sum_K Q^{-1} R_K' Z^K S_K + Q^{-1} T \end{bmatrix}$$

Let

$$\delta = \sum_K Q R_K' Z^K S_K - Q^{-1} T$$

or

$$= Q^{-1} \Sigma R_K' Z^K S_K - T$$

Finally

$$\beta = \begin{pmatrix} Z^1 S_1 + Z^1 R_1 \delta \\ Z^2 S_2 + Z^2 R_2 \delta \\ \vdots \\ Z^m S_m + Z^m R_m \delta \\ - \delta \end{pmatrix}$$

Where δ is most easily computed if tought of as:

$$\delta = Q^{-1} \quad \Sigma R_K' Z^K S_K - T$$

$$= Q^{-1} \quad \Sigma (R_K' Z^K S_K - P_i Y_i)$$

Recall that:

$$Z^i = (X_i'X_i)^{-1}$$

$$S_i = X_i'Y_i$$

$$R_i = X_i'P_i$$

$$Q = \Sigma\,(P_i'P_i - R_i'Z^iR_i)$$

The above procedure allows us to compute β without inverting a huge matrix. Conceptually, β is formed by first computing the parameter estimates, group by group, in the absence of the inter-group price interactions ($Z'S_i$). These estimates are then modified to reflect the group price interaction ($+ Z^i R_i \delta$). (The component pieces of δ can be cumulated during the group by group initial estimations.)

EXTENDING EQUATION 4.10 TO INCLUDE SUBGROUPS

To include subgroups into our system of equations, we replace each of the relative terms

$$\left(\frac{P_i}{\overline{P}_I}\right)^{-S_I\lambda_{II}}$$

by the following product of relative price terms

$$\prod_{K=1}^{H} \left(\frac{P_i}{{}_I\bar{P}_K} \right)^{-S_K^I \lambda_{LK}^I} , \quad i \in G_L^I$$

Where ${}_I\bar{P}_K$ - the average price of the K^{th} subgroup in group I.

S_K^I - the total share of the K^{th} subgroup in group I.

λ_{LK}^I - the price parameter of the (L, K) subgroup combination in group I.

G_L^I - denotes the L^{th} subgroup in group I.

H - the number of subgroups.

The new expression is a natural extension since it modifies the concept of the price of a good relative to the group price to a concept of the price relative to individual subgroup prices.

Our new expression can be shown to equal the original if every λ_{LK}^I equals λ_{II}. That is

$$\prod_{K=1}^{H} \left(\frac{P_i}{{}_I\bar{P}_K} \right)^{-S_K^I \lambda_{LK}^I} = \left(\prod_K P_i^{-S_K^I} \cdot \prod_K {}_I\bar{P}_K^{S_K^I} \right)^{\lambda_{II}}$$

and since $\Sigma S_K^I = S_I$ then

$$= P_i^{-S_I} \prod_K {}_I\overline{P}_K^{S_K^I} \; \lambda_{II}$$

and since ${}_I\overline{P}_K = (\prod_{j\epsilon G_K^I} P_j^{s_j})^{\frac{1}{S_K^I}}$ then

$$= P_j^{-S_I} \prod_K (\prod_{j\epsilon G_K^I} P_j^{s_j}) \; \lambda_{II}$$

$$= P_i^{-S_I} \prod_{j\epsilon G_K^I} P_j^{s_j} \; \lambda_{II} \quad = \quad P_i^{-S_I} \overline{P}_I^{S_I} \; \lambda_{II}$$

$$= \frac{P_i}{\overline{P}_I}^{-S_I \lambda_{II}}$$

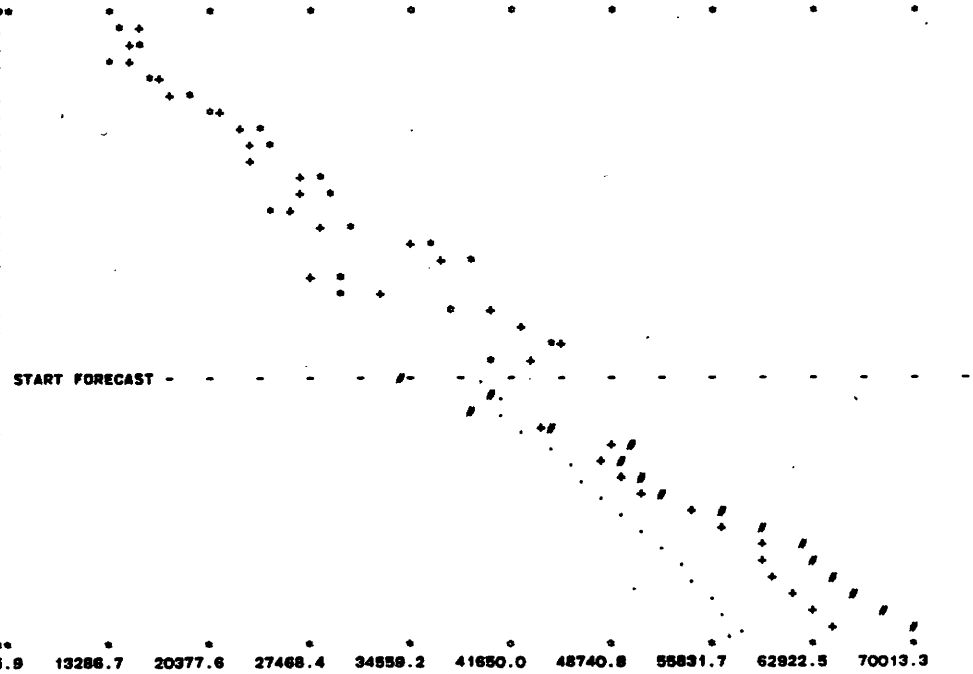
which is precisely the original price term in equation (4.10).

SECTOR # 1

TITLE : NEW CARS & TRUCKS

RSQ = 0.967
AAPE = 5.77%
RHO = 0.214
SHARE = 4.40%
UBAR = 76.485

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	14353.	16022.	-1670.
1960	15440.	15091.	348.
1961	13287.	15343.	-2056.
1962	16688.	17193.	-505.
1963	19307.	18196.	1111.
1964	20556.	21241.	-686.
1965	24587.	22646.	1942.
1966	24882.	23837.	1046.
1967	23603.	23606.	-3.
1968	28398.	26990.	1408.
1969	28904.	26930.	1974.
1970	24662.	26080.	-1418.
1971	30868.	28339.	2529.
1972	36205.	34706.	1499.
1973	39305.	36774.	2532.
1974	29825.	27556.	2270.
1975	30118.	32643.	-2525.
1976	38090.	40383.	-2292.
1977	42880.	43046.	-166.
1978	44573.	45820.	-1246.
1979	40713.	43199.	-2486.
1980	40148.	34485.	34228.
1981	41140.	40447.	40484.
1982	41619.	39174.	39066.
1983	43068.	44478.	45123.
1984	45001.	49373.	50408.
1985	46178.	48334.	49504.
1986	47254.	49482.	50875.
1987	48343.	50948.	52738.
1988	49812.	54569.	56826.
1989	51315.	57111.	59756.
1990	52848.	59811.	62875.
1991	53935.	59462.	62933.
1992	55026.	60786.	64718.
1993	56103.	61982.	66423.
1994	57181.	63248.	68212.
1995	58258.	64525.	70013.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

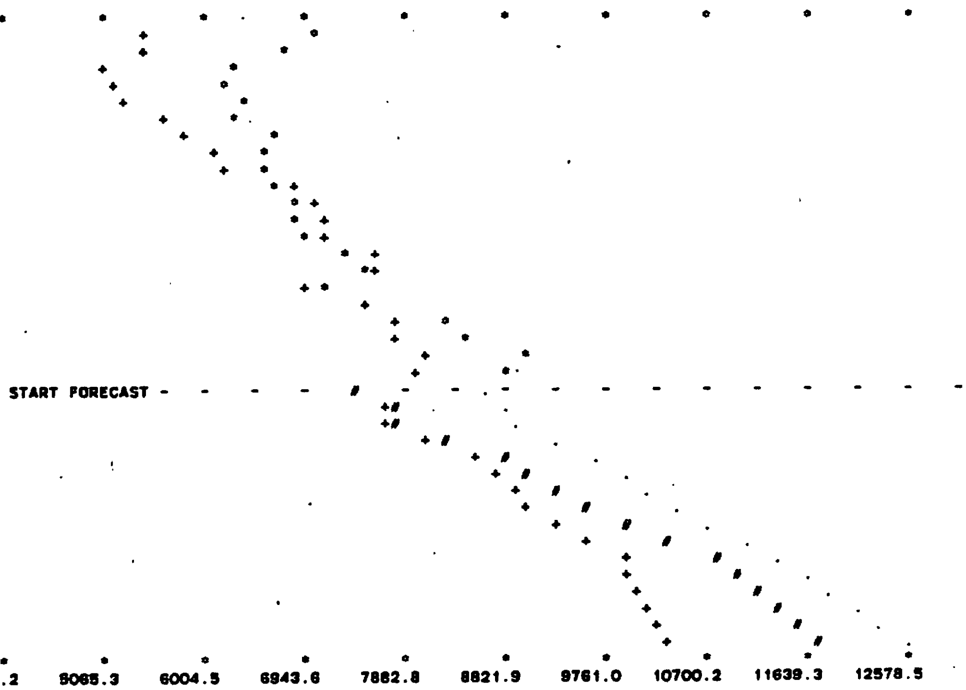


SECTOR # 2

TITLE : NET PURCHASES OF USED CARS

RSQ = 0.092
AAPE = 8.84%
RHO = 1.031
SHARE = 0.95%
UBAR =498.150

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	7100.	5469.	1631.
1960	6825.	5478.	1347.
1961	6325.	5065.	1260.
1962	6250.	5237.	1013.
1963	6425.	5316.	1109.
1964	6375.	5658.	717.
1965	6750.	5876.	874.
1966	6575.	6150.	425.
1967	6650.	6250.	400.
1968	6725.	6868.	-143.
1969	6925.	7092.	-167.
1970	6850.	7165.	-315.
1971	7025.	7215.	-190.
1972	7325.	7654.	-329.
1973	7550.	7692.	-142.
1974	7150.	6959.	191.
1975	7525.	7531.	-6.
1976	8325.	7856.	469.
1977	8450.	7840.	610.
1978	9050.	8128.	922.
1979	8825.	8041.	784.
1980	8668.	7442.	7491.
1981	8863.	7704.	7802.
1982	8986.	7698.	7876.
1983	9299.	8106.	8341.
1984	8716.	8572.	8856.
1985	9970.	8744.	9093.
1986	10203.	8919.	9350.
1987	10438.	9074.	9613.
1988	10755.	9355.	9986.
1989	11079.	9643.	10378.
1990	11410.	9999.	10848.
1991	11645.	10040.	11006.
1992	11881.	10120.	11192.
1993	12113.	10207.	11374.
1994	12346.	10300.	11557.
1995	12579.	10398.	11736.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

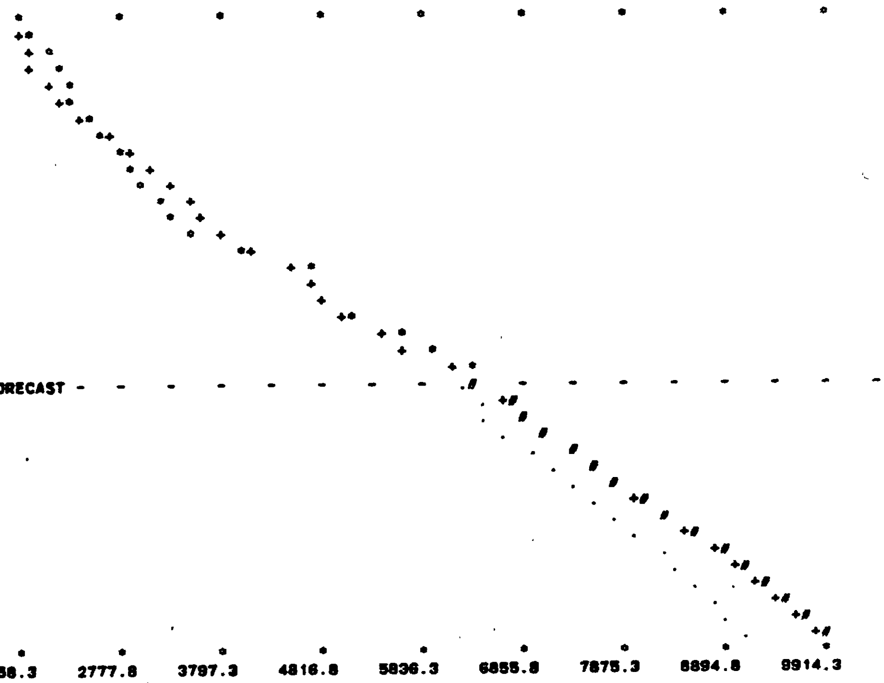


SECTOR # 3

TITLE : TIRES AND TUBES

RSQ = 0.978
AAPE = 5.53%
RHO = 0.790
SHARE = 0.69%
UBAR = 0.842

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	1873.	1758.	115.
1960	2075.	1896.	179.
1961	2237.	1961.	276.
1962	2316.	2109.	207.
1963	2347.	2250.	97.
1964	2472.	2425.	47.
1965	2604.	2690.	-87.
1966	2831.	2965.	-134.
1967	2909.	3120.	-211.
1968	3044.	3297.	-253.
1969	3200.	3509.	-309.
1970	3313.	3689.	-376.
1971	3589.	3851.	-262.
1972	4007.	4190.	-183.
1973	4726.	4533.	193.
1974	4779.	4793.	-14.
1975	4850.	4874.	-24.
1976	5140.	5105.	35.
1977	5664.	5453.	211.
1978	6023.	5698.	325.
1979	6391.	6206.	186.
1980	6296.	6438.	6447. START FORECAST
1981	6452.	6746.	6760.
1982	6527.	6863.	6897.
1983	6754.	7111.	7143.
1984	7057.	7403.	7424.
1985	7242.	7605.	7627.
1986	7410.	7813.	7845.
1987	7581.	8038.	8082.
1988	7811.	8310.	8363.
1989	8047.	8582.	8644.
1990	8287.	8828.	8898.
1991	8458.	9031.	9110.
1992	8629.	9226.	9312.
1993	87[illegible]8.	9421.	9514.
1994	[illegible]67.	9619.	9714.
1995	9136.	9819.	9914.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

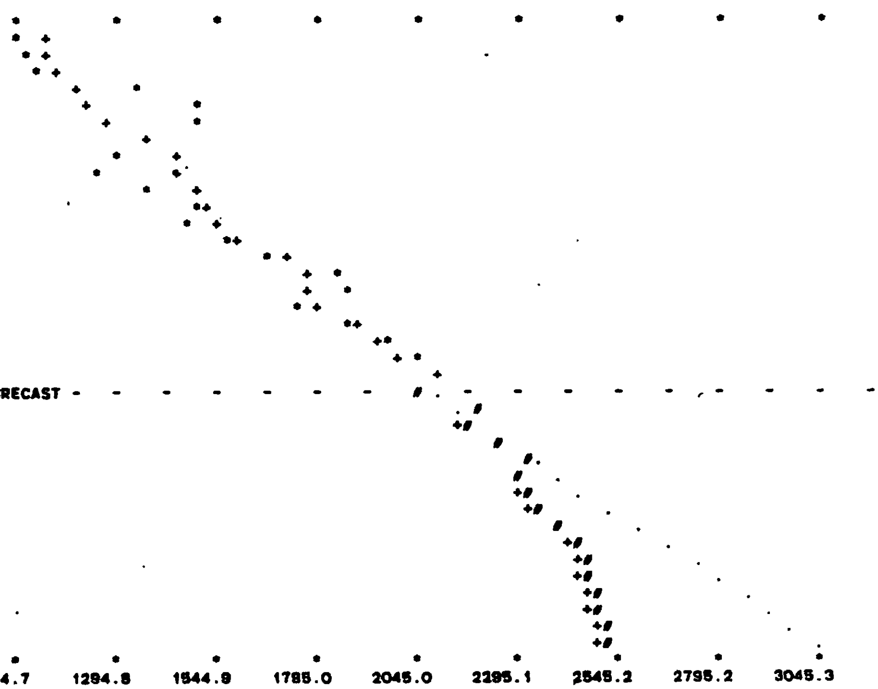


SECTOR # 4

TITLE : ACCESSORIES AND PARTS (AUTO)

RSQ = 0.877
AAPE = 5.88%
RHO = 0.646
SHARE = 0.23%
UBAR = -1.633

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	1045.	1133.	-88.
1960	1073.	1145.	-71.
1961	1114.	1146.	-32.
1962	1391.	1216.	135.
1963	1500.	1239.	262.
1964	1515.	1293.	222.
1965	1371.	1376.	-4.
1966	1302.	1451.	-149.
1967	1269.	1450.	-181.
1968	1394.	1512.	-117.
1969	1500.	1541.	-41.
1970	1482.	1556.	-73.
1971	1573.	1602.	-28.
1972	1684.	1724.	-40.
1973	1866.	1795.	71.
1974	1879.	1774.	106.
1975	1746.	1803.	-57.
1976	1887.	1906.	-19.
1977	1992.	1969.	23.
1978	2049.	2000.	49.
1979	2100.	2102.	-1.
1980	2099.	2062.	2069. START FORECAST
1981	2151.	2198.	2202.
1982	2176.	2162.	2180.
1983	2251.	2256.	2261.
1984	2352.	2326.	2326.
1985	2414.	2305.	2309.
1986	2470.	2318.	2328.
1987	2527.	2343.	2357.
1988	2604.	2401.	2415.
1989	2682.	2439.	2455.
1990	2762.	2469.	2487.
1991	2819.	2463.	2485.
1992	2876.	2477.	2500.
1993	2933.	2488.	2513.
1994	2989.	2501.	2527.
1995	3045.	2514.	2539.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

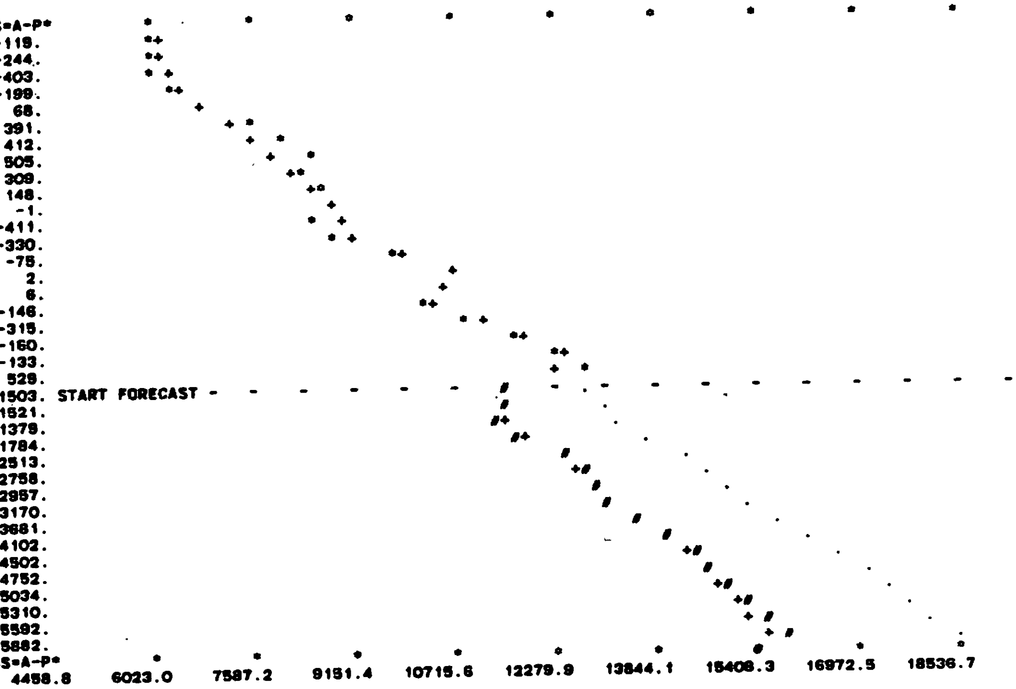


SECTOR # 5

TITLE : FURNITURE, MATTRESSES, AND BEDSPRINGS

RSQ = 0.980
AAPE = 2.77%
RHO = 0.591
SHARE = 1.40%
UBAR = -7.932

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	6115.	6233.	-119.
1960	6072.	6316.	-244.
1961	6023.	6426.	-403.
1962	6423.	6622.	-199.
1963	6896.	6828.	68.
1964	7697.	7307.	391.
1965	8112.	7701.	412.
1966	8555.	8050.	505.
1967	8522.	8213.	309.
1968	8758.	8609.	148.
1969	8846.	8848.	-1.
1970	8611.	9022.	-411.
1971	8940.	9270.	-330.
1972	9920.	9996.	-75.
1973	10861.	10860.	2.
1974	10679.	10673.	6.
1975	10337.	10483.	-146.
1976	10932.	11247.	-315.
1977	11799.	11959.	-160.
1978	12309.	12442.	-133.
1979	12900.	12371.	529.
1980	12774.	11555.	11503.
1981	13090.	11874.	11521.
1982	13242.	11540.	11379.
1983	13703.	11875.	11784.
1984	14319.	12493.	12513.
1985	14693.	12705.	12758.
1986	15035.	12928.	12957.
1987	15382.	13151.	13170.
1988	15849.	13621.	13681.
1989	16327.	14011.	14102.
1990	16815.	14373.	14502.
1991	17161.	14628.	14752.
1992	17506.	14898.	15034.
1993	17851.	15138.	15310.
1994	18194.	15370.	15592.
1995	18537.	15590.	15882.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

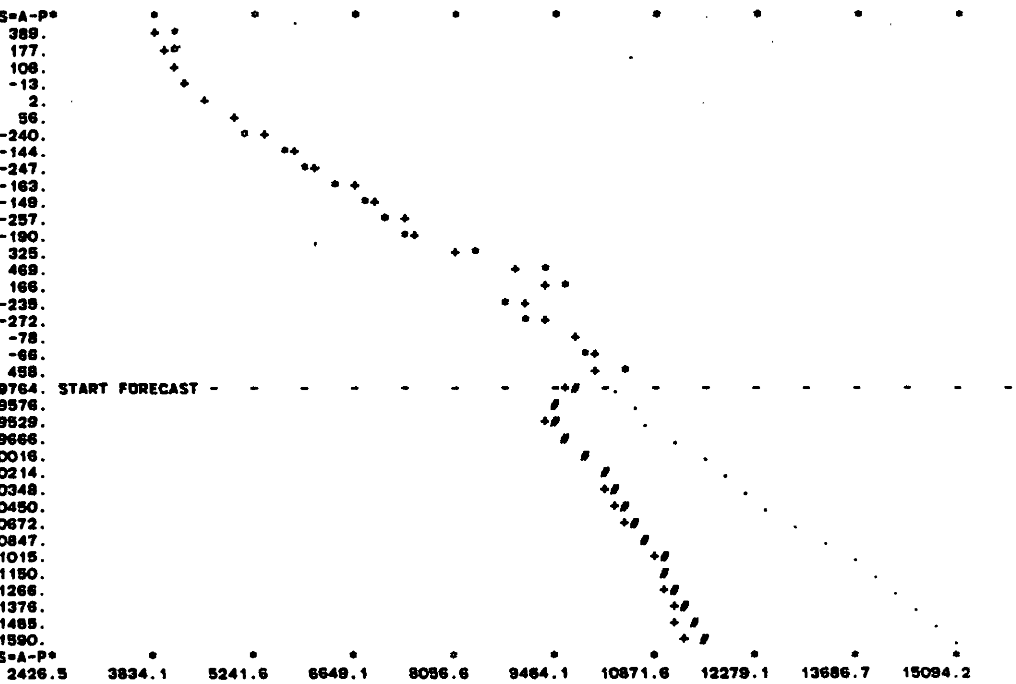


SECTOR # 6

TITLE : KITCHEN AND OTHER HOUSEHOLD APPLIANCES

RSQ = 0.988
AAPE = 2.93%
RHO = 0.467
SHARE = 1.14%
UBAR = 4.571

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	4223.	3834.	389.
1960	4155.	3978.	177.
1961	4234.	4126.	108.
1962	4371.	4384.	-13.
1963	4647.	4645.	2.
1964	5071.	5015.	56.
1965	5216.	5456.	-240.
1966	5778.	5923.	-144.
1967	5976.	6223.	-247.
1968	6500.	6663.	-163.
1969	6921.	7071.	-149.
1970	7099.	7385.	-257.
1971	7428.	7618.	-190.
1972	8449.	8124.	325.
1973	9459.	8990.	469.
1974	9614.	9448.	166.
1975	8887.	9122.	-235.
1976	9115.	9387.	-272.
1977	9747.	9825.	-78.
1978	9962.	10028.	-66.
1979	10544.	10086.	458.
1980	10402.	9735.	9764.
1981	10659.	9538.	9576.
1982	10783.	9463.	9529.
1983	11159.	9606.	9666.
1984	11659.	9978.	10016.
1985	11964.	10174.	10214.
1986	12243.	10283.	10348.
1987	12529.	10363.	10450.
1988	12906.	10575.	10672.
1989	13295.	10742.	10847.
1990	13692.	10902.	11015.
1991	13974.	11022.	11150.
1992	14257.	11113.	11266.
1993	14536.	11192.	11376.
1994	14815.	11267.	11485.
1995	15094.	11339.	11590.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

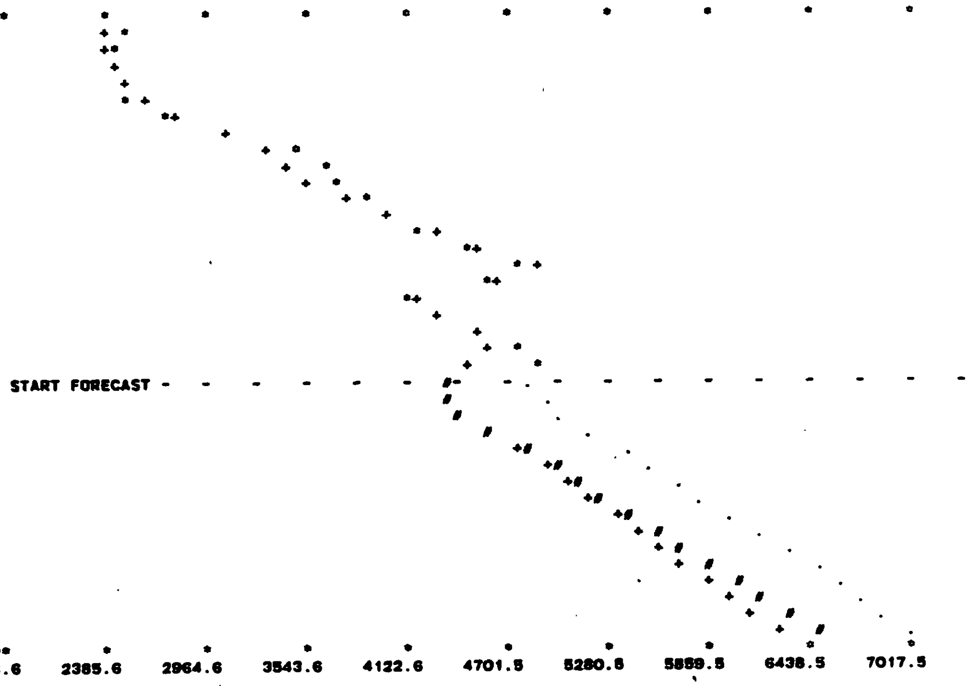


SECTOR # 7

TITLE : CHINA, GLASSWARE, TABLEWARE, AND UTENSILS

RSQ = 0.975
AAPE = 2.70%
RHO = 0.564
SHARE = 0.53%
UBAR = 45.828

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	2553.	2386.	167.
1960	2474.	2403.	71.
1961	2469.	2457.	12.
1962	2550.	2547.	3.
1963	2523.	2625.	-102.
1964	2774.	2845.	-71.
1965	3098.	3136.	-38.
1966	3504.	3331.	173.
1967	3668.	3468.	201.
1968	3773.	3569.	205.
1969	3918.	3805.	113.
1970	4035.	4064.	-29.
1971	4221.	4302.	-81.
1972	4497.	4566.	-68.
1973	4817.	4888.	-71.
1974	4634.	4680.	-45.
1975	4140.	4193.	-53.
1976	4316.	4327.	-11.
1977	4555.	4550.	5.
1978	4775.	4594.	181.
1979	4909.	4510.	400.
1980	4836.	4377.	4376.
1981	4956.	4383.	4388.
1982	5013.	4448.	4453.
1983	5188.	4599.	4617.
1984	5421.	4809.	4845.
1985	5562.	4951.	5002.
1986	5692.	5061.	5124.
1987	5823.	5171.	5253.
1988	6000.	5340.	5440.
1989	6181.	5475.	5600.
1990	6366.	5591.	5738.
1991	6407.	5726.	5897.
1992	6625.	5860.	6051.
1993	6758.	5998.	6204.
1994	6888.	6140.	6357.
1995	7017.	6286.	6511.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

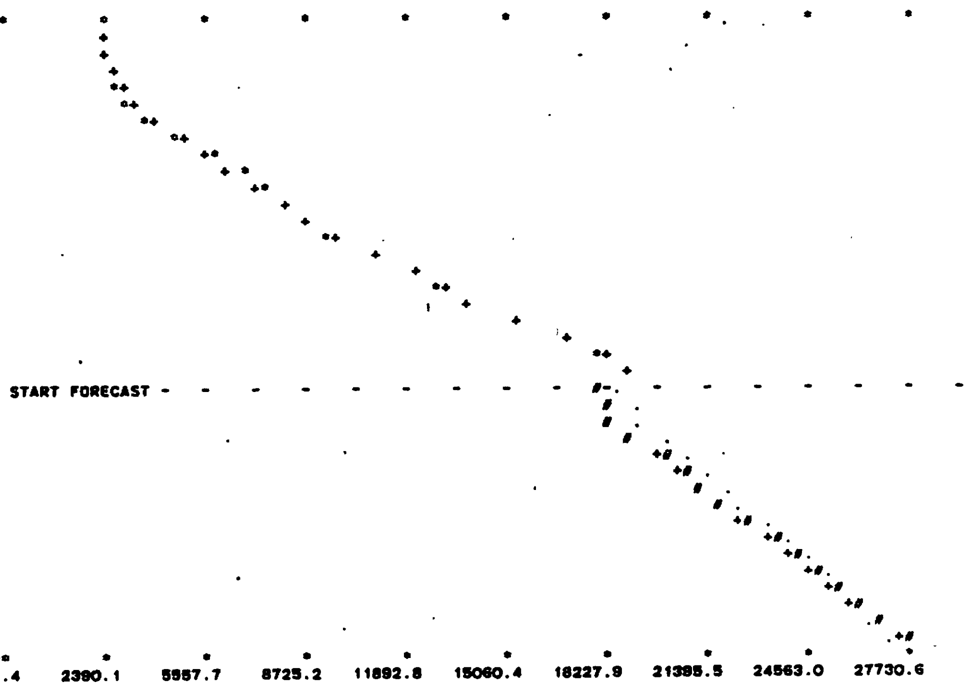


SECTOR # 8

TITLE : RADIO, TV, RECORDS, AND MUSICAL INSTRUMENTS

RSQ = 0.998
AAPE = 3.19%
RHO = 0.506
SHARE = 2.06%
UBAR = 2.377

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	2554.	2390.	164.
1960	2542.	2550.	-8.
1961	2722.	2763.	-41.
1962	2980.	3223.	-242.
1963	3312.	3615.	-303.
1964	3917.	4253.	-336.
1965	4791.	4972.	-180.
1966	6168.	5803.	365.
1967	6997.	6358.	638.
1968	7647.	7347.	300.
1969	8234.	8197.	37.
1970	8935.	8850.	84.
1971	9546.	9676.	-130.
1972	10965.	10980.	-16.
1973	12324.	12524.	-200.
1974	12986.	13257.	-271.
1975	14098.	13875.	223.
1976	15519.	15507.	12.
1977	16961.	16994.	-33.
1978	18089.	18249.	-160.
1979	19044.	18898.	146.
1980	18797.	18117.	18149.
1981	19261.	18353.	18425.
1982	19485.	18367.	18461.
1983	20164.	19039.	19168.
1984	21069.	20076.	20245.
1985	21620.	20594.	20783.
1986	22124.	21181.	21378.
1987	22633.	21757.	21950.
1988	23321.	22659.	22861.
1989	24025.	23409.	23620.
1990	24742.	24174.	24397.
1991	25252.	24799.	25026.
1992	25762.	25475.	25703.
1993	26266.	26140.	26375.
1994	26771.	26829.	27051.
1995	27275.	27536.	27731.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

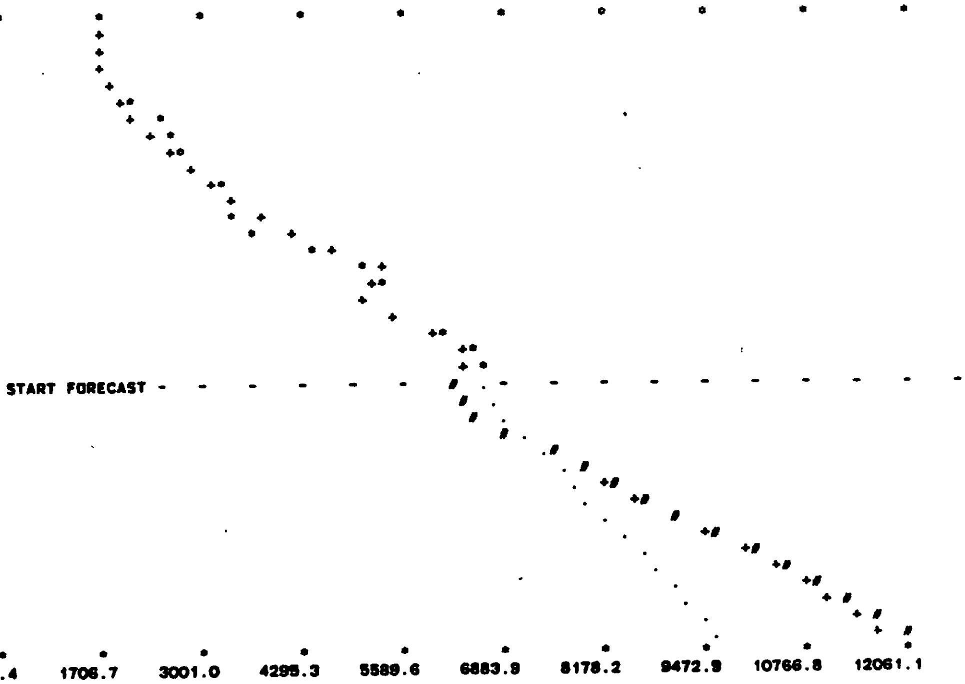


SECTOR # 9

TITLE : FLOOR COVERINGS

RSQ = 0.984
AAPE = 4.54%
RHO = 0.667
SHARE = 0.73%
UBAR = 20.328

DATE	ACTL=°	PREDIC=+	MISS=A-P*
1959	1802.	1707.	96.
1960	1753.	1744.	9.
1961	1753.	1809.	-56.
1962	1895.	1901.	-6.
1963	2157.	2001.	156.
1964	2511.	2188.	323.
1965	2661.	2453.	209.
1966	2775.	2668.	107.
1967	2876.	2889.	-13.
1968	3317.	3177.	140.
1969	3450.	3491.	-41.
1970	3510.	3849.	-339.
1971	3758.	4198.	-440.
1972	4438.	4761.	-322.
1973	5142.	5422.	-280.
1974	5425.	5291.	134.
1975	5154.	5151.	3.
1976	5589.	5465.	124.
1977	6190.	6000.	190.
1978	6517.	6370.	147.
1979	6713.	6425.	288.
1980	6661.	6243.	6240.
1981	6826.	6393.	6390.
1982	6905.	6613.	6572.
1983	7145.	6992.	6972.
1984	7466.	7545.	7581.
1985	7661.	7970.	8042.
1986	7940.	8306.	8387.
1987	8020.	8643.	8729.
1988	8264.	9105.	9210.
1989	8514.	9573.	9697.
1990	8768.	10097.	10246.
1991	8948.	10473.	10631.
1992	9129.	10813.	10985.
1993	9308.	11144.	11340.
1994	9487.	11463.	11698.
1995	9666.	11771.	12061.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

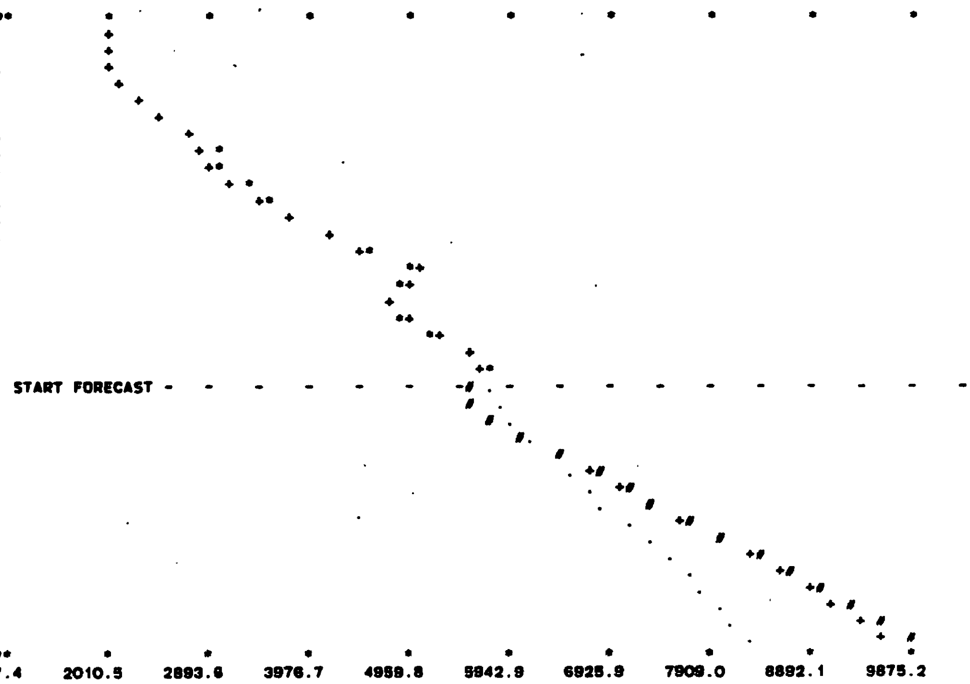


SECTOR # 10

TITLE : DURABLE HOUSEFURNISHINGS NEC

RSQ = 0.996
AAPE = 1.73%
RHO = 0.625
SHARE = 0.63%
UBAR = 13.210

DATE	ACTL=°	PREDIC=+	MISS=A-P*
1959	2058.	2092.	-33.
1960	2010.	2081.	-71.
1961	2044.	2104.	-59.
1962	2162.	2182.	-20.
1963	2312.	2325.	-13.
1964	2577.	2564.	13.
1965	2832.	2809.	24.
1966	3114.	2978.	136.
1967	3142.	3017.	125.
1968	3414.	3247.	168.
1969	3648.	3520.	128.
1970	3851.	3869.	-18.
1971	4201.	4185.	16.
1972	4572.	4530.	43.
1973	5039.	5071.	-32.
1974	4951.	4961.	-10.
1975	4786.	4844.	-58.
1976	4928.	4966.	-38.
1977	5174.	5278.	-104.
1978	5557.	5579.	-22.
1979	5827.	5724.	103.
1980	5749.	5619.	5622.
1981	5891.	5636.	5635.
1982	5959.	5806.	5778.
1983	6167.	6078.	6059.
1984	6443.	6497.	6519.
1985	6612.	6826.	6877.
1986	6766.	7072.	7131.
1987	6922.	7322.	7386.
1988	7132.	7670.	7743.
1989	7347.	8008.	8094.
1990	7567.	8338.	8443.
1991	7723.	8645.	8757.
1992	7879.	8913.	9034.
1993	8033.	9173.	9311.
1994	8187.	9424.	9591.
1995	8342.	9664.	9875.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

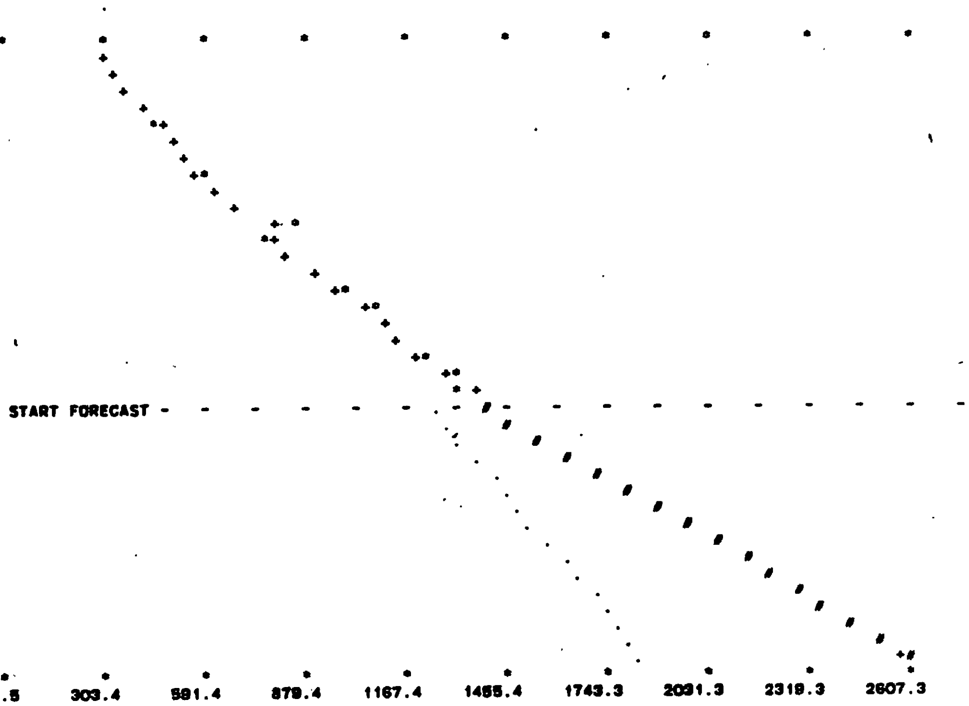


SECTOR # 11

TITLE : WRITING EQUIPMENT

RSQ = 0.996
AAPE = 2.06%
RHO = 0.026
SHARE = 0.14%
UBAR = 5.519

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	320.	303.	17.
1960	341.	348.	-7.
1961	376.	384.	-7.
1962	424.	428.	-3.
1963	459.	478.	-19.
1964	520.	511.	9.
1965	543.	541.	3.
1966	602.	584.	18.
1967	639.	633.	6.
1968	688.	690.	-2.
1969	862.	803.	59.
1970	783.	795.	-11.
1971	835.	837.	-2.
1972	914.	914.	-0.
1973	1023.	990.	33.
1974	1100.	1068.	33.
1975	1127.	1112.	15.
1976	1155.	1165.	-10.
1977	1241.	1225.	16.
1978	1313.	1302.	11.
1979	1339.	1382.	-43.
1980	1277.	1423.	1423.
1981	1309.	1484.	1484.
1982	1324.	1546.	1546.
1983	1370.	1638.	1638.
1984	1432.	1720.	1720.
1985	1468.	1806.	1806.
1986	1504.	1891.	1891.
1987	1538.	1982.	1982.
1988	1585.	2068.	2068.
1989	1633.	2149.	2149.
1990	1682.	2221.	2221.
1991	1716.	2297.	2297.
1992	1751.	2374.	2374.
1993	1785.	2452.	2452.
1994	1819.	2530.	2530.
1995	1854.	2607.	2607.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

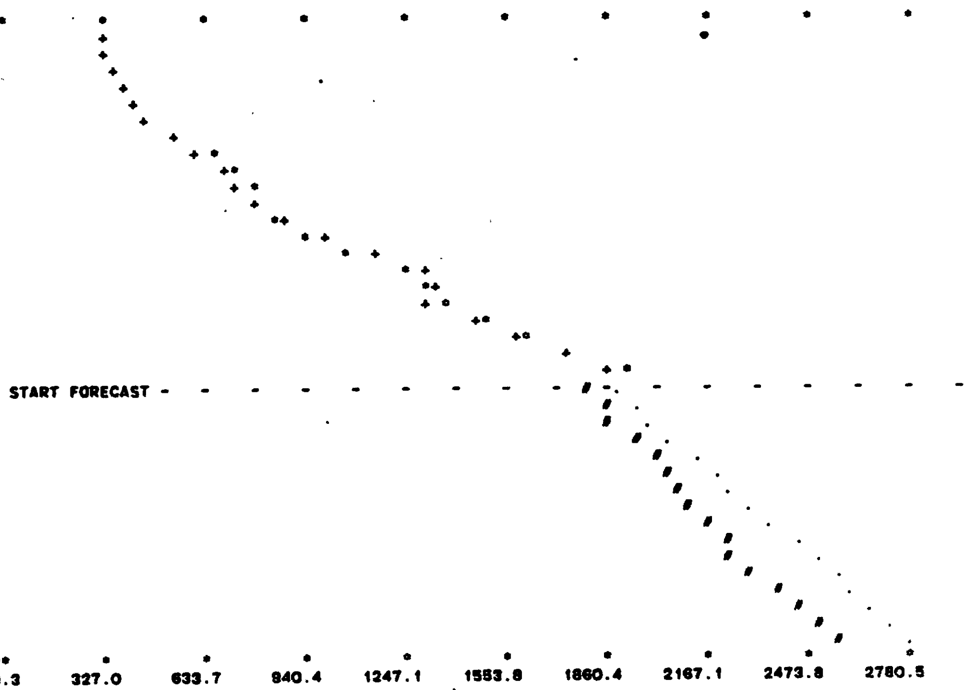


SECTOR # 12

TITLE : HAND TOOLS

RSQ = 0.993
AAPE = 3.65%
RHO = 0.680
SHARE = 0.21%
UBAR = 8.474

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	327.	329.	-2.
1960	354.	357.	-2.
1961	361.	362.	-1.
1962	409.	389.	20.
1963	438.	422.	15.
1964	480.	475.	5.
1965	571.	543.	28.
1966	694.	630.	64.
1967	749.	697.	52.
1968	800.	756.	44.
1969	817.	800.	17.
1970	861.	892.	-31.
1971	957.	1031.	-74.
1972	1083.	1174.	-91.
1973	1270.	1317.	-47.
1974	1339.	1351.	-12.
1975	1376.	1331.	45.
1976	1503.	1463.	40.
1977	1645.	1585.	60.
1978	1760.	1763.	-3.
1978	1924.	1874.	50.
1980	1916.	1827.	1827.
1981	1964.	1877.	1877.
1982	1986.	1888.	1888.
1983	2056.	1961.	1961.
1984	2148.	2035.	2035.
1985	2204.	2060.	2060.
1986	2255.	2091.	2091.
1987	2307.	2126.	2126.
1988	2377.	2183.	2183.
1989	2449.	2244.	2244.
1990	2522.	2257.	2257.
1991	2574.	2319.	2319.
1992	2626.	2385.	2385.
1993	2678.	2451.	2451.
1994	2729.	2518.	2518.
1995	2781.	2584.	2584.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

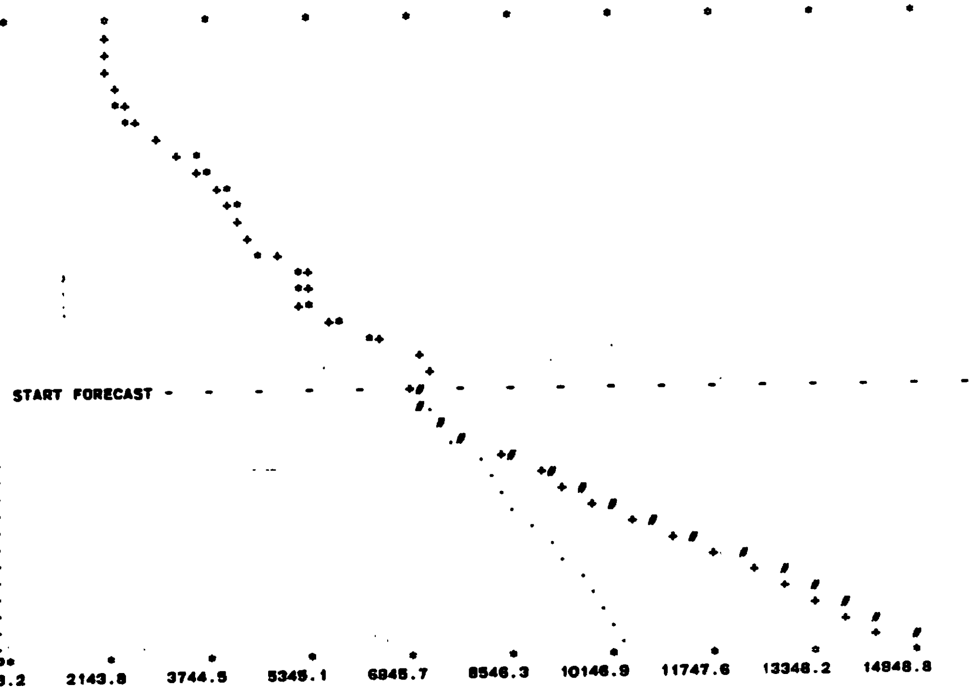


SECTOR # 13

TITLE : JEWELRY

RSQ = 0.994
AAPE = 2.61%
RHO = 0.456
SHARE = 0.79%
UBAR = -6.442

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	2220.	2144.	76.
1960	2203.	2266.	-63.
1961	2170.	2301.	-131.
1962	2333.	2376.	-44.
1963	2492.	2508.	-56.
1964	2583.	2653.	-70.
1965	2944.	2994.	-50.
1966	3648.	3416.	232.
1967	3877.	3684.	193.
1968	4126.	3977.	149.
1969	4228.	4138.	91.
1970	4327.	4324.	3.
1971	4428.	4495.	-67.
1972	4694.	4917.	-222.
1973	5223.	5413.	-190.
1974	5344.	5397.	-53.
1975	5357.	5344.	13.
1976	5915.	5762.	153.
1977	6334.	6484.	-150.
1978	7157.	7118.	39.
1979	7327.	7315.	12.
1980	7208.	7098.	7122.
1981	7387.	7155.	7185.
1982	7472.	7433.	7433.
1983	7733.	7869.	7884.
1984	8080.	8510.	8640.
1985	8291.	9052.	9294.
1986	8484.	9474.	9769.
1987	8680.	9872.	10250.
1988	8944.	10548.	10857.
1989	9213.	11202.	11562.
1990	9489.	11900.	12316.
1991	9684.	12473.	12908.
1992	9880.	12953.	13409.
1993	10073.	13398.	13915.
1994	10267.	13848.	14426.
1995	10460.	14315.	14949.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

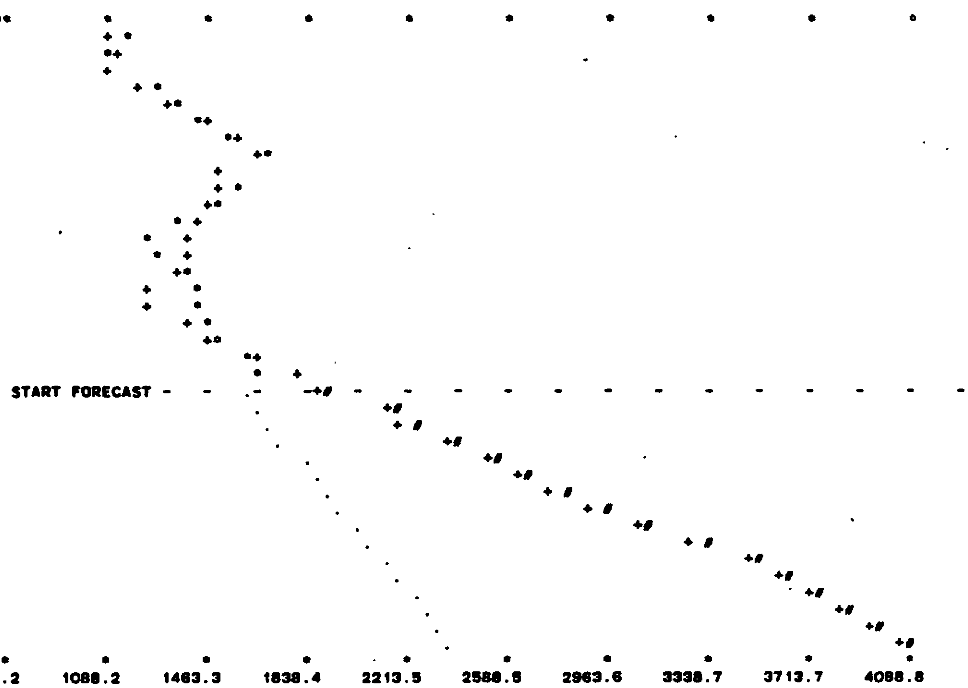


SECTOR # 14

TITLE : OPHTHALMIC AND ORTHOPEDIC APPLIANCES

RSQ = 0.723
AAPE = 4.85%
RHO = 0.549
SHARE = 0.18%
UBAR = 10.277

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	1170.	1088.	82.
1960	1113.	1141.	-28.
1961	1090.	1118.	-28.
1962	1309.	1223.	86.
1963	1372.	1334.	38.
1964	1462.	1477.	-16.
1965	1558.	1594.	-37.
1966	1694.	1670.	24.
1967	1513.	1514.	-1.
1968	1583.	1537.	47.
1969	1514.	1487.	27.
1970	1385.	1442.	-57.
1971	1254.	1405.	-151.
1972	1313.	1407.	-94.
1973	1421.	1377.	44.
1974	1440.	1248.	192.
1975	1460.	1274.	186.
1976	1481.	1395.	86.
1977	1508.	1498.	10.
1978	1614.	1666.	-52.
1979	1684.	1827.	-142.
1980	1642.	1909.	1921.
1981	1683.	2162.	2184.
1982	1703.	2213.	2252.
1983	1762.	2375.	2418.
1984	1841.	2538.	2582.
1985	1889.	2632.	2681.
1986	1933.	2767.	2823.
1987	1978.	2907.	2965.
1988	2038.	3089.	3142.
1989	2099.	3293.	3340.
1990	2162.	3501.	3541.
1991	2206.	3611.	3646.
1992	2251.	3729.	3757.
1993	2285.	3848.	3867.
1994	2339.	3966.	3978.
1995	2383.	4082.	4089.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

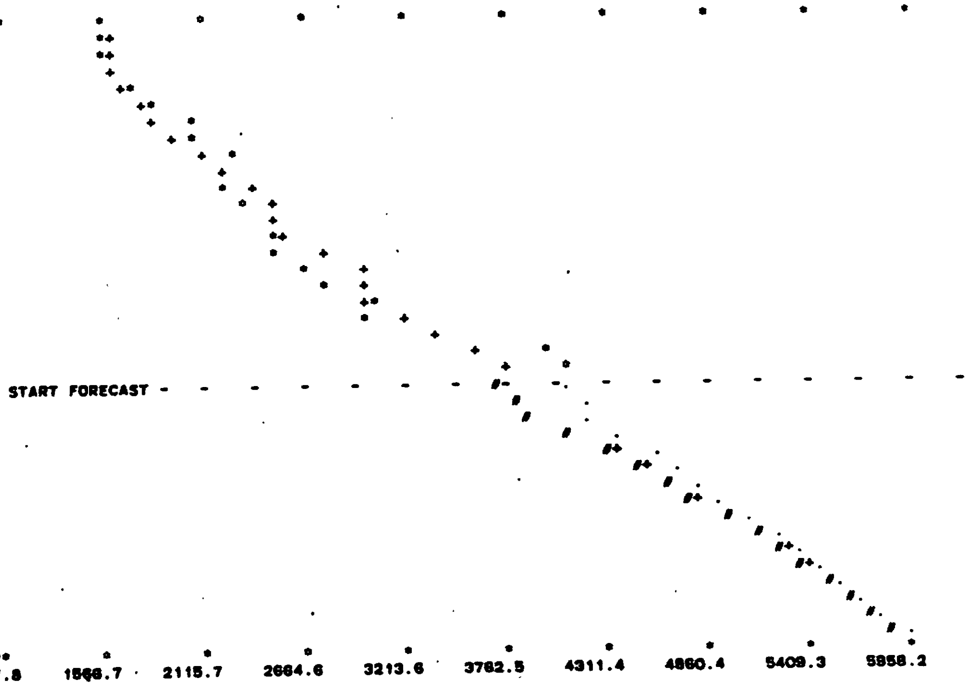


SECTOR # 15

TITLE : BOOKS AND MAPS

RSQ = 0.933
AAPE = 5.22%
RHO = 0.524
SHARE = 0.45%
UBAR = -3.854

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	1567.	1632.	-66.
1960	1602.	1651.	-48.
1961	1667.	1633.	35.
1962	1733.	1719.	14.
1963	1870.	1818.	53.
1964	2084.	1880.	204.
1965	2109.	2003.	106.
1966	2317.	2160.	157.
1967	2270.	2242.	28.
1968	2278.	2392.	-114.
1969	2353.	2525.	-172.
1970	2551.	2519.	32.
1971	2534.	2572.	-38.
1972	2529.	2807.	-278.
1973	2702.	3006.	-304.
1974	2788.	3028.	-240.
1975	3068.	3044.	24.
1976	3008.	3254.	-246.
1977	3432.	3404.	28.
1978	4011.	3624.	387.
1979	4140.	3783.	358.
1980	4106.	3739.	3728.
1981	4208.	3871.	3851.
1982	4256.	3923.	3903.
1983	4405.	4146.	4119.
1984	4602.	4381.	4345.
1985	4723.	4538.	4497.
1986	4833.	4684.	4642.
1987	4944.	4833.	4798.
1988	5094.	5005.	4974.
1989	5248.	5166.	5143.
1990	5405.	5302.	5284.
1991	5516.	5411.	5399.
1992	5628.	5524.	5521.
1993	5738.	5635.	5641.
1994	5846.	5750.	5762.
1995	5958.	5870.	5883.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

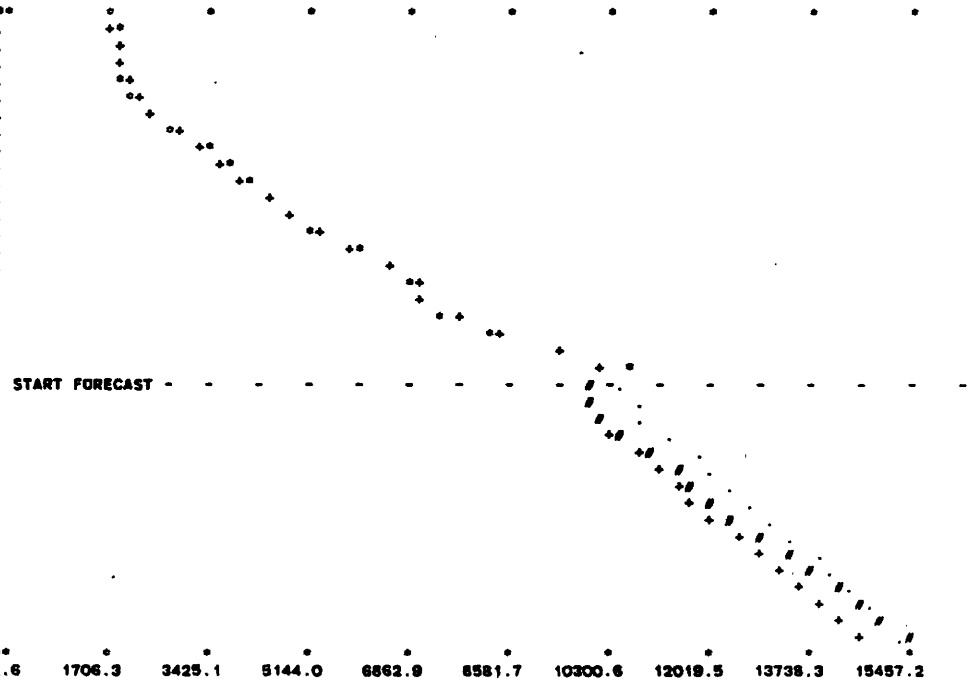


SECTOR # 16

TITLE : WHEEL GOODS AND DURABLE TOYS

RSQ = 0.995
AAPE = 3.62%
RHO = 0.242
SHARE = 1.16%
UBAR = 9.014

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	2006.	1706.	300.
1960	1939.	1910.	29.
1961	1940.	1972.	-32.
1962	2013.	2090.	-76.
1963	2142.	2304.	-162.
1964	2415.	2537.	-122.
1965	2826.	2932.	-106.
1966	3469.	3338.	131.
1967	3792.	3660.	132.
1968	4276.	4077.	199.
1969	4626.	4520.	107.
1970	4909.	4941.	-32.
1971	5162.	5344.	-182.
1972	6111.	6002.	109.
1973	6618.	6675.	-57.
1974	6888.	7134.	-246.
1975	7153.	7101.	52.
1976	7499.	7733.	-234.
1977	8257.	8523.	-266.
1978	9600.	9486.	114.
1979	10760.	10230.	531.
1980	10585.	10013.	10047.
1981	10846.	10048.	10117.
1982	10972.	10159.	10267.
1983	11354.	10442.	10599.
1984	11864.	10920.	11111.
1985	12174.	11288.	11508.
1986	12458.	11562.	11809.
1987	12745.	11785.	12091.
1988	13132.	12124.	12483.
1989	13528.	12592.	13004.
1990	13933.	12936.	13397.
1991	14219.	13352.	13878.
1992	14507.	13683.	14272.
1993	14791.	14015.	14667.
1994	15075.	14349.	15061.
1995	15359.	14682.	15457.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

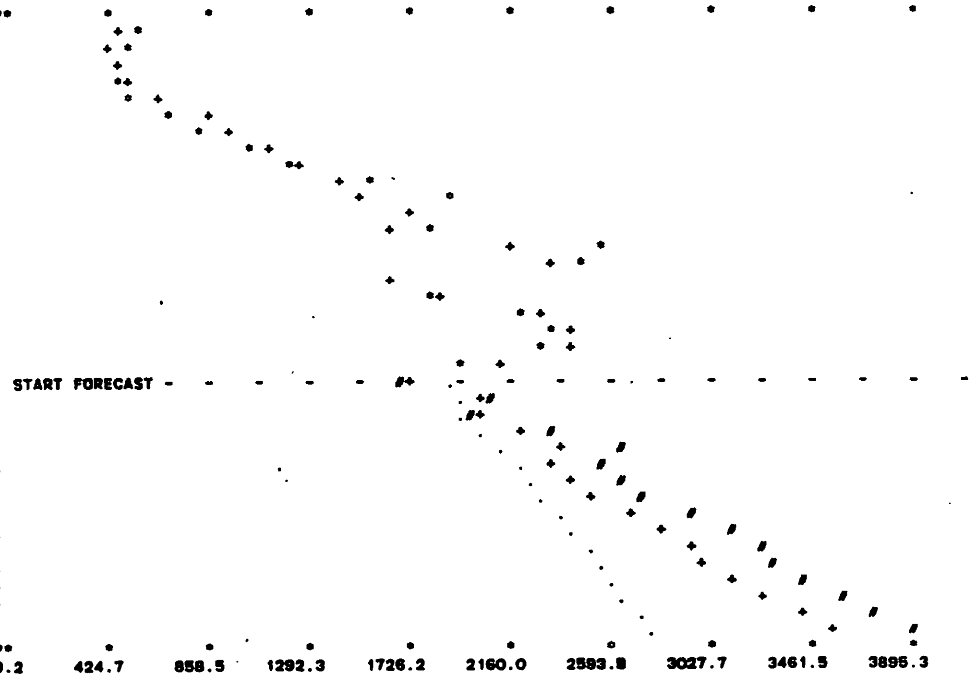


SECTOR # 17

TITLE : BOATS, RECREATIONAL VECH., AND AIRCRAFT

RSQ = 0.953
AAPE = 9.91%
RHO = 0.492
SHARE = 0.21%
UBAR = 10.613

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	563.	481.	81.
1960	554.	425.	130.
1961	489.	494.	-5.
1962	478.	549.	-70.
1963	546.	657.	-111.
1964	711.	891.	-180.
1965	829.	974.	-145.
1966	1071.	1153.	-82.
1967	1232.	1279.	-46.
1968	1558.	1454.	104.
1969	1911.	1539.	372.
1970	1735.	1764.	-29.
1971	1841.	1668.	173.
1972	2558.	2185.	373.
1973	2478.	2361.	117.
1974	1674.	1657.	17.
1975	1855.	1861.	-6.
1976	2226.	2304.	-78.
1977	2352.	2436.	-84.
1978	2321.	2421.	-100.
1979	1948.	2155.	-207.
1980	1916.	1756.	1723.
1981	1964.	2052.	2084.
1982	1986.	2030.	2025.
1983	2056.	2229.	2355.
1984	2148.	2420.	2844.
1985	2204.	2367.	2593.
1986	2255.	2437.	2652.
1987	2307.	2518.	2737.
1988	2377.	2691.	2960.
1989	2449.	2839.	3128.
1990	2522.	2945.	3252.
1991	2574.	3012.	3310.
1992	2626.	3153.	3455.
1993	2678.	3285.	3597.
1994	2729.	3428.	3744.
1995	2781.	3574.	3895.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

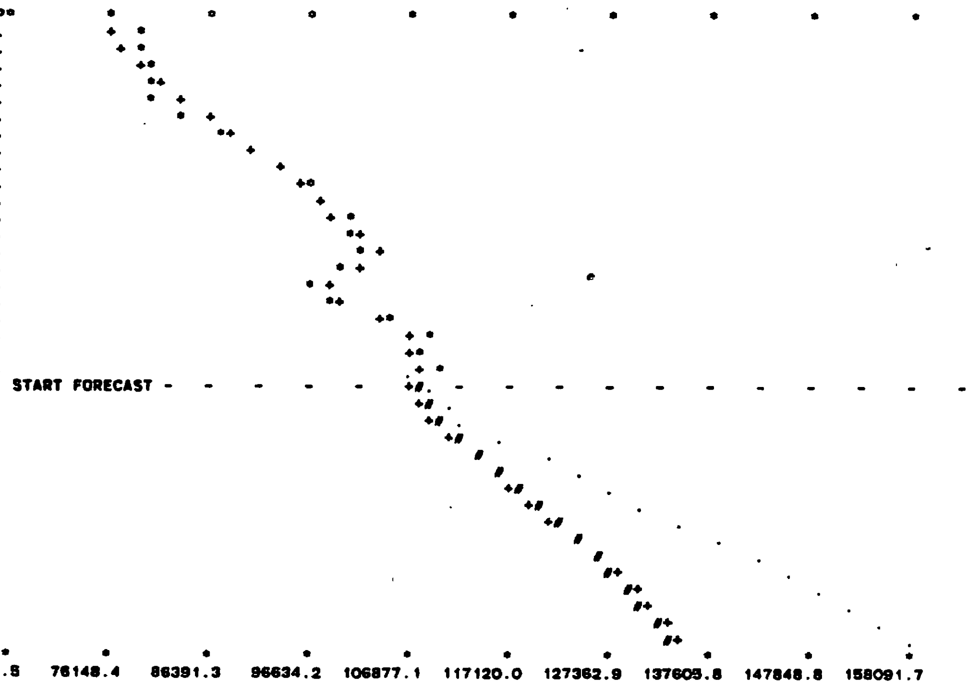


SECTOR # 18

TITLE : FOOD, OFF PREMISE

RSQ = 0.972
AAPE = 1.56%
RHO = 0.696
SHARE = 11.94%
UBAR = 3.589

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	79375.	76148.	3227.
1960	79892.	78185.	1707.
1961	80729.	79650.	1079.
1962	80837.	81979.	-1142.
1963	81124.	84130.	-3007.
1964	84253.	86574.	-2321.
1965	88392.	88951.	-558.
1966	91171.	90616.	555.
1967	93639.	93909.	-270.
1968	96950.	96564.	386.
1969	98488.	98563.	-75.
1970	101181.	99659.	1522.
1971	101633.	102152.	-519.
1972	102573.	103845.	-1271.
1973	99885.	102216.	-2331.
1974	96918.	99313.	-2395.
1975	98868.	100009.	-1140.
1976	104991.	104095.	896.
1977	109110.	107116.	1994.
1978	108906.	107644.	1262.
1979	110431.	107954.	2477.
1980	108948.	107630.	107939.
1981	111639.	108394.	108943.
1982	112938.	109324.	110209.
1983	116871.	111286.	112209.
1984	122117.	114077.	114833.
1985	125311.	116243.	116908.
1986	128231.	117995.	118674.
1987	131184.	119785.	120357.
1988	135173.	122028.	122383.
1989	139250.	124480.	124564.
1990	143409.	126831.	126647.
1991	146361.	128737.	128319.
1992	149319.	130481.	129826.
1993	152242.	132217.	131297.
1994	155167.	133910.	132734.
1995	158092.	135519.	134136.
DATE	ACTL=*	PREDIC=+	MISS=A-P*



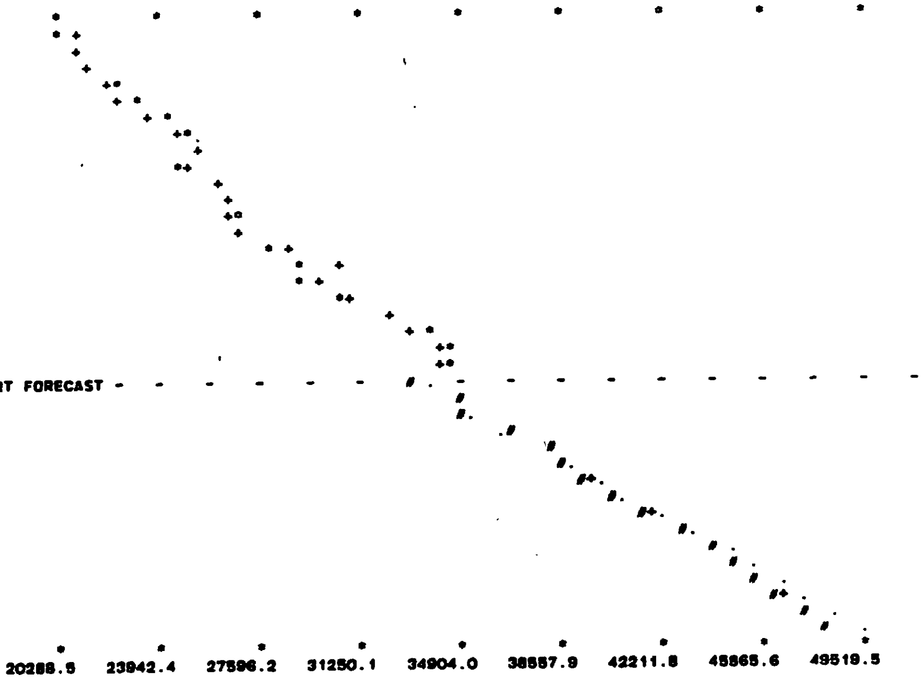
SECTOR # 19

TITLE : FOOD, ON PREMISE

RSQ = 0.980
AAPE = 1.82%
RHO = 0.672
SHARE = 3.74%
UBAR = -2.401

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	20288.	21249.	-961.
1960	21028.	21150.	-122.
1961	21738.	21393.	345.
1962	22691.	22197.	494.
1963	23493.	22690.	803.
1964	24543.	23924.	620.
1965	25287.	24924.	364.
1966	25434.	25752.	-318.
1967	24994.	25343.	-349.
1968	26476.	26468.	8.
1969	26780.	26767.	13.
1970	27079.	26558.	522.
1971	26871.	27112.	-240.
1972	28054.	29025.	-970.
1973	29341.	30793.	-1451.
1974	29418.	29991.	-573.
1975	30868.	31001.	-133.
1976	32653.	32503.	150.
1977	34157.	33217.	940.
1978	34863.	34377.	486.
1979	34568.	34246.	322.
1980	34126.	33151.	33111.
1981	34969.	35055.	35015.
1982	35376.	35182.	35097.
1983	36608.	36819.	36774.
1984	38251.	38498.	38476.
1985	39251.	38906.	38869.
1986	4C166.	39680.	39619.
1987	41091.	40515.	40444.
1988	42340.	41854.	41788.
1989	43618.	43033.	42957.
1990	44920.	44291.	44199.
1991	45845.	44919.	44794.
1992	46772.	45804.	45662.
1993	47687.	46657.	46509.
1994	48603.	47525.	47366.
1995	49520.	48393.	48223.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

16634.6



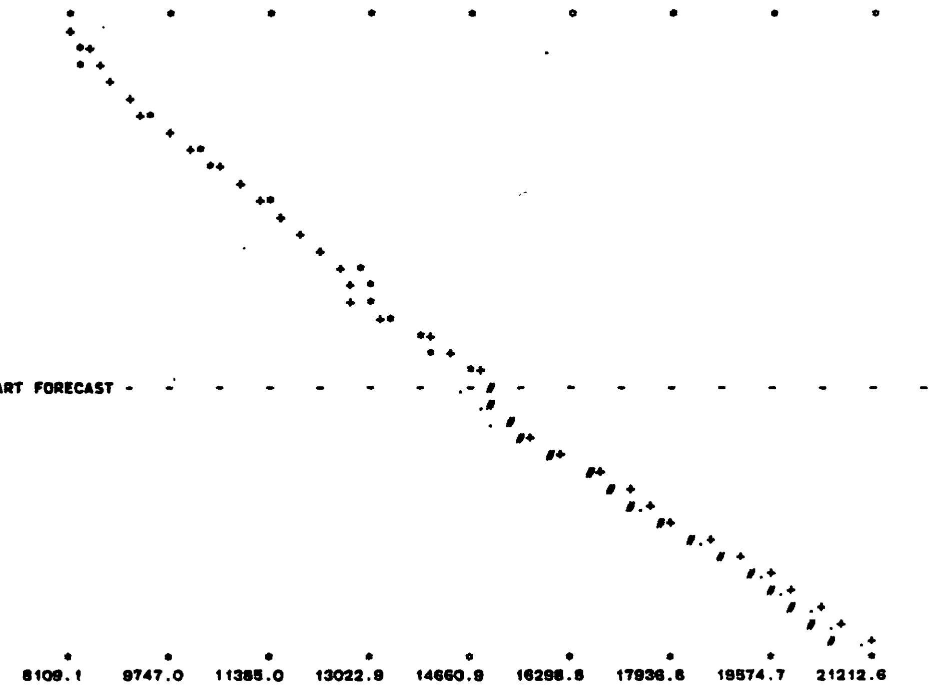
SECTOR # 20

TITLE : ALCOHOL, OFF PREMISE

RSQ = 0.991
AAPE = 1.36%
RHO = 0.526
SHARE = 1.59%
UBAR = 36.387

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	8254.	8109.	145.
1960	8302.	8450.	-148.
1961	8368.	8630.	-262.
1962	8893.	8818.	75.
1963	9162.	9102.	60.
1964	9507.	9396.	111.
1965	9818.	9754.	65.
1966	10285.	10075.	210.
1967	10512.	10599.	-86.
1968	11043.	10920.	123.
1969	11387.	11352.	35.
1970	11626.	11659.	-33.
1971	11965.	11987.	-22.
1972	12354.	12322.	31.
1973	12871.	12581.	290.
1974	13038.	12707.	332.
1975	13090.	12746.	344.
1976	13452.	13268.	184.
1977	13896.	14009.	-113.
1978	14080.	14462.	-382.
1979	14671.	14867.	-196.
1980	14508.	15119.	15080.
1981	14867.	15099.	15035.
1982	15040.	15442.	15381.
1983	15563.	15720.	15607.
1984	16262.	16265.	16114.
1985	16687.	16874.	16687.
1986	17076.	17287.	17076.
1987	17469.	17673.	17435.
1988	18000.	18095.	17825.
1989	18543.	18623.	18315.
1990	19097.	19158.	18809.
1991	19490.	19675.	19269.
1992	19984.	20066.	19617.
1993	20273.	20452.	19966.
1994	20663.	20832.	20310.
1995	21052.	21213.	20683.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

6471.1

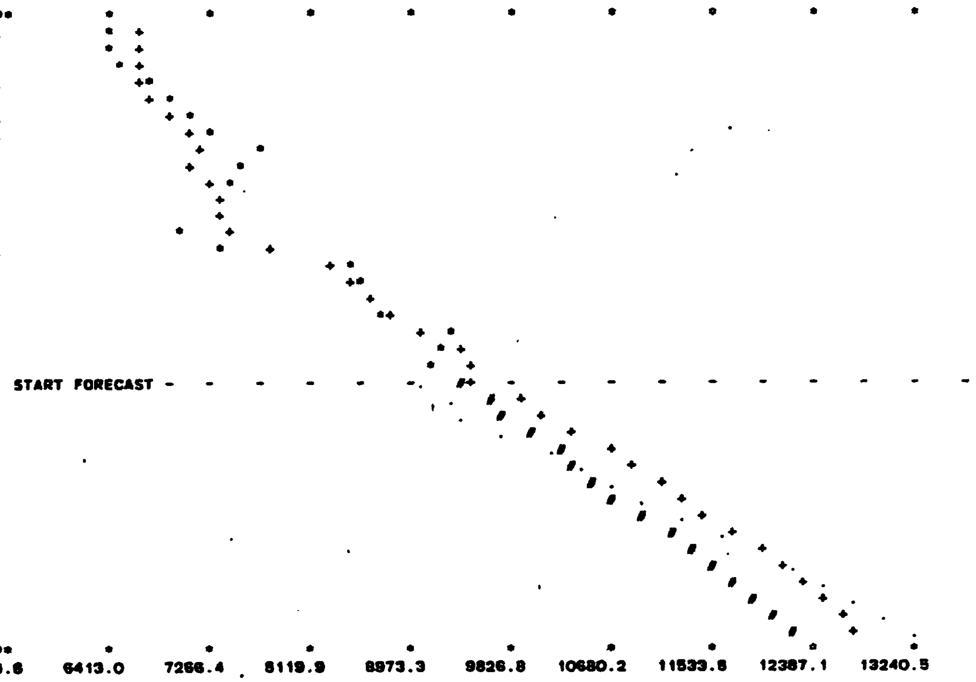


SECTOR # 21

TITLE : ALCOHOL, ON PREMISE

RSQ = 0.929
AAPE = 2.70%
RHO = 0.527
SHARE = 1.00%
UBAR = 1.342

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	6441.	6715.	-274.
1960	6413.	6697.	-284.
1961	6551.	6717.	-166.
1962	6760.	6752.	9.
1963	6960.	6824.	136.
1964	7097.	6987.	110.
1965	7350.	7103.	247.
1966	7710.	7212.	498.
1967	7563.	7160.	403.
1968	7507.	7313.	195.
1969	7357.	7414.	-57.
1970	7425.	7413.	12.
1971	7039.	7482.	-443.
1972	7436.	7823.	-387.
1973	8521.	8318.	203.
1974	8553.	8485.	68.
1975	8649.	8695.	-46.
1976	8802.	8857.	-55.
1977	9334.	9059.	279.
1978	9288.	9415.	-127.
1979	9223.	9510.	-287.
1980	9125.	9557.	9444.
1981	9350.	9813.	9701.
1982	9459.	10088.	9766.
1983	9788.	10386.	10010.
1984	10228.	10716.	10291.
1985	10495.	10903.	10423.
1986	10740.	11117.	10577.
1987	10987.	11293.	10737.
1988	11321.	11527.	10972.
1989	11662.	11759.	11198.
1990	12011.	12015.	11441.
1991	12258.	12200.	11897.
1992	12506.	12371.	11771.
1993	12751.	12511.	11942.
1994	12996.	12652.	12113.
1995	13241.	12799.	12284.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

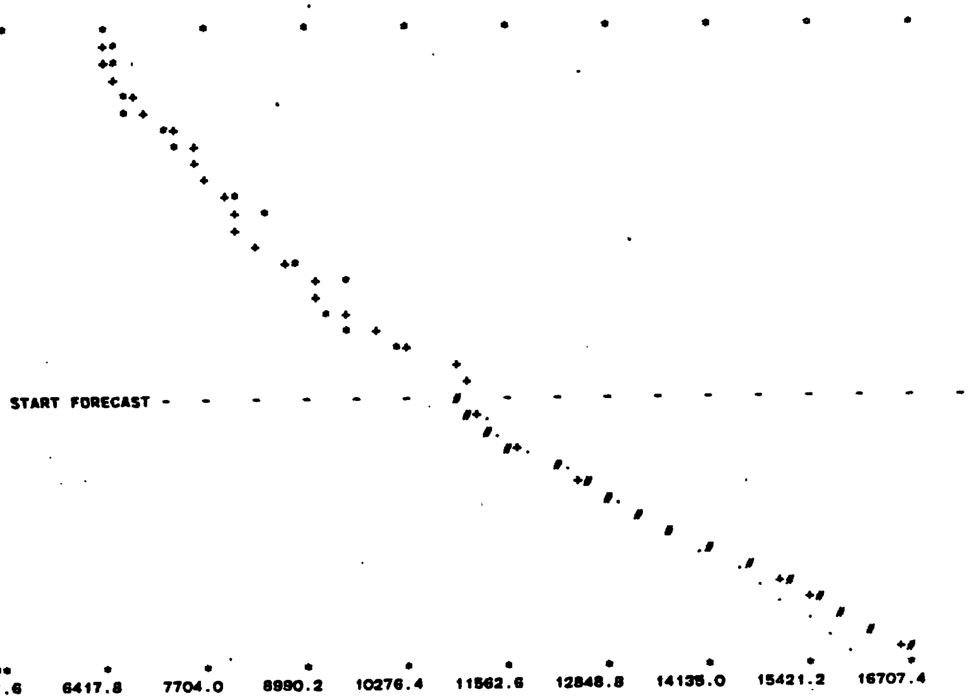


SECTOR # 22

TITLE : SHOES AND FOOTWARE

RSQ = 0.981
AAPE = 1.68%
RHO = 0.409
SHARE = 1.21%
UBAR = 0.510

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	6566.	6418.	148.
1960	6576.	6526.	50.
1961	6598.	6667.	-69.
1962	6797.	6820.	-23.
1963	6798.	7038.	-239.
1964	7276.	7393.	-116.
1965	7382.	7640.	-258.
1966	7692.	7682.	10.
1967	7714.	7763.	-49.
1968	8171.	8012.	159.
1969	8561.	8138.	424.
1970	8210.	8198.	13.
1971	8388.	8373.	15.
1972	8914.	8784.	131.
1973	9568.	9151.	417.
1974	9185.	9209.	-25.
1975	9269.	9512.	-243.
1976	9608.	9933.	-325.
1977	10229.	10344.	-115.
1978	10955.	10936.	19.
1979	11167.	11080.	87.
1980	11041.	11041.	11015.
1981	11314.	11194.	11154.
1982	11445.	11399.	11323.
1983	11844.	11742.	11673.
1984	12375.	12228.	12209.
1985	12699.	12589.	12604.
1986	12995.	12924.	12936.
1987	13294.	13254.	13254.
1988	13698.	13662.	13670.
1989	14112.	14135.	14161.
1990	14533.	14701.	14742.
1991	14832.	15131.	15167.
1992	15132.	15525.	15550.
1993	15428.	15916.	15933.
1994	15725.	16303.	16318.
1995	16021.	16690.	16707.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

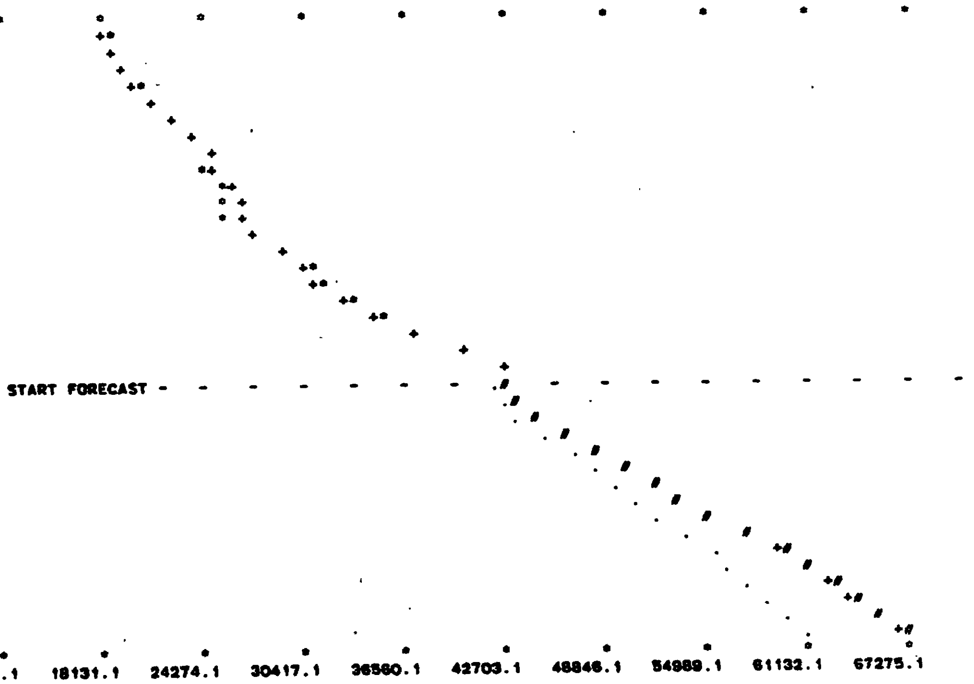


SECTOR # 23

TITLE : WOMENS CLOTHING

RSQ = 0.995
AAPE = 1.46%
RHO = 0.691
SHARE = 4.63%
UBAR = 10.807

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	18895.	18131.	764.
1960	19179.	19021.	158.
1961	19642.	19527.	115.
1962	20742.	20469.	273.
1963	21288.	21380.	-92.
1964	22884.	22771.	113.
1965	23728.	24042.	-313.
1966	25170.	25218.	-48.
1967	24782.	25431.	-650.
1968	25589.	26151.	-562.
1969	25986.	26853.	-867.
1970	26103.	27244.	-1141.
1971	27696.	27757.	-61.
1972	29343.	29222.	121.
1973	31561.	30762.	799.
1974	32059.	31293.	-767.
1975	33727.	33250.	477.
1976	35727.	35269.	458.
1977	37327.	37456.	-129.
1978	40507.	40425.	82.
1979	42815.	42852.	-37.
1980	42247.	42705.	42712.
1981	43291.	43744.	43761.
1982	43794.	44782.	44775.
1983	45319.	46449.	46466.
1984	47384.	48743.	48826.
1985	48892.	50517.	50630.
1986	49724.	52025.	52122.
1987	50870.	53539.	53634.
1988	52416.	55358.	55468.
1989	53997.	57498.	57644.
1990	55610.	59879.	60074.
1991	56755.	61407.	61650.
1992	57902.	62797.	63060.
1993	59035.	64190.	64463.
1994	60170.	65592.	65866.
1995	61304.	66993.	67275.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

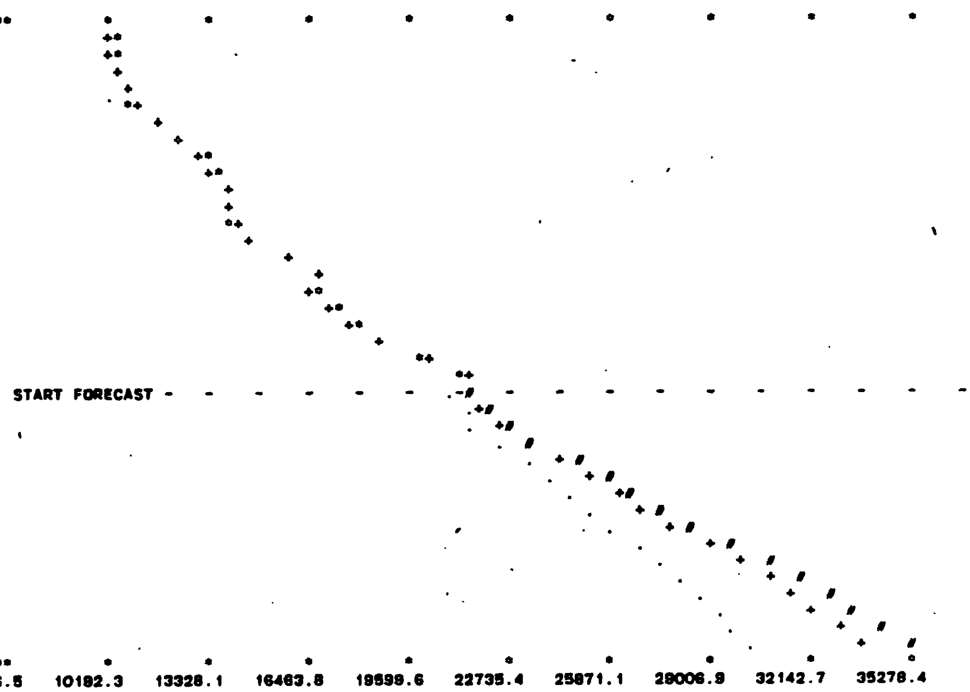


SECTOR # 24

TITLE : MENS CLOTHING

RSQ = 0.995
AAPE = 1.26%
RHO = 0.507
SHARE = 2.30%
UBAR = 32.204

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	10515.	10192.	323.
1960	10529.	10486.	44.
1961	10661.	10613.	48.
1962	11006.	10988.	18.
1963	11106.	11426.	-321.
1964	11935.	12021.	-86.
1965	12468.	12667.	-199.
1966	13409.	13177.	232.
1967	13799.	13569.	230.
1968	14121.	14036.	85.
1969	14249.	14222.	27.
1970	14058.	14430.	-372.
1971	14674.	14874.	-199.
1972	15965.	15983.	-19.
1973	17028.	16841.	187.
1974	16876.	16625.	251.
1975	17530.	17118.	412.
1976	18199.	17963.	236.
1977	18885.	18727.	158.
1978	20116.	20228.	-112.
1979	21283.	21550.	-267.
1980	20987.	21524.	21578.
1981	21505.	22059.	22172.
1982	21755.	22585.	22749.
1983	22513.	23427.	23669.
1984	23523.	24603.	24950.
1985	24139.	25481.	25925.
1986	24701.	26236.	26759.
1987	25270.	26996.	27602.
1988	26038.	27907.	28611.
1989	26824.	29025.	29836.
1990	27625.	30234.	31157.
1991	28193.	31039.	32058.
1992	28763.	31749.	32863.
1993	29326.	32444.	33666.
1994	28890.	33144.	34470.
1995	30453.	33851.	35279.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

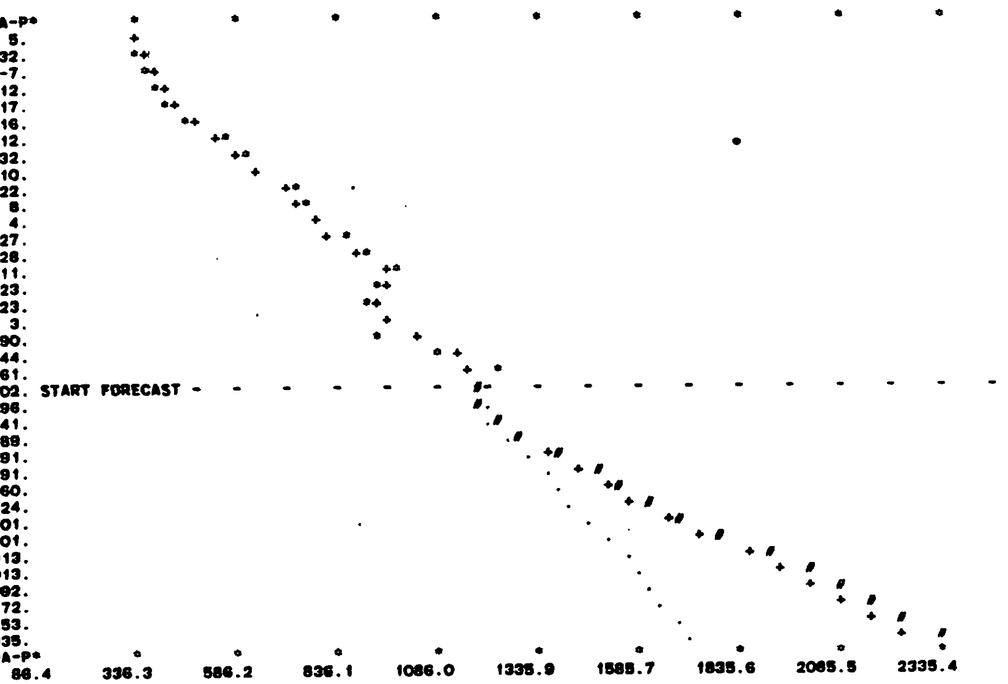


SECTOR # 25

TITLE : LUGGAGE

RSQ = 0.986
AAPE = 3.19%
RHO = 0.196
SHARE = 0.13%
UBAR = -2.098

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	341.	336.	5.
1960	341.	373.	-32.
1961	384.	392.	-7.
1962	402.	414.	-12.
1963	427.	445.	-17.
1964	481.	497.	-16.
1965	570.	558.	12.
1966	630.	598.	32.
1967	653.	644.	10.
1968	736.	714.	22.
1969	763.	758.	8.
1970	801.	797.	4.
1971	862.	835.	27.
1972	917.	889.	28.
1973	996.	986.	11.
1974	947.	970.	-23.
1975	923.	946.	-23.
1976	985.	983.	3.
1977	955.	1045.	-90.
1978	1095.	1139.	-44.
1979	1244.	1183.	61.
1980	1186.	1195.	1202.
1981	1216.	1191.	1196.
1982	1230.	1237.	1241.
1983	1272.	1289.	1289.
1984	1330.	1376.	1391.
1985	1364.	1459.	1491.
1986	1396.	1518.	1560.
1987	1428.	1586.	1624.
1988	1472.	1661.	1701.
1989	1516.	1755.	1801.
1990	1561.	1861.	1913.
1991	1594.	1958.	2013.
1992	1626.	2035.	2092.
1993	1658.	2107.	2172.
1994	1689.	2180.	2253.
1995	1721.	2256.	2335.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

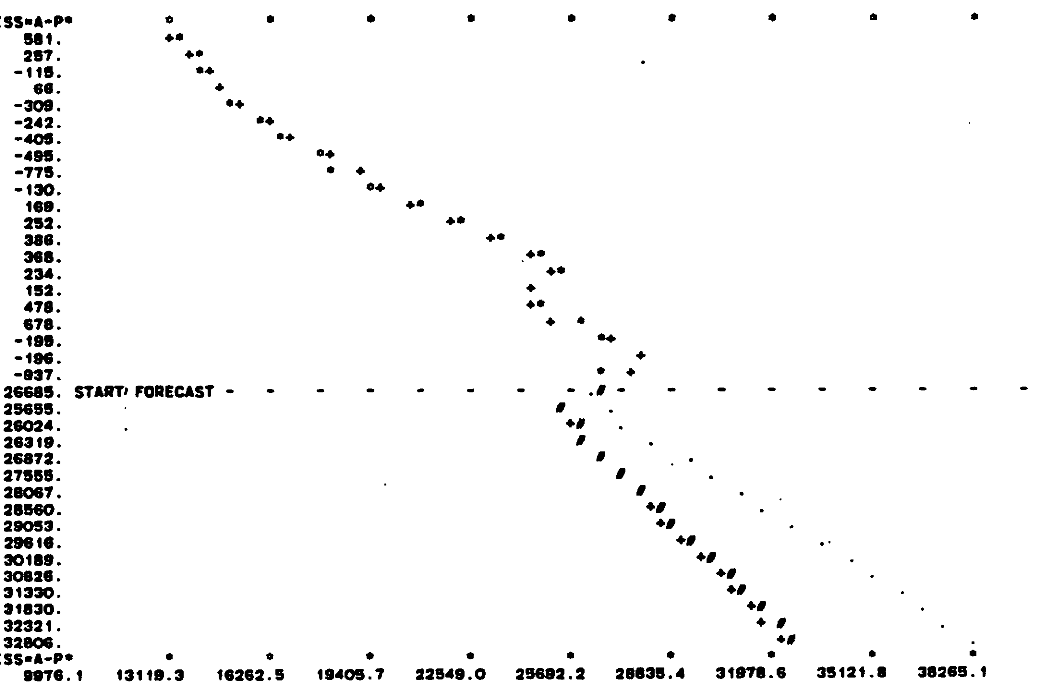


SECTOR # 26

TITLE : GASOLINE AND OIL

RSQ = 0.992
AAPE = 1.76%
RHO = 0.541
SHARE = 2.89%
UBAR = -8.477

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	13700.	13119.	581.
1960	14175.	13918.	257.
1961	14275.	14390.	-115.
1962	14875.	14809.	66.
1963	15300.	15609.	-309.
1964	16025.	16267.	-242.
1965	16800.	17205.	-405.
1966	17850.	18345.	-495.
1967	18400.	19175.	-775.
1968	19650.	19780.	-130.
1969	21025.	20856.	169.
1970	22475.	22223.	252.
1971	23700.	23314.	386.
1972	24875.	24507.	368.
1973	25475.	25241.	234.
1974	24650.	24498.	152.
1975	25000.	24522.	478.
1976	26050.	25372.	678.
1977	26775.	26970.	-195.
1978	27975.	28171.	-196.
1979	26700.	27637.	-937.
1980	26370.	26700.	26685.
1981	27022.	25626.	25655.
1982	27336.	25976.	26024.
1983	28288.	26194.	26319.
1984	29558.	26762.	26872.
1985	30331.	27475.	27555.
1986	31038.	27967.	28067.
1987	31752.	28407.	28560.
1988	32718.	28832.	29053.
1989	33705.	29356.	29616.
1990	34711.	29894.	30189.
1991	35426.	30500.	30826.
1992	36142.	30955.	31330.
1993	36849.	31411.	31830.
1994	37557.	31873.	32321.
1995	38265.	32345.	32806.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

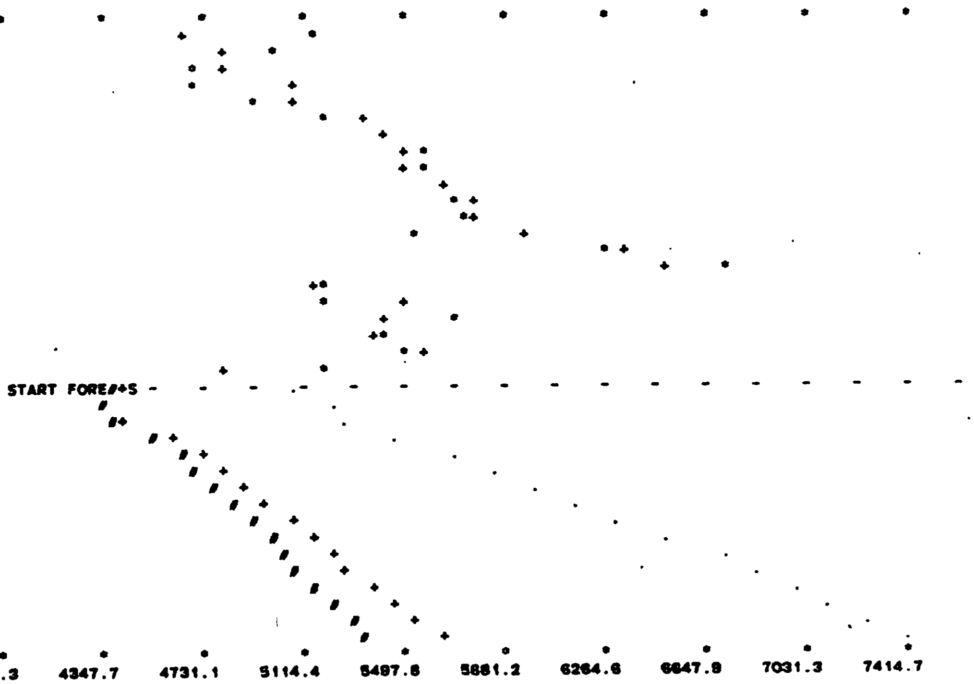


SECTOR # 27

TITLE : FUEL OIL AND COAL

RSQ = 0.767
AAPE = 3.23%
RHO = 0.175
SHARE = 0.56%
UBAR = -1.128

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	5175.	4690.	485.
1960	5025.	4818.	206.
1961	4700.	4827.	-127.
1962	4700.	5099.	-399.
1963	4950.	5092.	-142.
1964	5200.	5362.	-162.
1965	5450.	5446.	4.
1966	5575.	5520.	55.
1967	5600.	5507.	93.
1968	5675.	5665.	10.
1969	5725.	5771.	-46.
1970	5750.	5802.	-52.
1971	5550.	5961.	-411.
1972	6275.	6365.	-90.
1973	6725.	6530.	195.
1974	5225.	5172.	53.
1975	5200.	5510.	-310.
1976	5700.	5428.	272.
1977	5450.	5417.	33.
1978	5525.	5594.	-69.
1979	5200.	4823.	377.
1980	5110.	4440.	4416.
1981	5236.	4384.	4348.
1982	5297.	4425.	4390.
1983	5481.	4620.	4547.
1984	5727.	4757.	4673.
1985	5877.	4812.	4718.
1986	6014.	4891.	4790.
1987	6153.	4977.	4856.
1988	6340.	5091.	4946.
1989	6531.	5159.	5001.
1990	6728.	5235.	5052.
1991	6864.	5292.	5099.
1992	7003.	5388.	5170.
1993	7140.	5474.	5239.
1994	7278.	5563.	5308.
1995	7415.	5657.	5375.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

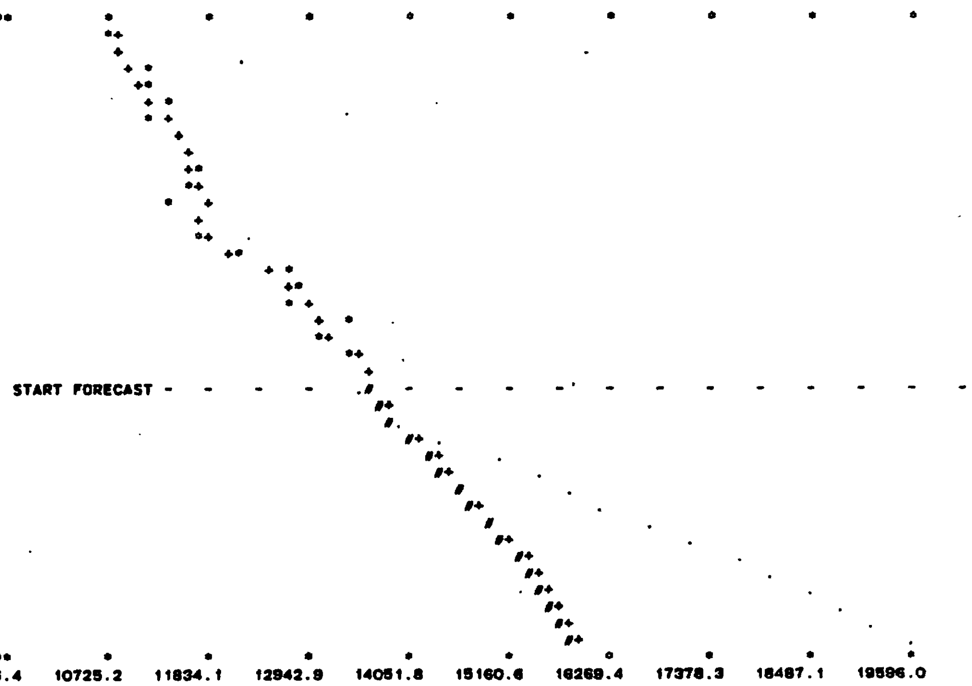


SECTOR # 28

TITLE : TOBACCO

RSQ = 0.960
AAPE = 1.13%
RHO = -0.112
SHARE = 1.48%
UBAR = -3.883

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	10725.	10921.	-195.
1960	10863.	10893.	-29.
1961	11174.	10956.	218.
1962	11202.	11141.	61.
1963	11392.	11244.	149.
1964	11265.	11450.	-185.
1965	11582.	11539.	42.
1966	11699.	11676.	23.
1967	11810.	11657.	153.
1968	11673.	11778.	-106.
1969	11397.	11839.	-442.
1970	11739.	11745.	-6.
1971	11831.	11835.	-4.
1972	12204.	12093.	112.
1973	12812.	12581.	231.
1974	12844.	12823.	21.
1975	12732.	12950.	-218.
1976	13484.	13114.	370.
1977	13114.	13259.	-145.
1978	13480.	13550.	-70.
1979	13647.	13707.	-60.
1980	13504.	13638.	13634.
1981	13838.	13845.	13822.
1982	13999.	13918.	13897.
1983	14486.	14168.	14110.
1984	15137.	14437.	14352.
1985	15533.	14577.	14488.
1986	15895.	14711.	14625.
1987	16261.	14851.	14759.
1988	16755.	15038.	14942.
1989	17260.	15227.	15125.
1990	17776.	15427.	15317.
1991	18142.	15551.	15429.
1992	18509.	15671.	15542.
1993	18871.	15784.	15649.
1994	18233.	15896.	15752.
1995	19596.	16007.	15851.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

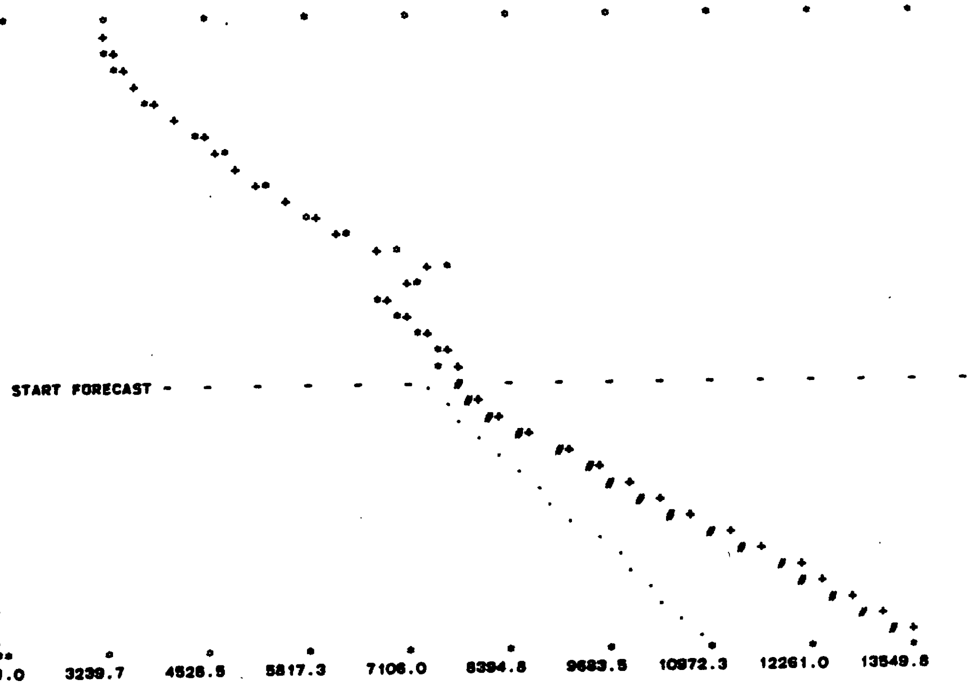


SECTOR # 29

TITLE : SEMIDURABLE HOUSEFURNISHINGS

RSQ = 0.991
AAPE = 2.25%
RHO = 0.598
SHARE = 0.82%
UBAR =-12.620

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	3240.	3323.	-83.
1960	3284.	3441.	-157.
1961	3430.	3569.	-138.
1962	3734.	3746.	-12.
1963	3858.	3950.	-92.
1964	4242.	4267.	-25.
1965	4520.	4539.	-19.
1966	4901.	4760.	141.
1967	5012.	4939.	72.
1968	5414.	5218.	196.
1969	5685.	5578.	109.
1970	5924.	5988.	-64.
1971	6359.	6325.	34.
1972	6982.	6756.	226.
1973	7666.	7431.	236.
1974	7316.	7139.	177.
1975	6794.	6952.	-158.
1976	7016.	7137.	-121.
1977	7262.	7426.	-164.
1978	7577.	7745.	-168.
1979	7549.	7805.	-256.
1980	7482.	7844.	7810.
1981	7667.	8052.	7970.
1982	7756.	8359.	8202.
1983	8026.	8745.	8551.
1984	8387.	9240.	9050.
1985	8606.	9645.	9451.
1986	8806.	10013.	9785.
1987	9009.	10365.	10110.
1988	9283.	10796.	10529.
1989	9563.	11255.	10991.
1990	9849.	11734.	11479.
1991	10082.	12143.	11888.
1992	10255.	12512.	12256.
1993	10456.	12867.	12626.
1994	10656.	13214.	12998.
1995	10857.	13550.	13375.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

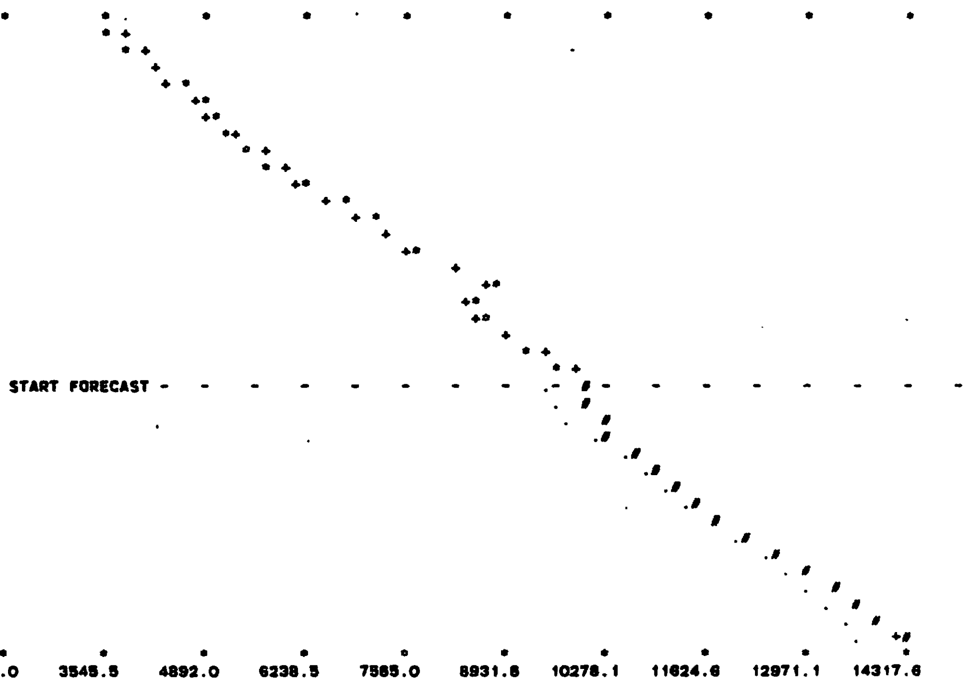


SECTOR # 30

TITLE : DRUG PREPARATIONS AND SUNDRIES

RSQ = 0.990
AAPE = 2.62%
RHO = 0.559
SHARE = 1.04%
UBAR = -1.880

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	3545.	3827.	-281.
1960	3896.	4120.	-224.
1961	4283.	4305.	-22.
1962	4663.	4483.	180.
1963	4908.	4779.	130.
1964	5057.	4988.	69.
1965	5269.	5381.	-82.
1966	5504.	5732.	-227.
1967	5807.	6033.	-226.
1968	6339.	6217.	121.
1969	6788.	6549.	239.
1970	7245.	6934.	311.
1971	7332.	7318.	14.
1972	7780.	7678.	103.
1973	8330.	8265.	66.
1974	8804.	8758.	47.
1975	8618.	8414.	204.
1976	8777.	8611.	166.
1977	9007.	9063.	-56.
1978	9315.	9497.	-182.
1979	9607.	9996.	-388.
1980	9490.	10086.	10086.
1981	9724.	10013.	10013.
1982	9837.	10291.	10291.
1983	10180.	10362.	10362.
1984	10637.	10697.	10697.
1985	10915.	11079.	11079.
1986	11169.	11322.	11322.
1987	11426.	11554.	11554.
1988	11774.	11799.	11799.
1989	12129.	12237.	12237.
1990	12491.	12680.	12680.
1991	12748.	13091.	13091.
1992	13006.	13398.	13398.
1993	13261.	13707.	13707.
1994	13515.	14012.	14012.
1995	13770.	14318.	14318.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

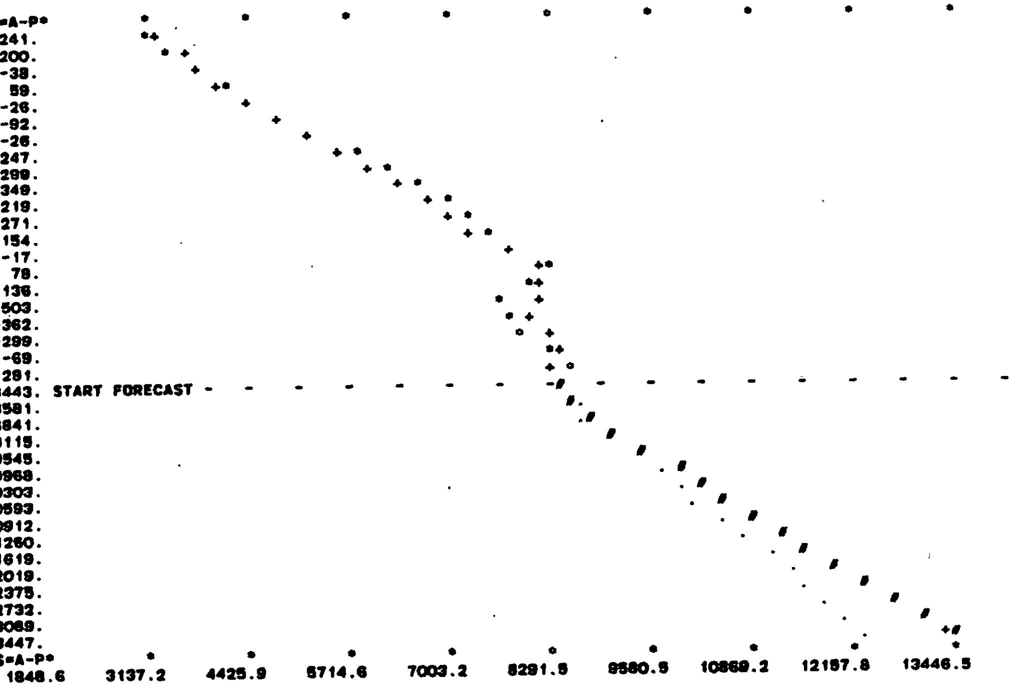


SECTOR # 31

TITLE : TOILET ARTICLES AND PREPARATIONS

RSQ = 0.983
AAPE = 3.03%
RHO = 0.708
SHARE = 0.93%
UBAR = -1.997

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	3137.	3378.	-241.
1960	3475.	3675.	-200.
1961	3860.	3898.	-38.
1962	4223.	4164.	59.
1963	4485.	4511.	-26.
1964	4827.	4918.	-92.
1965	5290.	5316.	-26.
1966	5934.	5686.	247.
1967	6283.	5984.	299.
1968	6743.	6394.	349.
1969	7039.	6821.	219.
1970	7359.	7088.	271.
1971	7523.	7369.	154.
1972	7869.	7887.	-17.
1973	8339.	8261.	78.
1974	8150.	8285.	-136.
1975	7682.	8185.	-503.
1976	7782.	8144.	-362.
1977	8013.	8312.	-299.
1978	8376.	8445.	-69.
1979	8616.	8326.	291.
1980	8486.	8443.	8443.
1981	8696.	8581.	8581.
1982	8797.	8841.	8841.
1983	9103.	9115.	9115.
1984	9512.	9545.	9545.
1985	9760.	9968.	9968.
1986	9988.	10303.	10303.
1987	10218.	10593.	10593.
1988	10529.	10912.	10912.
1989	10846.	11260.	11260.
1990	11170.	11619.	11619.
1991	11400.	12019.	12019.
1992	11630.	12375.	12375.
1993	11858.	12732.	12732.
1994	12086.	13089.	13089.
1995	12314.	13447.	13447.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

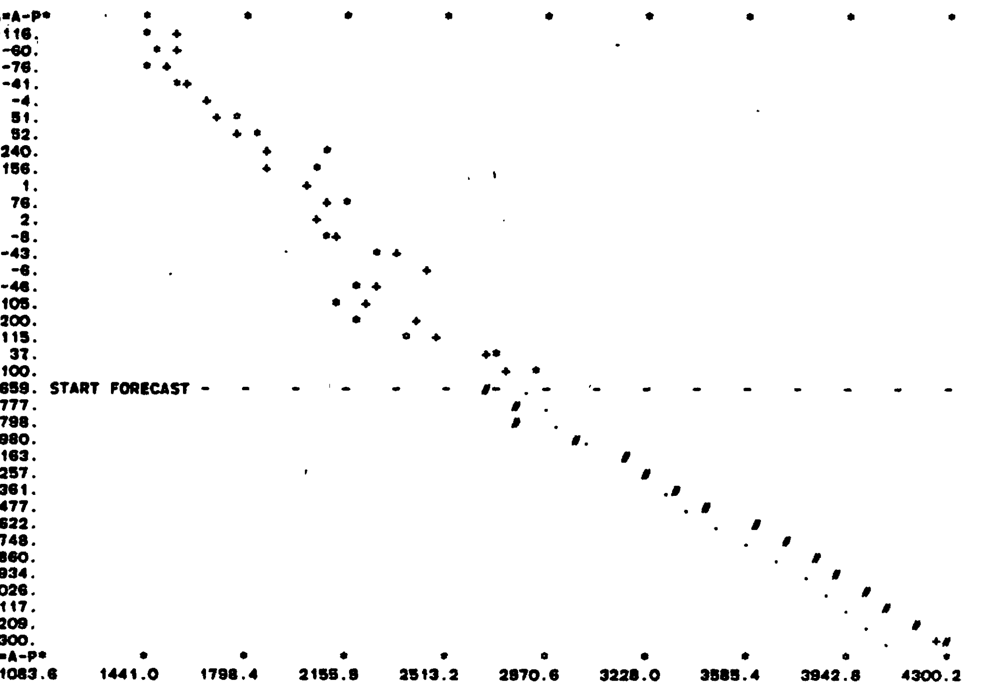


SECTOR # 32

TITLE : STATIONERY AND WRITING SUPPLIES

RSQ = 0.935
AAPE = 3.64%
RHO = 0.635
SHARE = 0.31%
UBAR = -4.914

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	1441.	1557.	-116.
1960	1494.	1555.	-60.
1961	1466.	1542.	-76.
1962	1565.	1606.	-41.
1963	1668.	1672.	-4.
1964	1770.	1719.	51.
1965	1835.	1783.	52.
1966	2115.	1874.	240.
1967	2052.	1896.	156.
1968	2022.	2021.	1.
1969	2186.	2110.	76.
1970	2070.	2068.	2.
1971	2114.	2122.	-8.
1972	2296.	2339.	-43.
1973	2450.	2456.	-6.
1974	2218.	2264.	-46.
1975	2150.	2255.	-105.
1976	2225.	2425.	-200.
1977	2389.	2504.	-115.
1978	2702.	2665.	37.
1979	2858.	2759.	100.
1980	2829.	2659.	2659.
1981	2899.	2777.	2777.
1982	2932.	2798.	2798.
1983	3034.	2980.	2980.
1984	3171.	3163.	3163.
1985	3253.	3257.	3257.
1986	3329.	3361.	3361.
1987	3406.	3477.	3477.
1988	3510.	3622.	3622.
1989	3615.	3748.	3748.
1990	3723.	3860.	3860.
1991	3800.	3934.	3934.
1992	3877.	4028.	4026.
1993	3953.	4117.	4117.
1994	4029.	4209.	4209.
1995	4105.	4300.	4300.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

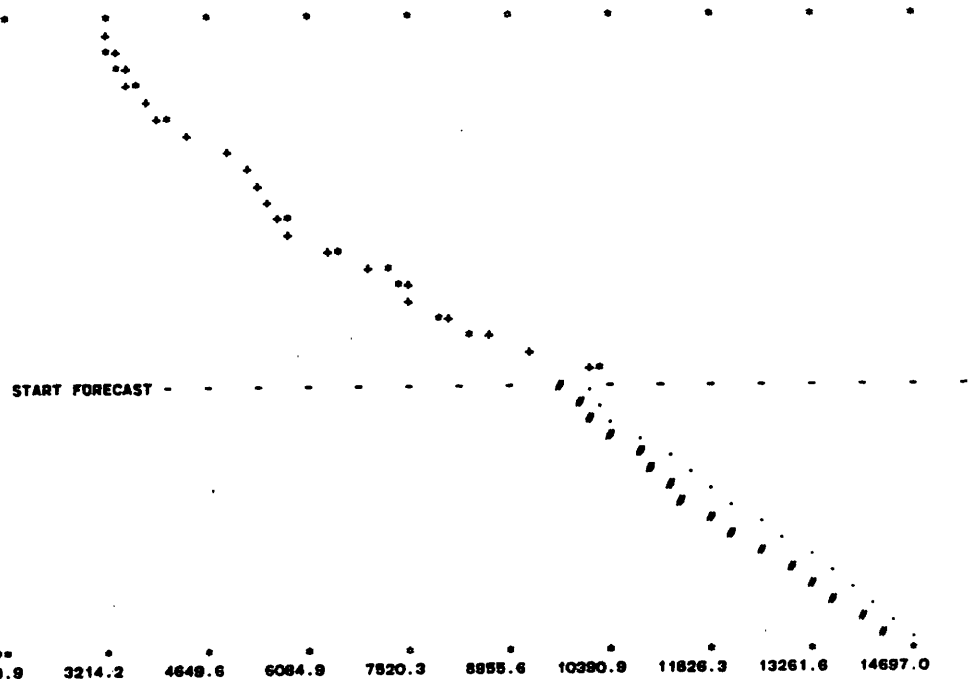


SECTOR # 33

TITLE : NONDURABLE TOYS AND SPORT SUPPLIES

RSQ = 0.996
AAPE = 1.61%
RHO = 0.419
SHARE = 1.11%
UBAR = 3.292

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	3214.	3254.	-40.
1960	3289.	3448.	-159.
1961	3463.	3526.	-63.
1962	3678.	3637.	41.
1963	3897.	3828.	69.
1964	4181.	4051.	130.
1965	4466.	4440.	26.
1966	5051.	4947.	104.
1967	5242.	5283.	-41.
1968	5417.	5476.	-59.
1969	5623.	5599.	23.
1970	5800.	5747.	53.
1971	5929.	5934.	-5.
1972	6541.	6378.	163.
1973	7236.	7023.	213.
1974	7513.	7522.	-10.
1975	7532.	7569.	-37.
1976	7980.	8170.	-190.
1977	8410.	8722.	-312.
1978	9264.	9272.	-8.
1979	10306.	10136.	170.
1980	10128.	9788.	9788.
1981	10379.	10047.	10047.
1982	10499.	10152.	10152.
1983	10865.	10505.	10505.
1984	11353.	10827.	10827.
1985	11649.	11015.	11015.
1986	11921.	11261.	11261.
1987	12196.	11518.	11518.
1988	12566.	11835.	11835.
1989	12945.	12249.	12249.
1990	13332.	12597.	12597.
1991	13606.	12976.	12976.
1992	13881.	13329.	13329.
1993	14153.	13683.	13683.
1994	14425.	14036.	14036.
1995	14697.	14389.	14389.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

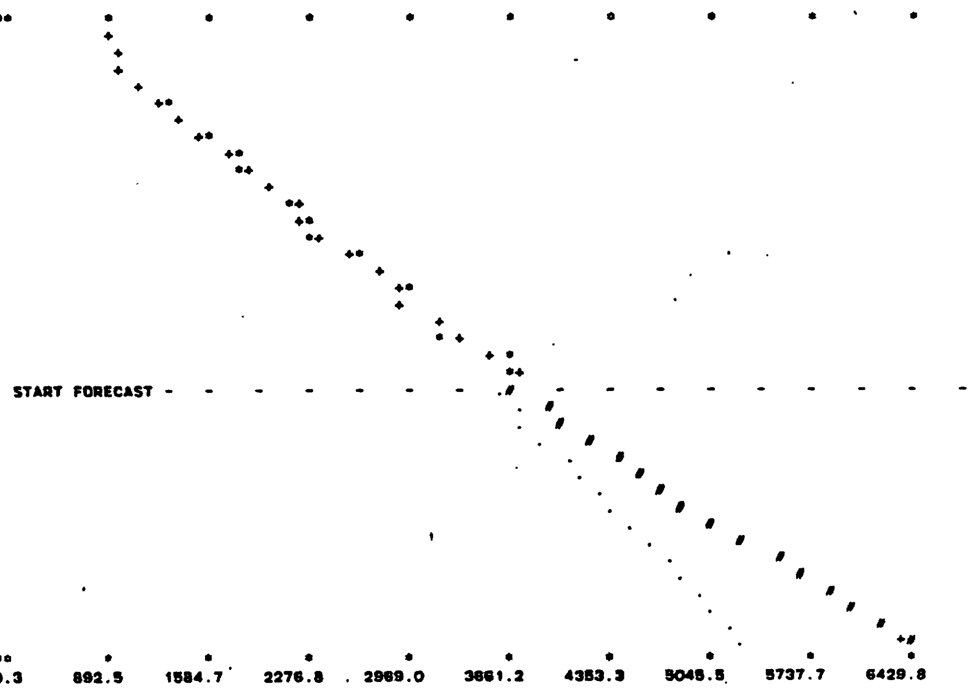


SECTOR # 34

TITLE : FLOWERS, SEEDS, AND POTTED PLANTS

RSQ = 0.995
AAPE = 2.10%
RHO = -0.403
SHARE = 0.40%
UBAR = 6.009

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	892.	898.	-6.
1960	988.	974.	14.
1961	981.	1027.	-46.
1962	1131.	1141.	-10.
1963	1312.	1258.	55.
1964	1385.	1387.	-1.
1965	1628.	1559.	70.
1966	1800.	1743.	58.
1967	1819.	1871.	-51.
1968	2003.	2048.	-45.
1969	2198.	2208.	-10.
1970	2311.	2266.	44.
1971	2330.	2357.	-27.
1972	2655.	2573.	81.
1973	2803.	2812.	-9.
1974	2987.	2906.	81.
1975	2902.	2936.	-34.
1976	3193.	3194.	-1.
1977	3229.	3355.	-126.
1978	3720.	3581.	139.
1979	3697.	3746.	-49.
1980	3650.	3682.	3682.
1981	3740.	3969.	3969.
1982	3784.	4045.	4048.
1983	3915.	4254.	4254.
1984	4091.	4491.	4491.
1985	4196.	4605.	4605.
1986	4296.	4743.	4743.
1987	4395.	4872.	4872.
1988	4528.	5047.	5047.
1989	4665.	5287.	5287.
1990	4804.	5547.	5847.
1991	4903.	5721.	5721.
1992	5002.	5898.	5898.
1993	5100.	6074.	6074.
1994	5198.	6252.	6252.
1995	5296.	6430.	6430.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

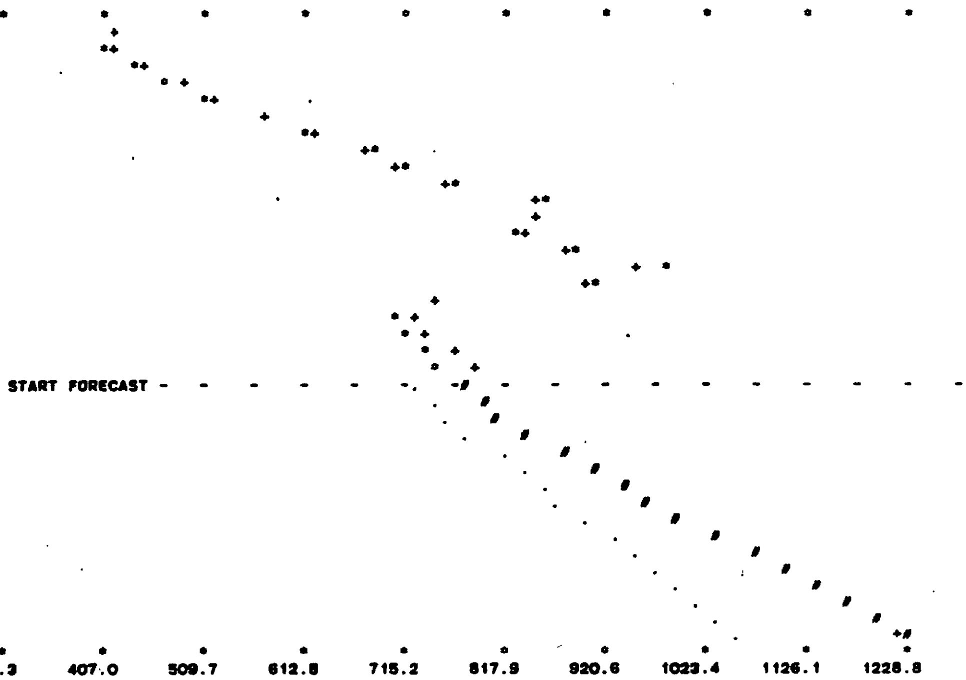


SECTOR # 35

TITLE : CLEANING PREPARATIONS

RSQ = 0.991
AAPE = 1.86%
RHO = 0.499
SHARE = 0.08%
UBAR = -3.943

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	424.	420.	4.
1960	407.	419.	-12.
1961	440.	448.	-8.
1962	473.	493.	-20.
1963	518.	530.	-12.
1964	574.	578.	-3.
1965	619.	633.	-13.
1966	688.	676.	12.
1967	716.	714.	2.
1968	776.	765.	11.
1969	866.	855.	12.
1970	855.	857.	-2.
1971	836.	841.	-5.
1972	893.	889.	4.
1973	984.	954.	29.
1974	917.	902.	15.
1975	752.	755.	-3.
1976	713.	728.	-15.
1977	721.	736.	-15.
1978	746.	768.	-22.
1979	749.	790.	-41.
1980	730.	786.	786.
1981	748.	799.	799.
1982	757.	814.	814.
1983	783.	844.	844.
1984	818.	888.	888.
1985	840.	917.	917.
1986	859.	945.	945.
1987	879.	968.	968.
1988	906.	1001.	1001.
1989	933.	1038.	1038.
1990	961.	1077.	1077.
1991	981.	1110.	1110.
1992	1000.	1140.	1140.
1993	1020.	1170.	1170.
1994	1040.	1199.	1199.
1995	1059.	1229.	1229.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

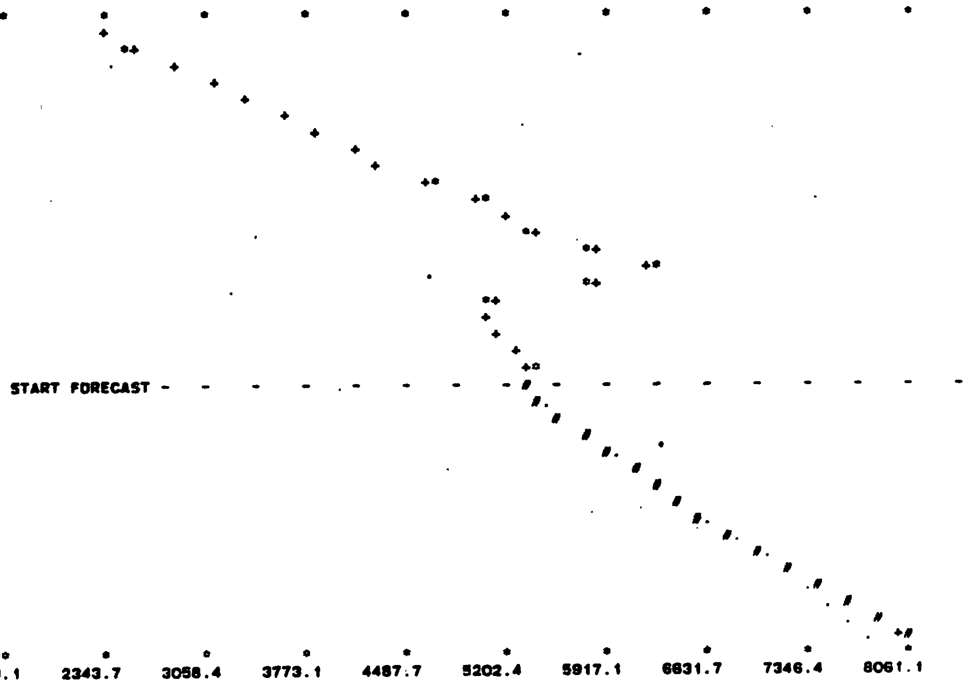


SECTOR # 36

TITLE : LIGHTING SUPPLIES

RSQ = 0.999
AAPE = 0.71%
RHO = 0.058
SHARE = 0.59%
UBAR = 0.962

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	2344.	2354.	-10.
1960	2540.	2604.	-64.
1961	2891.	2873.	18.
1962	3190.	3133.	58.
1963	3374.	3351.	23.
1964	3658.	3648.	11.
1965	3874.	3904.	-29.
1966	4156.	4137.	19.
1967	4299.	4338.	-39.
1968	4718.	4680.	38.
1969	5081.	5050.	31.
1970	5255.	5223.	32.
1971	5408.	5435.	-27.
1972	5803.	5852.	-48.
1973	6300.	6269.	31.
1974	5839.	5853.	-14.
1975	5115.	5138.	-23.
1976	5070.	5101.	-31.
1977	5137.	5148.	-11.
1978	5288.	5283.	5.
1979	5466.	5413.	53.
1980	5384.	5364.	5364.
1981	5517.	5444.	5444.
1982	5581.	5595.	5595.
1983	5775.	5795.	5795.
1984	6034.	5982.	5982.
1985	6192.	6137.	6137.
1986	6336.	6290.	6290.
1987	6482.	6446.	6446.
1988	6679.	6629.	6629.
1989	6881.	6812.	6812.
1990	7086.	7009.	7009.
1991	7232.	7223.	7223.
1992	7378.	7432.	7432.
1993	7523.	7642.	7642.
1994	7667.	7851.	7851.
1995	7812.	8061.	8061.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

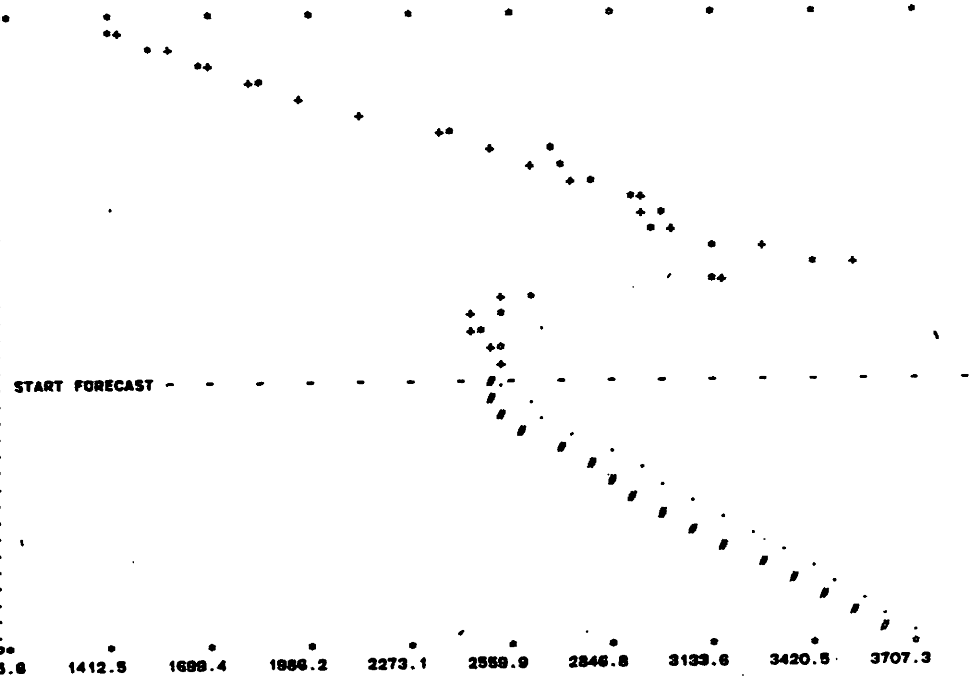


SECTOR # 37

TITLE : HOUSEHOLD PAPER PRODUCTS

RSQ = 0.984
AAPE = 2.10%
RHO = 0.599
SHARE = 0.28%
UBAR = 4.424

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	1412.	1468.	-56.
1960	1541.	1600.	-59.
1961	1698.	1707.	-9.
1962	1858.	1829.	30.
1963	1969.	1976.	-7.
1964	2144.	2158.	-14.
1965	2408.	2360.	48.
1966	2679.	2530.	149.
1967	2707.	2640.	67.
1968	2794.	2754.	40.
1969	2911.	2936.	-25.
1970	2990.	2960.	30.
1971	2980.	3034.	-54.
1972	3157.	3282.	-125.
1973	3424.	3559.	-135.
1974	3141.	3171.	-29.
1975	2637.	2533.	104.
1976	2553.	2464.	89.
1977	2496.	2458.	38.
1978	2532.	2526.	6.
1979	2558.	2556.	1.
1980	2555.	2528.	2528.
1981	2618.	2509.	2509.
1982	2648.	2560.	2560.
1983	2741.	2616.	2616.
1984	2864.	2714.	2714.
1985	2938.	2804.	2804.
1986	3007.	2862.	2862.
1987	3076.	2919.	2919.
1988	3170.	2995.	2995.
1989	3265.	3086.	3086.
1990	3363.	3181.	3181.
1991	3432.	3287.	3287.
1992	3502.	3376.	3376.
1993	3570.	3465.	3465.
1994	3639.	3554.	3554.
1995	3707.	3643.	3643.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

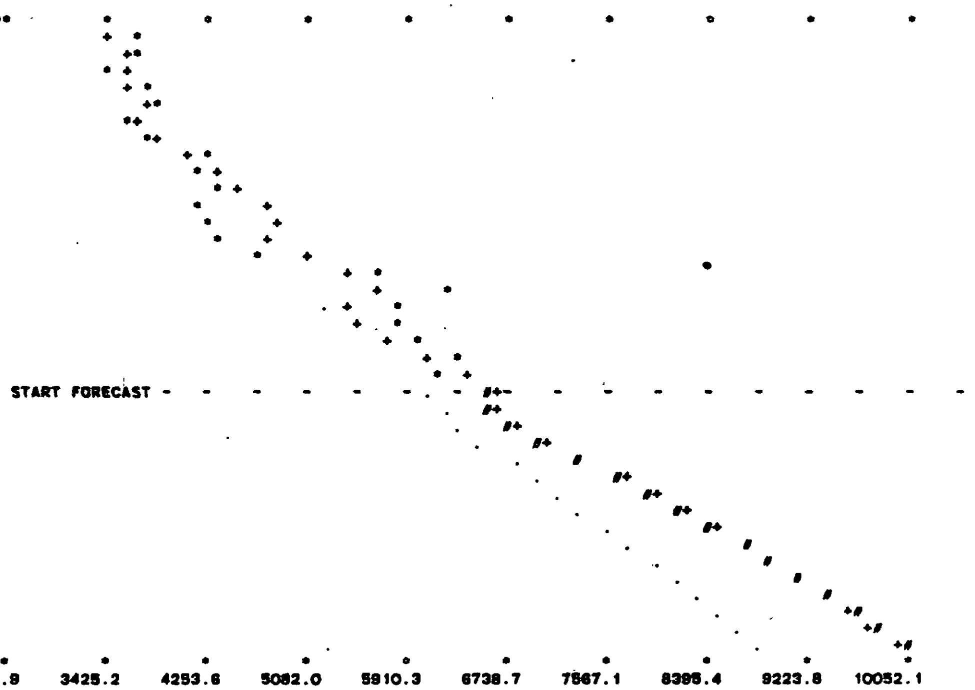


SECTOR # 38

TITLE : MAGAZINES AND NEWSPAPER

RSQ = 0.902
AAPE = 5.76%
RHO = 0.605
SHARE = 0.67%
UBAR =-11.817

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	3741.	3445.	297.
1960	3747.	3635.	112.
1961	3425.	3610.	-185.
1962	3818.	3632.	187.
1963	3844.	3785.	59.
1964	3627.	3745.	-118.
1965	3758.	3885.	-127.
1966	4275.	4157.	118.
1967	4240.	4401.	-161.
1968	4408.	4531.	-123.
1969	4202.	4822.	-620.
1970	4330.	4834.	-504.
1971	4374.	4801.	-426.
1972	4685.	5085.	-400.
1973	5698.	5465.	233.
1974	6265.	5723.	542.
1975	5859.	5487.	372.
1976	5846.	5543.	303.
1977	6050.	5771.	279.
1978	6344.	6121.	223.
1979	6161.	6470.	-309.
1980	6114.	6662.	6641.
1981	6265.	6670.	6640.
1982	6337.	6852.	6815.
1983	6558.	7077.	7042.
1984	6852.	7382.	7340.
1985	7032.	7755.	7702.
1986	7196.	8022.	7964.
1987	7361.	8275.	8228.
1988	7585.	8499.	8468.
1989	7814.	8759.	8742.
1990	8047.	8969.	8962.
1991	8213.	9216.	9220.
1992	8379.	9409.	9430.
1993	8543.	9601.	9639.
1994	8707.	9795.	9846.
1995	8871.	9998.	10052.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

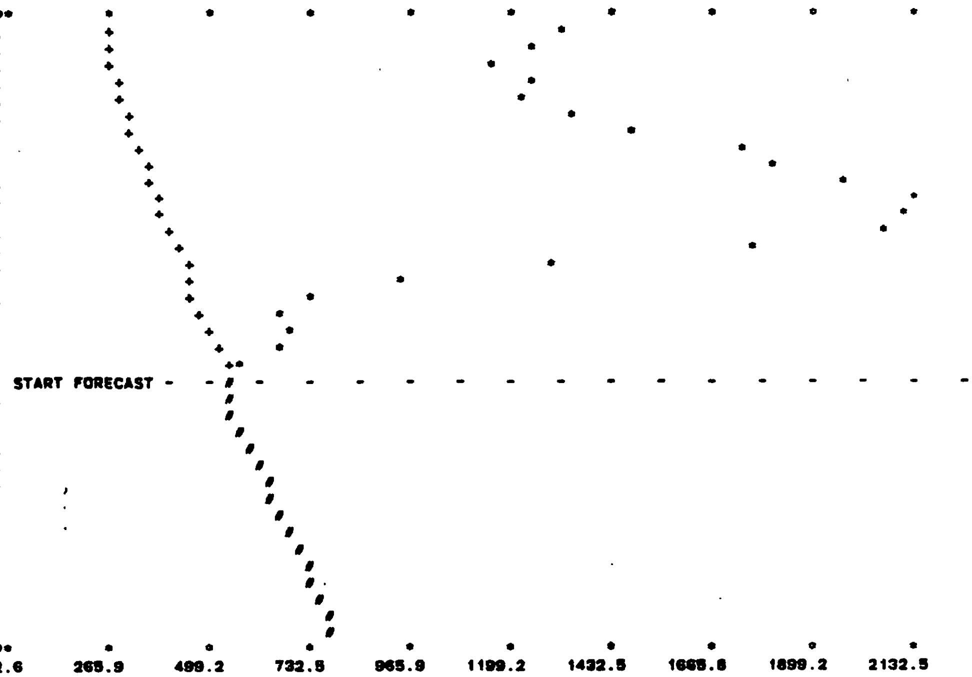


SECTOR # 39

TITLE : OTHER NONDURABLES -- IDENTITY

RSQ = -3.890
AAPE = 63.60%
RHO = 1.009
SHARE = 0.06%
UBAR =958.451

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	1333.	266.	1068.
1960	1251.	272.	980.
1961	1164.	277.	897.
1962	1253.	290.	963.
1963	1224.	301.	923.
1964	1362.	317.	1045.
1965	1489.	335.	1154.
1966	1743.	352.	1392.
1967	1827.	362.	1465.
1968	1977.	380.	1597.
1969	2132.	393.	1739.
1970	2127.	401.	1726.
1971	2085.	415.	1670.
1972	1770.	440.	1330.
1973	1303.	460.	843.
1974	964.	456.	507.
1975	754.	465.	289.
1976	685.	492.	193.
1977	708.	517.	191.
1978	677.	540.	137.
1979	583.	555.	28.
1980	547.	547.	547.
1981	561.	561.	561.
1982	568.	568.	568.
1983	587.	587.	587.
1984	614.	614.	614.
1985	630.	630.	630.
1986	644.	644.	644.
1987	659.	659.	659.
1988	679.	679.	679.
1989	700.	700.	700.
1990	721.	721.	721.
1991	735.	735.	735.
1992	750.	750.	750.
1993	765.	765.	765.
1994	780.	780.	780.
1995	794.	794.	794.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

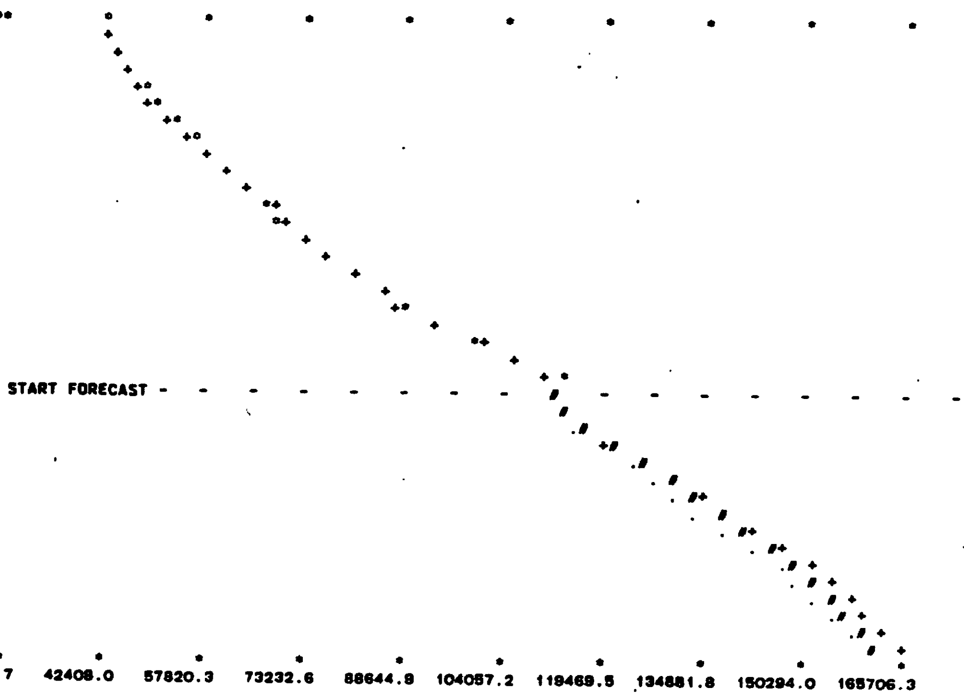


SECTOR # 40

TITLE : OWNER OCCUPIED SPACE RENT

RSQ = 0.987
AAPE = 1.50%
RHO = 0.400
SHARE = 12.26%
UBAR = 18.553

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	42408.	43865.	-1457.
1960	44703.	45242.	-539.
1961	46749.	46171.	578.
1962	49282.	47610.	1672.
1963	51368.	49574.	1794.
1964	53593.	52248.	1344.
1965	56324.	55763.	562.
1966	58828.	59119.	-290.
1967	61406.	62437.	-1031.
1968	64514.	64924.	-410.
1969	67563.	68897.	-1333.
1970	70033.	70957.	-924.
1971	73441.	74115.	-674.
1972	77476.	77049.	427.
1973	81353.	82397.	-1044.
1974	85895.	86259.	-364.
1975	90077.	88257.	1820.
1976	94369.	93921.	448.
1977	100512.	102081.	-1570.
1978	106648.	107060.	-412.
1979	113371.	111579.	1792.
1980	111868.	112913.	113132.
1981	114631.	114391.	114740.
1982	115965.	116959.	117494.
1983	120003.	120703.	121160.
1984	125390.	126619.	126567.
1985	128669.	131690.	131205.
1986	131668.	135214.	134610.
1987	134700.	138965.	138149.
1988	138795.	143539.	142348.
1989	142882.	148404.	146690.
1990	147253.	151963.	148760.
1991	150283.	155380.	152760.
1992	153321.	158071.	155166.
1993	156323.	160713.	157532.
1994	159326.	163267.	159859.
1995	162329.	165706.	162162.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

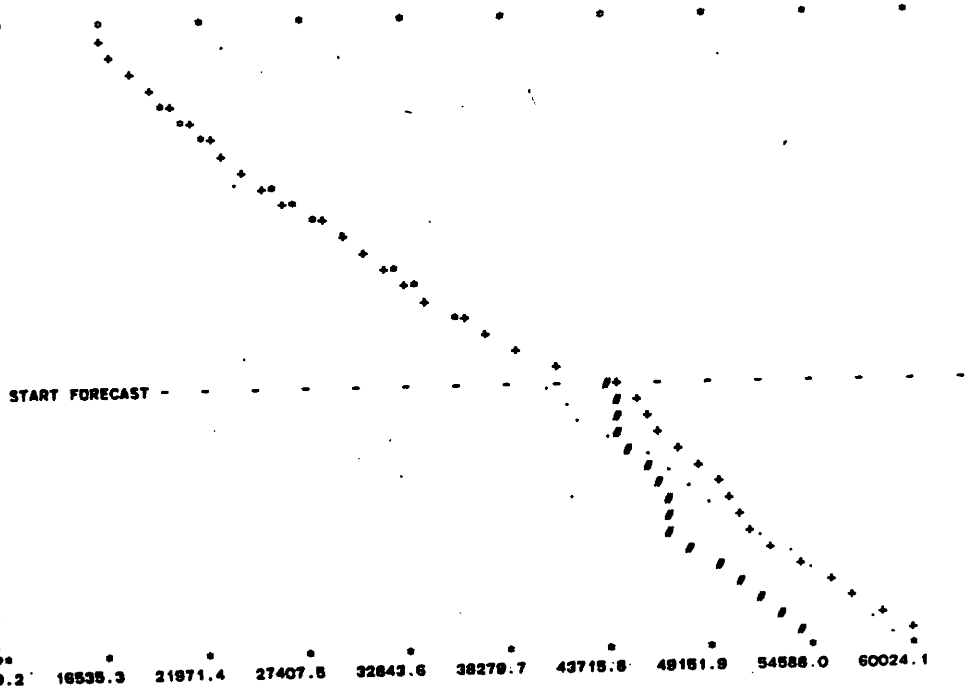


SECTOR # 41

TITLE : TENANT OCCUPIED SPACE RENT

RSQ = 0.999
AAPE = 0.68%
RHO = 0.264
SHARE = 4.49%
UBAR = 16.233

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	16792.	16535.	257.
1960	17489.	17420.	69.
1961	18362.	18466.	-104.
1962	19343.	18533.	-190.
1963	20287.	20388.	-100.
1964	21327.	21468.	-141.
1965	22502.	22531.	-29.
1966	23516.	23336.	181.
1967	24490.	24414.	76.
1968	25787.	25641.	146.
1969	27102.	26827.	275.
1970	28363.	28561.	-198.
1971	29634.	29852.	-218.
1972	31015.	31116.	-101.
1973	32306.	31927.	379.
1974	33468.	33214.	254.
1975	[illegible]	34416.	-153.
197[illegible]	[illegible]	36234.	-529.
197[illegible]	[illegible]	37273.	75.
1978	[illegible]	39035.	314.
1979	[illegible]	41433.	79.
1980	40970.	44376.	43758.
1981	41982.	45808.	44625.
1982	42470.	46233.	44496.
1983	43949.	46784.	44586.
1984	45922.	47768.	45183.
1985	47123.	49114.	46118.
1986	48221.	50228.	46798.
1987	49331.	50771.	47050.
1988	50831.	51254.	47309.
1989	52364.	51588.	47477.
1990	53929.	52922.	48565.
1991	55039.	54358.	49758.
1992	56151.	55776.	50939.
1993	57250.	57162.	52120.
1994	58350.	58571.	53301.
1995	59450.	60024.	54479.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

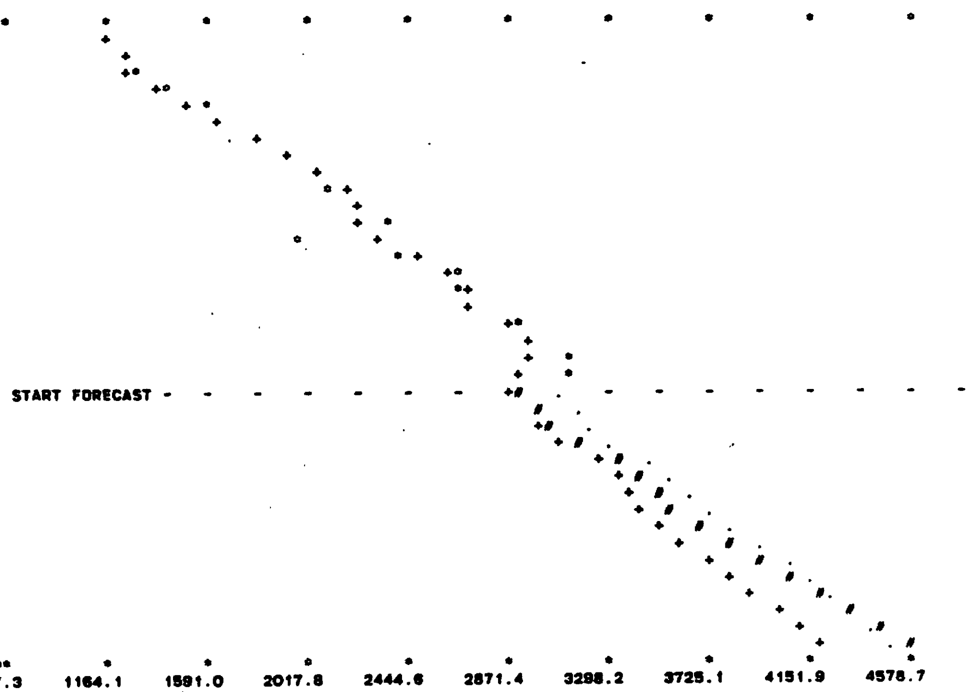


SECTOR # 42

TITLE : HOTELS AND MOTELS

RSQ = 0.972
AAPE = 3.03%
RHO = 0.082
SHARE = 0.34%
UBAR = 12.891

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	1182.	1164.	18.
1960	1280.	1253.	28.
1961	1311.	1289.	23.
1962	1445.	1395.	50.
1963	1596.	1538.	58.
1964	1675.	1661.	14.
1965	1841.	1805.	36.
1966	1942.	1972.	-30.
1967	2094.	2075.	19.
1968	2132.	2190.	-58.
1969	2244.	2259.	-15.
1970	2373.	2235.	138.
1971	2001.	2323.	-321.
1972	2412.	2498.	-86.
1973	2684.	2649.	36.
1974	2667.	2715.	-48.
1975	2710.	2721.	-11.
1976	2937.	2906.	31.
1977	2999.	2997.	2.
1978	3155.	2992.	163.
1979	3156.	2930.	226.
1980	3102.	2911.	2921.
1981	3179.	3005.	3029.
1982	3216.	3029.	3073.
1983	3328.	3113.	3176.
1984	3477.	3268.	3344.
1985	3568.	3346.	3438.
1986	3651.	3413.	3526.
1987	3736.	3454.	3590.
1988	3849.	3522.	3688.
1989	3965.	3639.	3831.
1990	4084.	3740.	3958.
1991	4168.	3844.	4092.
1992	4252.	3937.	4213.
1993	4335.	4031.	4335.
1994	4418.	4129.	4457.
1995	4502.	4236.	4579.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

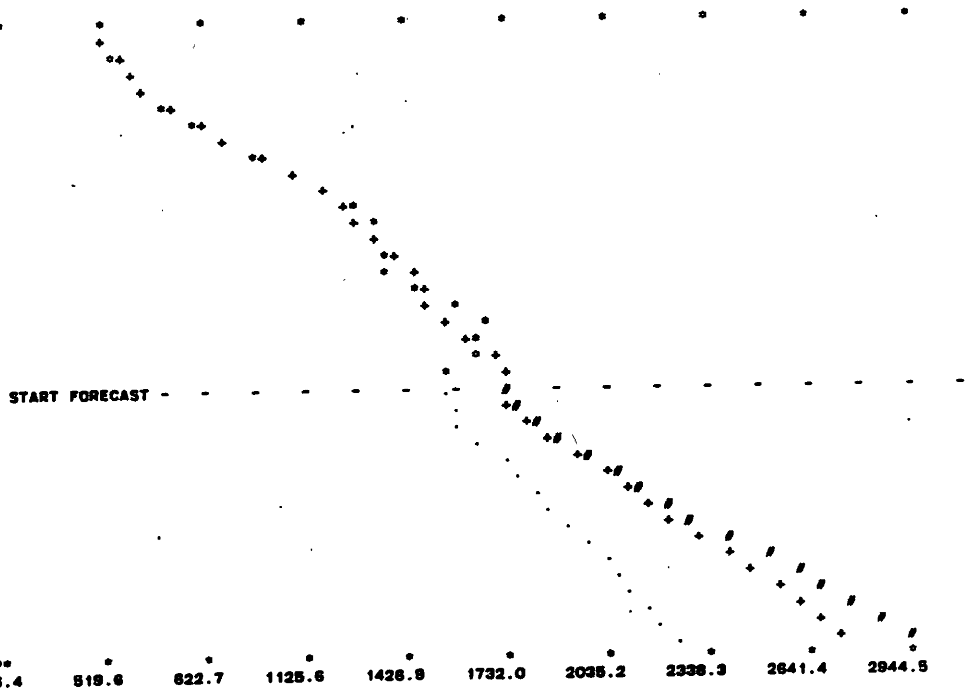


SECTOR # 43

TITLE : OTHER HOUSING -- EDUCATIONAL HOUSING

RSQ = 0.970
AAPE = 3.68%
RHO = 0.414
SHARE = 0.17%
UBAR = -4.983

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	538.	520.	18.
1960	563.	587.	-24.
1961	617.	615.	2.
1962	650.	662.	-12.
1963	715.	752.	-37.
1964	797.	825.	-28.
1965	905.	906.	-1.
1966	987.	1013.	-25.
1967	1115.	1101.	14.
1968	1199.	1192.	7.
1969	1302.	1259.	43.
1970	1354.	1303.	51.
1971	1361.	1342.	19.
1972	1372.	1426.	-54.
1973	1390.	1490.	-99.
1974	1480.	1491.	-11.
1975	1608.	1497.	111.
1976	1699.	1559.	140.
1977	1668.	1627.	41.
1978	1648.	1715.	-67.
1979	1556.	1748.	-192.
1980	[illegible]	1737.	1740.
1981	[illegible]	1753.	1763.
1982	[illegible]	1813.	1832.
1983	[illegible]	1862.	1890.
1984	[illegible]	1956.	1992.
1985	[illegible]	2041.	2084.
1986	1826.	2101.	2156.
1987	1868.	2160.	2227.
1988	1925.	2219.	2302.
1989	1983.	2309.	2408.
1990	2042.	2410.	2525.
1991	2084.	2485.	2617.
1992	2126.	2551.	2698.
1993	2168.	2616.	2780.
1994	2209.	2687.	2862.
1995	2251.	2762.	2945.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

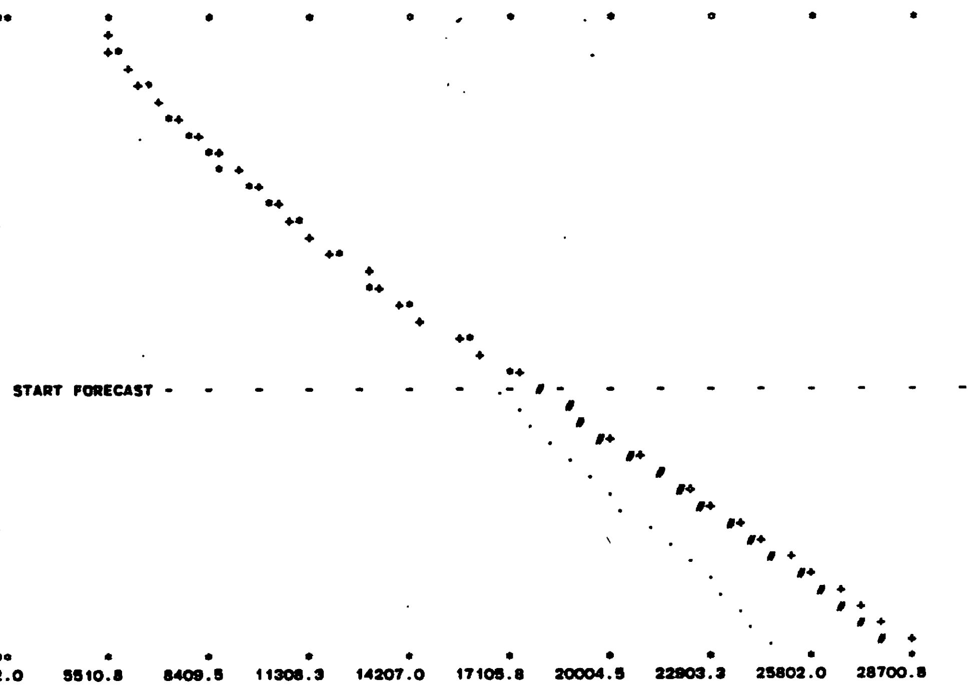


SECTOR # 44

TITLE : ELECTRICITY

RSQ = 0.995
AAPE = 2.30%
RHO = 0.562
SHARE = 1.87%
UBAR =-14.238

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	5690.	5511.	179.
1960	6030.	5762.	268.
1961	6329.	6098.	231.
1962	6744.	6593.	151.
1963	7066.	7020.	47.
1964	7517.	7592.	-74.
1965	7927.	8247.	-320.
1966	8451.	8864.	-413.
1967	8949.	9379.	-430.
1968	9636.	10032.	-395.
1969	10344.	10558.	-214.
1970	11045.	11011.	34.
1971	11544.	11813.	32.
1972	12314.	12052.	262.
1973	13200.	13226.	-26.
1974	13286.	13601.	-315.
1975	14248.	13947.	301.
1976	14727.	14528.	199.
1977	15977.	15684.	292.
1978	16511.	16335.	176.
1979	17285.	17569.	-284.
1980	17063.	18129.	18133.
1981	17485.	18673.	18851.
1982	17686.	19351.	19333.
1983	18304.	20071.	19986.
1984	19126.	20937.	20775.
1985	19626.	21660.	21458.
1986	20083.	22327.	22098.
1987	20546.	23028.	22749.
1988	21170.	23641.	23498.
1989	21809.	24606.	24197.
1990	22460.	25405.	24827.
1991	22923.	26070.	25525.
1992	23386.	26734.	26127.
1993	23844.	27396.	26725.
1994	24302.	28050.	27323.
1995	24760.	28701.	27818.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

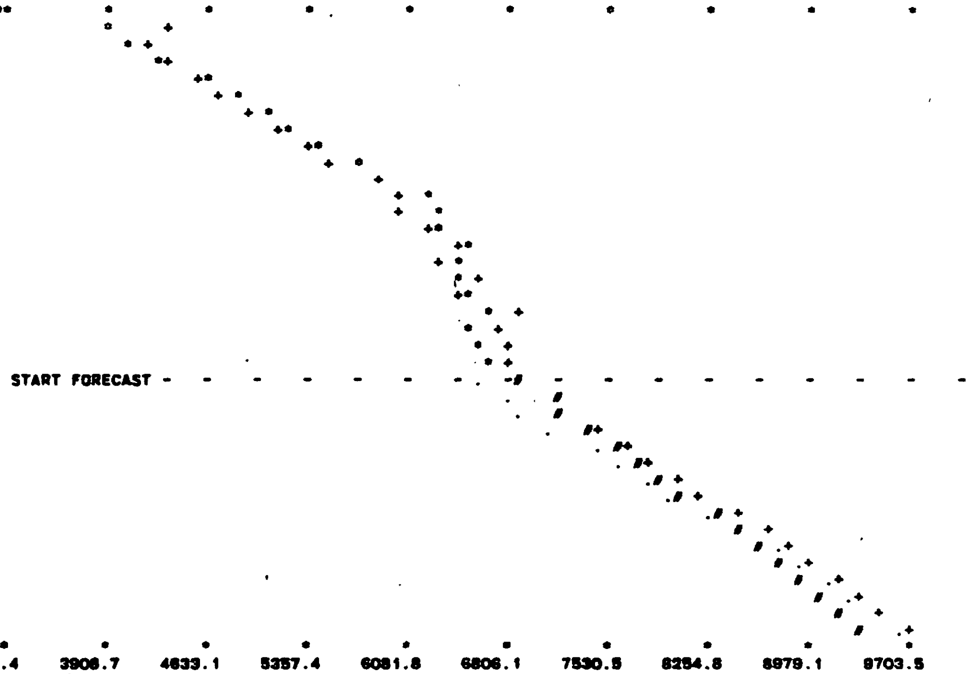


SECTOR # 45

TITLE : NATURAL GAS

RSQ = 0.964
AAPE = 2.63%
RHO = 0.706
SHARE = 0.73%
UBAR =-11.906

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	3909.	4376.	-467.
1960	4094.	4266.	-171.
1961	4332.	4382.	-50.
1962	4656.	4615.	41.
1963	4855.	4754.	101.
1964	5068.	4952.	116.
1965	5251.	5188.	65.
1966	5449.	5363.	86.
1967	5723.	5563.	161.
1968	5929.	5870.	59.
1969	6232.	6043.	189.
1970	6310.	6066.	244.
1971	6370.	6267.	103.
1972	6541.	6481.	61.
1973	6448.	6368.	80.
1974	6446.	6631.	-185.
1975	6576.	6498.	78.
1976	6667.	6928.	-261.
1977	6558.	6741.	-183.
1978	6660.	6831.	-170.
1979	6705.	6852.	-147.
1980	6861.	6934.	6938.
1981	6826.	7234.	7216.
1982	6905.	7228.	7207.
1983	7145.	7482.	7418.
1984	7466.	7736.	7636.
1985	7661.	7881.	7768.
1986	7840.	8050.	7930.
1987	8020.	8247.	8109.
1988	8264.	8504.	8329.
1989	8514.	8704.	8506.
1990	8768.	8883.	8658.
1991	8948.	9028.	8784.
1992	9129.	9197.	8933.
1993	9308.	9372.	9080.
1994	9487.	9540.	9226.
1995	9666.	9703.	9370.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

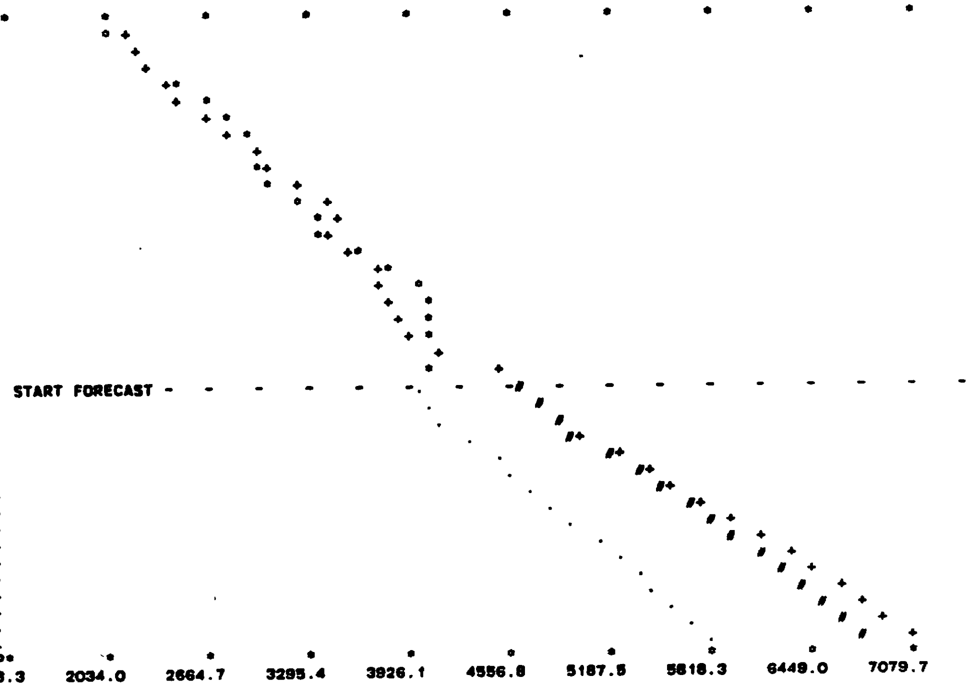


SECTOR # 46

TITLE : WATER AND OTHER SANITARY SERVICES

RSQ = 0.942
AAPE = 3.79%
RHO = 0.522
SHARE = 0.44%
UBAR = 5.827

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	2034.	2179.	-145.
1960	2230.	2233.	-2.
1961	2323.	2313.	11.
1962	2491.	2458.	33.
1963	2709.	2519.	190.
1964	2820.	2668.	152.
1965	2941.	2839.	103.
1966	2980.	3019.	-38.
1967	3017.	3089.	-72.
1968	3082.	3295.	-213.
1969	3237.	3434.	-197.
1970	3394.	3494.	-100.
1971	3397.	3467.	-70.
1972	3637.	3569.	68.
1973	3824.	3751.	73.
1974	4009.	3788.	221.
1975	4068.	3844.	224.
1976	4057.	3866.	191.
1977	4094.	3972.	121.
1978	4136.	4144.	-8.
1979	4093.	4515.	-421.
1980	4015.	4634.	4637.
1981	4114.	4762.	4755.
1982	4162.	4886.	4882.
1983	4307.	5023.	4993.
1984	4500.	5251.	5192.
1985	4618.	5478.	5401.
1986	4725.	5622.	5536.
1987	4834.	5802.	5696.
1988	4981.	5978.	5845.
1989	5131.	6143.	5986.
1990	5285.	6373.	6190.
1991	5394.	6512.	6307.
1992	5503.	6655.	6430.
1993	5610.	6799.	6551.
1994	5718.	6942.	6672.
1995	5826.	7080.	6791.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

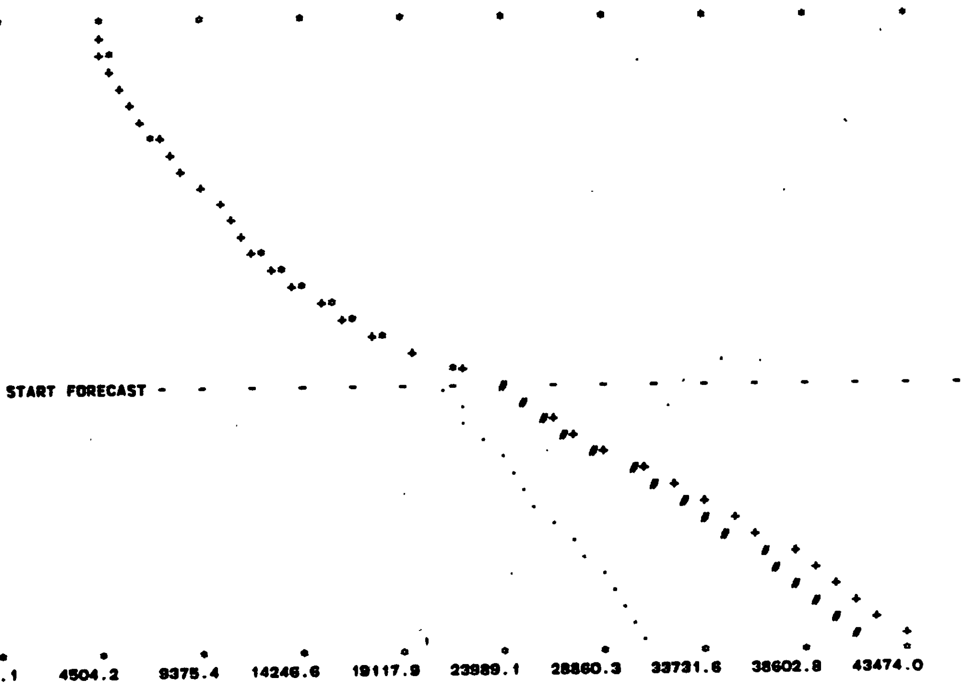


SECTOR # 47

TITLE : TELEPHONE AND TELEGRAPH

RSQ = 0.996
AAPE = 2.53%
RHO = 0.622
SHARE = 2.36%
UBAR = 31.476

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	4741.	4504.	237.
1960	5038.	4762.	276.
1961	5369.	5106.	262.
1962	5682.	5674.	8.
1963	6136.	6126.	11.
1964	6607.	6755.	-148.
1965	7300.	7481.	-181.
1966	8055.	8367.	-312.
1967	8709.	8824.	-115.
1968	9457.	9861.	-404.
1969	10379.	10699.	-319.
1970	11137.	11303.	-166.
1971	11621.	11728.	-107.
1972	12386.	12222.	164.
1973	13690.	13115.	575.
1974	14365.	13983.	382.
1975	15730.	15380.	350.
1976	17014.	16540.	474.
1977	18228.	17945.	283.
1978	19988.	19953.	36.
1979	21823.	22468.	-645.
1980	21534.	24215.	24123.
1981	22066.	25366.	25152.
1982	22323.	26653.	26319.
1983	23100.	27576.	27101.
1984	24137.	29260.	28641.
1985	24768.	31265.	30491.
1986	25346.	32546.	31640.
1987	25929.	34050.	33003.
1988	26716.	35326.	34141.
1989	27523.	36491.	35176.
1990	28346.	38134.	36664.
1991	28929.	39183.	37570.
1992	29514.	40258.	38507.
1993	30091.	41323.	39440.
1994	30670.	42396.	40374.
1995	31248.	43474.	41308.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

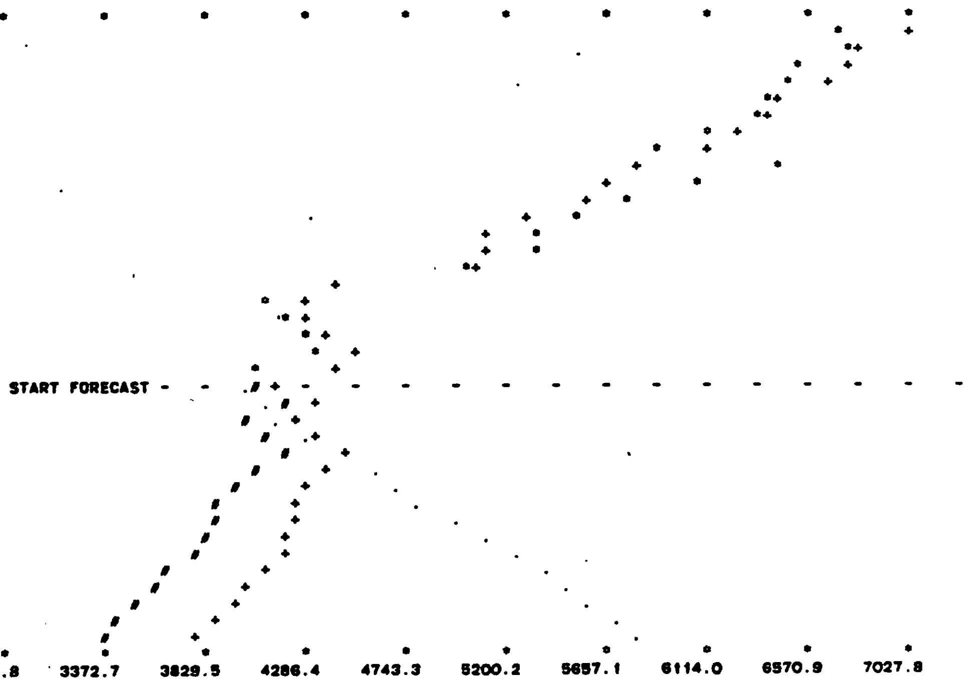


SECTOR # 48

TITLE : DOMESTIC SERVICES

RSQ = 0.933
AAPE = 3.55%
RHO = 0.463
SHARE = 0.44%
UBAR =-12.360

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	6717.	7028.	-311.
1960	6756.	6809.	-53.
1961	6555.	6774.	-219.
1962	6517.	6669.	-152.
1963	6431.	6460.	-29.
1964	6346.	6395.	-48.
1965	6143.	6263.	-121.
1966	5902.	6148.	-246.
1967	6442.	5805.	637.
1968	6091.	5697.	394.
1969	5785.	5574.	211.
1970	5531.	5316.	215.
1971	5382.	5139.	243.
1972	5349.	5131.	218.
1973	5029.	5092.	-63.
1974	4424.	4442.	-18.
1975	4115.	4297.	-182.
1976	4227.	4317.	-91.
1977	4292.	4381.	-89.
1978	4362.	4537.	-175.
1979	4075.	4459.	-384.
1980	4015.	4173.	4102.
1981	4114.	4347.	4223.
1982	4162.	4279.	4048.
1983	4307.	4351.	4107.
1984	4500.	4483.	4215.
1985	4616.	4386.	4074.
1986	4725.	4325.	3967.
1987	4834.	4269.	3881.
1988	4981.	4273.	3879.
1989	5131.	4239.	3832.
1990	5285.	4241.	3824.
1991	5394.	4122.	3688.
1992	5503.	4054.	3613.
1993	5610.	3972.	3532.
1994	5718.	3886.	3452.
1995	5826.	3797.	3373.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

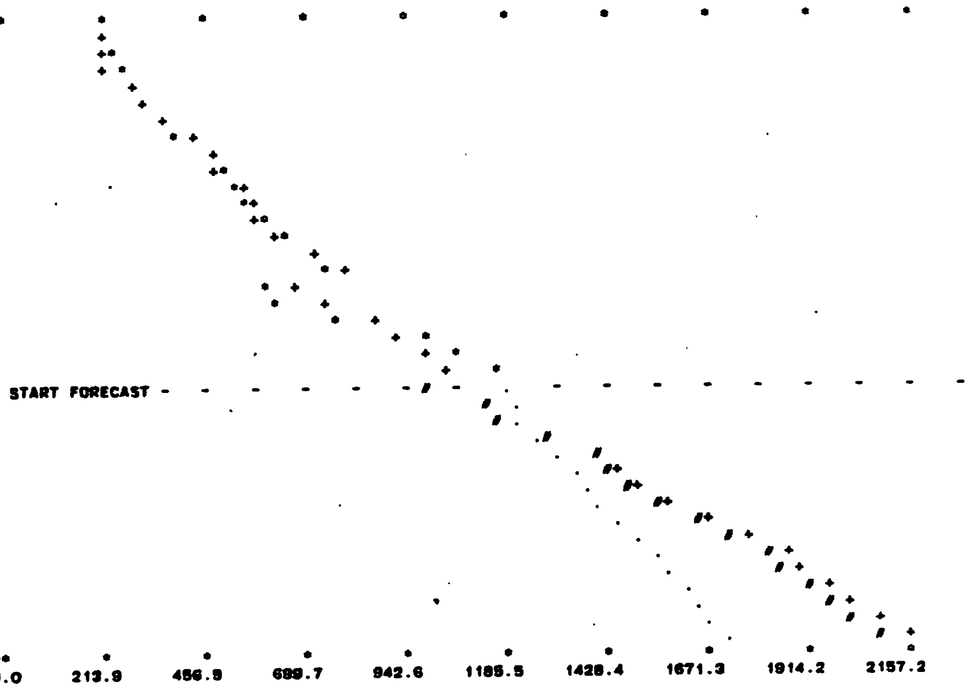


SECTOR # 49

TITLE : HOUSEHOLD INSURANCE

RSQ = 0.956
AAPE = 7.31%
RHO = 0.499
SHARE = 0.13%
UBAR = -5.125

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	219.	233.	-14.
1960	243.	214.	30.
1961	269.	230.	39.
1962	295.	294.	1.
1963	320.	315.	5.
1964	367.	383.	-16.
1965	393.	439.	-46.
1966	492.	485.	7.
1967	525.	486.	39.
1968	534.	576.	-42.
1969	560.	594.	-35.
1970	610.	596.	14.
1971	662.	644.	18.
1972	730.	744.	-13.
1973	755.	797.	-41.
1974	611.	684.	-73.
1975	633.	758.	-125.
1976	780.	880.	-100.
1977	1001.	936.	65.
1978	1083.	1011.	72.
1979	1166.	1058.	108.
1980	1186.	996.	995.
1981	1216.	1151.	1149.
1982	1230.	1172.	1165.
1983	1272.	1295.	1287.
1984	1330.	1422.	1412.
1985	1364.	1459.	1446.
1986	1396.	1516.	1499.
1987	1428.	1589.	1566.
1988	1472.	1693.	1667.
1989	1516.	1776.	1744.
1990	1561.	1877.	1838.
1991	1594.	1908.	1862.
1992	1626.	1972.	1919.
1993	1658.	2033.	1975.
1994	1689.	2096.	2032.
1995	1721.	2157.	2090.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

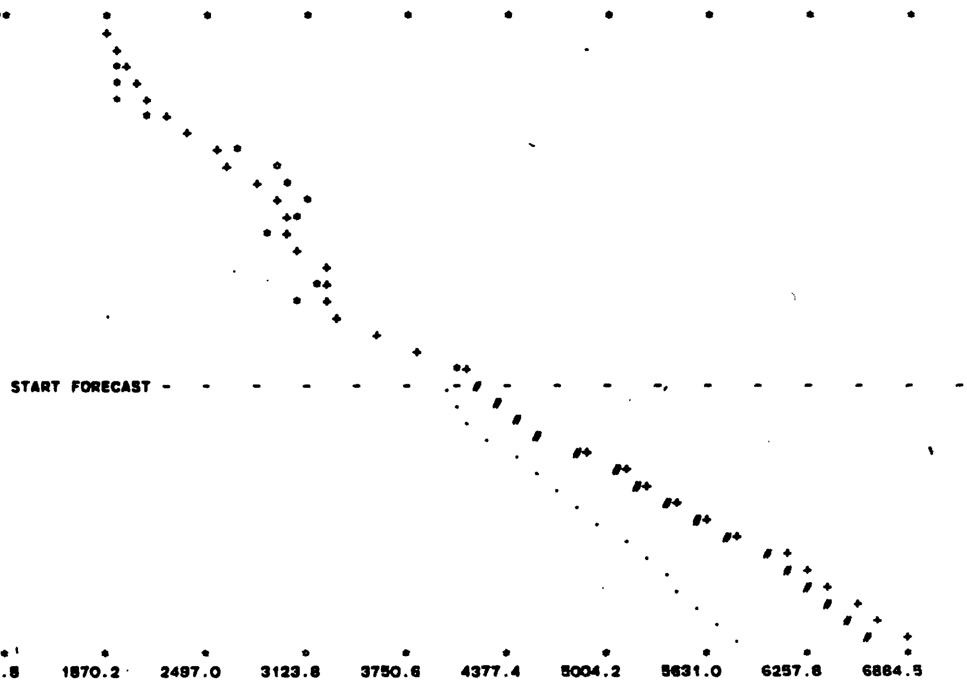


SECTOR # 50

TITLE : OTHER HOUSEHOLD OPERATIONS -- REPAIR

RSQ = 0.963
AAPE = 3.36%
RHO = 0.707
SHARE = 0.44%
UBAR = 3.776

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	1870.	1887.	-17.
1960	1957.	1941.	16.
1961	1960.	2002.	-42.
1962	1987.	2104.	-117.
1963	1992.	2166.	-173.
1964	2155.	2290.	-135.
1965	2406.	2433.	-27.
1966	2722.	2594.	127.
1967	2974.	2652.	322.
1968	3041.	2817.	225.
1969	3144.	2942.	202.
1970	3098.	3006.	92.
1971	2927.	3008.	-80.
1972	3099.	3117.	-18.
1973	3255.	3309.	-54.
1974	3242.	3255.	-13.
1975	3111.	3270.	-159.
1976	3333.	3363.	-30.
1977	3578.	3577.	1.
1978	3851.	3852.	-0.
1979	4110.	4150.	-40.
1980	4019.	4213.	4210.
1981	4114.	4338.	4328.
1982	4162.	4472.	4482.
1983	4307.	4623.	4592.
1984	4500.	4892.	4852.
1985	4618.	5146.	5097.
1986	4725.	5294.	5235.
1987	4834.	5476.	5400.
1988	4981.	5668.	5576.
1989	5131.	5868.	5758.
1990	5285.	6137.	6007.
1991	5394.	6294.	6143.
1992	5503.	6446.	6275.
1993	5610.	6596.	6406.
1994	5718.	6742.	6537.
1995	5826.	6885.	6668.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

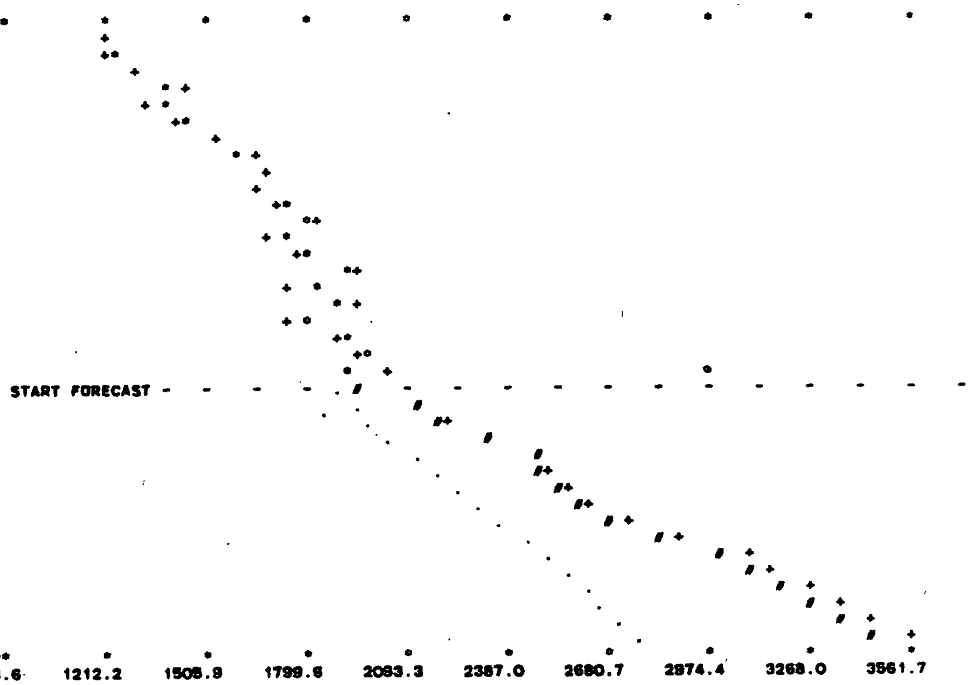


SECTOR # 51

TITLE : POSTAGE

RSQ = 0.963
AAPE = 2.11%
RHO = -0.341
SHARE = 0.21%
UBAR = 1.317

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	1212.	1232.	-20.
1960	1244.	1231.	12.
1961	1303.	1307.	-4.
1962	1410.	1452.	-41.
1963	1391.	1334.	57.
1964	1468.	1435.	33.
1965	1543.	1554.	-11.
1966	1623.	1667.	-45.
1967	1709.	1699.	11.
1968	1670.	1669.	1.
1969	1746.	1740.	6.
1970	1806.	1836.	-30.
1971	1746.	1698.	48.
1972	1818.	1782.	36.
1973	1929.	1951.	-22.
1974	1838.	1754.	84.
1975	1893.	1973.	-80.
1976	1805.	1756.	49.
1977	1930.	1901.	28.
1978	1983.	1957.	26.
1979	1938.	2050.	-112.
1980	1916.	1959.	1957. START FORECAST
1981	1964.	2152.	2147.
1982	1986.	2219.	2208.
1983	2056.	2351.	2336.
1984	2149.	2497.	2477.
1985	2204.	2521.	2496.
1986	2258.	2581.	2551.
1987	2307.	2649.	2611.
1988	2377.	2751.	2705.
1989	2449.	2900.	2844.
1990	2522.	3096.	3029.
1991	2574.	3178.	3097.
1992	2626.	3273.	3185.
1993	2678.	3370.	3272.
1994	2729.	3467.	3360.
1995	2781.	3562.	3448.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

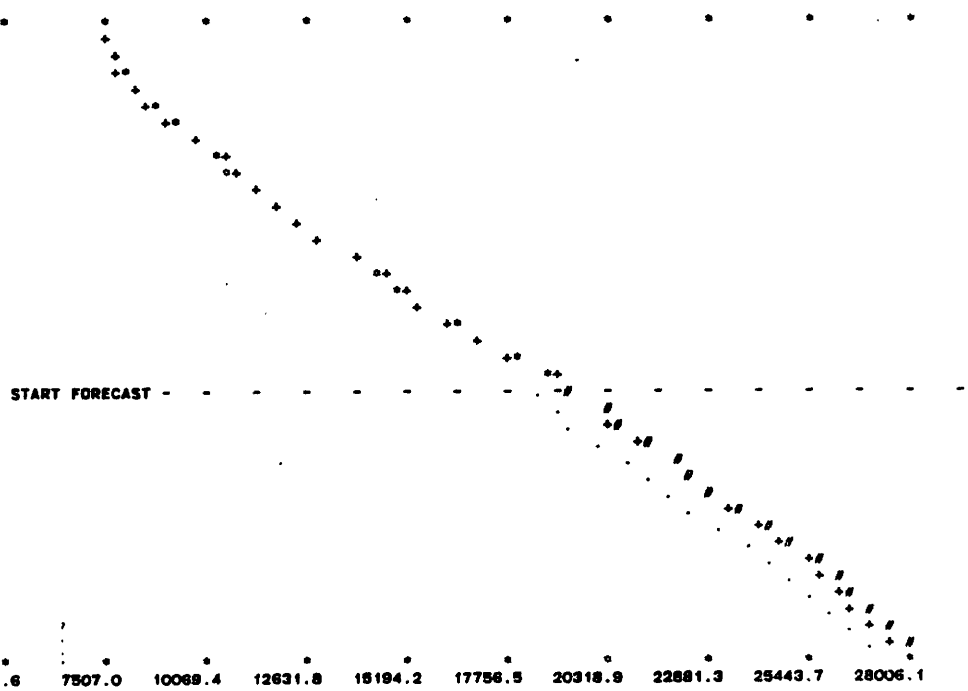


SECTOR # 52

TITLE : AUTO REPAIR

RSQ = 0.997
AAPE = 1.43%
RHO = 0.424
SHARE = 2.05%
UBAR = -0.771

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	7507.	7531.	-24.
1960	7857.	7871.	-14.
1961	8107.	7969.	138.
1962	8530.	8399.	131.
1963	8997.	8730.	268.
1964	9460.	9214.	246.
1965	9882.	9995.	-112.
1966	10381.	10764.	-383.
1967	10810.	11091.	-282.
1968	11355.	11599.	-243.
1969	11973.	12098.	-126.
1970	12605.	12499.	107.
1971	13113.	12911.	202.
1972	13922.	13956.	-34.
1973	14652.	14873.	-221.
1974	15177.	15293.	-116.
1975	15606.	15456.	150.
1976	16511.	16239.	272.
1977	17185.	17204.	-19.
1978	18086.	17839.	247.
1979	18999.	19202.	-203.
1980	18706.	19478.	19505. START FORECAST
1981	19168.	20423.	20464.
1982	19391.	20533.	20635.
1983	20066.	21273.	21370.
1984	20967.	22127.	22213.
1985	21515.	22498.	22614.
1986	22016.	22951.	23107.
1987	22523.	23462.	23667.
1988	23208.	24184.	24432.
1989	23908.	24876.	25166.
1990	24622.	25497.	25819.
1991	25129.	25890.	26250.
1992	25637.	26300.	26696.
1993	26139.	26708.	27135.
1994	26641.	27120.	27571.
1995	27143.	27539.	28006.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

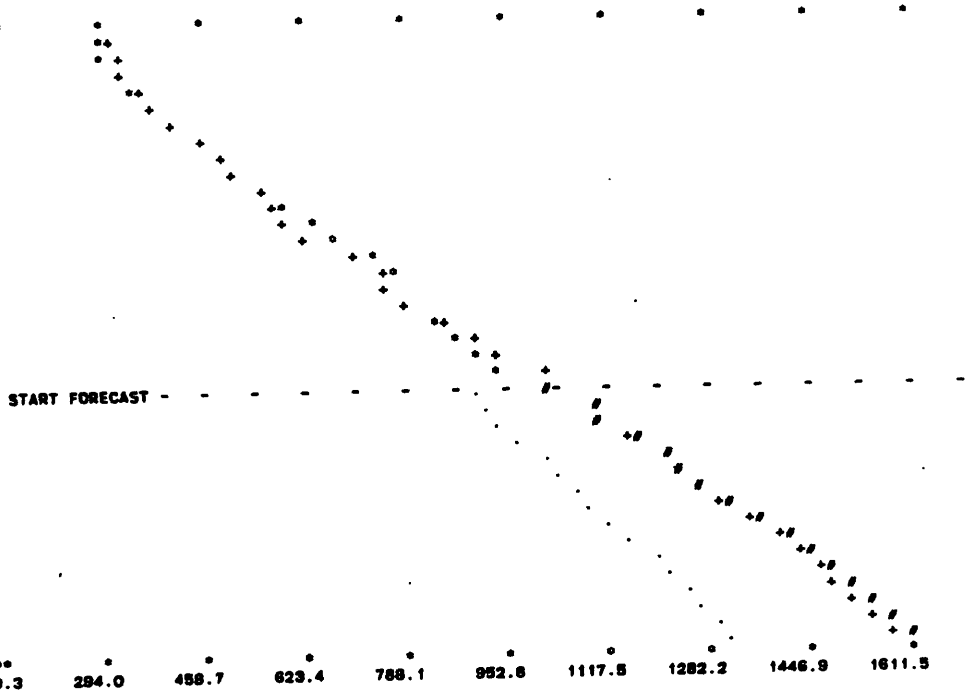


SECTOR # 53

TITLE : BRIDGE, TOLLS, ETC.

RSQ = 0.983
AAPE = 3.50%
RHO = 0.698
SHARE = 0.10%
UBAR = -3.745

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	294.	320.	-26.
1960	310.	333.	-23.
1961	330.	341.	-11.
1962	356.	371.	-15.
1963	379.	390.	-11.
1964	421.	422.	-1.
1965	463.	465.	-3.
1966	495.	507.	-12.
1967	517.	522.	-5.
1968	563.	560.	3.
1969	603.	585.	18.
1970	643.	607.	36.
1971	689.	639.	50.
1972	745.	706.	39.
1973	784.	757.	27.
1974	764.	764.	-0.
1975	798.	792.	6.
1976	841.	856.	-15.
1977	879.	911.	-32.
1978	918.	950.	-32.
1979	952.	1023.	-72.
1980	912.	1025.	1027.
1981	935.	1102.	1104.
1982	946.	1107.	1113.
1983	979.	1167.	1171.
1984	1023.	1224.	1228.
1985	1050.	1240.	1246.
1986	1074.	1270.	1278.
1987	1099.	1304.	1318.
1988	1132.	1355.	1368.
1989	1166.	1400.	1416.
1990	1201.	1442.	1459.
1991	1226.	1465.	1484.
1992	1251.	1495.	1517.
1993	1275.	1525.	1548.
1994	1300.	1555.	1580.
1995	1324.	1586.	1612.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

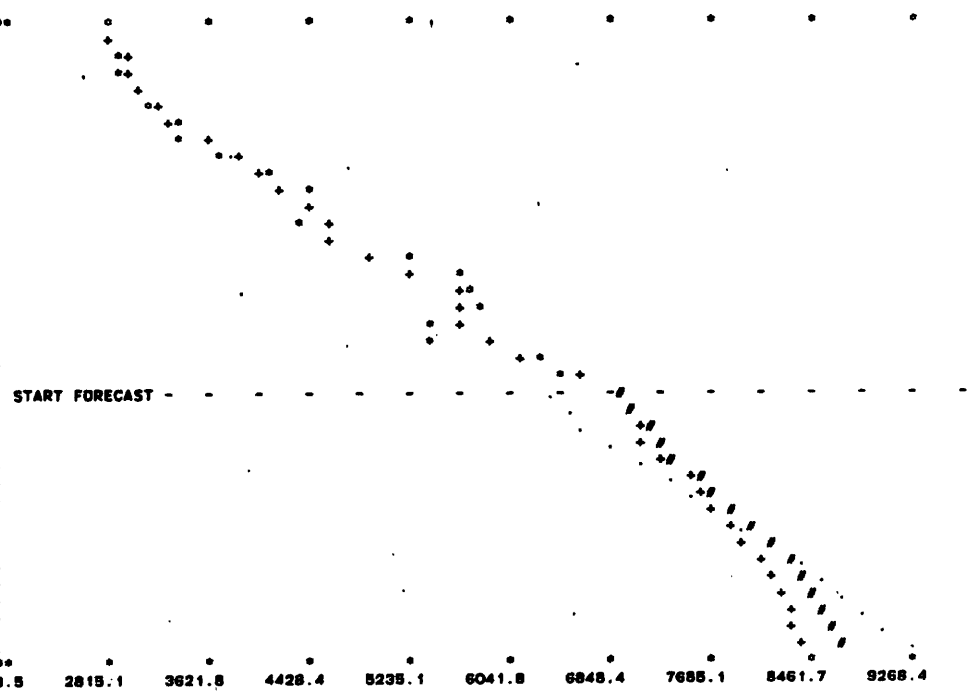


SECTOR # 54

TITLE : AUTO INSURANCE

RSQ = 0.970
AAPE = 3.14%
RHO = 0.220
SHARE = 0.70%
UBAR = -3.897

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	2822.	2815.	7.
1960	2940.	3003.	-63.
1961	2961.	3029.	-68.
1962	3096.	3104.	-8.
1963	3213.	3251.	-38.
1964	3388.	3379.	9.
1965	3445.	3624.	-179.
1966	3772.	3898.	-126.
1967	4171.	4094.	78.
1968	4462.	4195.	267.
1969	4471.	4439.	32.
1970	4421.	4609.	-167.
1971	4631.	4663.	-32.
1972	5248.	4920.	328.
1973	5671.	5265.	406.
1974	5773.	5681.	92.
1975	5869.	5674.	195.
1976	5427.	5667.	-240.
1977	5438.	5938.	-500.
1978	6287.	6137.	150.
1979	6454.	6661.	-207.
1980	6387.	6969.	6975.
1981	6545.	7047.	7082.
1982	6621.	7121.	7181.
1983	6852.	7154.	7258.
1984	7159.	7314.	7411.
1985	7347.	7498.	7587.
1986	7518.	7611.	7714.
1987	7691.	7712.	7849.
1988	7925.	7820.	7994.
1989	8164.	7965.	8164.
1990	8408.	8084.	8303.
1991	8581.	8191.	8433.
1992	8754.	8247.	8518.
1993	8925.	8308.	8602.
1994	9097.	8367.	8681.
1995	9268.	8434.	8758.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

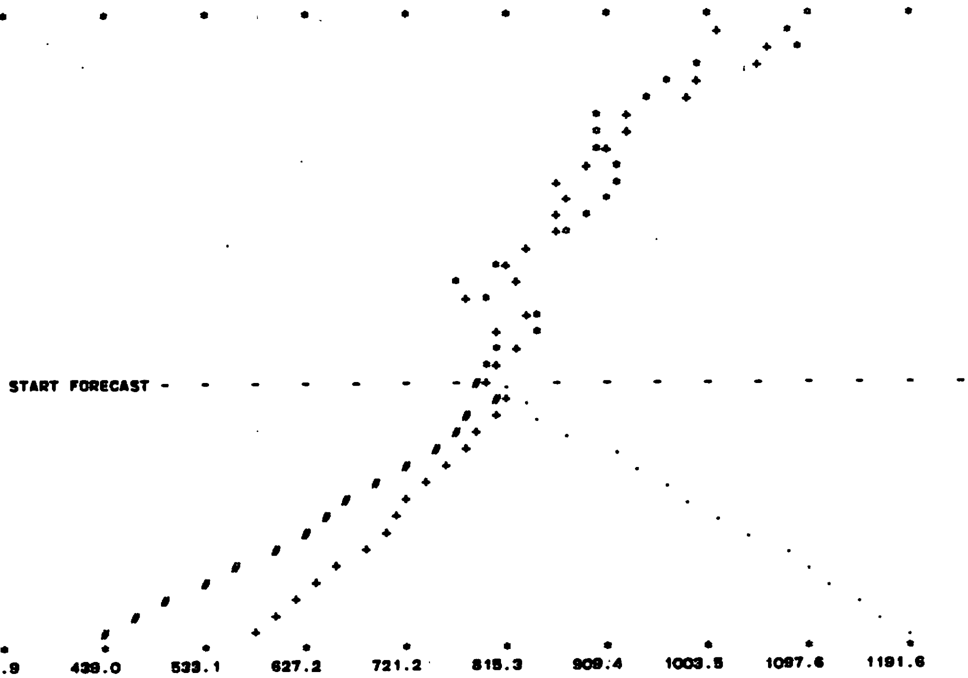


SECTOR # 55

TITLE : TAXICABS

RSQ = 0.852
AAPE = 3.03%
RHO = 0.450
SHARE = 0.09%
UBAR = -0.263

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	1084.	1020.	64.
1960	1092.	1067.	26.
1961	994.	1051.	-56.
1962	969.	1001.	-32.
1963	954.	985.	-30.
1964	901.	935.	-34.
1965	904.	930.	-26.
1966	902.	914.	-11.
1967	923.	897.	26.
1968	924.	872.	52.
1969	914.	880.	35.
1970	891.	871.	20.
1971	874.	863.	11.
1972	842.	842.	0.
1973	808.	821.	-13.
1974	770.	828.	-58.
1975	801.	784.	17.
1976	844.	842.	2.
1977	845.	810.	35.
1978	806.	828.	-22.
1979	802.	813.	-11.
1980	821.	800.	789.
1981	842.	824.	809.
1982	851.	810.	780.
1983	881.	795.	771.
1984	920.	783.	758.
1985	945.	763.	725.
1986	967.	745.	696.
1987	989.	729.	671.
1988	1019.	719.	652.
1989	1050.	704.	628.
1990	1081.	691.	606.
1991	1103.	662.	568.
1992	1126.	645.	537.
1993	1148.	620.	505.
1994	1170.	604.	472.
1995	1192.	582.	439.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

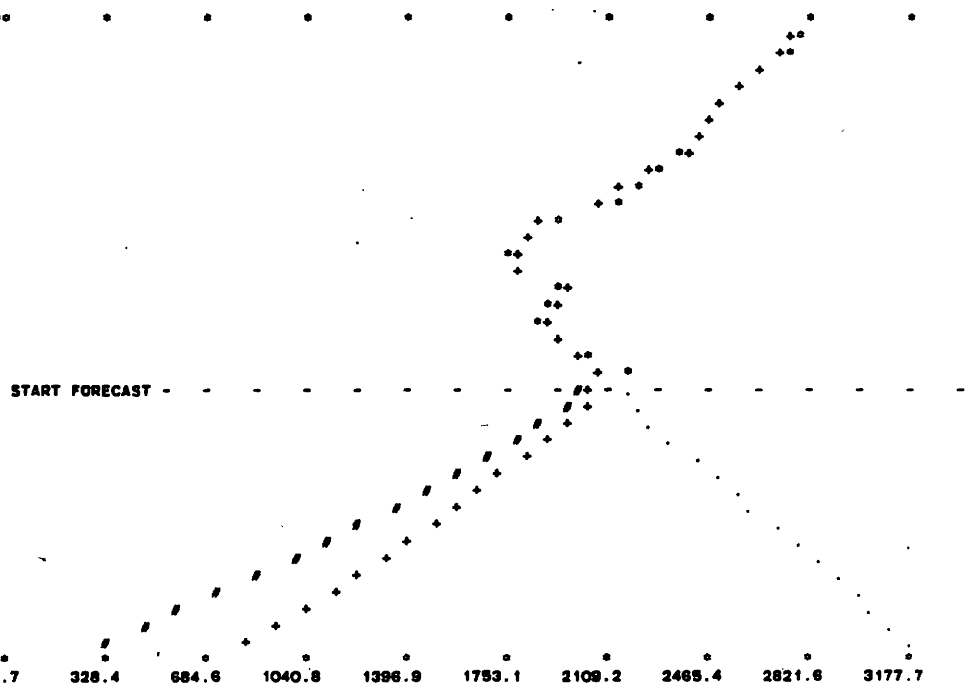


SECTOR # 56

TITLE : LOCAL PUBLIC TRANSPORT

RSQ = 0.986
AAPE = 1.42%
RHO = 0.568
SHARE = 0.24%
UBAR = 10.210

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	2795.	2784.	11.
1960	2759.	2747.	12.
1961	2647.	2650.	-2.
1962	2590.	2583.	8.
1963	2535.	2529.	5.
1964	2481.	2466.	15.
1965	2434.	2460.	-26.
1966	2383.	2397.	-13.
1967	2317.	2277.	40.
1968	2217.	2179.	37.
1969	2172.	2088.	84.
1970	1948.	1870.	78.
1971	1856.	1846.	11.
1972	1762.	1797.	-35.
1973	1795.	1802.	-8.
1974	1960.	1992.	-32.
1975	1923.	1965.	-42.
1976	1879.	1910.	-31.
1977	1934.	1950.	-16.
1978	2047.	2009.	38.
1979	2180.	2101.	79.
1980	2190.	2056.	2026.
1981	2244.	2051.	1998.
1982	2270.	1981.	1893.
1983	2349.	1909.	1803.
1984	2455.	1832.	1709.
1985	2519.	1750.	1598.
1986	2578.	1664.	1478.
1987	2637.	1584.	1363.
1988	2717.	1508.	1253.
1989	2799.	1429.	1139.
1990	2883.	1353.	1025.
1991	2942.	1252.	889.
1992	3001.	1158.	752.
1993	3060.	1057.	613.
1994	3119.	961.	472.
1995	3178.	862.	328.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

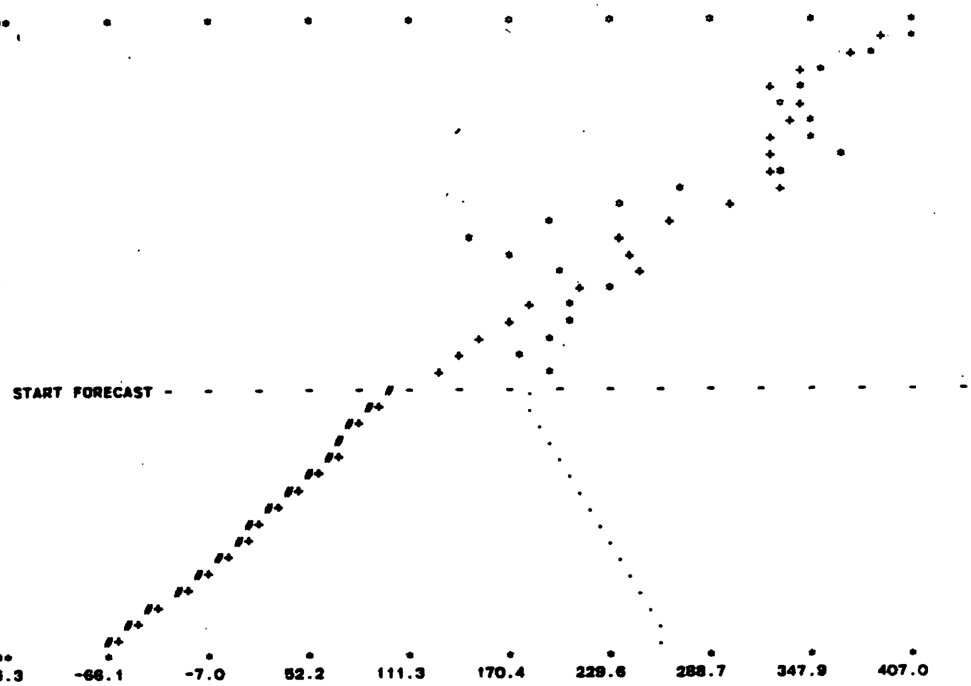


SECTOR # 57

TITLE : INTERCITY RAILROAD

RSQ = 0.703
AAPE = 17.17%
RHO = 0.770
SHARE = 0.02%
UBAR = -2.063

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	407.	393.	14.
1960	387.	376.	11.
1961	357.	344.	13.
1962	345.	326.	19.
1963	331.	344.	-13.
1964	349.	337.	13.
1965	353.	328.	25.
1966	370.	329.	41.
1967	335.	329.	6.
1968	277.	332.	-56.
1969	236.	306.	-69.
1970	195.	266.	-71.
1971	152.	237.	-85.
1972	175.	246.	-71.
1973	205.	252.	-46.
1974	234.	214.	20.
1975	207.	186.	21.
1976	210.	172.	38.
1977	200.	153.	47.
1978	179.	145.	34.
1979	198.	131.	67.
1980	182.	102.	100.
1981	187.	94.	92.
1982	188.	82.	78.
1983	196.	75.	71.
1984	205.	70.	67.
1985	210.	58.	55.
1986	215.	47.	43.
1987	220.	35.	31.
1988	226.	27.	22.
1989	233.	18.	13.
1990	240.	9.	4.
1991	245.	-5.	-10.
1992	250.	-19.	-24.
1993	255.	-32.	-38.
1994	260.	-46.	-52.
1995	265.	-60.	-66.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

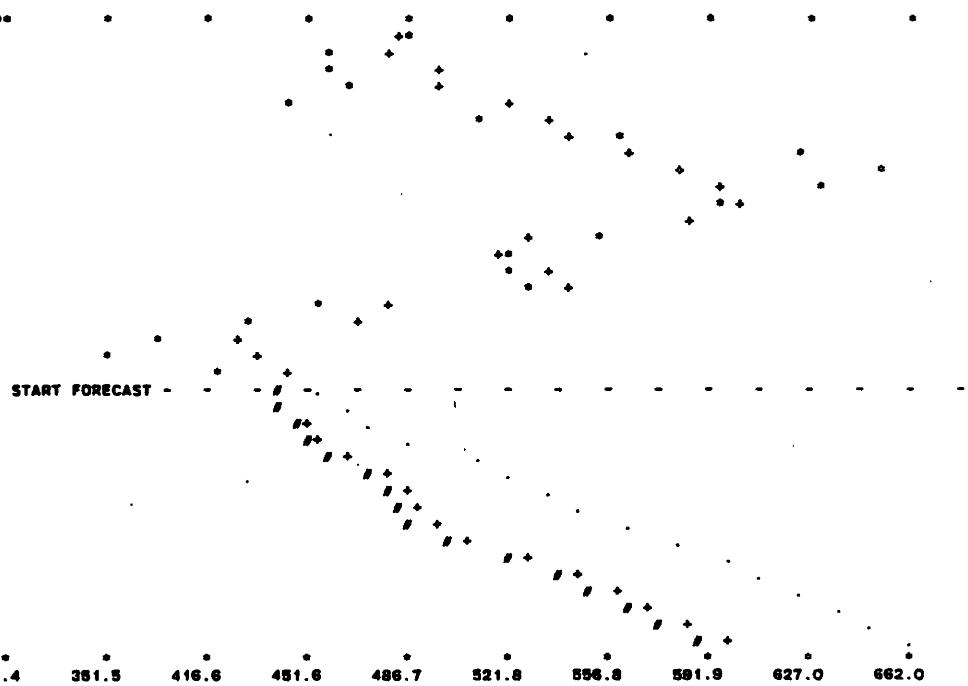


SECTOR # 58

TITLE : INTERCITY BUSES

RSQ = 0.781
AAPE = 5.97%
RHO = 0.688
SHARE = 0.05%
UBAR = -8.668

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	490.	485.	5.
1960	459.	483.	-24.
1961	460.	499.	-39.
1962	469.	499.	-30.
1963	447.	524.	-76.
1964	514.	539.	-25.
1965	562.	546.	16.
1966	626.	566.	60.
1967	654.	583.	71.
1968	633.	596.	38.
1969	596.	605.	-9.
1970	587.	587.	1.
1971	554.	531.	23.
1972	523.	519.	4.
1973	523.	536.	-12.
1974	532.	543.	-11.
1975	456.	483.	-27.
1976	431.	470.	-39.
1977	401.	428.	-27.
1978	381.	437.	-56.
1979	421.	447.	-26.
1980	456.	444.	444.
1981	468.	444.	441.
1982	473.	455.	451.
1983	489.	458.	452.
1984	511.	468.	460.
1985	525.	483.	476.
1986	537.	487.	480.
1987	549.	492.	485.
1988	566.	498.	489.
1989	583.	511.	502.
1990	601.	531.	522.
1991	613.	549.	540.
1992	625.	561.	552.
1993	638.	574.	565.
1994	650.	587.	577.
1995	662.	599.	590.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

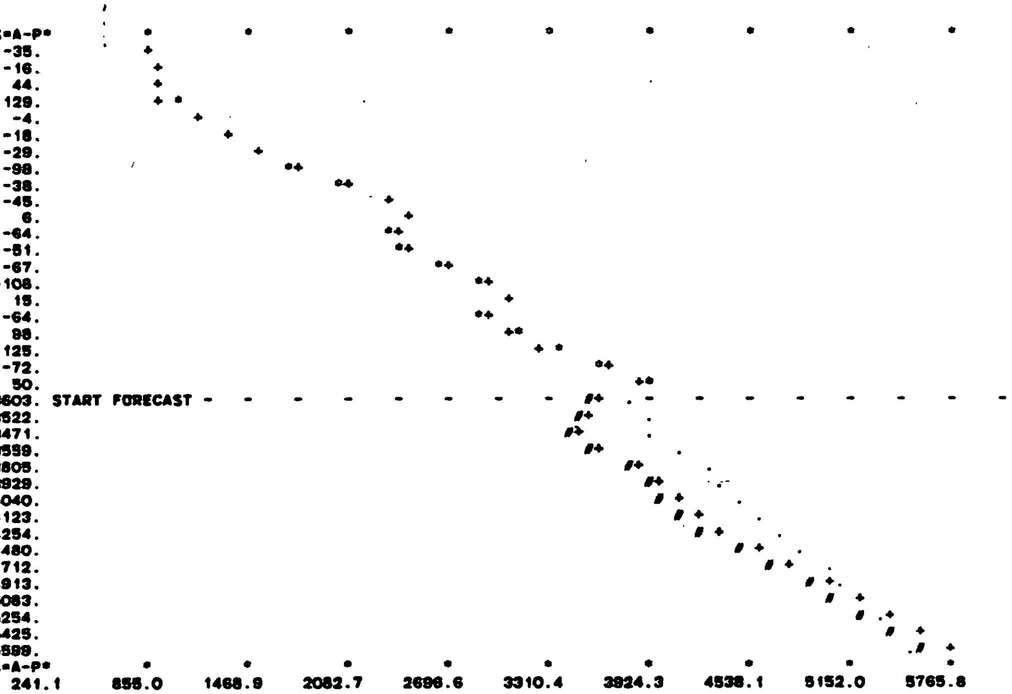


SECTOR # 59

TITLE : AIRLINES

RSQ = 0.995
AAPE = 2.83%
RHO = 0.192
SHARE = 0.42%
UBAR =-11.509

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	855.	890.	-35.
1960	919.	935.	-16.
1961	970.	926.	44.
1962	1070.	941.	129.
1963	1210.	1214.	-4.
1964	1372.	1390.	-18.
1965	1557.	1586.	-29.
1966	1734.	1832.	-98.
1967	2060.	2098.	-38.
1968	2343.	2388.	-45.
1969	2477.	2472.	6.
1970	2383.	2447.	-64.
1971	2409.	2461.	-51.
1972	2636.	2703.	-67.
1973	2894.	3002.	-108.
1974	3095.	3080.	15.
1975	2934.	2998.	-64.
1976	3168.	3071.	98.
1977	3419.	3294.	125.
1978	3623.	3695.	-72.
1979	3926.	3876.	50.
1980	3832.	3630.	3603.
1981	3927.	3577.	3522.
1982	3973.	3552.	3471.
1983	4111.	3659.	3559.
1984	4296.	3901.	3805.
1985	4408.	4023.	3929.
1986	4511.	4146.	4040.
1987	4815.	4241.	4123.
1988	4755.	4380.	4254.
1989	4898.	4608.	4480.
1990	5045.	4844.	4712.
1991	5148.	5052.	4913.
1992	5252.	5229.	5083.
1993	5355.	5407.	5254.
1994	5458.	5585.	5425.
1995	5561.	5766.	5589.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

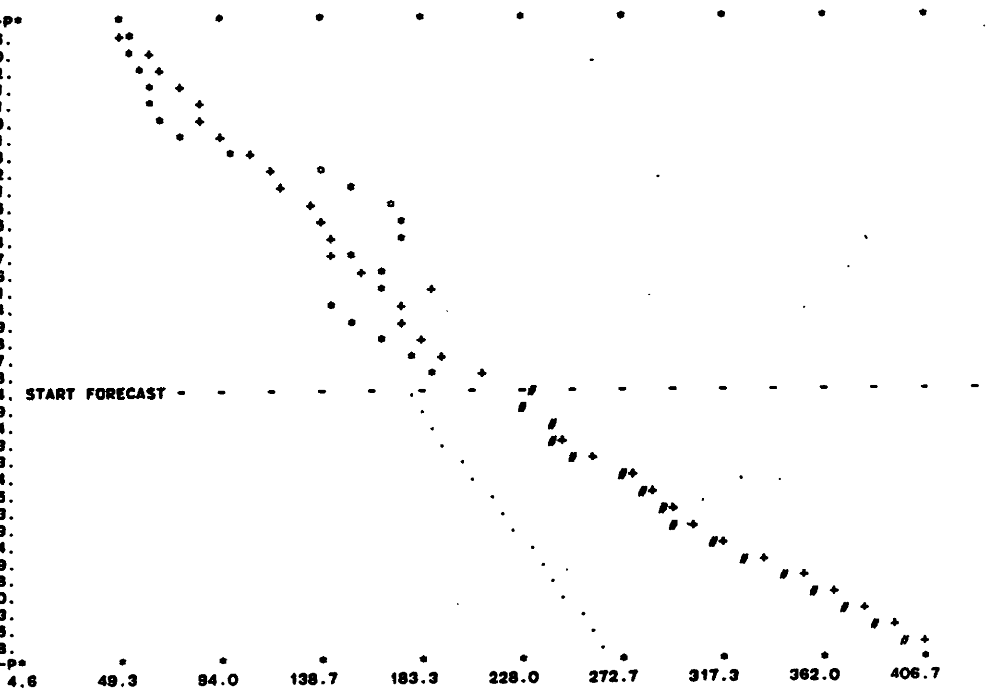


SECTOR # 60

TITLE : TRAVEL AGENTS AND OTHER TRANSPORTATION SERVICES

RSQ = 0.808
AAPE = 16.34%
RHO = 0.811
SHARE = 0.02%
UBAR = -2.532

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	56.	49.	6.
1960	54.	64.	-10.
1961	59.	71.	-12.
1962	66.	77.	-11.
1963	65.	85.	-21.
1964	70.	89.	-19.
1965	76.	98.	-21.
1966	100.	108.	-8.
1967	141.	119.	22.
1968	155.	124.	31.
1969	170.	135.	35.
1970	175.	140.	35.
1971	178.	144.	34.
1972	152.	145.	7.
1973	166.	160.	6.
1974	168.	189.	-21.
1975	144.	178.	-34.
1976	156.	175.	-19.
1977	169.	187.	-18.
1978	180.	196.	-17.
1979	192.	211.	-18.
1980	182.	234.	234.
1981	187.	231.	229.
1982	189.	246.	244.
1983	196.	249.	243.
1984	205.	260.	253.
1985	210.	280.	274.
1986	215.	290.	285.
1987	220.	299.	293.
1988	226.	306.	299.
1989	233.	321.	314.
1990	240.	336.	329.
1991	245.	355.	348.
1992	250.	368.	360.
1993	255.	381.	373.
1994	260.	394.	385.
1995	265.	407.	398.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

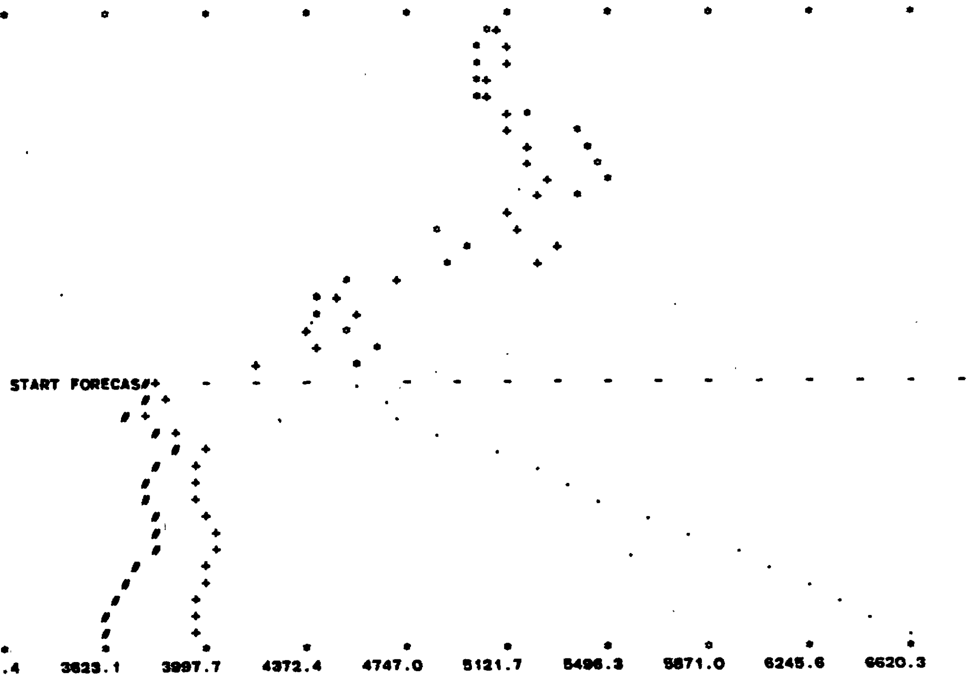


SECTOR # 61

TITLE : CLEANING, LAUNDERING AND SHOE REPAIR

RSQ = 0.622
AAPE = 3.57%
RHO = 0.732
SHARE = 0.50%
UBAR = 15.421

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	5081.	5095.	-13.
1960	5042.	5134.	-92.
1961	5031.	5126.	-94.
1962	5023.	5074.	-51.
1963	5033.	5065.	-32.
1964	5214.	5143.	72.
1965	5409.	5140.	269.
1966	5458.	5231.	227.
1967	5462.	5199.	264.
1968	5514.	5297.	218.
1969	5416.	5242.	174.
1970	5128.	5149.	-21.
1971	4872.	5195.	-323.
1972	4975.	5326.	-351.
1973	4914.	5237.	-323.
1974	4554.	4743.	-189.
1975	4445.	4511.	-67.
1976	4437.	4576.	-139.
1977	4548.	4373.	175.
1978	4661.	4413.	248.
1979	4591.	4216.	375.
1980	4562.	3823.	3787.
1981	4675.	3860.	3807.
1982	4729.	3808.	3702.
1983	4894.	3916.	3818.
1984	5114.	4021.	3915.
1985	5248.	3974.	3837.
1986	5370.	3971.	3800.
1987	5493.	3976.	3782.
1988	5660.	4033.	3830.
1989	5831.	4048.	3828.
1990	6005.	4068.	3830.
1991	6129.	4015.	3751.
1992	6253.	4007.	3722.
1993	6375.	3990.	3689.
1994	6498.	3981.	3656.
1995	6620.	3870.	3623.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

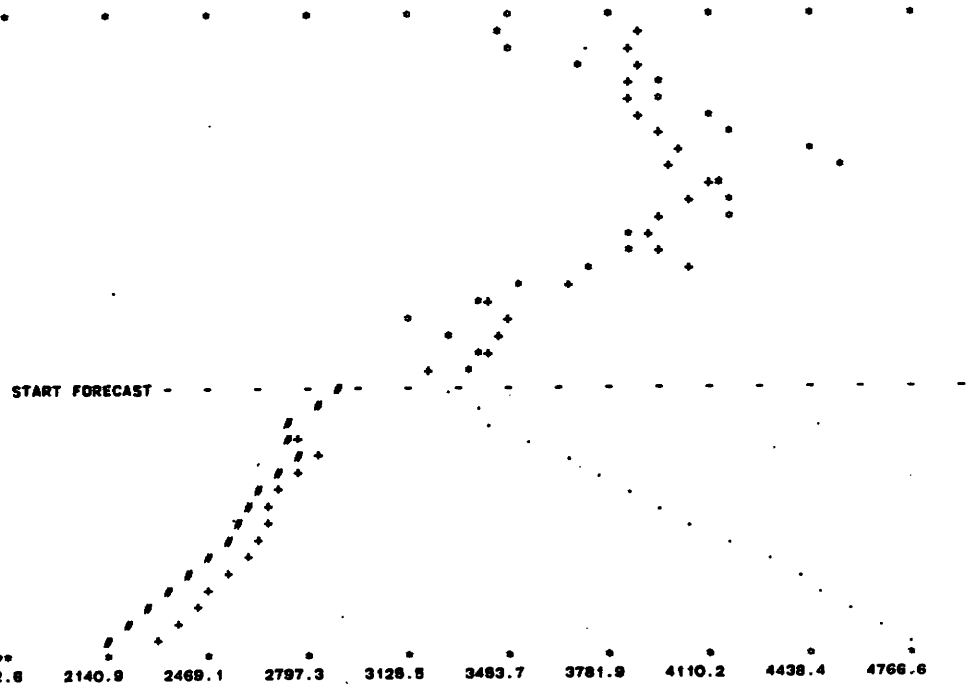


SECTOR # 62

TITLE : BARBERSHOPS AND BEAUTY SHOPS

RSQ = 0.891
AAPE = 5.49%
RHO = 0.730
SHARE = 0.36%
UBAR = 0.088

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	3425.	3896.	-471.
1960	3468.	3873.	-405.
1961	3712.	3884.	-171.
1962	3976.	3869.	107.
1963	3975.	3866.	109.
1964	4114.	3908.	206.
1965	4178.	3956.	222.
1966	4468.	4043.	425.
1967	4559.	3990.	570.
1968	4174.	4129.	45.
1969	4184.	4052.	132.
1970	4208.	3957.	251.
1971	3862.	3914.	-52.
1972	3880.	3957.	-77.
1973	3739.	4056.	-318.
1974	3499.	3662.	-163.
1975	3358.	3400.	-42.
1976	3154.	3469.	-315.
1977	3288.	3440.	-152.
1978	3381.	3415.	-33.
1979	3330.	3196.	134.
1980	3285.	2902.	2901.
1981	3366.	2842.	2830.
1982	3405.	2755.	2742.
1983	3524.	2795.	2761.
1984	3682.	2832.	2778.
1985	3778.	2778.	2715.
1986	3866.	2725.	2656.
1987	3955.	2686.	2604.
1988	4076.	2682.	2582.
1989	4198.	2653.	2536.
1990	4324.	2624.	2492.
1991	4413.	2554.	2412.
1992	4502.	2500.	2348.
1993	4590.	2443.	2280.
1994	4678.	2384.	2211.
1995	4767.	2319.	2141.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

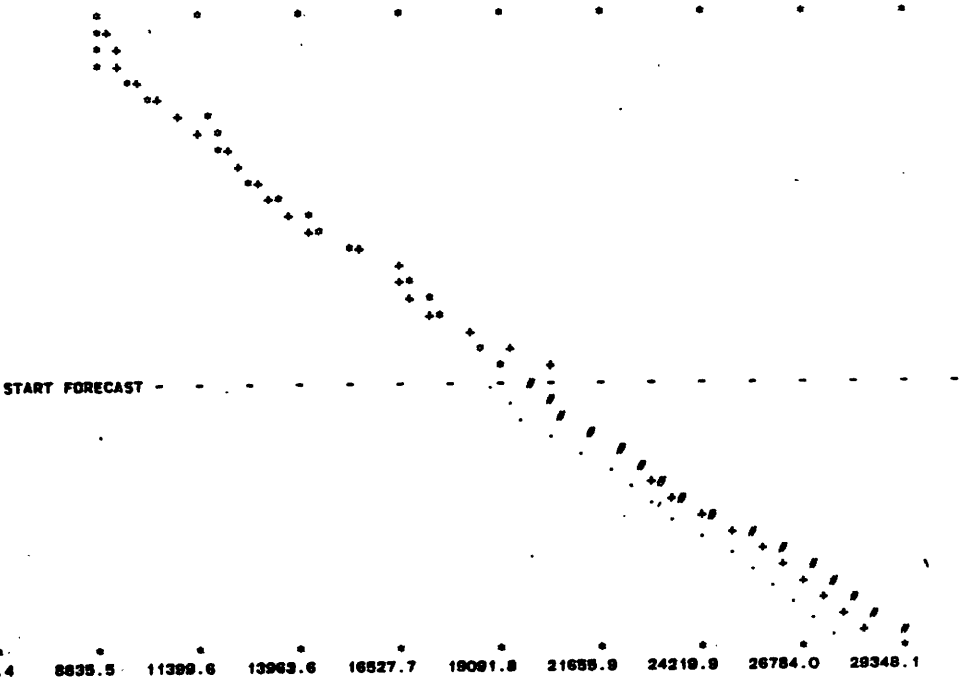


SECTOR # 63

TITLE : PHYSICIANS

RSQ = 0.981
AAPE = 2.69%
RHO = 0.481
SHARE = 2.09%
UBAR =-24.462

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	8835.	9168.	-332.
1960	9003.	9404.	-401.
1961	9084.	9579.	-494.
1962	9749.	10017.	-267.
1963	10242.	10479.	-237.
1964	11894.	11006.	888.
1965	12107.	11634.	474.
1966	12141.	12218.	-77.
1967	12523.	12459.	64.
1968	12712.	12995.	-282.
1969	13565.	13425.	140.
1970	14262.	13756.	506.
1971	14648.	14420.	228.
1972	15489.	15556.	-67.
1973	16642.	16602.	40.
1974	16930.	16694.	236.
1975	17490.	16784.	706.
1976	17691.	17479.	212.
1977	18421.	18444.	-22.
1978	18752.	19476.	-723.
1979	19337.	20442.	-1105.
1980	19070.	20000.	19985.
1981	19542.	20567.	20559.
1982	19769.	20761.	20748.
1983	20457.	21419.	21442.
1984	21376.	22275.	22374.
1985	21935.	22689.	22861.
1986	22446.	23164.	23383.
1987	22963.	23658.	23934.
1988	23661.	24324.	24695.
1989	24375.	25126.	25605.
1990	25103.	25915.	26507.
1991	25619.	26422.	27086.
1992	26137.	26924.	27653.
1993	26649.	27443.	28219.
1994	27161.	27943.	28780.
1995	27673.	28444.	29348.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

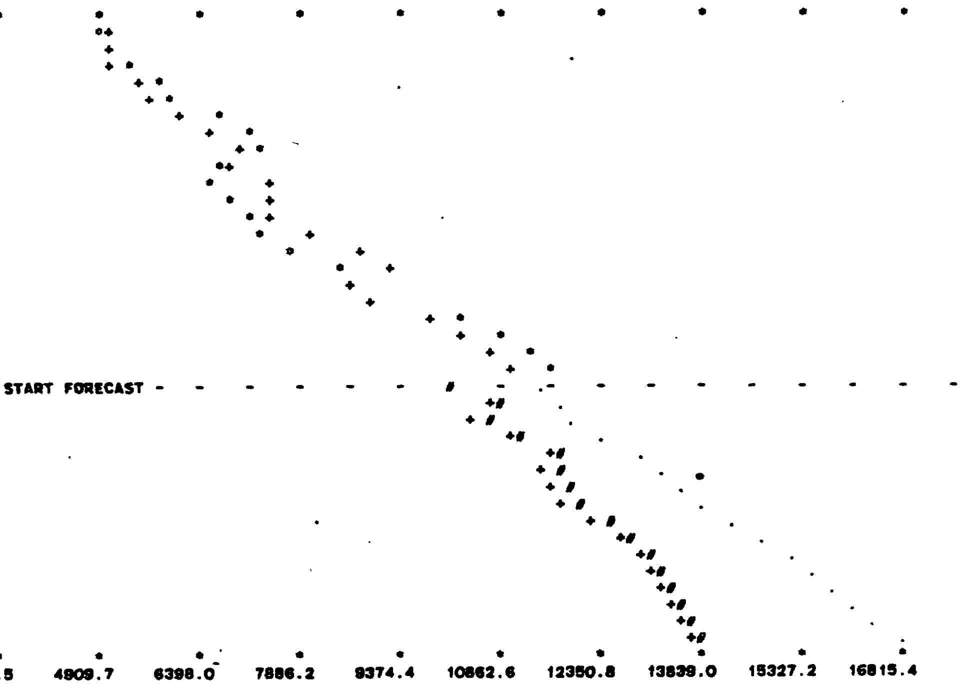


SECTOR # 64

TITLE : DENTISTS AND OTHER PROFESSIONAL SERVICES

RSQ = 0.930
AAPE = 5.77%
RHO = 0.778
SHARE = 1.27%
UBAR =-21.932

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	4910.	5109.	-200.
1960	5145.	5112.	33.
1961	5420.	5168.	251.
1962	5848.	5576.	272.
1963	6068.	5779.	289.
1964	6834.	6167.	667.
1965	7145.	6624.	521.
1966	7334.	6996.	338.
1967	6715.	6965.	-250.
1968	6689.	7481.	-792.
1969	6918.	7586.	-668.
1970	7273.	7587.	-314.
1971	7302.	8041.	-738.
1972	7738.	8827.	-1088.
1973	8614.	9309.	-694.
1974	8697.	8774.	-77.
1975	8984.	8995.	-11.
1976	10321.	9935.	386.
1977	10887.	10402.	486.
1978	11359.	10855.	505.
1979	11735.	11111.	624.
1980	11588.	10168.	10258.
1981	11875.	10745.	10876.
1982	12013.	10477.	10718.
1983	12431.	11047.	11271.
1984	12989.	11631.	11830.
1985	13329.	11587.	11794.
1986	13639.	11665.	11935.
1987	13953.	11828.	12119.
1988	14378.	12257.	12503.
1989	14811.	12655.	12866.
1990	15254.	13033.	13214.
1991	15568.	13096.	13279.
1992	15882.	13280.	13439.
1993	16193.	13453.	13589.
1994	16504.	13626.	13741.
1995	16815.	13786.	13889.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

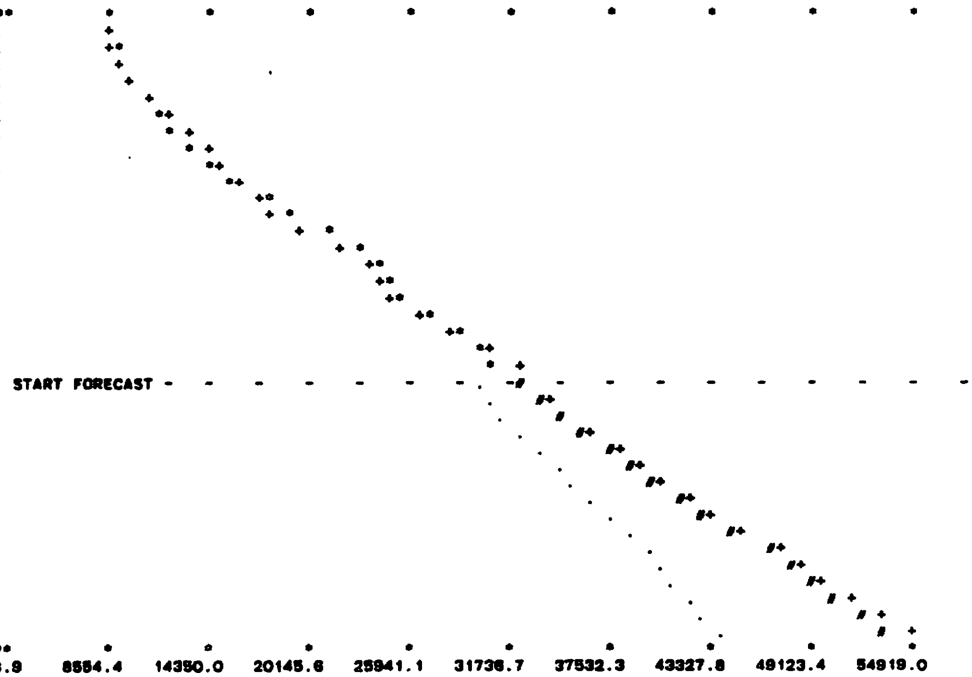


SECTOR # 65

TITLE : PRIVATE HOSPITALS AND SANITARIUMS

RSQ = 0.989
AAPE = 3.16%
RHO = 0.604
SHARE = 3.32%
UBAR = 25.511

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	8608.	8554.	54.
1960	9170.	9010.	161.
1961	9605.	9449.	156.
1962	10163.	10245.	-82.
1963	11159.	11050.	109.
1964	11928.	12043.	-115.
1965	12485.	13238.	-753.
1966	13417.	14546.	-1129.
1967	14464.	15144.	-680.
1968	15596.	16196.	-600.
1969	17951.	17367.	584.
1970	19521.	18272.	1250.
1971	21377.	19898.	1479.
1972	23303.	22238.	1065.
1973	24305.	24126.	179.
1974	25092.	24592.	500.
1975	25658.	25241.	417.
1976	27203.	26838.	365.
1977	29099.	28830.	269.
1978	30144.	30861.	-717.
1979	30741.	32718.	-1976.
1980	30294.	32630.	32527.
1981	31042.	34213.	34003.
1982	31403.	34974.	34753.
1983	32497.	36616.	36277.
1984	33956.	38417.	38021.
1985	34843.	39511.	39087.
1986	35656.	40861.	40318.
1987	36477.	42226.	41607.
1988	37588.	43821.	43202.
1989	38719.	45643.	45017.
1990	39876.	47428.	46811.
1991	40687.	48823.	48125.
1992	41519.	50274.	49479.
1993	42332.	51824.	50831.
1994	43145.	53372.	52185.
1995	43958.	54919.	53552.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

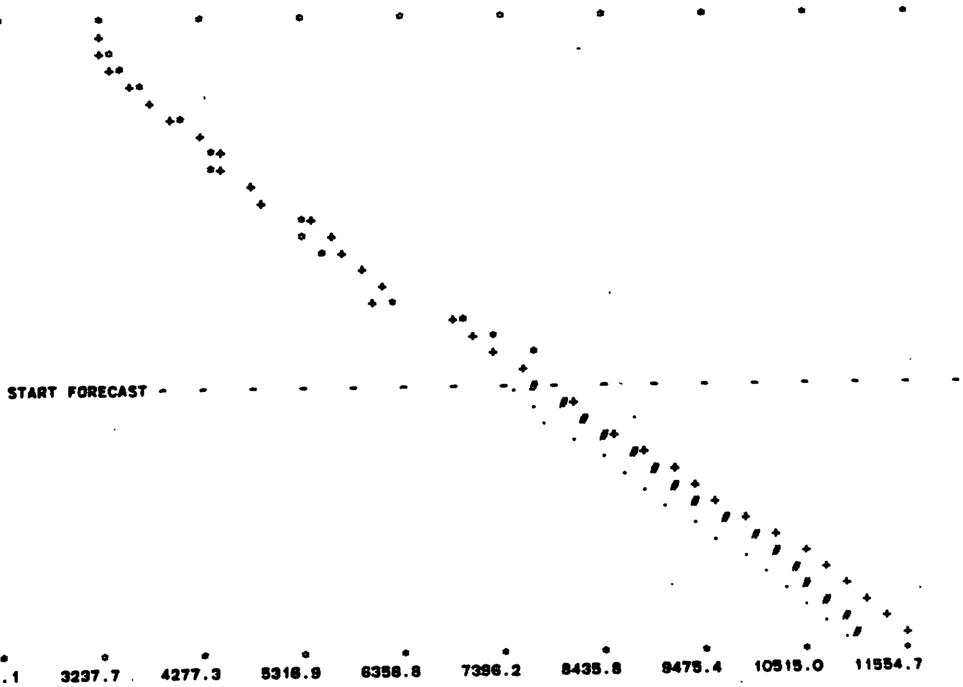


SECTOR # 66

TITLE : HEALTH INSURANCE

RSQ = 0.988
AAPE = 2.14%
RHO = 0.542
SHARE = 0.83%
UBAR = 10.104

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	3296.	3238.	58.
1960	3386.	3327.	59.
1961	3492.	3358.	135.
1962	3695.	3579.	116.
1963	3859.	3837.	22.
1964	4129.	4052.	77.
1965	4351.	4311.	40.
1966	4463.	4516.	-53.
1967	4383.	4572.	-189.
1968	4823.	4844.	-21.
1969	4943.	4968.	-25.
1970	5352.	5447.	-95.
1971	5369.	5680.	-311.
1972	5564.	5800.	-235.
1973	5976.	6042.	-66.
1974	6181.	6220.	-39.
1975	6260.	6117.	143.
1976	6987.	6953.	34.
1977	7329.	7091.	238.
1978	7712.	7351.	361.
1979	7668.	7707.	-38.
1980	7573.	7810.	7797.
1981	7761.	8126.	8088.
1982	7851.	8278.	8241.
1983	8124.	8592.	8509.
1984	8489.	8928.	8791.
1985	8711.	9166.	9000.
1986	8914.	9389.	9220.
1987	9119.	9648.	9451.
1988	9396.	9954.	9727.
1989	9660.	10259.	10000.
1990	9969.	10559.	10268.
1991	10174.	10761.	10439.
1992	10380.	10961.	10613.
1993	10583.	11161.	10784.
1994	10786.	11358.	10953.
1995	10990.	11555.	11120.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

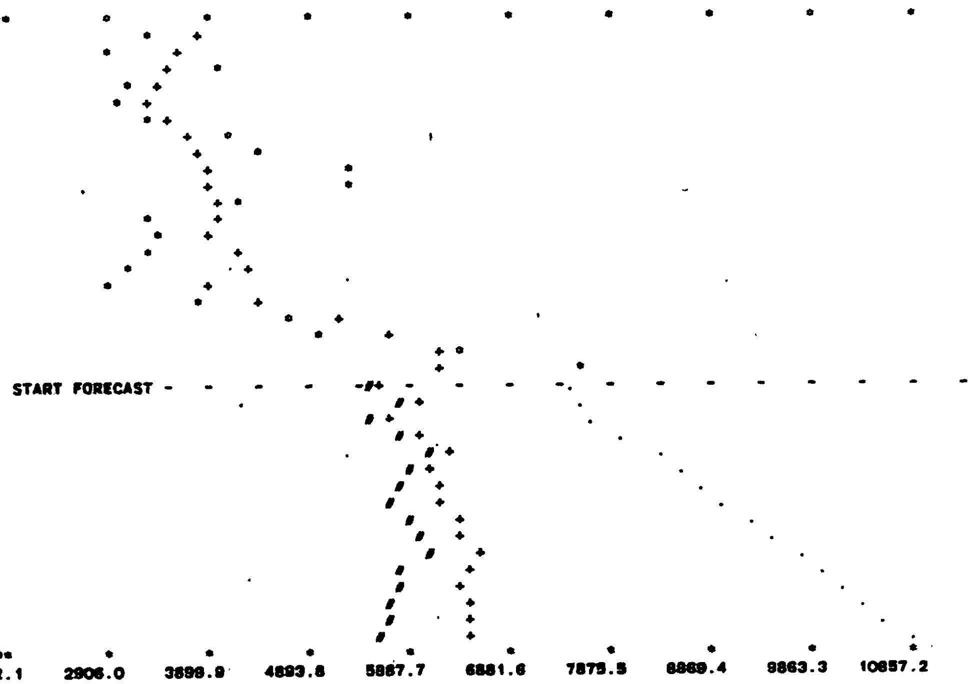


SECTOR # 67

TITLE : BROKERAGE AND INVESTMENT COUNSELING

RSQ = 0.886
AAPE = 16.46%
RHO = 0.613
SHARE = 0.82%
UBAR =-82.759

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	3375.	3866.	-491.
1960	2947.	3626.	-678.
1961	4039.	3558.	481.
1962	3145.	3455.	-310.
1963	3068.	3323.	-255.
1964	3394.	3529.	-135.
1965	4117.	3796.	322.
1966	4461.	3803.	658.
1967	5365.	3933.	1432.
1968	5333.	3951.	1382.
1969	4243.	4000.	243.
1970	3304.	4022.	-718.
1971	3460.	3995.	-535.
1972	3364.	4240.	-876.
1973	3196.	4372.	-1175.
1974	2906.	3986.	-1080.
1975	3899.	4408.	-509.
1976	4792.	5219.	-427.
1977	5060.	5706.	-646.
1978	6402.	6199.	203.
1979	7612.	6236.	1377.
1980	7482.	5618.	5501.
1981	7667.	6017.	5862.
1982	7756.	5745.	5490.
1983	8026.	6078.	5807.
1984	8387.	6350.	6128.
1985	8606.	6185.	5905.
1986	8806.	6211.	5829.
1987	9009.	6226.	5776.
1988	9283.	6415.	5956.
1989	9563.	6461.	6001.
1990	9849.	6595.	6089.
1991	10052.	6491.	5881.
1992	10255.	6483.	5827.
1993	10456.	6510.	5762.
1994	10656.	6500.	5703.
1995	10857.	6541.	5649.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

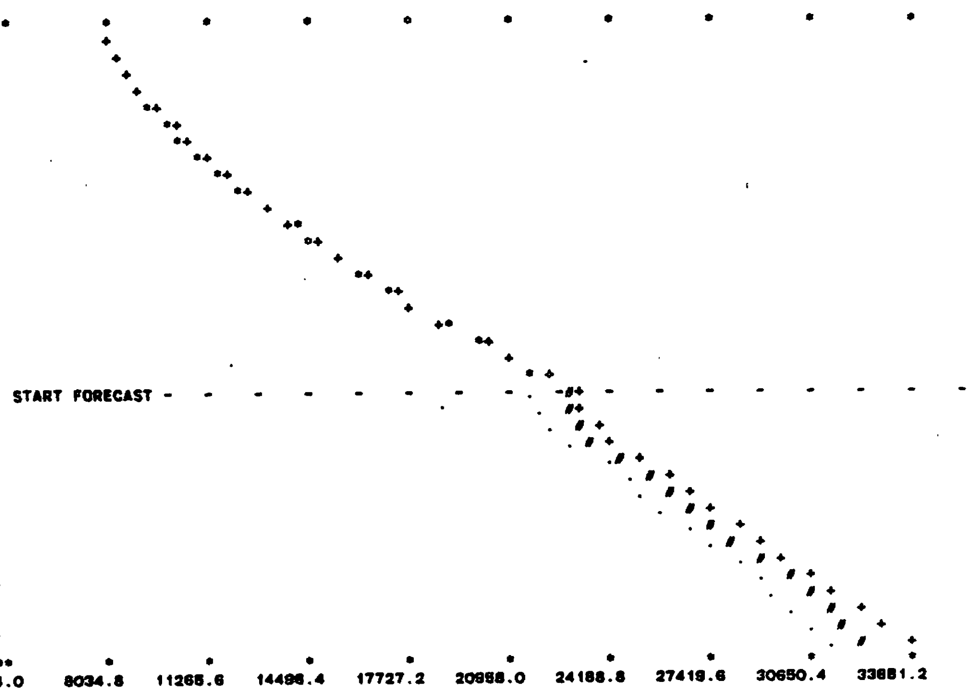


SECTOR # 68

TITLE : BANK SERVICE CHARGES AND SERVICES W/O PAYMENT

RSQ = 0.997
AAPE = 1.70%
RHO = 0.606
SHARE = 2.37%
UBAR =-154.29

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	8151.	8035.	116.
1960	8603.	8399.	204.
1961	8879.	8814.	65.
1962	9064.	9283.	-219.
1963	9498.	9685.	-186.
1964	10079.	10355.	-276.
1965	10484.	10937.	-453.
1966	11056.	11434.	-378.
1967	11677.	12071.	-394.
1968	12433.	12701.	-268.
1969	13366.	13427.	-61.
1970	14200.	14137.	63.
1971	14730.	14900.	-170.
1972	15693.	15746.	-53.
1973	16263.	16677.	-414.
1974	17337.	17527.	-190.
1975	18001.	17963.	38.
1976	19122.	18985.	138.
1977	20258.	20528.	-271.
1978	21123.	21213.	-90.
1979	21885.	22327.	-442.
1980	21625.	23351.	23205.
1981	22160.	23380.	23077.
1982	22417.	23903.	23476.
1983	23198.	24362.	23811.
1984	24239.	25238.	24645.
1985	24873.	26308.	25733.
1986	25453.	27048.	26419.
1987	26039.	27723.	27029.
1988	26831.	28456.	27703.
1989	27640.	29136.	28393.
1990	28466.	29996.	29258.
1991	29052.	30850.	30073.
1992	29639.	31577.	30685.
1993	30219.	32353.	31302.
1994	30800.	33124.	31916.
1995	31380.	33881.	32534.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

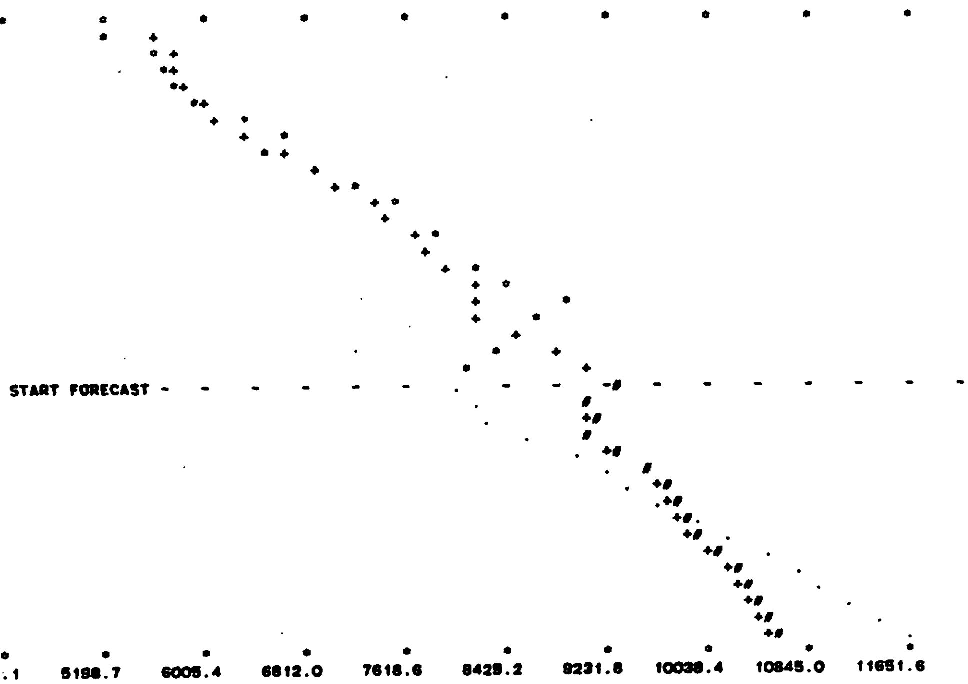


SECTOR # 69

TITLE : LIFE INSURANCE

RSQ = 0.901
AAPE = 3.30%
RHO = 0.482
SHARE = 0.88%
UBAR = 13.938

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	5199.	5657.	-459.
1960	5669.	5796.	-127.
1961	5718.	5802.	-84.
1962	5838.	5877.	-39.
1963	5996.	6048.	-52.
1964	6343.	6147.	196.
1965	6723.	6383.	340.
1966	6546.	6694.	-149.
1967	6939.	6917.	22.
1968	7237.	7111.	126.
1969	7554.	7388.	166.
1970	7504.	7527.	-23.
1971	7890.	7702.	188.
1972	7826.	7799.	28.
1973	8210.	7961.	249.
1974	8476.	8253.	223.
1975	8961.	8228.	733.
1976	8703.	8243.	460.
1977	8512.	8534.	-22.
1978	8345.	8830.	-485.
1979	8106.	9104.	-997.
1980	8030.	9366.	9390.
1981	8228.	9107.	9141.
1982	8324.	9142.	9184.
1983	8614.	9105.	9147.
1984	9000.	9270.	9323.
1985	9236.	9562.	9635.
1986	9451.	9670.	9759.
1987	9669.	9762.	9844.
1988	9962.	9855.	9934.
1989	10263.	9954.	10038.
1990	10570.	10102.	10193.
1991	10787.	10263.	10357.
1992	11005.	10334.	10425.
1993	11221.	10406.	10491.
1994	11436.	10473.	10553.
1995	11652.	10535.	10614.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

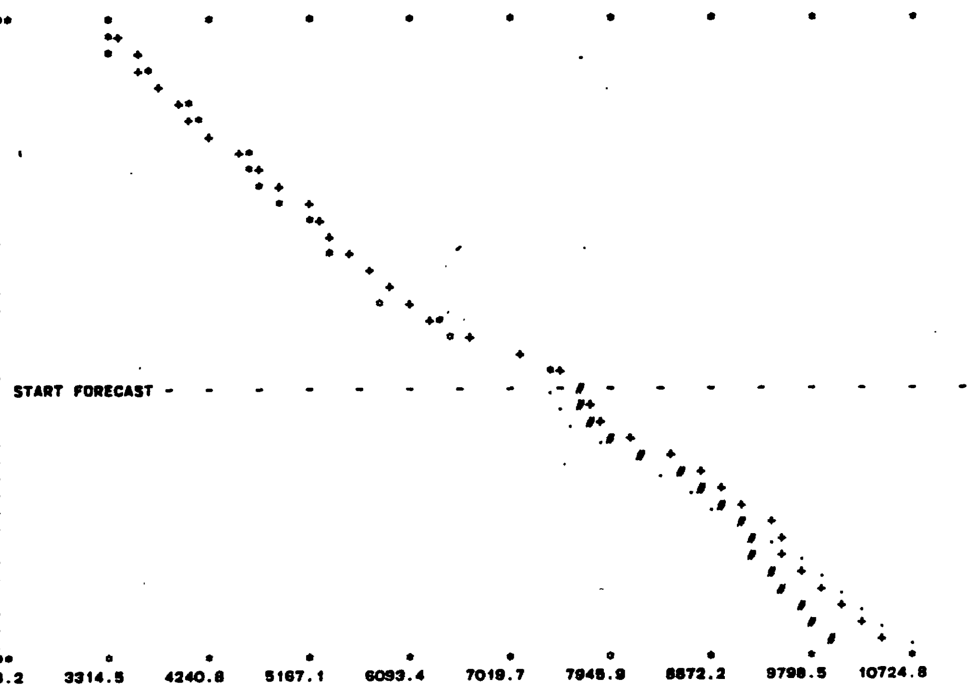


SECTOR # 70

TITLE : LEGAL SERVICES

RSQ = 0.983
AAPE = 2.45%
RHO = 0.232
SHARE = 0.81%
UBAR =-55.593

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	3322.	3496.	-175.
1960	3314.	3606.	-293.
1961	3694.	3664.	30.
1962	3847.	3803.	44.
1963	4141.	3974.	167.
1964	4169.	4099.	70.
1965	4277.	4264.	13.
1966	4680.	4535.	145.
1967	4697.	4711.	-14.
1968	4781.	4977.	-196.
1969	4894.	5198.	-303.
1970	5258.	5283.	-24.
1971	5388.	5437.	-49.
1972	5434.	5594.	-159.
1973	5805.	5738.	66.
1974	5976.	5941.	35.
1975	5852.	6148.	-296.
1976	6402.	6369.	34.
1977	6487.	6723.	-236.
1978	7192.	7190.	3.
1979	7468.	7498.	-30.
1980	7391.	7756.	7701.
1981	7574.	7801.	7696.
1982	7662.	7932.	7780.
1983	7928.	8177.	7985.
1984	8284.	8510.	8307.
1985	8501.	8821.	8617.
1986	8699.	9044.	8814.
1987	8899.	9242.	8985.
1988	9170.	9460.	9182.
1989	9447.	9592.	9315.
1990	9729.	9528.	9258.
1991	9929.	9734.	9442.
1992	10130.	9910.	9579.
1993	10328.	10104.	9715.
1994	10526.	10292.	9851.
1995	10725.	10480.	9988.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

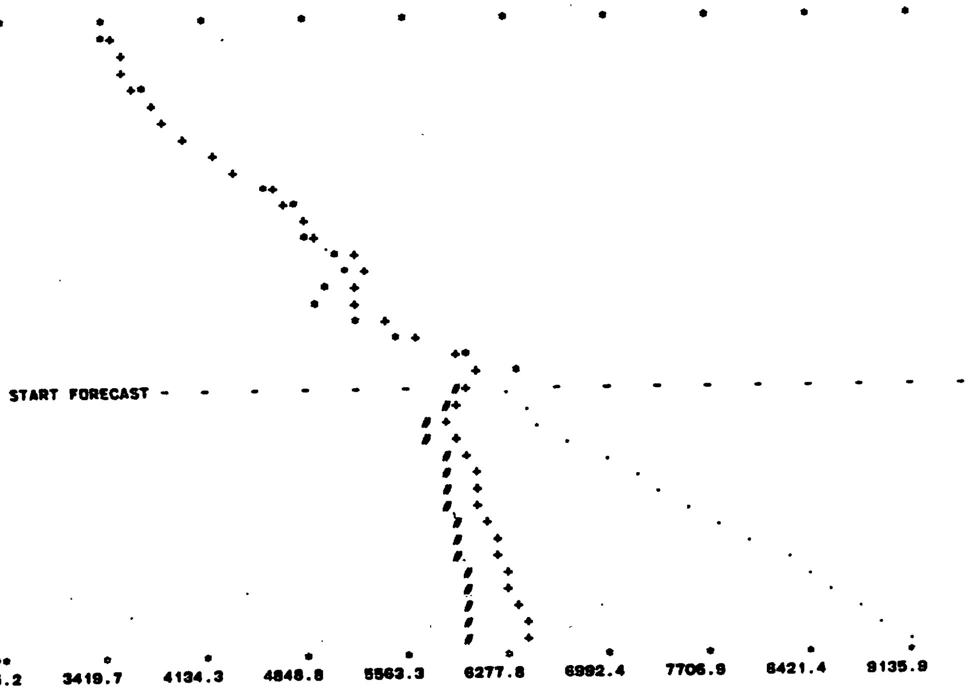


SECTOR # 71

TITLE : FUNERAL EXPENCES AND OTHER PERSONAL BUSINESS

RSQ = 0.970
AAPE = 2.02%
RHO = 0.681
SHARE = 0.69%
UBAR =-53.283

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	3420.	3555.	-135.
1960	3570.	3603.	-33.
1961	3581.	3611.	-30.
1962	3715.	3697.	18.
1963	3812.	3823.	-11.
1964	3888.	3910.	-21.
1965	4060.	4045.	15.
1966	4236.	4268.	-33.
1967	4370.	4360.	10.
1968	4629.	4635.	-6.
1969	4835.	4762.	73.
1970	4885.	4855.	30.
1971	4853.	4953.	-100.
1972	5099.	5211.	-112.
1973	5150.	5333.	-183.
1974	5023.	5255.	-232.
1975	4953.	5270.	-317.
1976	5272.	5480.	-208.
1977	5499.	5693.	-194.
1978	6034.	5967.	67.
1979	6381.	6100.	281.
1980	6296.	6014.	5959.
1981	6452.	5967.	5872.
1982	6527.	5872.	5732.
1983	6754.	5923.	5754.
1984	7057.	6043.	5875.
1985	7242.	6088.	5912.
1986	7410.	6122.	5913.
1987	7581.	6135.	5897.
1988	7811.	6185.	5930.
1989	8047.	6207.	5950.
1990	8287.	6244.	5977.
1991	8458.	6292.	5993.
1992	8629.	6331.	5996.
1993	8798.	6382.	5996.
1994	8967.	6425.	5995.
1995	9136.	6473.	5996.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

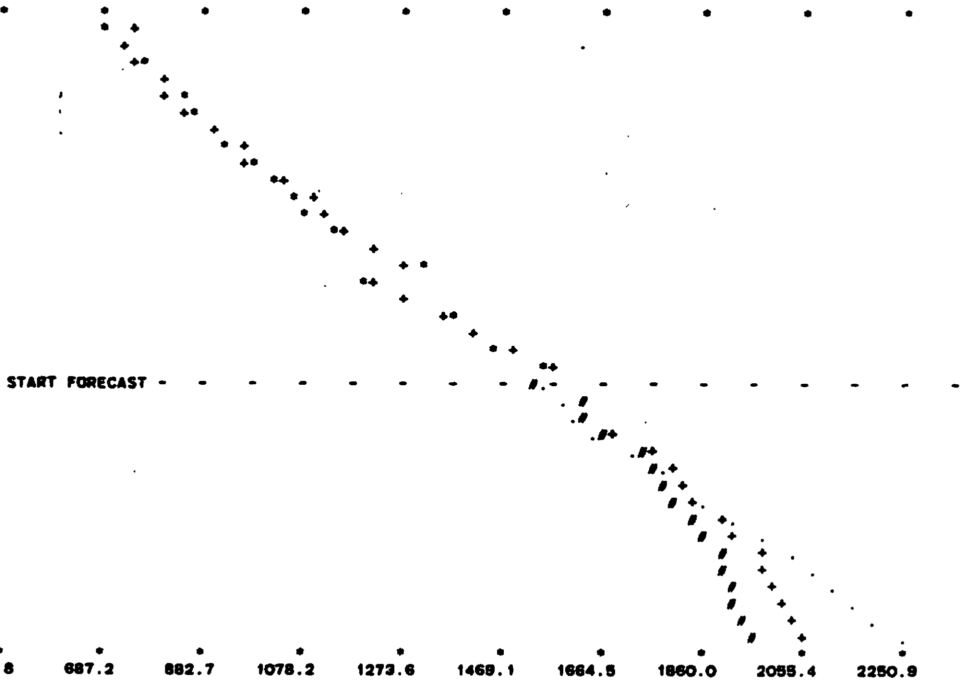


SECTOR # 72

TITLE : RADIO AND TELEVISION REPAIR

RSQ = 0.986
AAPE = 2.41%
RHO = 0.326
SHARE = 0.17%
UBAR = -8.819

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	687.	750.	-63.
1960	734.	732.	2.
1961	783.	750.	33.
1962	816.	806.	10.
1963	852.	814.	38.
1964	879.	862.	17.
1965	904.	919.	-15.
1966	937.	980.	-42.
1967	981.	972.	9.
1968	1023.	1057.	-35.
1969	1060.	1103.	-44.
1970	1094.	1131.	-38.
1971	1140.	1164.	-24.
1972	1221.	1223.	-1.
1973	1313.	1279.	33.
1974	1198.	1228.	-30.
1975	1276.	1277.	-1.
1976	1374.	1363.	11.
1977	1412.	1415.	-3.
1978	1461.	1495.	-34.
1979	1563.	1572.	-9.
1980	1551.	1539.	1542.
1981	1590.	1632.	1626.
1982	1608.	1626.	1626.
1983	1664.	1702.	1680.
1984	1739.	1782.	1745.
1985	1784.	1804.	1764.
1986	1826.	1825.	1783.
1987	1868.	1858.	1808.
1988	1925.	1906.	1845.
1989	1983.	1934.	1869.
1990	2042.	1982.	1905.
1991	2084.	1989.	1905.
1992	2126.	2012.	1921.
1993	2168.	2033.	1935.
1994	2209.	2053.	1950.
1995	2251.	2071.	1964.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

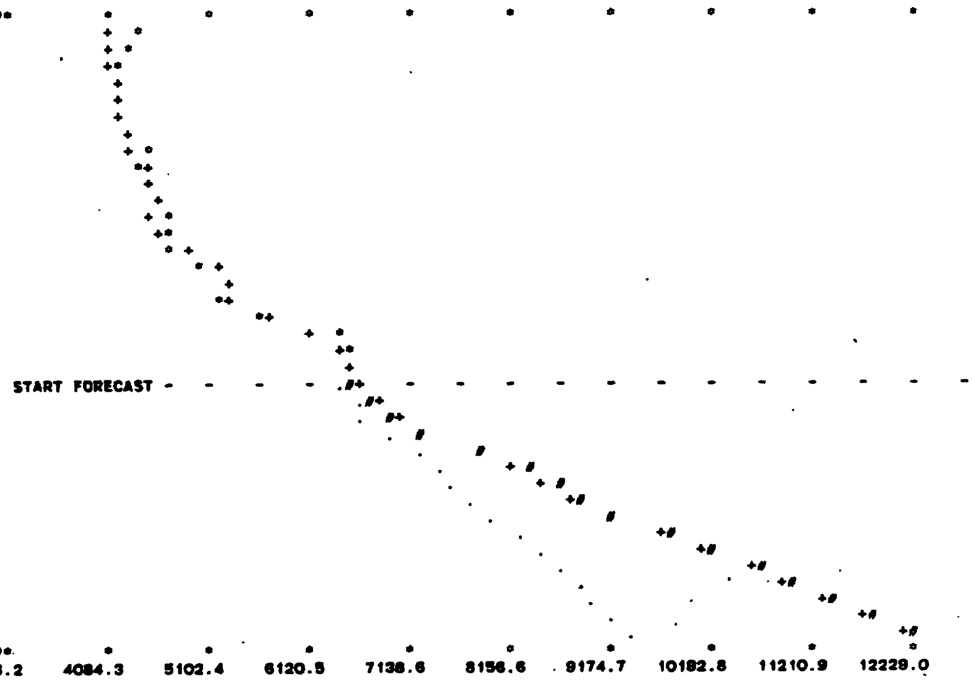


SECTOR # 73

TITLE : MOVIES, LEGITIMATE THEATRE, SPECTATOR SPORTS

RSQ = 0.963
AAPE = 2.34%
RHO = 0.425
SHARE = 0.71%
UBAR = 48.716

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	4420.	4084.	336.
1960	4358.	4178.	180.
1961	4287.	4153.	134.
1962	4270.	4188.	82.
1963	4282.	4200.	82.
1964	4254.	4253.	2.
1965	4358.	4318.	40.
1966	4493.	4367.	126.
1967	4431.	4498.	-67.
1968	4565.	4565.	-0.
1969	4665.	4688.	-23.
1970	4707.	4582.	125.
1971	4716.	4646.	70.
1972	4752.	4924.	-172.
1973	5005.	5239.	-234.
1974	5397.	5366.	31.
1975	5260.	5336.	-76.
1976	5657.	5785.	-128.
1977	6487.	6169.	318.
1978	6605.	6472.	132.
1979	6599.	6535.	64.
1980	6478.	6631.	6622.
1981	6639.	6838.	6825.
1982	6716.	7054.	7012.
1983	6950.	7340.	7310.
1984	7262.	7875.	7932.
1985	7451.	8243.	8363.
1986	7625.	6548.	8666.
1987	7801.	8824.	8903.
1988	8038.	9189.	9258.
1989	8280.	9712.	9798.
1990	8528.	10160.	10267.
1991	8703.	10603.	10708.
1992	8879.	10999.	11081.
1993	9053.	11392.	11459.
1994	9227.	11778.	11840.
1995	9401.	12170.	12229.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

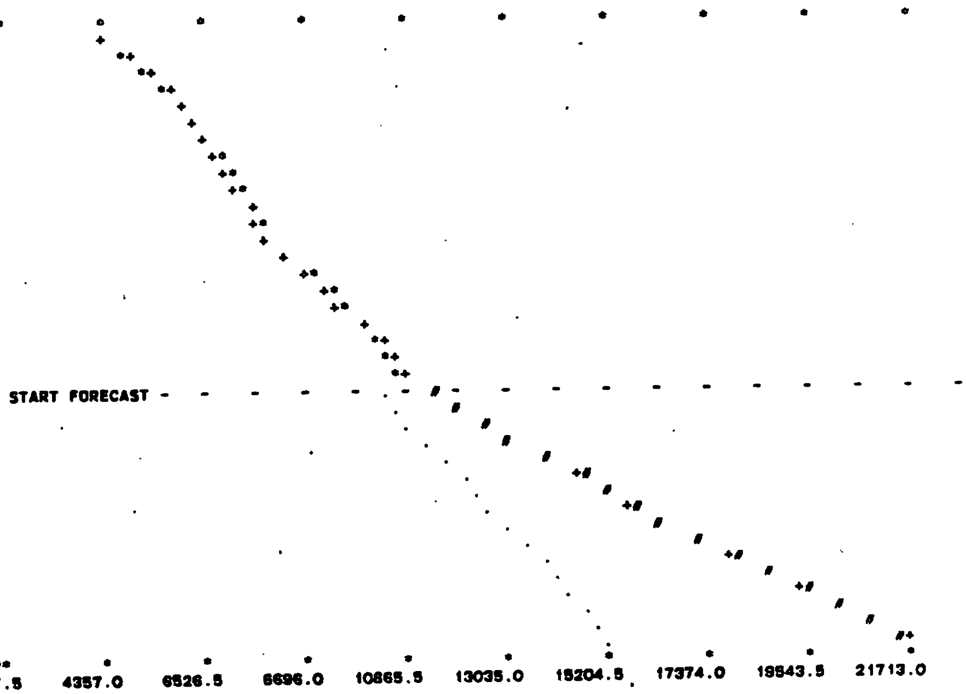


SECTOR # 74

TITLE : OTHER RECREATIONAL SERVICES

RSQ = 0.991
AAPE = 1.92%
RHO = 0.580
SHARE = 1.16%
UBAR = 15.106

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	4476.	4357.	119.
1960	4936.	5042.	-105.
1961	5346.	5476.	-130.
1962	5804.	5911.	-108.
1963	6145.	6284.	-138.
1964	6508.	6450.	58.
1965	6657.	6636.	21.
1966	7007.	6835.	172.
1967	7282.	7159.	123.
1968	7505.	7367.	138.
1969	7763.	7700.	63.
1970	7893.	7684.	209.
1971	7927.	7963.	-35.
1972	8432.	8311.	122.
1973	9125.	8762.	364.
1974	9448.	9326.	122.
1975	9615.	9449.	166.
1976	10151.	10083.	68.
1977	10253.	10510.	-257.
1978	10464.	10853.	-389.
1979	10736.	11000.	-264.
1980	10585.	11659.	11687.
1981	10846.	12115.	12153.
1982	10972.	12656.	12720.
1983	11354.	13149.	13209.
1984	11664.	13947.	14066.
1985	12174.	14622.	14799.
1986	12458.	15206.	15393.
1987	12745.	15722.	15870.
1988	13132.	16329.	16432.
1989	13528.	17202.	17296.
1990	13933.	18007.	18093.
1991	14219.	18802.	18865.
1992	14507.	19530.	19578.
1993	14791.	20264.	20279.
1994	15075.	20988.	20982.
1995	15359.	21713.	21690.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

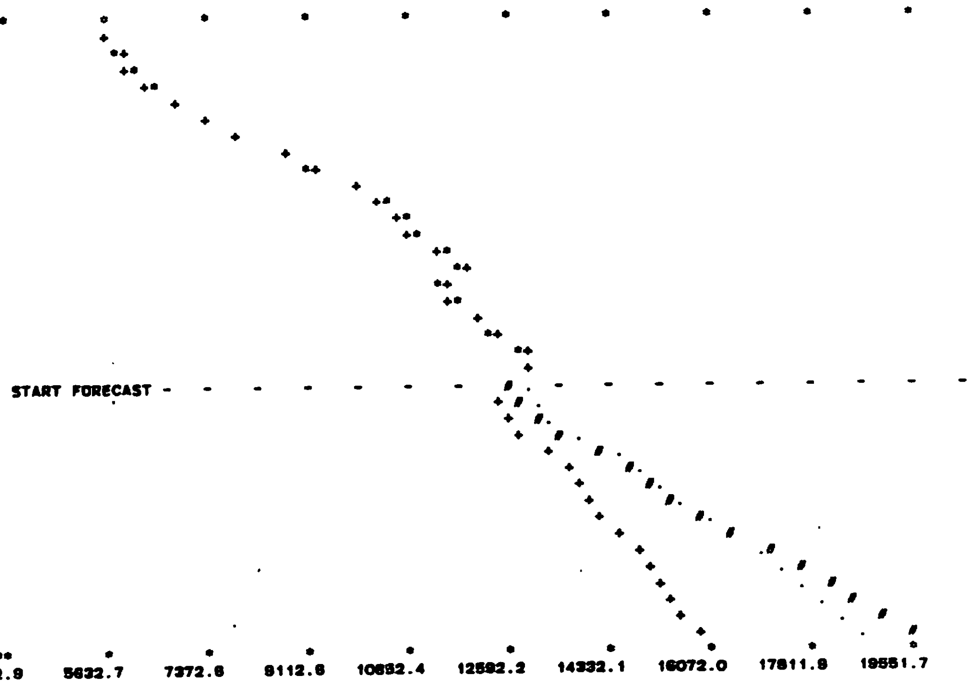


SECTOR # 75

TITLE : EDUCATION

RSQ = 0.996
AAPE = 1.42%
RHO = 0.357
SHARE = 1.42%
UBAR = -5.526

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	5633.	5790.	-157.
1960	5968.	6102.	-134.
1961	6268.	6093.	176.
1962	6608.	6401.	207.
1963	6969.	6999.	-29.
1964	7406.	7477.	-70.
1965	8057.	8048.	9.
1966	8765.	8864.	-100.
1967	9258.	9394.	-136.
1968	10075.	10046.	30.
1969	10554.	10450.	104.
1970	10879.	10680.	200.
1971	11150.	10875.	275.
1972	11586.	11495.	92.
1973	11772.	11897.	-125.
1974	11421.	11700.	-279.
1975	11725.	11634.	92.
1976	12139.	12072.	67.
1977	12251.	12466.	-215.
1978	12805.	12976.	-171.
1979	13083.	13033.	50.
1980	12957.	12660.	12764.
1981	13277.	12551.	12814.
1982	13432.	12695.	13160.
1983	13899.	12822.	13497.
1984	14523.	13314.	14167.
1985	14903.	13699.	14718.
1986	15250.	13934.	15107.
1987	15601.	14075.	15499.
1988	16076.	14235.	15833.
1989	16561.	14566.	16574.
1990	17055.	14857.	17281.
1991	17406.	15133.	17791.
1992	17758.	15286.	18234.
1993	18106.	15481.	18675.
1994	18454.	15724.	19114.
1995	18802.	16018.	19582.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

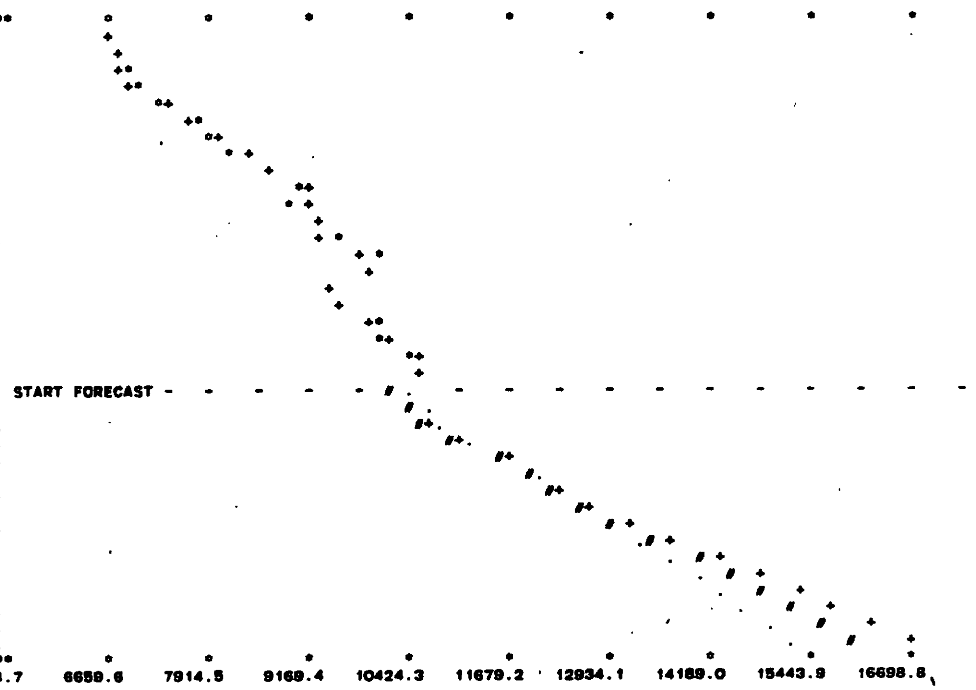


SECTOR # 76

TITLE : RELIGIOUS AND WELFARE SERVICES

RSQ = 0.987
AAPE = 1.29%
RHO = 0.132
SHARE = 1.15%
UBAR = -3.215

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	6671.	6660.	12.
1960	6848.	6832.	16.
1961	7008.	6845.	163.
1962	7135.	7031.	104.
1963	7341.	7434.	-93.
1964	7879.	7774.	105.
1965	8016.	8079.	-62.
1966	8196.	8517.	-322.
1967	8721.	8742.	-20.
1968	9120.	9193.	-73.
1969	8930.	9288.	-358.
1970	9404.	9306.	98.
1971	9560.	9400.	160.
1972	10105.	9880.	225.
1973	10013.	10025.	-12.
1974	9451.	9539.	-88.
1975	9669.	9580.	89.
1976	10063.	9951.	112.
1977	10097.	10196.	-99.
1978	10490.	10578.	-88.
1979	10643.	10579.	63.
1980	10493.	10203.	10187.
1981	10753.	10460.	10433.
1982	10878.	10708.	10651.
1983	11256.	11108.	11037.
1984	11762.	11689.	11614.
1985	12069.	12042.	11954.
1986	12351.	12378.	12261.
1987	12635.	12755.	12587.
1988	13019.	13207.	12994.
1989	13412.	13791.	13530.
1990	13812.	14437.	14126.
1991	14097.	14882.	14504.
1992	14392.	15337.	14888.
1993	14663.	15800.	15270.
1994	14945.	16254.	15653.
1995	15227.	16699.	16040.
DATE	ACTL=*	PREDIC=+	MISS=A-P*

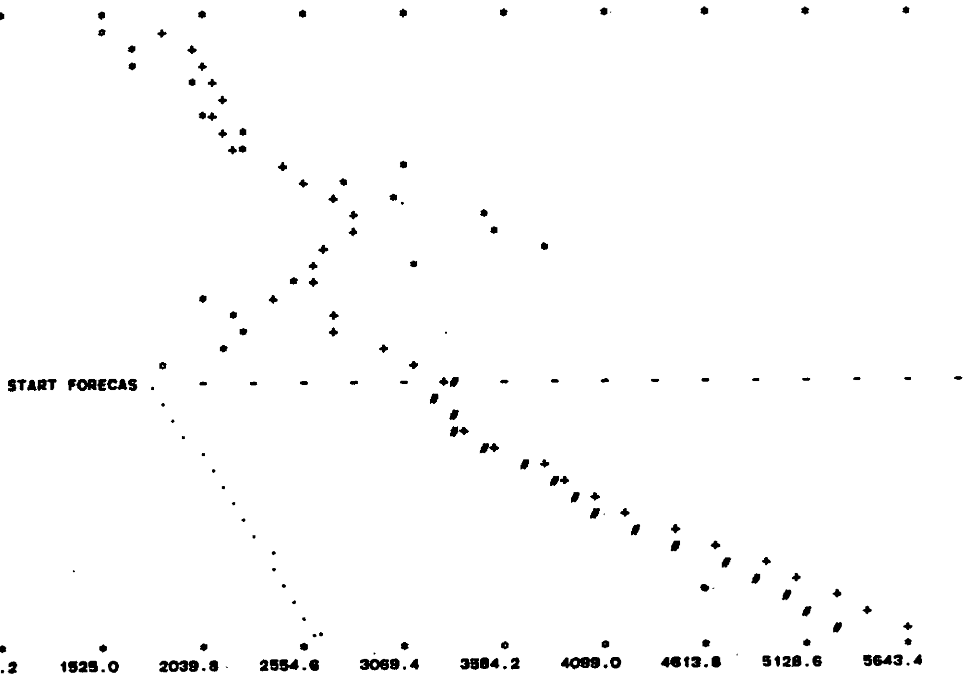


SECTOR # 77

TITLE : FOREIGN TRAVEL

RSQ = 0.263
AAPE = 17.77%
RHO = 0.707
SHARE = 0.20%
UBAR =-22.269

DATE	ACTL=*	PREDIC=+	MISS=A-P*
1959	1525.	1856.	-333.
1960	1688.	1992.	-304.
1961	1699.	2087.	-388.
1962	1993.	2121.	-128.
1963	2192.	2153.	39.
1964	2079.	2139.	-60.
1965	2249.	2168.	81.
1966	2247.	2245.	3.
1967	3074.	2466.	608.
1968	2766.	2556.	210.
1969	3053.	2735.	317.
1970	3520.	2834.	686.
1971	3543.	2825.	718.
1972	3814.	2681.	1133.
1973	3140.	2632.	508.
1974	2545.	2628.	-83.
1975	2088.	2424.	-336.
1976	2208.	2752.	-544.
1977	2246.	2760.	-514.
1978	2175.	2973.	-798.
1979	1872.	3155.	-1283.
1980	1825.	3322.	3336.
1981	1870.	3244.	3228.
1982	1892.	3361.	3355.
1983	1958.	3422.	3356.
1984	2046.	3574.	3492.
1985	2099.	3792.	3723.
1986	2148.	3944.	3871.
1987	2197.	4089.	3987.
1988	2264.	4222.	4084.
1989	2332.	4465.	4301.
1990	2402.	4694.	4502.
1991	2452.	4947.	4732.
1992	2501.	5124.	4879.
1993	2550.	5303.	5030.
1994	2599.	5475.	5178.
1995	2648.	5643.	5327.
DATE	ACTL=*	PREDIC=+	MISS=A-P*



SELECTED BIBLIOGRAPHY

1. Almon, C. (1979), "A System of Consumption Functions and Its Estimation For Belgium," Southern Economic Journal, Vol. 46, pp.85-106.

2. Bergmann, B.R., et al. (1980), "The Effect of Wives' Labor Force Participation on Inequality in the Distribution of Family Income," Journal of Human Resources, Vol 15, pp.452-455.

3. Brown, J.A.C. and A.S. Deaton (1972), "Models of Consumer Behavior: A Survey," Economic Journal, Vol. 82, pp.1145-1236.

4. Deaton, A. and J. Muelbauer, Economics and Consumer Behavior, Cambridge: Cambridge University Press, 1980.

5. Maddala, G.S., Econometrics, New York: McGraw-Hill, 1977.

6. Poirier, D.J., the Econometrics of Structural Change, New York: Elsevier, 1976.

7. Prais, S.J., and H.S. Houthaker (1955), The Analysis of Family Budgets, Cambridge: Cambridge University Press; 2nd edition, 1971.

8. Singh, G. and A.L. Nagar (1973), "Determination of Consumer Unit Scales," Econometrica, Vol. 41, pp.347-355.

9. Sydenstricker, E. and W.I. King (1921), "The Measurement of the Relative Economic Status of Families," Quarterly Publication of the American Statistical Association, Vol. 17, pp.842-857.