Econometric analysis of household expenditures

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ECONOMETRIC ANALYSIS OF HOUSEHOLD EXPENDITURES

Samuel Berhanu

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ABSTRACT

An Econometric Analysis of Household Expenditures

Samuel Berhanu

While the traditional methods of measuring income inequality reveals interesting and important features of labor markets, estimates of income inequality do not provide complete summary statistics of the distribution of well-being. Interpreting the Gini coefficient of family earnings as a measure of disparity in welfare implicitly assumes that households with the same level of before tax income are equally well-off. Utility is derived from the consumption of goods and services and there is ample empirical evidence which indicate that the distribution of total expenditure is likely to be different from the distribution of income. As Friedman indicated households with low income levels are disproportionately represented by with those temporary reductions in current income and will typically have high ratios of consumption to income. Households with high income levels are over represented by those with transitory increases in income and will exhibit low ratios of consumption to income. The implication is that, all other things equal, one would expect less dispersion in the distribution of total expenditure relative to the income distribution. The problems of using family income as a measure of well-being go beyond the differences in the expenditure and income distributions. Treating heterogeneous households symmetrically, as is common in income inequality studies, indirectly assumes that two households with the same level of income but different sizes are equally well-off. If household characteristics influences household expenditure patterns, consumption needs and welfare, such effects are likely to have an important effect on both the level and trend of inequality in the distribution of welfare. Consumption rather than income may be a better measure of the actual economic welfare of a household than its current income.

The main objectives of this study are to: 1. Measure the impact of demographic characteristics on the distribution of individual expenditures on the consumption of goods and services. 2. Examine the inequality in the distribution of household consumption expenditures using the Gini coefficient.

The data are drawn from the 1980 through 1994 interview surveys conducted and gathered by the U.S. Labor Statistics. An econometric method using the translog model is specified for seven commodity groups. We estimated six equations using Seemingly Unrelated Regression procedure.

The parameters estimated to measure the impacts of demographic characteristics on the consumption of goods and services indicated that the allocation of budget shares for different consumer goods is affected by the composition and characteristics of households.

The decomposition of the Gini provides specific information concerning the concentration of consumption expenditures by budget components, and information about how the marginal changes in particular expenditures affect overall inequality. Unlike in income distribution, the Gini estimates in expenditure distribution appear to be closer. It is possible to conclude that expenditure on goods and services does depend not only on current income, but also on income earned through the years. This substantiates the permanent income hypothesis theory articulated by Friedman (1957). Being able to measure these impacts can be useful for policy makers interested in the effect that certain programs may have on the spending patterns of households. Results obtained in this study substantiate the importance of evaluating the differential impacts of proposed and enacted policies.
on subgroups of the population and differences in inequality which can result when expenditures for budget components change. Without adequate evaluation, policies and programs intended to decrease inequality may lead to the opposite outcome in the distribution of material well-being across household units in the population.
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The task of conducting this research has been one of the most challenging and satisfying experiences of my life. The completion of this work would have been impossible without the generous advice, support and encouragement of many people.

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CHAPTER 1: INTRODUCTION

1.1 Background and Statement of the Problem

The measurement of individual and household welfare stands out in applied welfare economics for its ability to usefully combine economic theory with empirical practice. It is an area where empirical study clearly relies on theoretical insight. There are important issues to be addressed in identifying who lost and who gained as a result of complex policy implementations. Potential Pareto improvements to societal welfare may not be known until the sizes of the gains and losses are specifically measured or evaluated in some kind of quantitative unit.

In welfare economics, different considerations arise between the theoretical formulation of a problem and the actual measurement of the effect of initiating a particular policy. Some theoretical variables are not observable in the real world. For example, how does one measure a change in conditions and how does one determine if the change is generally good or not. Measures showing changes in income, wealth or expenditures are often used. However, these indicators are far from precise and difficult to interpret for different circumstances. Alternative measures must be designed.

One observable alternative for measuring the intensity of individual preferences for a situation is the amount of money the individual would pay or accept to move from one situation to another (Just, Hueth and Schmitz, p.10, 1982). This principle has become the basis of modern applied welfare economics. The two most important willingness-to-pay measures are compensating (CV) and equivalent variations (EV). Based on the definition by Just, Hueth and Schmitz (p. 10-11, 1982) compensating variation (CV) is the amount of money, which when taken away from an individual after a price and/or income change, will restore the individual’s original welfare level. Similarly, equivalent variation is the amount of money given to an individual which if an economic
change does not happen leaves the individual as well off as if the change had taken place. In this case the individual can be a consumer or producer. Thus, compensating and equivalent variations are defined and perceived as mechanisms used to adjust the consumer’s income in order to maintain his or her level of welfare. The compensating variation deals with the initial level of welfare, that which the consumer held prior to price and/or income changes; and equivalent variation deals with the subsequent level of welfare, that which the consumer would obtain with potential price and/or income changes.

In most real world cases, public policies are enacted on a large number of people in a uniform fashion. However, the determination of the policy effects on each individual decision unit is impractical, both computationally and from the standpoint of the availability of relevant data. Generally, to perform a good welfare analysis of alternative policies, some aggregation is needed. The welfare change measures discussed above are constructed on the assumption that all consumers could be aggregated into a single representative consumer for welfare measurement purposes. The conditions under which this can be done are very stringent. For one, it assumes that the marginal social utility of income is identical for all persons, whether this results from a process of continually redistributing income to maintain this equality, or whether this is a created assumption such as marginal utility of income is the same for all households. The latter situation is straightforward in the case where household indifference curve maps coincide. Failing either of these means that the entire demand side of the economy could not be aggregated into a single individual from the social point of view.

Nonetheless, most empirical studies using applied welfare economics proceed to measure welfare change by simply aggregating CVs or consumer’s surplus over individuals. The question
naturally arises as to what interpretation can be given to the results of such exercises. The usual argument is that the use of aggregated CVs to measure welfare change should not be interpreted as measuring social welfare in any direct sense but, rather, it should be interpreted as indicating whether or not there has been a potential improvement in social welfare. A potential improvement means that the gainers from the change could hypothetically compensate the losers from the change while remaining at least as well off after the change as before.

To obtain a measure of social change many consumer-economists rank all alternatives. The ranking of social states involves making value judgements regarding measurability and comparability which are not required when using the Pareto criterion or the compensation test. Although a social welfare function is a desirable concept in theory, it does not exist in reality. As Just et al. (1982) suggested, one should keep the concept of welfare economics in the background; but this does not mean that one should totally forget the study of welfare economics just because the welfare function cannot be specified in terms of any practical meaning. Even those who are critical of welfare economics for the lack of defining a welfare function, must come to a consensus that it is often possible to conclude who loses and who gains at least in monetary terms, as well as the magnitude of these losses and gains, from specific policies, and that this information is crucial for policymakers.

Due to the problem of welfare aggregation and the non-existence of the social welfare function, we are forced to rely on imperfect measures of welfare such as income distribution, wealth distribution and expenditure functions.

There are a number of ways of characterizing income distributions. These are often used as summary statistics for evaluating inequality in the distribution of income or for evaluating the distributive impact of, say, tax policy changes. They include the Gini coefficient, or its graphical
counterpart the Lorenz curve, the variance of income, the relative mean deviation, the standard deviation of logarithms of incomes, and the like.

Similarly, a money metric of utility, such as an expenditure function, has a role in measuring social welfare. The utility of an individual may be written as a function of a money metric representing the expenditure function. Indifference curves can uniquely define utility associated with the expenditure function. Utility can be written or defined as a function of expenditures given the reference price vector. Based on this definition, the value of the indirect utility of the consumer at the reference prices, given that utility is, fully measurable. Social welfare may be written as a function of the individual expenditure function at a given set of reference prices. The measurement of social welfare can proceed by using the appropriate aggregation of the money metric measures of utilities rather than the utilities themselves. There are also a variety of other imperfect methods to measure welfare changes, in addition to the ones discussed above.

While the investigation of inequality using the imperfect methods observed above reveals interesting and important features of the market, estimates of inequality are not particularly informative summary statistics of the distribution of well-being in the United States. For example, interpretation of the Gini coefficient of family income as a measure of dispersion in welfare implicitly assumes that families with the same level of before tax income are equally well-off. However, utility is derived from the consumption of goods and services and there is ample evidence, emanating from Friedman’s (1957) permanent income hypothesis, which suggests that the distribution of total expenditures is likely to be quite different from the distribution of incomes. According to Friedman, households with low income levels are disproportionately represented by those with temporary reductions in current income and will typically have high ratios of consumption
to income. Households with high income levels are over represented by those with transitory increases in income and will exhibit low ratios of consumption to income. The implication is that, all other things equal, one would expect less dispersion in the distribution of total expenditures relative to the income distribution.

The problems created as a result of using family income as a measure of well-being go beyond the differences in income and expenditure distributions. Households have different characteristics. Treating heterogeneous households symmetrically, as is common in income inequality examination, indirectly assumes that two households with the same level of income but different sizes and demographic characteristics are equally well-off. If household composition influences household expenditure patterns, needs and welfare, such effects are likely to have an important impact on both the levels and trends of expenditures and inequality in the distribution of welfare.

Using family income as a measure of household welfare also ignores the potential impact of prices on the distribution of well-being. Increases in the prices of basic necessities relative to luxuries will hurt the poor relatively more than the rich and increase the disparity in welfare. The large increase in the relative prices of energy goods in the 1970s could have had a substantial impact on the relative welfare levels. Looking at the distribution of family income alone would obviously ignore the above effect.

One of the goals of this study is to use a different methodology for measuring inequality in the distribution of welfare, one which is operationally feasible and broader in scope than the traditional money income measure. This approach to inequality measurement is based on the theory of exact aggregation developed by Lau (1977). One of the important implication’s of Lau’s theory
of exact aggregation is that systems of demand functions for individuals with common demographic characteristics can be recovered uniquely from the system of aggregate demand functions. By requiring that the individual demand functions be integrable, it is possible to recover the indirect utility functions for all consumers. Finally, measures of individual welfare can be defined in terms of these indirect utilities. The model used in this study incorporates pseudo-panel micro data on the allocation of consumer expenditures due to different demographic consumer characteristics.

1.2 Objectives

The overall goals of this study are to provide information on inequality in the distribution of household consumption expenditures and to measure the impact of demographic attributes of a household on consumption expenditures. The specific objectives are to:

1. Measure the impact of demographic characteristics on the distribution of individual expenditures on the consumption of goods and services in the United States between 1980 and 1994.

2. Evaluate the changes in individual household expenditures across demographic subgroups.

3. Examine the inequality in the distribution of household consumption expenditures using the Gini coefficient. Gini coefficients will be calculated for commodity components and demographic subgroups of the population defined in terms of household composition, the race, age of the reference person, and region of residence.

1.3 Method and Organization

Chapter 2 presents a review of related literature and is divided into 4 sections. An introduction is given in section 2.1 followed by section 2.2 addressing the history and development of welfare economics. The conventional ways of measuring income distribution are presented in
section 2.3. A discussion on the expected contribution of this study is given in section 2.4. The theoretical framework to address the development of empirical models for this topic is addressed in sections 3.2 and 3.4 of chapter 3. The data set used in this study is discussed in chapter 4. This data set is developed from a BLS consumer expenditure survey. In section 5.2 of chapter 5, the econometric methodology for developing a model to measure the impact of demographic characteristics on household consumption expenditures is outlined. In section 5.3 of the same chapter, the implementation of the econometric model, its results, and detailed discussions are presented. In chapter 6, section 6.2 the method for measuring the inequality of household consumption expenditures is presented. The estimates are presented and broad discussions of the results are reported in section 6.3.

Finally, a summary, conclusions, limitations of the study, and a discussions of future research needs are presented in chapter 7.
CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

The measurement of inequality has long concerned writers in the field of personal income distribution. Interest in measurement of income inequality and level of poverty can be traced to as early as 1890, when the development of a poverty line was discussed by Charles Booth. Economists are well aware that money income is not a completely accurate indication of relative standard of living. But most people interested in the issue of inequality base their perception of the degree of economic inequality on the Census Bureau’s data on the distribution of money income. The underlaying issues of measuring the economic status of families and defining the poor remain to be settled. The effects of these problems are detrimental if the intention is to provide uniform treatment to families of equivalent economic status. For example, government programs directed at poor families often intend to include all those who are poor and to totally exclude those who are not. When receipt or denial of very much needed benefits is decided by a single empirical index, it is obviously important for that index to conform to a generally shared view of both horizontal and vertical equity. Hugh Dalton, in the preface to The Inequality of Income (September 1920), referred to the ambiguity of the conception of inequality and the need to give it a more precise definition and a logical measure (Atkinson, 1983). Dalton, in this pioneering article on the measurement of inequality, took issue with earlier researchers who had suggested that the position of an economist choosing a measure of inequality was identical to that of a biologist in determining the distribution of a physical characteristic (Atkinson, 1983). Dalton (1920, p. 348) argued that:

This is clearly wrong. For the economist is primarily interested, not in the distribution of income as such, but in the effect of the distribution of income upon the distribution and total amount of economic welfare, which may be derived from
The above statement of Dalton did not receive the attention which it deserved for many years (Atkinson, 1983). Empirical work on income and wealth inequality continued to use summary indicators of inequality, such as the mean deviation of the Gini coefficient, which were statistical in origin rather than derived from considerations of social welfare. It was, indeed, nearly fifty years later that Serge Kolm (1969) independently raised Dalton’s approach and argued for a reconsideration of the measurement of inequality. These contributions led in turn to a very substantial literature on the underlying and basic conceptual issues.

Cash income is the most commonly used indicator of economic status, but it is widely recognized that this measure is inadequate. Comparisons using a cash income measure may not assure horizontal equity since other consumable resources may be missing. For some families current cash receipts constitute only a small portion of the available sources of economic welfare. Differing amounts of in kind transfers and physical and human capital can substantially change the economic status of families with similar cash incomes, causing them to no longer be as equals. For this reason, other sources of resources are often included to create alternative indices of family status. Moreover, vertical equity considerations--the ranking of the families and the equality of the distribution are more likely to be affected. Wealth, family size, location of residence, disability, income variability, and age are often introduced to alter the rankings that result from using either cash income alone or some expanded definition of economic welfare.

The need for a more expansive and accurate measure of economic status for descriptive, analytic, and policy purposes is obvious if standards are to be identified. The place to start, perhaps, is the theory of welfare economics, since measurement of inequality falls in the study of welfare
Welfare economics is a branch of economics developed to help society make better choices (Just et al., 1982). The measurement of individual and household welfare stands out in applied welfare economics for its capability to usefully blend economic theory with empirical practice (Blundell et al., 1994). It is an area where empirical investigation clearly benefits from theoretical insight and where theoretical concepts are brought alive and appropriately focused by the discipline of empirical relevance and policy design (Blundell et al., 1994). Yet there are many unanswered questions in identifying who gains and who loses from complex policy initiatives. This is exactly the problem to which this study is directed. A good measure of well-beingness is required for successful policy implementation.

This chapter has three more sections. The summary of the history of welfare economics and related theoretical and empirical developments is presented in section 2.2. Section 2.3 addresses the traditional methods of the measurement of income inequality and gives a summary of literature in this area. The third section, 2.4, discusses the potential contributions this research will make in field of income and welfare distribution.

2.2 The History and Development of Welfare Economics

An answer to the question of the method and content of normative economics, and more precisely welfare economics, can be made to turn on historic analysis. What for instance, did Marshal (1920), Pigou (1946), Little (1957), Graaf (1957), and many others, mean when they wrote about welfare economics? There is much conflict between what the better known writers have meant by welfare economics and its understanding among the profession today. Differences between the conclusions reached by the older tradition associated with Marshal, Pigou, Robertson, and to some extent Lerner (1946), as distinguished proponents of the Cambridge or Neoclassical School--which
is built on a foundation of diminishing marginal utility and a belief in a basic similarity of human beings and a more modern approach, associated with the names of Vilfredo Pareto (1896), Hicks (1939), Samuelson (1950), and many others, turn out to be significant only with respect to distributional propositions. With respect to the purely allocative analysis, there is a general agreement, although with the passage of time there is a greater appreciation today of its limitations. We adopt what is today the more popular approach to the subject, building on the foundation laid by Bergson (1938), Kaldor (1939), and Hicks (1939) from whence sprang modern welfare economics; there will be little difficulty in pointing out, from time to time, certain differences in premises and conclusions between the older neoclassicist treatment and the more modern treatment.

Often, a distinction is made between the old welfare economics of Marshal et al. and what has come to be called the new welfare economics. The old welfare economics accepts the principle that social gains are maximized by competitive markets and, therefore, where noncompetitive interferences exist, the economist is justified in recommending policy measures that eliminate those distortions (Just et al., 1982). Also, the old welfare economics employs the technique of partial-equilibrium analysis in developing recommendations. Partial-equilibrium or piecemeal analysis considers the welfare effects of a change in one market, assuming the effects in other markets are negligible (Just et al., 1982). From an empirical stand point, the old welfare economics holds that the triangle like area to the left of the demand curve and above price (often called consumer surplus) is a serviceable money measure of utility to the consumer in a market and that a triangle like area to the left of the supply curve and below price (producer’s surplus) is similarly an adequate money measure of welfare for producers in a market (Just et al., 1982). Changes in these areas can be used to measure welfare changes to society.
The principles of the old welfare economics have been attacked on several grounds by those economists associated with the new welfare economics. For example, beginning in 1942, economists such as Paul A. Samuelson demonstrated that the basic welfare measure of the old welfare economics--consumer surplus--is not well defined (Just et al., 1982). That is, consumer surplus is not generally a unique money measure of utility; uniqueness can imply contradictions depending on the use of empirical data. This criticism of the use of consumer surplus put applied welfare economics on somewhat shaky grounds until Willig’s work appeared in the mid 1970's (Just et al., 1982).

Another criticism of welfare economics is based on an argument advanced as early as 1896 by Pareto. He argued that any policy that makes any person worse off cannot be supported on objective grounds. As further elaborated by Hicks and Kaldor, the welfare weight attached to each individual need not be the same and, hence, simply summing changes in consumer or producer surpluses across individuals is not a sufficient basis for evaluating change. Pareto argued that the only objective basis under which one can say society is better off is when some people are made better off and no one is made worse off. This criterion has come to be known as the Pareto principle.

In an attempt to extend the class of questions that can be addressed objectively by welfare economics, Hicks and Kaldor introduced the compensation principle in 1939 by which a change should be made if potential gain exists so all could be made better off by some redistribution of goods or income following the change (Just et al., 1982). The associated measurement problem was addressed by Hicks who suggested that alternative money measures of welfare, while not directly related to utility gains and losses, can be given willingness to pay interpretations (Just et al., 1982). These measures, known as compensating and equivalent variations, are unique measures in any
situation and are hence not subject to the Samuelson criticism of consumer surplus (Just et al., 1982). The notion of compensating and equivalent variations and the associated compensating criteria are key concepts and form the foundation of applied welfare economics.

But even the compensating principles did not escape criticism. Scitovsky, in what has become known as the *reversal paradox*, illustrated how inconsistencies can arise in using this principle in policy analysis. Later, Gorman extended this analysis to illustrated the *intransivity* problem associated with inconsistent rankings of three or more situations (Just et al., 1982).

Applied welfare economics have been used extensively in recent years as though (if not actually) innocent of the controversy. Applied welfare economists continued to use partial equilibrium models for policy recommendations; and some recommendations have been legislatively mandated. The Flood Control Act of 1936 required that the benefits from water resource development projects must exceed the costs regardless of to whomever either may accrue (Just et al., 1982). To measure these benefits and costs in project evaluation work, economists continue to use the areas behind supply and demand curves. Policy makers demand economic analysis of policy decisions and applied welfare economists have used the only tools they have had available to provide information (Just et al., 1982).

Fortunately, however, some theoretical justification for feasible empirical work practices have followed. For example, the piecemeal approach has been shown to be appropriate when some markets or sectors have little economic impact on others. Where market interdependence exists, welfare economists now have better guidance as to how far they need to look to obtain the total welfare effects of a policy change. Similar advances have been made in other areas and under other assumptions. A number of important issues have characterized the recent literature on the
measurement of welfare: how to incorporate differences in household characteristics into welfare evaluation; how to evaluate the welfare of individuals when they live in households; the potential for using subjective survey data for measuring welfare; and how to measure social welfare, inequality and poverty from individual welfare measures (Blundell et al., 1994).

One of the key concepts in economics is utility or welfare. The first thorough introductions of the concept were those by Gossen (1854) and Jevons (1871) and Edgeworth (1881). They assumed, using modern jargon, that a commodity bundle $x$ in the commodity space ($\mathbb{R}^n$) contains the intrinsic utility value ($U_x$). The consumer problem could then be described as looking for the bundle with the highest utility value that could be bought at prices $p$ and income $y$ (Van Praag, 1994). Such a model is capable of describing and predicting the purchasing behavior of an individual. Actually, this is the behavioral aspect of the model. According to Van Praag the model can also be used for normative purposes, where we compare utility differences between bundles $x_1$, $x_2$, $x_3$ for a specific individual. The utility of income levels $y_1$, $y_2$, $y_3$ may be calculated by means of the indirect utility function $V(y, p)$ which is defined as the maximum utility to be derived from income $y$ at given prices $p$. It also would be possible to define a social welfare function, $W(U_1, \ldots, U_n)$, where social welfare is a function of individual utilities. The most common application of that concept is to compare distributions of social wealth and design policies which may lead to a better distribution.

Pareto (1909) gave a fierce blow to the utility concept by showing that demand behavior was completely determined by the contour lines, defined by the equation $U(x) = \text{constant}$ (Van Praag, 1994; Just et al., 1982). The result is that demand behavior does not define the utility function uniquely, but rather that there is a whole equivalence class of utility functions which yields the same demand behavior. Those utility functions have a property that $\hat{u} = \phi(U)$ where $\phi(.)$ is any
monothonically increasing function (Van Praag, 1994). This eroded utility concept is called the ordinal concept. The original one of, for example, Edgeworth is called the cardinal utility concept. Pareto (1909) did not state that cardinal utility was a nonsensical concept but only that it was not necessary to know the utility function to explain demand behavior, as knowledge of the contour lines of the utility surface on the commodity space is all that is needed (Kirman, 1987).

Robbins (1932) made a fierce attack on cardinal utility and stated that it was an unmeasurable concept altogether. Hicks and Allen (1934) and later Houthakker (1950) gave rigorous explanations of demand behavior without applying the utility concept at all. Deaton and Muellbauer (1982) made similar observations. So, the utility concept degenerated to a handsome tool to describe choice behavior. However, during the last thirty years the number of economists disagreeing with Pareto has been increasing. Several attempts at measurement or developing methods of possible measurement of utility have been made. The procedure can be described by the assumption that utility is the same function of a number of determinants or components for all individuals or households but with parameters characterized by the individual being considered which differ among individuals (Jorgenson and Slesnick, 1984). Thus, in recent years, major empirical measurements were made by three different groups of economists American, Dutch, and French groups.

The American group, which is made up of Christensen, Jorgenson, Slesnick, and Stocker, use a translog utility function, that is, one where the log utility is a quadratic function of the log of determinants and the latter are three or five consumption goods or services. The number of parameters to characterize the groups of consumers is also five: family size, age of head, region of residence, race, and type of residence. They introduce restrictions on preferences not used by ordinalists which may be considered the price they pay to justify being cardinalists. The restrictions
used are exact aggregation of individual demand to total demand and the integrability of demand functions rather than formal criteria.

The Dutch economists are led by Van Praag and Kapteyn. They use one determinant, income and test a large number of utility functions, although they prefer the cumulated lognormal function, for reason of convenience in a number of applications (Van Praag, 1971; Kapteyn, 1977; Van Herwaarden and Kapteyn, 1981). The function they prefer is linear in the logs of determinants $x_i$, plus unity:

$$ w = \sum_i \alpha_i \ln(x_i + 1) $$  \hspace{1cm} (2.1)

The advantage of this relationship is that it shows falling marginal utilities, namely:

$$ \frac{\partial w}{\partial x_i} = \frac{\alpha_i}{(x_i + 1)} $$  \hspace{1cm} (2.2)

The general restriction implies that the qualifications used to carry out the measurement procedure of the satisfaction experienced have the same meaning to the person compared. This restriction can be accepted since, in discussion on the policy resulting from the use of welfare measurement, the same words are also used either to accept or reject the policy. The restriction can be applicable only on a local or national level, rather than on international level, because the concept of a good income means something different to, say, an American and a Chinese metal worker.

The French economist who engaged in measuring welfare is Maurice Allias. He uses one component, psychological assets, and prefers the functional shape of linearity in its log (Allias, 1984). He only claims this shape for the main interval of the variable and admits that deviations
occur at the extremes. At the upper extreme he finds the phenomenon of satiety (an asymptote).

Measuring welfare or utility has become a respectable activity among many economists, and is considered to be comparable to similar processes and developments in other sciences. Clear examples can be found in physics where initially qualitative characteristics were followed by very satisfactory quantitative measurements. In the theory of heat qualification, qualitative values such as hot, warm, lukewarm, and cold were later replaced by specific temperature. In the theory of light, qualitative characteristics such as red, orange, yellow, green, blue, and purple were replaced by wavelength. In the theory of sound and music, wave lengths also became characteristics of low and high sounds.

One way to measure economic status as suggested by Peter Hammond (1976) is to do interpersonal comparisons. Interpersonal comparisons can be of utility levels and/or utility differences. Comparisons of levels can be used to define equity in the distribution of income. Sen (1973) gives a particular example by a thorough and interesting discussion of the welfare economics of income distribution in his book, *On Economic Inequality*. At the beginning of this book, utilitarianism is criticized on the grounds that it may lead to choices of income distribution which conflict with the notion of equity (Sen, 1973). He emphasized how one can make interpersonal comparisons of utility differences.

Hammond (1976), instead, set out to find an equity-regarding additive Bergson social welfare function, taking account of both types of comparisons. He further explains (p. 70):

It may not exist unless the interpersonal comparisons satisfy certain restrictions. The precise nature of these restrictions depends upon the precise nature of the dual interpersonal comparison. The most restrictive case is the one which Sen considered,
where both levels and differences of a single list of consumers' utility functions are being compared. In the least restrictive case, the level of one list of utility functions and the differences of a quite separable list of utility functions are compared. There is a third, intermediate case, where one compares the levels of a list of utility functions and the differences of a cardinally related but different list of utility functions.

If the price vector is considered along with the distribution of income, then dual interpersonal comparability may restrict the form of the consumers' indirect utility functions (Hammond, 1976).

Hammond goes on to say (p.70):

In the most restrictive case, the restrictions imply that any one consumer's Engel curves can be obtained from any other consumer's Engel curves by way of simple lateral shift. The property needed for consistent aggregation, the Engel curves are parallel straight lines, emerges as special case. The intermediate kind of dual comparability gives somewhat weaker restrictions; the least restrictive kind of dual comparability puts no restriction at all on consumers' indirect utility functions, or on their demand functions.

Hammond (1976) points out that market data helps to determine the precise form of the welfare function.

Muellbauer (1974a) analyzed household composition, Engel curves and welfare comparisons between households using a duality approach. The household composition effects in consumer theory are important for the specification and estimation of Engel curves and demand functions. The models examined by Muellbauer (1974a) have important applications in the areas of measurement
of cost of living indices, the study of poverty and equality and in certain aspects of social policy. These models are based on the approach of Barten (1964). In his study, test differences between households are parameterized in a way which has been called simple good augmenting or simple repackaging in the literature on equality change--see Fisher and Shell (1967) and Muellbauer (1973a). In this theory, changes in household composition play an analogous role to price changes. Barten (1964) suggests that price elasticities might be estimated from cross-section data alone.

The indices introduced are of considerable importance in analyzing poverty and inequality (Muellbauer, 1974a). Unless household composition is taken into account in this way, it makes virtually no sense to compare the money incomes of different households. Recently Atkinson (1970) and Sen (1973), among others, have discussed measures of inequality. As far as operational measures are concerned, this always boils down to measures of money inequality and it is always assumed that the individual utility functions are identical (Muellbauer, 1974a). Clearly, this is inadequate for households. However, with the above theory, the approach of Atkinson and Sen can be extended to measure economic inequality between households. Muellbauer states that the Engel method is painfully devoid of any micro-economic theoretical basis and continues in use only because recent advances in the basic theory of consumption economics have not been applied to the estimation of equivalence scale.

Still on the subject of welfare comparison, Pollak and Wales (1979) addressed the distinction between the equivalence scale required for welfare comparisons and the equivalence scale which arises in demand analysis. Of course, equivalence scales are used in both demand and welfare analyses. In demand analysis they permit us to pool data from households of different sizes, or more generally, with different demographic profiles. In welfare analysis, they enable comparison of the
well-being of such households, since they purport to answer questions of the form: what expenditure level would make a family with three children as well off as it would be with two children and $12,000? According to Pollak and Wales (1979) such welfare comparisons are generally thought to provide the rationale for different treatments of different family types in income tax or family allowance schedules, or in an income maintenance program (Pollak and Wales, 1979).

The authors also explicitly pointed out the types of equivalence scale appropriate for demand analysis or welfare comparisons. Conditional equivalence scales are used in demand analysis while unconditional equivalence scales are used for welfare comparisons. Conditional equivalence scales can be estimated from observed differences in the consumption patterns of households with different demographic profiles, but construction of unconditional equivalence scales requires more information than is contained in household consumption data (Pollak and Wales, 1979).

Pollak and Wales (1979) explicitly stated the implications of their analysis of welfare comparisons and equivalence scales as:

1. Even if all families have identical unconditional preferences, conditional equivalence scales estimated from observed differences in the consumption patterns of families with different demographic profiles cannot be used to make welfare comparisons; for example, we cannot use such data to determine the amount needed to make families with three children as well off as those with two children and $12,000. Unconditional equivalence scales are required to make welfare comparisons.

2. If tastes vary systematically with demographic characteristics, then the construction of unconditional equivalence scales requires the selection of an
appropriate base unconditional preference ordering; theory offers little guidance in making this selection, but there is no selection which permits us to compare the welfare of a family with a strong desire for children with that of one with a weak desire for children. Such comparisons require interpersonal or inter family comparisons of welfare levels.

Slesnick (1994) empirically demonstrated that the distribution of expenditures is different from the distribution of income. The paper also assesses the robustness of the widely accepted conclusion that inequality in the United States has reversed course and attained unprecedented (high) levels. The author avoided the problems associated with money income inequality studies by using a measure of welfare that is based on consumption level and incorporates the needs of households, as well as the influence of prices. It came out that the distribution of a consumption based welfare measure is different from the family income distribution, which is used to demonstrate rising inequality in the United States (Slesnick, 1994). The result points out that income performs poorly as a proxy for household welfare in measuring inequality (Slesnick, 1994). Further, Slesnick found that income inequality overstates consumption based on inequality measures by a substantial amount. The trends and consumption based on inequality indexes also diverge, with income measures indicating rising inequality over the postwar United States and the consumption measure showing the reverse.

What accounts for the difference between the distribution of before tax income and the distribution of real per equivalent expenditure? The answer given by Slesnick is that the distribution of total expenditure is less dispersed than the distribution of income which, in turn, appears to be the result of consumption smoothing across the population. The inclusion of household needs in the
evaluation of welfare is also an important component in accounting for the differences in the levels and trends of inequality in the United States.

The focus of attention of policy makers and researchers has been the U-turn in income inequality in the United States. But Slesnick’s findings indicate that when household welfare is measured using real per equivalent expenditures, the level of inequality fell until the early 1970s and has remained essentially constant thereafter. However, in 1991 the level of inequality remains high so that substantial gains in social welfare can be had through further equalization of the distribution of welfare. The suggestion given on policy issues is that it is perhaps more useful to focus attention on the forces that induced the reduction in inequality rather than try to explain the illusory U-turn in inequality that occurred in the 1970's and 1980's.

On a related topic Blundell, Browning and Meghir (1994) estimated the parameters of household preferences that determine the allocation of goods within the period and over the life-cycle, using micro data. In doing so, they were able to identify important effects of demographic, labor market status and other household characteristics on the intertemporal allocation of expenditures. The distinctive feature of their approach is that it integrates traditional demand analysis with an intertemporal substitution model in a coherent way.

Based on the author’s suggestions, the findings of this type of research is open to a variety of interpretations which cannot be distinguished convincingly within this framework. First, it is quite possible that the importance of labor market variables in the intertemporal model does in fact reflect a shift in tastes as a function of labor market status; since labor market status and the growth rate of income are obviously correlated ignoring the former makes the later spuriously significant (Blundell, Browning and Meghir, 1994). Further, they point out that for the same reason labor
market status is a good predictor of income growth and, thus, labor market status may just capture excess sensitivity. In a recent empirical finding, Jorgenson and Slesnick (1984) were able to measure welfare inequality based on an econometric model of aggregate consumer behavior. This model allows them to uniquely recover systems of individual demand functions from the systems of aggregate demand functions. By requiring that individual demand functions be integrable, they recovered indirect utility functions for all consumers (Jorgenson and Slesnick, 1984). As a result, they were able to define measures of individual welfare in terms indirect utility functions.

To represent preferences for all individuals in a form suitable for measuring individual welfare, households are taken as consuming units. It is also assumed that expenditures on individual commodities are allocated so as to maximize welfare functions. As a result, the household behaves in the same way as an individual maximizing a utility function, as demonstrated by Samuelson (1956) and Pollak (1981). By assuming that each household maximizes a household welfare function, the focus can be on the distribution of welfare among households (Jorgenson and Slesnick, 1984). An econometric model based on exact aggregation can be defined through representing individual preferences by means of an indirect utility function for each consuming unit (Jorgenson and Slesnick, 1984). They also assume the kth consuming unit allocates expenditures in accordance with the translog indirect utility function. By applying Roy's identity, the system of individual shares is obtained. Aggregate expenditure patterns depend on the distribution of expenditures over all consuming units through summary statistics of the joint distribution of expenditures and attributes (Jorgenson and Slesnick, 1984). The first step in analyzing inequality in the distribution of individual welfare is to select a representation of the individual welfare function. The assumption is that the individual welfare of the kth consuming unit is equal to the logarithm of the indirect utility
function. The indirect utility function provides a cardinal measure of utility. If a system of individual expenditure shares can be generated as an indirect utility function, we can say that the system is integrable. A complete set of conditions for integrability is given by Jorgenson and Slesnick (1984):

Homogeneity The individual expenditure shares are homogeneous of degree zero in prices and total expenditure.

Summability: The sum of the individual expenditure shares over all commodity groups is equal to unity.

Symmetry: The matrix of compensated own- and cross-price substitution effects must be symmetric.

Nonnegativity: The individual expenditure shares must be nonnegative.

Monotonicity: The matrix of compensated own- and cross-price substitution effects must be non-positive definite.

To provide a basis for evaluating the impact of transfers among households on social welfare, it is useful to represent household preferences by means of utility functions that are the same for all consuming units. Consumer equilibrium implies the existence of an indirect utility function that is the same for all consuming units. The level of utility for the kth consuming unit depends on the prices of individual commodities, the household equivalence scale, and the level of total expenditures (Jorgenson and Slesnick, 1984). The first step in analyzing inequality in the distribution of welfare is to select a representation of the individual welfare function. Jorgenson and Slesnick (1984) assume that the individual welfare for the kth consuming unit is equal to the logarithm of the translog utility function. The next step is to generate a social welfare function that has the properties of an unrestricted domain, independence of irrelevant alternatives, positive
association, nonimposition, and cardinal full comparability (Jorgenson and Slesnick, 1984). They impose the additional assumption that the degree of aversion to inequality is constant and require the social welfare function to satisfy requirements of horizontal and vertical equity.

To develop indexes of inequality in the distribution of individual welfare, Jorgenson and Slesnick (1984) decompose the measure of social welfare into measures of efficiency and measures of equity. Efficiency can be defined as the maximum level of welfare that is potentially available through redistribution of aggregate expenditures. The absolute level of inequality is defined as the difference between the measure of efficiency and the actual level of social welfare. Also, a relative measure of inequality is defined as the ratio between the absolute index of inequality and the measure of efficiency. The decomposition of social welfare into measures of efficiency and equity takes place through the maximization of social welfare for a fixed level of aggregate expenditure. The average level of individual welfare for a given level of aggregate expenditures can be maximized by means of the Langrangian.

If aggregate expenditure is distributed so as to equalize total expenditures per household equivalent member, the level of individual welfare is the same for all consuming units. Equivalent member is a member of a household for which expenditure is allocated based on an index called equivalent scale. Equivalent scale is an index which deflates family income or expenditure by a score that may be less than one for each extra member. This is the maximum level of welfare that is potentially available and can be taken as a measure of efficiency. We can refer to this measure as the translog index of efficiency. The translog index is equal to the translog indirect utility function, evaluated at aggregate expenditure per household equivalent member for society as a whole (Jorgenson and Slesnick, 1984).
Given the translog index of efficiency defined in terms of the social welfare function, we can define a measure of inequality as the difference between the translog index of efficiency and the actual value of the social welfare function (Jorgenson and Slesnick, 1984). We can refer to this measure as the translog index of inequality. Likewise, it is possible to develop a measure of inequality within subgroups of the U.S. population. For this purpose, a group welfare functions are introduced that are precisely analogous to the social welfare function discussed earlier. A group welfare function can be defined as a mapping from the set of individual welfare functions to the set of group orderings (Jorgenson and Slesnick, 1984). A group ordering can be described in terms of properties of a social welfare function. The same steps can be taken to decompose a group welfare function into measures of efficiency and equity. As a result, measures of inequality within groups are obtained.

2.3 Conventional Ways of Measuring Income Distribution

The distribution of income is one of the main features of any social system. David Ricardo, the classical economist *par excellence*, regarded the determination of income distribution as the most important task facing economics. This view is no longer widely held in the face of today’s problems (unemployment, inflation). Nevertheless, stagnation in economic growth in virtually all modern industrialized societies, which has became the subject of public debate recently, has meant increasing pressure for more attention to be paid to the distribution of the national pie.

Theoretical success in the study of personal income distribution is still modest. None of the existing theories are entirely satisfactory. Money income is what we observe and tax. But it is not completely satisfactory indicator of well-being. Throughout the last fifty years numerous measurement methods have been employed to measure the distribution of income. This section
reviews and discusses some of the methods used and some of the articles and books published on this particular topic.

2.3.1 Lorenz Curve

The Lorenz curve is a powerful tool in the analysis of the size distribution of income and wealth. The curve is defined as the relationship between the commutative portion of income and the commutative portion of income receiving units. Let $\pi(x)$ represent the proportion of the units that receive income up to $x$ and $\eta(x)$ represent the proportion of total income received by the same units. The Lorenz curve is then the graphical representation of the parametric relationship between $\eta$ and $\pi$. The graph of the curve is represented in a unit square. The straight line is joining the points $(0,0)$ and $(1,1)$ is called the egalitarian line, because along the line $\eta = \pi$, which means that each unit receives the same income. The Lorenz curve falls below the egalitarian line. Figure 2.1 illustrates the Lorenz curve.

To derive the Lorenz curve, let $x$ be the income of the unit and $g(x)$ be the probability density function of $x$. $G(x)dx$ will then represent the probability that a unit selected at random will have income less that or equal to $x$ is:

$$\pi(x) = \int_0^x g(r)dr$$

(2.3)

and the average income earned by these units is:

$$Q(x) = \int_0^x rg(r)dr$$

(2.4)
Then the proportion of income earned by units whose incomes are less than or equal to $x$ will be:

$$\eta(x) = \frac{Q(x)}{Q}$$

(2.5)

where $Q$ is the average income of all the units. The Lorenz curve can be obtained by inverting the functions (2.3) and (2.5) and eliminating $x$ if the functions are conveniently invertible. Alternatively, the curve can be plotted by generating the values of $\pi(x)$ and $\eta(x)$ from (2.3) and (2.5) by giving some arbitrary values of $x$. If the distribution of income follows Pareto’s, the equation of the Lorenz curve will be:

$$(1 - \eta) = (1 - \pi)^\delta$$

(2.6)
where $0 < \delta < 1$, $\delta$ being the parameter. This Lorenz curve is not symmetric about the 45° line perpendicular to the egalitarian line. Generally, the Lorenz curve must satisfy the following conditions (Kakwani and Podder, 1973):

1. If $\pi = 0$, $\eta = 0$
2. If $\pi = 1$, $\eta = 1$
3. $\eta < \pi$
4. The slope of the curve increases monotonically. \hspace{1cm} (2.7)

Condition 1 rules out the possibility of a unit earning zero or negative income. Condition 4 implies that the curve lies below the egalitarian line. It should be recognized that the concept of Lorenz curve has been extended and generalized to deal with consumer behavior patterns with respect to different commodities. According to Kakwani and Podder (1973), generalized Lorenz curves, which describe the consumption pattern for commodities, are called concentration curves and the Lorenz curve is only a special case of such curves, namely, the concentration curve for income. Kakwani and Podder (1973) pointed out that the more general form of the Lorenz curve which satisfies the condition may be:

$$\eta = \pi \alpha e^{-\beta(1-\pi)}$$ \hspace{1cm} (2.8)

Where $\alpha$ and $\beta$ are parameters. Kakwani and Podder (1973) estimated the concentrated ratio for Australia on the basis of data collected in a survey of consumer expenditures during 1967-68. The general formula (2.8) gives a marginally better fit than the simple formula. Kakwani and Podder (1973) expressed the simple formula as:

$$\eta = \pi e^{-\beta(1-\pi)}$$ \hspace{1cm} (2.9)
The standard error of the concentration ratio based on the general formula is higher than that of the simple one. This may be because the concentration ratio is a function of a coefficient which could not be estimated precisely in the general formula due to the high correlation between the independent variables.

2.3.2 Gini Coefficient

The Gini coefficient is a well-known summary measure of inequality. It is derived from the Lorenz curve. A variety of empirical studies on income distribution have used the Gini and extended Gini to measure income distribution. Garner (1993) used the Lerman and Yitzhaki covariance method to analyze inequality in the distribution of household consumption expenditures, and to examine relationships between various expenditure budget components and total expenditures using United States data. This method had been applied previously to the study income inequality by income source in the U.S. (e.g., Ahearn, Johnson, and Strickland, 1985; Lerman and Yitzhaki, 1985), to assess the progressivity of taxation in Israel (Yitzhaki, 1990), and to determine the welfare dominance of excise taxation for the Cote d’Ivoire (Yitzhaki and Thrisk, 1990).

Other researchers (e.g. Iyengar, 1960; Kakwani, 1978; Blaylock and Smallwood, 1982; Yitzhaki, 1990; Yitzhaki and Thrisk, 1990) have used the Gini coefficient and concentration curves to produce income or expenditure elasticities. In each of these previous studies, with the exception of Kakwani (1978), elasticities were produced for a selected few commodities and commodity groups.

Gartner’s (1993) study disaggregated total expenditures into nine exhaustive categories: food, shelter, household fuels and utilities, household operations, apparel and services, transportation, medical care and services, entertainment, and other expenditures. Expenditures allocated to savings,
such as personal insurance and pensions, were excluded. Micro level data from the U.S. Consumer Expenditure Interview Survey (CEX) were analyzed with expenditures referring to those of the consumer unit (United States Department of Labor, 1978).

On another front, Silber (1989) presented the use of a new linear operator, called the G-matrix, which greatly simplifies not only the computation of the Gini Index but also the decomposition by factor components or population subgroups. The proposed approach also allows one to give a clear interpretation of the interaction term which is obtained when the Gini Index is broken down by population subgroups.

Following the work of Sen (1973) and Donaldson and Weymark (1980), it has been shown that the Gini index of inequality $I_G$ could be written as (Berrebi and Silber, 1985; Silber, 1989):

$$I_G = \sum_{j=1}^{n} s_j \left[ \frac{(n - j)}{n} - \frac{(j - 1)}{n} \right]$$  \hspace{1cm} (2.10)

Where $s_j$ is the proportion of total income earned by the individual whose income has the $j^{th}$ rank in the income distribution, assuming that

$$s_1 \geq s_2 \geq ... \geq s_j \geq ... \geq s_n$$

Expression (2.15) may be written as (Silber, 1989):

$$I_G = \sum_{i=1}^{n} s_i \left[ \sum_{j>i}^{n} \frac{1}{n} - \sum_{j>i}^{n} \frac{1}{n} \right]$$  \hspace{1cm} (2.11)

According to Berrebi and Silber (1987) equation (2.16) can be written as:

$$I_G = (e^G_s)$$  \hspace{1cm} (2.12)
Where $e$ is a column vector of $n$ elements which are equal to $1/n$ ($e'$ being the corresponding row vector), $s$ is a column vector of $n$ elements being, respectively, equal to $s_1$, $s_2$, ..., $s_n$ and $G$ (which could be called the G-matrix) is an $n \times n$ matrix whose elements $g_{ij}$ are equal to $-1$ when $j > i$, to $+1$ when $i > j$ and $0$ when $i = j$. This approach may be used to estimate an upper bound to the Gini Index when only group observation are available (Silber, 1989).

To show factor of components and the Gini Index, let $X_j$ denote an individual $j$’s total income and $X_{ij}$ the income the individual receives by providing productive factor $I$ component of individual $j$’s income. The share of individual $j$ in total income will now be denoted by $s_j$ and is written as (Silber, 1989):

$$ s_j = \frac{X_j}{X_T} \quad (2.13) $$

Where $X_T = \sum_{j=1}^{n} X_j$, and where the share of component $I$ in society’s total income will be denoted by $s_i$ defined by

$$ s_i = \frac{\left( \sum_{j=1}^{n} X_{ji} \right)}{X_T} \quad (2.14) $$

Let us call $s_{ji}$ the share of the component $I$ of individual $j$ in total income $X_T$, that is,

$$ s_{ji} = \frac{X_{ji}}{X_T} \quad (2.15) $$

and define an $n$ by $(k + 1)$ matrix $S$, whose first column is the vector $s$ of the shares of $s_j$, whose
second column is the vector $s_{1i}$ of the shares $s_{ji}$ and whose $(I + 1)^{th}$ column in the vector $s_i$ of the shares $s_{ji}$. The product

$$e'GS = z$$

(2.16)

is a row vector of $(k + 1)$ elements whose first element, as indicated by equation (2.12), is the Gini Index of total income inequality. The next $k$ element of $z$ may be written as:

$$z_{i+1} = e'G_{s_{ji}}$$

(i = 1...k)

(2.17)

so that

$$\sum_{i=1}^{k} z_{i+1} = e'G(s_{1i} + \ldots + s_{ji} + s_{ki}) = e'G = z_1$$

(2.18)

Let us call $v_{ji}$ the vector of the ratios $(s_{ji}/s_{1i})$ $(j = 1...n)$ so that the element $v_{ji}$ of $v_{ji}$ is the share of individual $j$ in the total income derived from component $I$. Expression (2.17) may then be written as:

$$z_{i+1} = e'G\begin{bmatrix} s_{ki} \\ s_{1i} \\ \vdots \\ s_{ni} \\ s_{ji} \end{bmatrix} = e'Gv_{ji}(s_{ji}) = (s_{ji})e'Gv_{ji}$$

(2.19)
The scalar $e'Gv_i$ is generally not the Gini Inequality Index $G_i$ of the $i^{th}$ component of income since the elements $v_{ji}$ and $v_{i.}$ ($j = 1,...,n$) may not necessarily be ranked by decreasing value as are the elements $s_j$ of $s$. To obtain the Gini Inequality index of $G_i$ of component $I$, one has to construct a new vector $y_i$ whose elements $y_{ji}$ ($j = 1,...,n$) are the shares $(s_{ji}/s_{.i})$ previously defined, but they are not ordered according to the order of the shares $s_j$ of vector $s$ but according to their own rank in the vector $y_{j.}$. The Gini Index $G_i$ for component $I$ is therefore defined as:

$$G_i = e'Gy_{j.} \quad (2.20)$$

The scalar $C_i = e'Gv_i$, on the other hand, has been called the pseudo Gini of component $I$ by Fei, Ranis and Kuo (1978) or the concentration ratio of component $I$ by Rao (1969), Kakwani (1980), Pyatt, Chen and Fei (1980) and Shalit (1985).

The above procedure to decompose the Gini Inequality Index among all factors that contribute to income is, therefore, relatively uncomplicated. It requires construction of a matrix $S$ whose first column refers to the shares of each individual’s total income in society’s total income whereas the next column refers to the shares of each individual’s income from specific component in society’s total income (Silber, 1989). All vectors are ranked according to the (decreasing) rank of the individuals in total income. The product $e'GS$ is then a vector $z$ whose first element is the Gini Inequality Index $I_G$, whereas the other elements are the contributions of each component to the overall inequality $I_G$. Both techniques presented above were tested with real data. The outcome is very consistent with the other measures of inequality.

Another study, by Husted (1991), examines the change in state-level income inequality from 1981 to 1987. Inequality is measured by the state’s Gini coefficient, as calculated from each state’s
Lorenz curve. The study uses techniques developed in Kakwani and Podder (1973, 1976) and described in Slottje (1989) to estimate state-level Lorenz curves. The parameter estimates then are used to calculate the associated Gini coefficients and their asymptotic standard errors.

Following Kakwani and Podder (1976), family income $Y$ is a random variable with probability density function $f(Y)$, so that

$$P(Y) = \int_0^y f(Y) dY$$

is the proportion of families with income less than or equal to $y$ and

$$Q(Y) = \frac{1}{\mu} \int_0^y Y f(Y) \, dY$$

is the proportion of income earned by the families who have income less than or equal to $y$, where $\mu$ represents the mean income of all families in the population.

Given these definitions, any point of a Lorenz curve can be described by two line segments,

$$\pi = \frac{1}{\sqrt{2}} [P(Y) + Q(Y)], \quad \sigma = \frac{1}{\sqrt{2}} [P(Y) - Q(Y)]$$

The first line segment $\pi$ is the ordinate from the point on the Lorenz curve to the diagonal egalitarian line. The second segment ($\sigma$) extends from the origin to this ordinate along the diagonal egalitarian line. It follows this definition that

$$\frac{d\pi}{d\sigma} = \frac{\mu - y}{\mu + y}$$

The proposed Lorenz curve for this study is (Husted, 1991):
\[ \sigma = a \pi \alpha (\sqrt{2} - \pi) \beta, 0 < \pi < \sqrt{2}, \quad \alpha, \beta > 0 \] (2.25)

Taking the log of both sides, equation (2.25) becomes

\[ \log(\sigma) = \log(a) + \alpha \log(\pi) + \beta \log(\sqrt{2} - \pi) \] (2.26)

This specification satisfies the necessary properties for a Lorenz curve (Husted, 1991). In particular, \( \sigma > 0 \) when \( a > 0 \) and the Lorenz curve lies below the egalitarian line. The parameters \( \alpha \) and \( \beta \) are restricted to be greater than zero, so that \( \sigma = 0 \) when \( \pi = 0 \) or \( \pi = \sqrt{2} \). Additional restrictions are imposed by equation (2.24) and the negative second derivative. The additional restrictions contain 0 < \( \sigma \leq 1 \) and 0 < \( \beta \leq 1 \) and indicate, for the Lorenz curve defined in equation (2.25), that

\[ \sigma(\sqrt{2} - \pi) - \beta \pi = \frac{(\mu - y) \pi (\sqrt{2} - \pi)}{(\mu + \pi) \sigma} \] (2.27)

To calculate the Gini coefficient, the parameters of the Lorenz curve in equation (2.25) and the restriction on the curve in equation (2.26) must be jointly estimated. However, since the available income data for the analysis by Husted (1991) are grouped by income class, \( \pi \) and \( \sigma \) are not observed (Husted, 1991). In the data used for this study, there are \( N \) families grouped into \( K + 1 \) income classes for each time series \( t \) (1 = 1, ......., T) and within each cross section. If \( n_{t,c}^k \) is the number of families earning income between \( y_{k-1} \) and \( y_k \) in time period \( t \) and cross section \( c \), then \( f_{t,c}^k = n_{t,c}^k / N \) is a consistent estimator of the probability that a family belongs to this particular income group in cross section \( c \) and time \( t \) (Husted, 1991). Therefore the estimators of \( P(Y) \) and \( Q(Y) \) are (Husted, 1991):
where $m_\sigma$ is the mean income group $\sigma$, and $\mu_{t,c}$ is the mean income for all families in cross section $c$ and in year $t$. By substituting $p_{t,c}^k$ and $q_{t,c}^k$ into the expressions in equation (2.23), consistent estimators of $\pi$ and $\sigma$ are (Husted, 1991):

$$I_{t,c}^k = \frac{|p_{t,c}^k + q_{t,c}^k|}{\sqrt{2}}, \quad n_{t,c}^k = \frac{|p_{t,c}^k + q_{t,c}^k|}{\sqrt{2}}$$  \hspace{1cm} (2.29)

Since the estimators differ from the true $\pi$ and $\sigma$ by a random disturbance, equation (2.26) is expressed as:

$$\log (n_{t,c}^k) = a' + \alpha \log (I_{t,c}^k) + \beta \log (\sqrt{2} - I_{t,c}^k) + \epsilon_1$$  \hspace{1cm} (2.30)

Finally, after substituting $p_{t,c}^k$ and $q_{t,c}^k$ for $\pi$ and $\sigma$, equation (2.27) becomes

$$\frac{(\mu_{t,c} - y_k)}{(\mu_{t,c} - y_k)} \frac{\sqrt{2} I_{t,c}^k}{n_{t,c}^k} = \alpha (\sqrt{2} - I_{t,c}^k) - \beta (I_{t,c}^k) + \epsilon_1$$  \hspace{1cm} (2.31)

A joint generalized least square (GLS) estimation of the proposed Lorenz curve in the equation (2.30) and its restrictions in equation (2.31) is carried out for state level grouped pre-tax family income data (Husted, 1991). This estimation is more efficient than ordinary least squares estimation.
of the Lorenz curve parameters in equation (2.29). With the estimated coefficients from the GLS estimation - \( a \), \( \alpha \), and \( \beta \), the Gini coefficient can be calculated. The Gini coefficient for each state derived from the Lorenz curve in equation (2.29) is (Husted, 1991):

\[
G = 2a \left( \sqrt{2} \right)^{1+\alpha+\beta} \beta (1 + \alpha, 1 + \beta)
\]  

(2.32)

where \( \beta (1 + \alpha, 1 + \beta) \) is the beta function, with \( 1 + \alpha \) and \( 1 + \beta \) degrees of freedom.

The calculated state level Gini coefficients for family income from 1981 to 1987 reflect the increasing inequality observed in the United States during the 1980s (Husted, 1991). This measure also indicates significant differences in the growth of family income inequality across states. Although the paper did not explore the exact cause of these differences, they reflect, in part, the uneven incidence of the state level economic restructuring, from high and middle wage manufacturing, construction, and mining sectors to the low wage service and trade sectors (Husted, 1991).

To explain the drawbacks to Gini measurements, Braun (1988) re-examined the direct relationship between income inequality (as measured by a variety of indices, including the Gini ratio) and development or economic improvement (as measured by several independent variables, including mean income). A corollary hypothesis suggested by Braun is that the original relationships may not be present when other measurements of income inequality are employed, both because of their differing sensitivities and because these alternate techniques are measuring substantively different types of income inequality. Growing evidence shows that the Gini ratio has serious weaknesses (Braun, 1988). The simple aging of a population will increase inequality (Morgan, 1962). Although Paglin (1975) introduced a modification to correct for this bias, it has
not been widely adopted in subsequent research. A popular method of computing Gini scores utilizes census income categories, frequently with the adjustment using a Pareto curve for the open-ended interval at the top (Knott, 1970). Employing the Pareto curve is not always done, however, which can lead to inconsistent comparisons. It has been shown that the Gini coefficient will be reduced to the degree that the number of income intervals also declines (Sale, 1974). Income intervals differ from one census to another, with 14 in 1950, 13 in 1960, 15 in 1970, and 9 in 1980.

The Gini coefficient is also insensitive to non-money income components and differential price indices between states, which exaggerate income inequalities in rural area (Jonish and Kau, 1973). Bud (1973) finds a tendency toward error for researchers making comparisons between various dates. Additionally, the Gini coefficient is more responsive to changes in income of the middle class than to changes among the rich or the poor (Osberg, 1984; Allison, 1978). This is perhaps why Gini scores show such stability over long periods of time in the United States (Braun, 1987). One study of Wisconsin income data (Soltow, 1971) shows no great change in Gini scores over 100 years. Reynolds and Smolensky (1977) find that despite major changes in taxation and welfare in the 1950-1970 period, inequality is virtually unchanged as measured by Gini ratios. A serious problem also results when Lorenz curves intersect as countries are compared (Allison, 1978). Schwarz and Winship’s (1979) re-examination of Kuznets’ data concludes that of 66 possible pairs of comparisons between countries, in only 16 comparisons is it possible to use Lorenz-based Gini scores to discover which country unequivocally has the most unequal distribution of income (Braun, 1988).

2.3.3 Stochastic Dominance

Until relatively recently, the conventional view in economics was that the size distribution
of income does not change very much across time (Bishop and Formby, 1994). Dominance techniques for ranking entire distributions stand at the forefront of these developments. If two income distributions differ, which one is better? If two growth processes distribute the benefits of economic growth differently, which is better? The dominance method can be used to address both of these questions. If we are interested in comparing two multi-variance distributions, represented by the (continuous) cumulative distribution functions \( F(x) \) and \( F'(x) \), where \( x \) is a vector of random variables. It is assumed that the comparison is based on the difference in expected utility (Atkinson, 1983):

\[
\Delta W = \int U(x) \, dF - \int U(x) \, dF' 
\]

(33)

Where expected utility is assumed to be well-defined. One distribution, \( F \), is said to stochastically dominate the other, \( F' \), for a specific class of utility functions when \( \Delta W \) is non-negative for all \( U \in U \) and is strictly positive for some \( U \) (Atkinson, 1983). The condition for \( F \) to dominate \( F' \) becomes progressively weaker as one strengthens the conditions on the class \( U \).

The dominance method of evaluating income distributions is very general and can be applied to investigate income inequality, economic efficiency, and changes in the overall status of welfare in an economic system. It can also be applied to evaluate the distribution of the benefits of economic growth across time. Recent empirical studies based on the dominance principle are indicative of the applicability of the methodology to the study of statistical distributions in general. Examples where dominance methodology is used to evaluate a variety of issues are changes in the U.S. income distribution across time (Bishop, Formby and Smith, 1991a; Bishop, Chow and Formby, 1991a); the convergence and divergence of U.S. regional income distribution in the 1970s (Bishop, Formby and
Thistle, 1992a,b); the effects of growth and recessions on poverty (Bishop, Chow and Formby, 1991a); international differences in income distribution (Bishop, Formby and Smith, 1991b, 1993; Bishop, Formby and Sakano, 1992a); the effects of tax evasion on the distribution of income and tax burdens (Bishop, Chow and Formby, 1991b; Bishop, Chow, Formby, and Ho, 1993); the effects of the U.S. Food Stamp program on under nutrition (Bishop, Formby and Zeager, 1992b); and differences in mortality distributions and the problem of "missing women" in major regions of the LDC world (Bishop, Formby and Zeager, 1992a).

According to Bishop and Formby (1994), the appeal of the dominance approach is traceable to three distinct but related features of the methodology. First, it rests upon explicit welfare criteria that are widely acceptable and which rank the distributions of interest using a series of steps, or stages, that are referred to as first, second, and third degree dominance. If two distributions can be ranked, any two researchers or policy makers are likely to be in general agreement concerning which of the distributions is best. Second, new statistical inference procedures developed over the last decade have substantially expanded the capacity of the dominance method to rank income distributions and evaluate comparative levels of welfare. As a consequence, studies of income distribution need no longer rely on descriptive statistics, but can make use of explicit tests of hypothesis. The dominance method relies on ordinal measures of entire distributions and levels of welfare, while avoiding the use of index numbers that rest on a dubious assumption of cardinality.

If two income distributions differ, which is "better"? If two growth processes distribute the benefits of economic growth differently, which is better? The dominance method can be used to answer both of these questions. Important theoretical contributions by Atkinson (1970), Shorrocks (1983), and Saposnick (1981, 1983) establish a powerful relationship between the dominance of one
income distribution over another and ordinal level of welfare. Foster and Skorocks (1988) extend
the theory to show an equally powerful relation between dominance of income distribution and
poverty. New statistical inference procedures pioneered by Beach and Davidson (1983) complement
the theoretical developments by permitting the dominance relationship between income distributions
to be subjected to rigorous hypothesis testing.

Atkinson (1970) demonstrates that, for distributions with equal means, strong inferences can
be made about comparative states of economic welfare when one Lorenz curve dominates another.
As emphasized by Sen (1973), when the mean of the distributions of interest are unequal, the Lorenz
dominance principle is devoid of welfare content. In related but distinct ways, Shorrocks (1983) and
Saposnik (1981, 1983) extended the dominance approach to consider distributions with unequal
means. Shorrocks demonstrates that Lorenz curves can be re-scaled by the mean of the distribution
and dominance comparison can be made in the same fashion as with ordinary Lorenz curves.
Shorocks refers to this re-scaled Lorenz curve as the Generalized Lorenz curve. Like dominance
in terms of ordinary Lorenz, GL dominance incorporates a preference for equality; but unlike the
Lorenz curve, the GL curve also incorporates an efficiency preference (Bishop and Formby, 1994).
Saposnik (1981, 1983) adopts a more straightforward approach and applies first order dominance
techniques directly to income distributions. The criterion compares absolute income in ranked
positions in the income distribution and is referred as "rank dominance" (Bishop and Formby, 1994).
It is well established that first order dominance implies second order dominance; as a result rank
dominance implies GL dominance. Further, a first order dominance is a pure efficiency criterion
and, unlike second order dominance, does not contain a preference for equity (Bishop, Formby and
Smith, 1991a)
Several sources of micro data have been analyzed and some of the findings from the analysis of CPS, Public Use Samples of the decennial Census of Populations are summarized below. The Internal Revenue Service’s Taxpayer Compliance Measurement Program (TCMP) and the Luxembourg Income Study are two such studies. Perhaps the most dramatic change uncovered using inferences based dominance analysis is the rise in U.S. income inequality in the period following 1978. Bishop, Formby and Smith (1991a) analyze the period 1967-1986 and present statistics that identify the sub-periods: 1967-1977, 1978-1982 and 1983-1986. Their results reveal a significant rise in inequality between 1978 and 1982 which they describe as "massive". Before 1978, there were several statistically significant changes in U.S. Lorenz curves, which were associated with cyclical swings in the economy (Bishop and Formby, 1994). Consistent with earlier findings of Beach (1977) and Blinder and Esaki (1978), inequality rose in recession years and declined in years of recovery. But beginning 1978, the shifts in Lorenz curves were different; inequality began to rise well before any recession, the changes were quite large by historical standards, and there were no reverse movements toward equality during the period of recovery (Bishop, Formby and Smith, 1991a). In fact, inequality rose slightly between 1982 and 1986. Further, a more recent study (Bishop, Chiou and Formby, 1992) extends the Lorenz dominance analysis to 1989 and finds that inequality continued to rise in the late 1980s.

The second dramatic change in U.S. income distributions revealed by inference-based dominance analysis involves convergence of regional income distributions in the 1970s (Bishop, Formby and Thistle, 1992a,b). The U.S. south historically had both lower absolute incomes and greater inequality than the Non-South. Bishop, Formby and Thistle (1992a) apply the dominance methodology to Public Use Samples from the 1970 and 1980 decennial censuses and show that, as
expected, the South was unambiguously dominated in 1969. However, the evidence reveals extraordinary changes in the 1970s. Lorenz curves, first order dominance and second order dominance all indicate that the south’s income distribution either converged or almost converged to that of the Non-South (Bishop and Formby, 1994).

The third dramatic result from inference-based dominance analysis comes from a follow-up study of U.S. regional income distribution. Bishop, Formby and Thistle (1992b) disaggregate the Non-South into its major sub-regions consisting of the West, Midwest, and Northeast and apply the same methodology used to show the convergence of the South to Non-South. Income distributions in the major regions of the Non-South were equivalent in 1969 and the South was uniformly dominated by all other regions. Bishop and Formby (1994) further point out that fundamental changes in the 1970s resulted in the West’s rank dominating the Midwest, which dominated the South, which in turn dominated the Northeast. Thus, while the South’s income distribution was converging to the Non-South, the West, Northeast and Midwest income distributions were significantly diverging from one another (Bishop, Formby and Thistle, 1992a,b).

The fourth dramatic result uncovered using inference-based dominance analysis relates to the effects of tax evasion on the U.S. distribution of income and tax burdens. Bishop, Chow and Formby (1991b) and Bishop, Chow, Formby, and Ho (1993) use the internal revenue service TCMP micro data to analyze the effects of tax evasion on the Lorenz and associated concentration curves of income and tax burdens. Confidential TCMP data consisting of weighted samples of approximately 50,000 tax payers were analyzed for 1979, 1982, and 1985 Bishop, Chow and Formby, 1991b; Bishop, Chow, Formby, and Ho, 1993). According to Bishop, Chow and Formby (1991b); Bishop, Chow, Formby and HO (1993) the results reveal a surprising but consistent
pattern; lower income tax-paying units under report a larger percentage of their incomes than higher income tax-paying units and pay proportionally less tax than required under the Internal Revenue Code (IRC). Stated differently, higher income receiving units have smaller shares of after-tax income and pay larger shares of the income tax burden before the TCMP audits than they do after random audits and compulsory compliance with the IRS (Bishop, Chow and Formby, 1991b; Bishop, Chow, Formby, and Ho, 1993).

The dominance technique is a general method that can be applied to evaluate income inequality, economic efficiency, and changes in the overall level of welfare in an economic system. This methodology has been used by many economists to address a variety of issues related to income, welfare and economics in general. The dominance technique remains one of the widely used methodologies.

2.3.4 An Income-Net Worth Approach

The income - net worth measure is based on the assumption that current income and current net worth are both important determinants, although not the sole determinants, of the economic position of a consumer. An individual’s economic well-being should be thought of as a function of the flow of services over which he or she has command. This flow depends importantly on the consumer’s current income and also on the services received from his or her assets, net of liabilities (Moon, 1977; Weisbrod and Hansen, 1977).

Weisbrod and Hansen used data from the Survey of Financial Characteristics of Consumers (SFCC) and the Current Population Survey (CPS) for 1962 to measure well-being or economic inequality in the United States. The SFCC provides data on families by age of head, income, and net worth; the CPS provides data on family income by age of head, broken down into finer income
classes. As Weisbrod and Hansen pointed out, the income-net worth approach while incomplete as a measure of economic welfare, has a number of useful attributes, the major one being that of merging two separate but obviously related measures of economic status into a unified measure. The most striking result is its impact on the economic position of the aged, who by this measure appear to be considerably better-off than is shown by the current income measure (Weisbrod and Hansen, 1977). This results from the interaction of income, net worth holdings, and life expectancy. The authors suggest that the income-net worth measure may be useful as a basis for redefining tax progressivity, and as explanatory variable in consumption behavior theory.

An empirical study by Moon (1977) also used the income-net worth approach to measure the economic well-being of the aged poor. To derive an empirical approximation of the potential consumption measure, she makes several adjustments to the annual money income indicator of economic status. These adjustments include an imputation for net worth including home equity, the addition of an estimate of the cash value of three in-kind transfers -- medicare, medicaid, and public housing -- the subtraction of an estimate of income and payroll taxes paid and the addition of an estimate of intra-family transfers. Moon then examines how the rankings of several groups of the aged vary with the definition of economic status that she employs. She discovers, for example, that relative to the annual money income measure, her more comprehensive measure of economic status places an even larger proportion of families headed by nonwhites in the bottom part of the distribution of economic well-being. An unexpected finding is that more aged families with workers fall into the bottom part of the distribution when the more comprehensive measure of economic status is used.

Finally, Moon employs her more comprehensive definition of economic well-being to
examine the impact of government programs on the well-being of the aged. Five cash transfer programs are examined: social security, public assistance, government pensions, veterans’ benefits, unemployment insurance, and workmen’s compensation; also included are three in-kind transfer programs (medicare, medicaid, and public housing) and three income tax provisions (the double personal exemption, exclusion of transfer income, and the retirement tax credit). Moon discovered that government pensions, workmen’s compensation, and unemployment benefits do provide substantial benefits to some aged families. Social security and medicare provide almost universal coverage for the aged but are a very inefficient way of helping those at the lower end of both distributions. The study also revealed that the income-conditioned transfers which provide the greatest share of benefits to aged families with the lowest resource level are none-the-less of limited help to this group. On the tax expenditure Moon writes that it is the most inefficient means for directing resources towards the aged poor.

In addition to the above methods of measuring income distribution, there are numerous other ways of measuring inequality. A large number of books and articles have articulated this issue to the point of saturation. What is being questioned is the level of precision of these studies and their methodological approach. The need for the development of a better approach to measure the well-beingness of families has become a hot topic in welfare economics.

2.4 The Contributions of this Research

The empirical results from this research will be used as indicators of economic well-being and will provide a better understanding for formulating public policy. The results are also expected to shed light on the impacts of relative price changes and the impacts of household composition on the patterns of distribution of household consumption expenditures. An examination of inequality
at a desegregated level will reveal that most of the level and trends of the consumption-based measure can be explained by within group movements rather than inequality between groups. This is true for households expenditures classified by commodity components, age, and race. A greater effort will be devoted in summarizing the results and rationalizing the implications.

The theoretical and empirical background included in this study will definitely consolidate and expand the dimension of the literature (knowledge) concerning this topic and the issue of welfare measurement in general. The use of combined time series and cross sectional data may reveal some interesting results in the measurement of the impact of demographic attributes on the distribution of consumption expenditures. This is a major contribution expected from of this research. The empirical results of this study should also enable comparison of the inequality in the distribution of consumption expenditure among the years between 1980 and 1994.
CHAPTER 3: THEORETICAL FRAMEWORK

3.1 Introduction

This chapter addresses the conceptual and methodological framework based on a remarkable convergence that has occurred between economic theory and econometrics over the past decade (Jorgensen et al., 1982). This convergence has taken place between the theory of social choice and econometric modeling of aggregate consumer behavior. The result of this phenomenon has produced a new approach to normative economics. This new approach has been implemented to test and evaluate economic policies, measure poverty and inequality, and assess the standard of living and its cost.

The following sections will be presented in this chapter: In section 3.2 aggregate consumer behavior is derived based on the theory of exact aggregation, following Jorgensen (1980, 1981, 1982, 1984); conclusions and a summary of the theoretical framework are given in section 3.3; section 3.4 presents methods for examining inequality in the distribution of consumption expenditures.

3.2 Aggregate Consumer Behavior

According to Jorgensen et al. (1982), a common problem in modeling consumer behavior and social choice is the representation of individual preferences. Simplification of the aggregate demand function is necessary for econometric modeling of aggregate consumer behavior. The simplest and most familiar approach to this problem is the technique of a representative consumer (Jorgensen et al., 1982). This model is required to justify applications of the theory of individual consumer behavior to aggregate data on prices and quantities consumed. The model is based on the assumption of identical homothetic preferences for all individuals.

Under identical homothetic preferences, aggregate quantities consumed are functions of
aggregate expenditure and prices. The functions exhibit the same properties as demand functions in the theory of individual consumer behavior. The conditions for identical homothetic preferences was weakened by Gorman (1953) to permit displacements from the origin. Gorman showed that a necessary and sufficient condition for aggregate demand functions to depend on aggregate expenditure is that all individuals must have parallel linear Engle curves. This condition has been used many times in modeling aggregate consumer behavior.

In 1975, Muelbauer significantly broadened Gorman’s definition of the concept of a representative consumer and constructed a model of a representative consumer where individual preferences are assumed to be identical, but not necessarily homothetic. Aggregate expenditure shares depend on prices and a function of the distribution of individual expenditures that is not restricted to aggregate expenditures. A model developed by Lau (1977b), however, does not require the concept of a representative consumer. Aggregate demand functions are obtained by exact aggregation over individual demand functions. The model incorporates differences in individual preferences into demand functions through attributes of individuals such as demographic characteristics. Aggregate demand functions depend on the joint distribution of attributes and total expenditure over all consuming units through summary statistics of the distribution. Jorgensen et al., (1982) point out that within the framework provided by Lau (1977b) and Muehlbauer (1975), the assumption of identical homothetic preferences for all individuals appears as a highly oversimplified approach to modeling aggregate consumer behavior. Homothetic preferences are inconsistent with well established empirical regularities in the behavior of individual consumers (Jorgensen and Slesnick, 1984). Besides, identical preferences are inconsistent with empirical findings that expenditure patterns depend on the demographic characteristics of consumers, among
other factors.

This framework to the measurement of welfare inequality is based on the a econometric model of aggregate consumer behavior. The advantage of this approach is that systems of individual demand functions can be obtained from the system of aggregate demand functions. Based on that demand function being integrable, one can recover the indirect utility functions for all consumers. Measures of individual welfare can be defined in terms of these utility functions.

To represent preferences for all individuals in a form suitable for measuring individual welfare, households are taken as a consuming unit. It is assumed that expenditures on individual commodities are allocated so as to maximize a household’s welfare function. As a consequence, the household behaves in the same way as an individual maximizing a utility function, as demonstrated by Samuelson (1956) and Pollak (1981). By assuming that each household maximizes a household welfare function, the focus can be on the distribution of welfare among households rather than the distribution among individuals within households.

To construct an econometric model based on exact aggregation, individual preferences are represented by means of an indirect utility function for each consuming unit, using the following notation (Jorgenson and Slesnick, 1984):

\[ p_n \text{ is the price of the } n^{th} \text{ commodity, assumed to be the same for all consuming units.} \]

\[ p = (p_1, p_2, \ldots, p_N) \text{ is the vector of prices of all commodities,} \]

\[ x_{nk} \text{ is the quantity of the } n^{th} \text{ commodity group consumed by the } k^{th} \text{ consuming unit} \]

\[ (n= 1, 2, \ldots, N; \ k = 1, 2, \ldots, K), \]

\[ M_k = \sum_{n=1}^{N} p_n x_{nk} \text{ to the total expenditure of the } k^{th} \text{ consuming unit} \]

\[ (k = 1, 2, \ldots, K), \]

\[ w_{nk} = p_n x_{nk}/M_k \text{ is the expenditure share of the } n^{th} \text{ commodity group in the budget of the } k^{th} \text{ consuming unit} \]
consuming unit \((n = 1, 2, \ldots, N; k = 1, 2, \ldots, K)\),

\[ w_k = (w_{1k}, w_{2k}, \ldots, w_{Nk}) \]

is the vector of expenditure shares for the \(k\)th consuming unit, \((k = 1, 2, \ldots, K)\),

\[
\ln \frac{\mathbf{p}}{\mathbf{M}_k} = (\ln \frac{p_1}{\mathbf{M}_k}, \ln \frac{p_2}{\mathbf{M}_k}, \ldots, \ln \frac{p_N}{\mathbf{M}_k}), \quad 3.1
\]

is the vector of logarithms of ratios of prices to expenditure by the \(k\)th consuming unit \((k = 1, 2, \ldots, K)\),

\[
\ln \mathbf{p} = (\ln p_1, \ln p_2, \ldots, \ln p_N) \]

is the vector of logarithms of prices, and

\[
\mathbf{A}_k \]

is the vector of attributes of the \(k\)th unit \((k = 1, 2, \ldots, K)\).

It is assumed that the \(k\)th consuming unit allocates expenditures in accord with the transcendental logarithmic or translog indirect utility function, say \(V_k\), where:

\[
\ln V_k = G(\ln \frac{\mathbf{p}^{'}}{\mathbf{M}_k} \alpha_p + \frac{1}{2} \ln \frac{\mathbf{p}^{'}}{\mathbf{M}_k} \beta_{pp} \ln \frac{\mathbf{p}^{'}}{\mathbf{M}_k} \beta_{pA} \mathbf{A}_k, \mathbf{A}_k) \quad 3.2
\]

In this representation, the function \(G\) is a monotone increasing function of the variable:

\[
\ln \frac{\mathbf{p}^{'}}{\mathbf{M}_k} \alpha_p + \frac{1}{2} \ln \frac{\mathbf{p}^{'}}{\mathbf{M}_k} \beta_{pp} \ln \frac{\mathbf{p}^{'}}{\mathbf{M}_k} + \ln \frac{\mathbf{p}^{'}}{\mathbf{M}_k} \beta_{pA} \mathbf{A}_k \quad 3.3
\]

In addition, the function \(G\) depends directly on the attribute vector \(\mathbf{A}_k\). The vector \(\alpha_p\) and the matrices \(\beta_{pp}\) and \(\beta_{pA}\) are constant parameters that are the same for all consuming units.

The expenditure shares of the \(k\)th consuming unit can be derived by the logarithmic form of
Roy's (1943) identity:

\[
w_{nk} = \frac{\partial \ln V_k}{\partial \ln \left(\frac{p_n}{M_k}\right)} \sum_{n=1}^{N} \frac{\partial \ln V_k}{\partial \ln \left(\frac{p_n}{M_k}\right)} (n=1,2,\ldots,N; k=1,2,\ldots,K)
\]  

(3.4)

Applying this identity to translog indirect utility function (3.1), the system of individual expenditure shares is obtained:

\[
w_k = \frac{1}{D_k(p)} \left( \alpha_p + \beta_{pp} \ln \frac{P}{M_k} + \beta_{pA} A_k \right), \quad (k=1,2,\ldots,K)
\]  

(3.5)

Where the denominators \(\{D_k\}\) take the form:

\[
D_k = \frac{i'\alpha_p}{i'\beta_{pp}} + i'\beta_{pA} A_k, \quad (k=1,2,\ldots,K).
\]  

(3.6)

The individual expenditure shares are homogeneous of degree zero in the unknown parameters \(\alpha_p, \beta_{pp}, \beta_{pA}\). By multiplying a given set of these parameters by a constant, another set of parameters that generates the same system of individual budget shares is obtained. Accordingly, we can choose a normalization for the parameters without affecting observed patterns of individual expenditure allocation. The normalization is applied as:

\[
i'\alpha_p = -1
\]

Under this restriction any change in the set of unknown parameters will be reflected in changes in individual expenditure patterns.
The conditions for exact aggregation are that the individual expenditure shares are linear in functions of the attributes \( \{A_k\} \) and total expenditures \( \{M_k\} \) for all consuming units. These conditions will be satisfied if and only if the terms involving the attributes and expenditures do not appear in the denominators of the expressions given above for the individual expenditure shares, so that:

\[
\begin{align*}
  \beta_{pp}^i &= 0 \\
  \beta_{pA} &= 0
\end{align*}
\]  

(3.7)

The exact aggregation restrictions imply that the denominators \( \{D_k\} \) reduce to:

\[
D = -1 + i' \beta_{pp} \ln p
\]  

(3.8)

Where the subscript \( k \) is no longer required, since the denominator is the same for all consuming units. Under these restrictions the individual expenditure shares can be written as:

\[
w_k = \frac{1}{D(p)} (\alpha_p + \beta_{pp} \ln p - \beta_{pp}^i \ln M_k + \beta_{pA} A_k),
\]  

(k=1,2,........, K).

(3.9)

The individual expenditure shares are linear in the logarithms of expenditures \( \{\ln M_k\} \) and in the attributes \( \{A_k\} \), as required for exact aggregation.

Under exact aggregation the indirect utility function for each consuming unit can be represented by the form:
\[
\ln V_k = F(A_k) + \ln p/(\alpha_p + \frac{1}{2} \beta_{pp} \ln p) + \beta_{pA} A_k - D(p) \ln M_k, \\
(k = 1, 2, \ldots, K).
\] (3.10)

In this representation the indirect utility function is linear in the logarithm of total expenditures (\(\ln M_k\)) with a coefficient that depends on the prices \(p(k=1, 2, \ldots, K)\). This property is invariant with respect to positive affine transformations, but is not preserved by arbitrary monotone increasing transformations. It is concluded that the indirect utility function (3.10) provides a cardinal measure of utility for each consuming unit.

To provide a basis for evaluating the impact of transfers among households on social welfare, it is useful to represent household preferences by means of a utility function that is the same for all accounting units. For this purpose, it is assumed that the \(k^{th}\) consuming unit maximizes its utility, say \(U_k\), where:

\[
U_k = U[\frac{x_{1k}}{m_1(A_k)}, \frac{x_{2k}}{m_2(A_k)}, \ldots, \frac{x_{Nk}}{m_N(A_k)}], \\
(k = 1, 2, \ldots, K),
\] (3.11)

subject to the budget constraint

\[
M_k = \sum_{n=1}^{N} p_n x_{nk}, \\
(k = 1, 2, \ldots, K),
\] (3.12)

In this representation of consumer preferences, the quantities \(\{x_{nk}/m_n(A_k)\}\) can be regarded as effective quantities consumed, as proposed by Barten (1964). The crucial assumption embodied in this representation is that differences in preferences among consumers enter the utility function \(U\)
only through differences in the commodity specific household equivalence scales \( \{ m_k(A_k) \} \).

Consumer equilibrium implies the existence of an indirect utility function, say \( V \), that is the same for all consuming units. The level of utility for the \( k \)th consuming unit, say \( V_k \), depends on the prices of individual commodities, the household equivalence scales, and the level of total expenditure:

\[
V_k = V\left[ \frac{p_1 m_1(A_k)}{M_k}, \frac{p_2 m_2(A_k)}{M_k}, \ldots, \frac{p_N m_N(A_k)}{M_k} \right],
\]

\((k=1, 2, \ldots, K). \tag{3.13}\)

In this representation the prices \( \{ p_n m_n(A_k) \} \) can be regarded as effective prices. Differences in preferences among consuming units enter this indirect utility function only through the household equivalence scales \( \{ m_n(A_k) \} \) \((k=1, 2, \ldots, K)\).

To represent the translog indirect utility function (3.2) in terms of household equivalence scales, Jorgenson and Slesnick (1984) used some additional notations:

\( \ln p m(A_k)/M_k \) is the vector of logarithms of ratios of effective prices \( \{ p_n m_n(A_k) \} \) to total expenditure \( M_k \) of the \( k \)th consuming unit \((k=1, 2, \ldots, K)\), and

\( \ln m(A_k) = (\ln m_1(A_k), \ln m_2(A_k), \ldots, \ln m_N(A_k)) \) is the vector of logarithms of the household equivalence scales of the \( k \)th consuming unit \((k=1, 2, \ldots, K)\).

It is assumed, as before, that the \( k \)th consuming unit allocates its expenditures in accord with the translog indirect utility function (3.2). However, it is assumed that this function, expressed in terms of the effective prices \( \{ p_n m_n(A_k) \} \) and total expenditures \( M_k \), is the same for all consuming units. The indirect utility function takes the form:
\[
\ln V_k = \left[ \ln \frac{pm(A_k)\alpha_p}{M_k} + \frac{1}{2} \ln \frac{pm(A_k)\beta_{pp}}{M_k} \ln \frac{pm(A_k)}{m_k} \right], \\
(k=1,2,\ldots,K).
\] (3.14)

Taking logarithms of the effective prices \(\{p_n m_n(A_k)\}\), the indirect utility function (3.14) can be rewritten in the form:

\[
\ln V_k = \ln m(A_k)\alpha_p + \frac{1}{2} \ln m(A_k)\beta_{pp} \ln m(A_k) + \ln \frac{p'_{M_k}}{\alpha_p}
+ \frac{1}{2} \ln \frac{p'_{M_k}}{m_k} \beta_{pp} \ln m(A_k), \\
(k=1,2,\ldots,K).
\] (3.15)

Comparing the representation (3.10) with the representation (3.15), we can see that the term involving only the household equivalent scales must take the form:

\[
F(A_k) = \ln m(A_k)\alpha_p + \frac{1}{2} \ln m(A_k)\beta_{pp} \ln m(A_k), \\
(k=1,2,\ldots,K)
\] (3.16)

Second, the term involving ratios of prices to total expenditure and the household equivalence scales must satisfy:

\[
\ln \frac{p'_{M_k}}{M_k} \beta_{pp} A_k = \ln \frac{p'_{M_k}}{M_k} \beta_{pp} m(A_k), \\
(k=1,2,\ldots,K)
\] (3.17)

for all prices and total expenditure.

The household equivalence scales \(\{m_n(A_k)\}\) defined by (3.17) must satisfy the equation:

\[
\beta_{pp} A_k = \beta_{pp} m(A_k), \\
(k=1,2,\ldots,K)
\] (3.18)
Under monotonicity of the individual expenditures shares the matrix $\beta_{pp}$ has an inverse, so that we can express the household equivalence scales in terms of the parameters of the translog indirect utility function, $\beta_{pp}$, $\beta_{pa}$, and the attributes $\{A_k\}$:

$$\ln m(A_k) = \beta_{pp}^{-1}\beta_{pa}A_k, \quad (k=1,2,\ldots, K). \quad (3.19)$$

These scales are referred to as the commodity specific translog household equivalence scales.

Substituting the commodity specific equivalence scales (3.18) into the indirect utility function (3.15) a representation of the indirect utility function can be obtained in terms of the attributes $\{A_k\}$:

$$\ln V_k = A_k\beta_{pa}'\beta_{pp}^{-1}\alpha_p + \frac{1}{2}A_k\beta_{pa}'\beta_{pp}^{-1}\beta_{pa}A_k + \ln p'(\alpha_p) + \frac{1}{2}\beta_{pp}\ln p + \beta_{pa}A_k - D(p)\ln M_k, \quad (k=1,2,\ldots, K). \quad (3.20)$$

This form of the translog indirect utility function is equivalent to the form (3.2) in that both generate the same system of individual demand functions. By requiring that the attributes $A_k$ enter only through the commodity specific household equivalence scales, the Jorgenson and Slesnick (1984) provided a specific form for the function $F(A_k)$ in (3.10).

Given the indirect utility function (3.20) for each consuming unit, total expenditures can be expressed as a function of prices, consumer attributes, and the level of utility:

$$\ln M_k = \frac{1}{D(p)}[A_k\beta_{pa}'\beta_{pp}^{-1}\alpha_p + \frac{1}{2}A_k\beta_{pa}'\beta_{pp}^{-1}\beta_{pa}A_k + \ln p'(\alpha_p) + \frac{1}{2}\beta_{pp}\ln p + \beta_{pa}A_k - \ln V_k], \quad (k=1,2,\ldots, K). \quad (3.21)$$
We can refer to this function as the translog expenditure function. The translog expenditure function gives the minimum expenditures required for the $k^{th}$ consuming unit to achieve the utility level $V_k$, given prices $p$ ($k=1,2,\ldots, K$).

Jorgenson and Slesnick (1984) also introduced household equivalence scales that are not specific to a given commodity. Equivalent scale is an index which deflates family income by a score that may be less than one for each extra member. Equivalent income for household equals observed income divided by the equivalence scale value for household of its type. Following Muellbauer (1974a), they defined a general household equivalence scale, say $m_0$, as follows:

$$m_0 = \frac{M_k[p m(A_k), V_k^0]}{M_0(p, V_k^0)}, \quad (k=1,2,\ldots, K) \quad (3.22)$$

Where $M_k$ is the expenditure function for the $k^{th}$ household, $M_0$ is the expenditure function for a reference household with commodity specific equivalence scales equal to unity for all commodities, and $p m (A_k)$ is a vector of effective prices $\{p_n m_n(A_k)\}$.

The general household equivalence scale $m_0$ is the ratio between total expenditures required by the $k^{th}$ household and by the reference household for the same level of utility, $V_k^0$ ($k=1,2,\ldots, K$). This scale can be interpreted as the number of household equivalence members. The number of members depends on the attributes $A_k$ of the consuming unit and on the prices $p$.

If each household has a translog indirect utility function, then the general household equivalence scale for the $k^{th}$ household takes the form:
\[
\ln m_0 = \ln M_k - M_0
\]
\[
\frac{1}{D(p)} \left[ \ln (A_k)^{\alpha_p} + \frac{1}{2} \ln (A_k)^{\beta_{pp}} \ln (A_k) + \ln (A_k)^{\gamma} \right]
\]
\[(k=1,2,\ldots, K).\]

We can refer to this scale as the general translog household equivalence scale. Given this general translog equivalence scale, the indirect utility function can be rewritten as:

\[
\ln V_k = \ln p^{\alpha_p} + \frac{1}{2} \beta_{pp} \ln p - D(p) \ln [M_k/m_0(p, A_k)],
\]
\[(k=1,2,\ldots, K).\]

The level of utility for the \(k^{th}\) consuming unit depends on prices \(p\) and total expenditure per household equivalent member \(M_k/m_0(p, A_k)\). Also, the expenditure function can be rewritten as:

\[
\ln M_k = \frac{1}{D(p)} \left[ \ln p^{\alpha_p} + \frac{1}{2} \beta_{pp} \ln p - \ln V_k \right]
\]
\[+ \ln m_0(p, A_k),
\]
\[(k = 1,2,\ldots, K).\]

To construct an econometric model of aggregate consumer behavior based on exact aggregation, we obtain aggregate expenditure shares, say \(w\), by multiplying individual expenditure shares (3.9) by expenditures for each consuming unit, adding over all consuming units, and dividing by aggregate expenditure, \(M = \sum_{k=1}^{K} M_k\):

\[
w = \frac{\sum M_k w_k}{M}
\]
[(3.26)\]
The aggregate expenditure shares can be expressed as:

\[ w = \frac{1}{D(p)} \left( \alpha_p + \beta_{pp} \ln p - \beta_{pp} \sum \frac{M_k \ln M_k}{M} + \beta_{pA} \sum \frac{M_k A_k}{M} \right), \] (3.27)

The aggregate expenditure patterns depend on the distribution of expenditures over all consumer units through summary statistics of the joint distribution of expenditures and attributes. Systems of individual expenditure shares (3.9) for consuming units with identical demographic characteristics can be recovered in one only one way from the system of aggregate expenditure share (3.23).

In estimating systems of demand equations many models have been proposed, but perhaps the most important apart from the translog model, are the linear expenditure system, the Rotterdam model and the Almost Ideal Demand System (AIDS). The AIDS is comparable to the Rotterdam and translog models and it has considerable advantages over both. The AIDS gives an arbitrary first-order approximation to any demand system; it satisfies the axiom of choice exactly; it aggregates perfectly over consumers without invoking parallel linear Engel curves; it has a functional form which is consistent with known household budget data; it is simple to estimate, largely avoiding the need for non-linear estimation; and it can be used to test the restrictions of homogeneity and symmetry through linear restrictions on fixed parameters (Deaton and Muellbauer, 1980). Many of these properties are possessed by one or other of the Rotterdam or translog models, neither possesses all of them simultaneously.

3.3 Summary of Theoretical Considerations

In this section a model of aggregate consumer behavior based on transcendental logarithmic indirect utility functions for all consuming units is presented. These indirect utility functions
incorporate restrictions on individual behavior that result from maximization of utility functions subject to budget constraints. Each individual consuming unit has an indirect utility function that is homogeneous of degree zero in prices and expenditures, non-increasing in prices and non-decreasing in expenditures. To include differences in individual preferences in the model of aggregate consumer behavior, we allow the indirect utility functions for all consuming units to depend on attributes, such as demographic characteristics, that vary among individual households.

Given a translog indirect utility function for each consuming unit, we derive the expenditure shares for that unit by using Roy’s identity. This results in expenditure shares that can be expressed as ratios of two functions that are linear in the logarithms of ratios of prices for all commodities to total expenditure and attributes. The denominators of these ratios are functions that are the same for all commodity groups. Under exact aggregation the individual expenditure shares are linear in functions of attributes and total expenditures, so that the denominators are independent of total expenditures and attributes and are the same for all individuals.

Under the exact aggregation condition, the translog indirect utility function is additive in functions of the attributes and the total expenditures of the individual consuming unit and provides a cardinal measure of individual welfare as well as an ordinal measure. Based on the indirect utility function for each unit, we can explicitly solve for the expenditure function, giving the minimum expenditures required to achieve the stipulated level of the individual welfare for given prices.

The expenditure function and indirect utility function can be employed in examining the impacts of alternative economic policies on the welfare of the individual consuming unit. In fact, the concept of equivalent and compensating variations in expenditures can be empirically tested. The equivalent variation gives the additional or reduction in expenditures required to achieve the level of utility after
the change in policy. The compensating variation gives the additional or reduction in expenditures to achieve the level of utility before the change in policy, i.e., that which would exist if the change actually taken place.

To derive aggregate expenditure shares, we multiply the individual expenditure shares by total expenditures for each consuming unit, sum over all consuming units, and divide by aggregate expenditure. The aggregate expenditure shares, can be expressed as ratios of two functions. The denominators are the same as for individual expenditure shares. The numerators are linear in the logarithms of prices, in a statistic of the distribution of expenditures over all consuming units \( \sum M_k \ln M_k \), and in the shares of all demographic groups in aggregate expenditures.

The individual expenditure shares are homogeneous of degree zero in prices and expenditures. Given the restrictions implied by exact aggregation, this implies an additional \( N - 1 \) restrictions on the parameters of the trans indirect utility functions, where \( N \) is the number of commodities. Second, the sum of individual expenditure shares over all commodity groups is equal to unity. Given the exact aggregation restrictions, there are \( N \) additional restrictions implied by summability. Third, the matrix of compensated own- and cross-price effects must be symmetric. The implication of this is that there are \( \frac{1}{2} (N - 1) \) restrictions on the parameters of the translog indirect utility functions.

Monotonicity of the indirect utility functions implies that the individual expenditure shares must be non-negative. The indirect utility function is quasi convex, which implies that the individual expenditure shares must be monotonic, or equivalently, that the matrix of compensated own- and cross-price substitution effects must be non-positive definite. It is always possible to choose prices so that monotonicity of the indirect utility functions or non-negativity of the individual expenditure shares is violated. Accordingly, we consider restrictions that imply monotonicity of the expenditure
3.4 Inequality in the Distribution of Household Consumption Expenditure

Economic well-being can be defined in terms of the capability individuals or households have for potential consumption. Official income statistics are produced to reflect the consumption ability of individuals and families, with money income used to proxy this consumption potential most frequently. Garner (1993) pointed out that consumption may be a better measure of the actual economic welfare of a household than its current income. The value of consumption sometimes can be greater than annually reported income to the extent that households have accumulated savings or accounting losses from a business (Sawhill, 1988; Garner, 1993), or that they are able to borrow against future income. Thus, it may be safe to assume that consumption reflects material well-being in terms of past, current, and expected future income, not just current income. How a household budgets its income across different consumption groups can reflect the overall economic well-being of households differently. Measuring the impact of marginal changes in different expenditures on the inequality of total expenditures can provide important information, particularly for policy makers.

The inequality in the distribution of household consumption can be measured using the Gini Coefficient. One of the most commonly calculated inequality statistics is the Gini Coefficient, which is illustrated in figure 3.1. It is equal to the ratio of the area enclosed by the Lorenz curve and the diagonal line of perfect equality to the total area below the diagonal.

\[
G = \frac{X}{X+Y} \quad (3.28)
\]

Although the standard Gini lacks the flexibility to yield estimates that vary with individual’ aversion shares wherever they are non-negative.
to inequality (Atkinson, 1970), several authors including Kakwani (1980), Yitzhaki (1983), and Donaldson and Weymark (1983) have developed versions of the extended Gini, a family of Ginis that depend on social welfare functions in a manner resembling the Atkinson index. More recently, Lerman and Yitzhaki (1984) derived a method for decomposing the Gini by income source and for calculating the marginal effects on inequality from alternative sources.

In spite of the advantages of the Gini index and the existence of many derivations of the Gini, calculating the Gini has remained a cumbersome process (Lerman and Yitzhaki, 1984). On this same subject Deaton (1982) noted that it is considerably easier to calculate the Theil information index than the Gini index. Lerman and Yitzhaki (1984) pointed out that this inconvenience in calculation along with the ease in working with such variance measures as the coefficient of variation and the log of the variance, have probably contributed to the frequent substitution of other measures for the Gini.

One formula for the absolute Gini as derived by Lerman and Yitzhaki (1983), is

\[ A = \int_{a}^{b} \left[ F(y) - F^{-1}(y) \right] dy \]  

(3.29)

where \( A \) is half of Gini’s expected mean difference, \( a \) is the lowest and \( b \) is the highest value of the variable \( y \), and \( F(y) \) is the commutative distribution of \( y \). Using integration by part, with \( u = F(y)[1-F(y)] \) and \( v = y \), we obtain

\[ A = 2 \int_{a}^{b} y[F(y) - \frac{1}{2}f(y)]dy \]  

(3.30)
Figure 3.1: Gini Coefficient

By transformation of variables, defining \( y(F) \) as the inverse function of \( F(y) \), we obtain

Note that \( F \) is uniformly distributed between \([0,1]\) so that its mean is \( \frac{1}{2} \). This means that equation (3.31) can be written as:

\[
A = 2 \int_0^1 y(F)(F - \frac{1}{2})dF
\]  

(3.31)
Dividing by the mean of $y$ yields the relative Gini. Stuart (1954) recognized the relationship between the absolute Gini and the covariance, but his interest was in the correlation coefficient.

Given equation (3.32), it becomes relatively simple to calculate the Gini. First, obtain the rank ($R$) for each observation $i$, Next, calculate the covariance between $R$ and $y$. Since $R/n$ terms are the empirical representation of $F(y)$, one must divide the covariance by $n$. Divide the covariance by mean $y$, multiply by 2 and voila, we have the Gini of $y$. Note that unlike standard approaches for calculating the Gini, this method requires no grouping of individual data to economize on computations. Thus, the method is not only easier, but also more accurate than standard methods.

A simple transformation of equation (3.32) shows the relationship between the Gini and the standard regression coefficients. This relationship is convenient for the purpose of interpretation as well as calculation. A regression of $y$ on $R/n$ yields the slope coefficient,

$$B = \frac{\text{cov}(y, \frac{R}{n})}{\text{var}(\frac{R}{n})}$$  \hspace{1cm} (3.33)

The variance of $R/n$ is a constant equal to $(1/12)(n+1)/n$, which for large samples of converges to $1/12$. Thus, the absolute Gini is essentially a constant times the regression coefficient. Using the regression coefficient yields a general graphical interpretation of the Gini.

In another step, Yitzhaki (1983) showed how to extend the Gini to resemble the sensitive property of the Atkinson index. Atkinson developed an index of income inequality that is sensitive to
judgements about how much one values reducing income inequality. As Lerman and Yitzhaki (1984) put it, the formula for the extended Gini is:

\[
G(v) = 1 - v(v - 1) \int_{0}^{1} (1 - F)^{v-2} \phi(F) dF, \quad v > 1
\]

Where \( G(v) \) is the relative extended Gini, \( \phi(F) \) is the Lorenz curve, and \( v \) is a parameter that reflects a preference for inequality. Aversion to inequality rises as \( v \) goes from zero to infinity. From 0 to 1, the index represents a preference for inequality. The index becomes the standard Gini at \( v=2 \), and implies indifference to inequality at \( v=1 \).

As in the case of the conventional Gini, the extended Gini also turns out to be a function of the covariance. Specifically, the Gini at a value \( v \) may be written as:

\[
G(v) = -\frac{v \text{ cov}[y,(1 - F)^{v-1}]}{m_y}
\]

where \( m \) is the mean of \( y \). In addition, Lerman and Yitzhaki (1984) proposed a way of calculating marginal contributions to inequality from the various elements.

Let \( y = x, k = 1, 2, ..., K, m_k \) and \( F_k() \) be equal to the mean and the cumulative distribution of \( x_k \), and \( m_y \) and \( F_y \) be the mean and cumulative distribution of \( y \), then the overall Gini can be expressed as Lerman and Yitzhaki, (1983):

\[
G(v) = \sum_{k=1}^{K} \frac{\text{ cov}[x_k,(1 - F_k)^{v-1}] - v \text{ cov}[x_k,(1 - F_k)^{v-1}] m_k}{\text{ cov}[x_k,(1 - F_k)^{v-1}] m_k} m_y
\]
Where \( C_k \) is the Gini correlation between element \( k \) and the rank of total \( y \), \( G_k \) is the Gini element \( k \), and \( S_k \) is the mean of \( x \) divided by the mean of \( y \) (or \( x \)'s share of \( y \)). The Gini correlation has properties that are similar to Pearson’s and the rank correlation. Lerman and Yitzhaki (1983) pointed out that Pearson correlation and Gini correlation between component \( x \) and the rank of \( y \) have the same numerators, but the Pearson numerator correlation deflates the \( \text{cov}(x_k, R_y) \) by a constant (equal to the standard deviation of the rank of \( x_k \)) while the Gini correlation uses the Gini of \( x_k \) as denominator. The result yields a convenient interpretation in the case of the standard Gini (\( v = 2 \)), where \( G_k \) may be represented by the ratio of the slope coefficient from the regression of \( x_k \) and \( R_y \), the slope coefficient from the regression of \( x_k \) and \( R_y \), according to Lerman and Yitzhaki.

The key rationale for studying decomposition by source is to learn how changes in particular income sources will affect overall income inequality. The theoretical framework explained in this section extends derivations reported by Kakwani (1977) and Shorrocks (1982) in which a given source’s contribution is the product of the share of total income and a term called the pseudo-Gini. The pseudo-Gini appears as the product of the source itself and the correlation between the source and the rank of total income (Lerman and Yitzhaki, 1984). It also has been shown that a similar result holds for the extended Gini, a measure that is like the Atkinson (1970) index in permitting alternative weights in different parts of income distributions (Lerman and Yitzhaki, 1984).
CHAPTER 4: DATA AND DATA ORGANIZATION

4.1 Introduction

This chapter discusses the source, organization and transformation of data. It is divided into three additional sections. The source of the data and the method in which the data are collected are presented in section 4.2. Section 4.3 discusses how the data are downloaded from one form of storage to another form of storage using the Job Control (JCL) and Statistical Analysis System Languages (SAS), including the creation of the SAS data set. The transformation of the cross sectional data downloaded from the external medium of storage to panel data is presented in section 4.4.

4.2 Source of Data

The key ingredient to the evaluation of consumption-based inequality is a disaggregated data set on consumer expenditures. In the United States, the only source of such data is the consumer expenditure surveys. The Census Bureau conducts this survey on behalf of the Bureau of Labor Statistics. The consumer expenditure data are collected from a national probability sample of households designed to represent the total civilian noninstitutional population and a portion of institutional population living in selected types of group quarters. Housing units occupied by students are also surveyed. The interview sample, selected on a rotating panel basis, is targeted at 5000 consumer units per quarter. Each quarter one-fifth of the sample is new to the survey. After being interviewed for five consecutive quarters, a panel is dropped from the survey. The fifth quarter overlaps with the first quarter of the next year.

The rotating sample design of the interview survey has an effect on the structure of the data files and the use of the data itself. This is described by the Bureau as a distinction between calendar period and collection period. Respondents are asked to report expenditures made since the first of the month
three months prior to the interview month. For example, if the Consumer Unit is interviewed in January of 1991, they are reporting expenditures for October, November, and December of 1990. The period between October 1 and December 31 is referred as the reference period for the interview. Files on the public use tapes are organized and identified by collection period, and the actual period of expenditure is not reflected.

The data upon which this study is based are drawn from the 1980 through 1994 Interview Surveys which include consumer characteristics and expenditures. The consumer characteristics or family characteristics data pertain to age, sex, race, marital status, education, and consumer unit relationship for each member. The expenditure file, which is referred as ‘Detailed Expenditure’, provides expenditure data at the most detailed level available. The mechanics of downloading the above two files and the creation of the SAS data set are presented in the next section.

4.3 Data Organization and Manipulation

Two files, consumer characteristics and expenditure files, were downloaded from a reel tape obtained from the BLS, to cartridge tapes by quarter using job control computer language (JCL). A permanent SAS data set was created by merging the two files, the consumer characteristics and expenditures by the unique consumer identification number assigned to each household. Appendix P-1 illustrates the JCL and SAS programs used to download and merge files, including that for creating a permanent SAS data set.

As stated in section 4.2, one problem with the structure is that the reference and collection periods of the data are different. The collection period is not consistent with the true price of the commodity for which the expenditure is made. The questions are written in such a way to ask the respondent how much she/he spent on a particular commodity in the last three months. Since this study
uses prices and price data are collected by month, it is important to make the date in which the expenditure was made consistent with price on the actual date of purchase. To do that we divided each quarter by three and back dated to the month of purchase. Once the data is disaggregated by month, the next task is to merge the data set with the data set for prices. Data for the prices of the commodities used in this study are obtained from BLS database using the internet access. All prices are reported as indexes. Appendix P-1 through appendix P9 show the SAS programs used to accomplish the above computing.

4.4 The Transformation of Time-Series-Cross Section Data to Panel Data

The transformation of cross section data to panel data is based on the theoretical framework described in chapter 3. The Consumer Expenditure Survey is not a panel; the same individual households are not followed through long period of time. Participation of a household is limited to only five quarters after adjustments. However, the survey is a continuous operation so that it provides a random sample of the population each quarter (subject to the exclusion and inclusion of certain households every quarter). Our data represents the period between 1980 and 1994. Hence, although we cannot track individual households, we can track groups of households. In particular, if we take age as age of the household head, we can look at the average behavior of, say, those 25 years old in 1980, 26 years old in 1981, etc. Given the linear in parameter functional forms, mean cohort behavior reproduces the form of individual behavior and the cohorts can thus effectively be treated as individuals. If the price of lifetime utility is constant for all members of the cohort from one year to the next, then its mean is constant for the cohort as a whole. Hence, the sample mean from the survey will be a consistent estimator of the same quantity from year to year, with a precision determined by the sample design (Deaton, 1985). Based on the conclusion made by Deaton (1985), the cohorts means can
be treated as panel data. Table 4.1 illustrates the number of households in each cohort in each year.

<table>
<thead>
<tr>
<th>Year</th>
<th>Age</th>
<th>Age</th>
<th>Age</th>
<th>Age</th>
<th>Age</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>16-25</td>
<td>25-34</td>
<td>35-44</td>
<td>45-54</td>
<td>55-64</td>
<td>&gt; 64</td>
</tr>
</tbody>
</table>

In practice, one year cohorts yield samples that are too small to give accurate estimates of the sample mean. Consequently, we use a ten-year age band. Deaton (1985) pointed out that in constructing cohort samples there is a trade off between cohort size and the number of cohort means. Smaller cohort size implies less precise sample means so the essential trade off is between the number of observations and the accuracy of each.
CHAPTER 5: Econometric Model and Estimation Results

5.1 Introduction

This chapter has three sections. Section 5.2 presents the econometric model and its implementation to estimate the impact of demographic characteristics on individual household expenditure patterns. The results of the empirical estimations are illustrated and discussed in section 5.3. Section 5.4 presents the summary and conclusions.

5.2 Econometric Model

The general econometric model to measure the impact of prices and demographic characteristics on the expenditure pattern of household units is specified as:

$$ Y_{it} = \alpha + \beta X_{it} + \epsilon_{it} $$  \hspace{2cm} (5.1)

Where \( Y \) is the a vector of expenditure shares used as dependent variables. The expenditures are divided among eight commodity groups. \( X \) represents a vector of independent variables, a nonrandom function of prices, expenditure and demographic characteristics. \( \epsilon \) is an unobserved random disturbance that is functionally independent of the explanatory variables. The disturbance may result from errors in implementation, random elements in the determination of consumer preferences not reflected in the list of attributes of consuming units, errors in measurements of individual expenditure shares, specification error, or errors in the design and collection of data. We assume that the individual disturbances have an expected value equal to zero. Since the individual expenditure shares for all commodities sum to unity for each consuming unit in each time period, the unobservable random disturbances for all commodities sum to zero. These disturbances are distributed normally with mean zero and covariance matrix \( \Omega_{\epsilon} \). We also assume that the covariance matrix of the individual
disturbances has the rank equal to N - 1, where N is the number of commodities. Finally, we assume that disturbances corresponding to distinct observations are uncorrelated. The above model is specified for eight commodity groups in which eight equations are specified and only seven equations are required for a complete model. Since the equations for the budget shares are generated from the indirect translog utility function, the parameters satisfy equality and symmetry restrictions that are strictly analogous to the corresponding restrictions the direct translog utility function.

5.2.1 Dependent Variable Descriptions

There are seven dependent variables one for each equation. As stated in chapter three, these expenditure shares are derived by the logarithmic form of Roy’s identity. Table 5.1 gives descriptions of the dependent variables which are the budget shares.

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOOD_SHARE</td>
<td>SHARE OF EXPENDITURE ON FOOD AND BEVERAGES.</td>
</tr>
<tr>
<td>HOUSING_SHARE</td>
<td>AGGREGATED EXPENDITURE SHARE ON HOUSING.</td>
</tr>
<tr>
<td>APPAREL_SHARE</td>
<td>EXPENDITURE SHARE ON APPAREL.</td>
</tr>
<tr>
<td>ENTER_SHARE</td>
<td>EXPENDITURE SHARE ON ALL FORMS OF ENTERTAINMENT.</td>
</tr>
<tr>
<td>HEALTH_SHARE</td>
<td>EXPENDITURE SHARE ON HEALTH.</td>
</tr>
<tr>
<td>TRANS_SHARE</td>
<td>EXPENDITURE SHARE ON TRANSPORTATION.</td>
</tr>
<tr>
<td>UTILITY_SHARE</td>
<td>EXPENDITURE SHARE ON UTILITY</td>
</tr>
</tbody>
</table>

5.2.2 Independent Variables

There are twenty five independent variables of which 17 are dummy variables. We have four categories of demographic characteristics: age of head of the household, family size, geographic region of residence, and race. The logarithms of price indexes for each commodity group along with the logarithms of total expenditure for each commodity group are also defined as explanatory variables.
Tables 5.2 and 5.3 illustrate the description of the independent variables used in the econometric model.

### Table 5.2: Explanatory Variables

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>VARIABLE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENTER_PRICE</td>
<td>PRICE INDEX FOR ENTERTAINMENT</td>
</tr>
<tr>
<td>UTILITY_PRICE</td>
<td>PRICE INDEX FOR ENERGY.</td>
</tr>
<tr>
<td>FOOD_PRICE</td>
<td>PRICE INDEX FOR FOOD AND BEVERAGES.</td>
</tr>
<tr>
<td>HOUSING_PRICE</td>
<td>PRICE INDEX FOR HOUSING.</td>
</tr>
<tr>
<td>HEALTH_PRICE</td>
<td>PRICE INDEX FOR HEALTH.</td>
</tr>
<tr>
<td>TRANS_PRICE</td>
<td>PRICE INDEX FOR TRANSPORTATION.</td>
</tr>
<tr>
<td>APPAREL_PRICE</td>
<td>PRICE INDEX FOR APPAREL</td>
</tr>
<tr>
<td>TOTAL_EXPENSE</td>
<td>TOTAL EXPENDITURE OF A HOUSEHOLD UNIT.</td>
</tr>
</tbody>
</table>

5.3 Estimation and Empirical Results

The translog model of individual expenditures described in chapter 3 can be presented in the form:

\[
    w_{it} = \alpha_p + \beta_{pp} \ln p_{it} - \beta_{pp} \ln M_{it} + B_{it} A_{it} + \epsilon_{it}
\]  

(5.2)

Where \( w_{it} \) is the observed budget share at time \( t \), \( M_{it} \) is the observed expenditure for the \( i \)th consuming unit at time \( t \), \( \ln p_{it} \) is the vector of logarithms of prices at time \( t \), and \( A_{it} \) is the vector of attributes of the \( i \)th consuming unit at time \( t \). We have seven commodity groups and we estimate six equations because of the symmetry restrictions we imposed on the system of equations. We employ time series - cross sectional data on household expenditure patterns for the years 1980 through 1994. By imposing the symmetry restriction, the system of equations defined above were estimated using the seemingly unrelated regression method (SUR). Seemingly unrelated regression may improve the efficiency of parameter estimates when there is contemporaneous correlation of errors across equations. In practice,
a contemporaneous correlation matrix is estimated using OLS residuals and the final parameter estimates take this information into account. Under two sets of circumstances, SUR parameter estimates are the same as those produced by OLS: when there is no contemporaneous correlation of errors across equations where $\Omega$ is diagonal, or where independent variables are the same across equations. Theoretically, SUR parameters will always be at least as efficient as OLS in large samples, provided that the equations are correctly specified. The consequences of specification error are more serious with SUR than with OLS.

Table 5.3: Explanatory Dummy Variables

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>DUMMY VARIABLE DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>A1  = 1 IF AGE IS 16 - 24, OTHERWISE A1 = 0. (Omitted)</td>
</tr>
<tr>
<td>A2</td>
<td>A2  = 1 IF AGE IS 25 - 34, OTHERWISE A2 = 0.</td>
</tr>
<tr>
<td>A3</td>
<td>A3  = 1 IF AGE IS 35 - 44, OTHERWISE A3 = 0.</td>
</tr>
<tr>
<td>A4</td>
<td>A4  = 1 IF AGE IS 45 - 54, OTHERWISE A4 = 0.</td>
</tr>
<tr>
<td>A5</td>
<td>A5  = 1 IF AGE IS 55 - 64, OTHERWISE A5 = 0.</td>
</tr>
<tr>
<td>A6</td>
<td>A6  = 1 IF AGE IS GREATER OR EQUAL TO 65, OTHERWISE A6 = 0.</td>
</tr>
<tr>
<td>F1</td>
<td>F1  = 1 IF FAMILY SIZE EQUALS 1, ELSE F1 = 0. (Omitted)</td>
</tr>
<tr>
<td>F2</td>
<td>F2  = 1 IF FAMILY SIZE EQUALS 2, ELSE F2 = 0.</td>
</tr>
<tr>
<td>F3</td>
<td>F3  = 1 IF FAMILY SIZE EQUALS 3, ELSE F3 = 0.</td>
</tr>
<tr>
<td>F4</td>
<td>F4  = 1 IF FAMILY SIZE EQUALS 4, ELSE F4 = 0.</td>
</tr>
<tr>
<td>F5</td>
<td>F5  = 1 IF FAMILY SIZE EQUALS OR GREATER THAN 5, ELSE F5 = 0.</td>
</tr>
<tr>
<td>NE</td>
<td>NE  = 1 IF RESIDENCE IS IN NORTHEAST, ELSE NE = 0. (Omitted)</td>
</tr>
<tr>
<td>WE</td>
<td>WE  = 1 IF RESIDENCE IS IN THE WEST, ELSE WE = 0.</td>
</tr>
<tr>
<td>MW</td>
<td>MW  = 1 IF RESIDENCE IS IN THE MIDWEST, ELSE MW = 0.</td>
</tr>
<tr>
<td>SO</td>
<td>SO  = 1 IF RESIDENCE IS IN THE SOUTH, ELSE SO = 0.</td>
</tr>
<tr>
<td>W</td>
<td>W   = 1 IF RACE IS WHITE, OTHERWISE W = 0. (Omitted)</td>
</tr>
<tr>
<td>B</td>
<td>B   = 1 IF RACE IS BLACK, OTHERWISE B = 0.</td>
</tr>
</tbody>
</table>
Economic theory requires that the individual expenditure shares be homogeneous of degree zero in prices and total expenditures, the sum of the individual expenditure shares over all commodity groups, be equal to unity, the matrix of compensated own and cross-price substitution effects be symmetric, and the individual expenditure shares be non-negative. The translog model with the above conditions imposed is estimated using the Zellner Regression Method and the results are illustrated in tables 5.5 - 5.11. To avoid the problem of perfect multicollinearity, one dummy variable from each category is omitted. The significant variables are shaded in the tables and the degree of significance is indicated by asterisks in the last column of each table.

5.3.1 Food and Beverages

Prices play an important role in the allocation of budget share for the consumption of food and beverages. The coefficient for FOOD_PRICE, price for food and beverages indicates that as price increases by one unit, the level of expenditure share for food and beverages increases by 0.075 (see table 5.4) indicating inelastic demand. Other prices such as the prices of health care and housing have negative effect indicating substitutability in the distribution of share of expenditures. The coefficient for apparel is 99% significant with a positive sign. Households tend to allocate less for food as the amount of their total expenditure rises. The coefficient for the prices of entertainment, utility, and transportation are not statistically significant.

As indicated by the coefficient for A2, the food expenditure share for the head of the household age 25-35 is less by 0.005597 compared with the expenditure share for a household headed by an individual aged 16-24 (Table 5.4). This difference may be attributed to the difference in life styles between these two age groups. The individual aged 16-24 may be spending more money on food and beverages away from home in outlets such as restaurants and hotels which are more expensive or it
could be that the income for age group 16-24 is smaller and, typically, people with smaller incomes spend a greater proportion of that income on food. Households headed by individuals aged 35-44, 45-54, and 55-64 have relatively larger shares of expenditures on food and beverages than the 16-24 age group. Estimates representing family size show that families with 2, 3, 4, and 5 family members have larger expenditure shares for food and beverages than households with a single person. The more the members the more the expenditure share on food and beverages. In terms of residence, households living in the west, south and mid-west allocate relatively less to food than do households residing in the northeast geographical region. This may be related to differences in prices, income, life style or culture.

The dummy variable representing race shows that the expenditure share decreases when the head of the household is black instead of white. Actually, the result should have been the other way around because of that blacks earn less than whites and lower income people tend to spend more of their incomes on food. One possible explanation for this phenomenon is that since many low income families receive subsidies in the form of food stamps they do not need to allocate more cash for food and this study does not include expenditures in other forms other than cash. However, lower income people may allocate more of their income on food items such as potatoes, chicken, and others which are priced low. Since higher income people are more educated and health conscious their share of expenditure could be higher because the type of food they consume may be more expensive. These data include food at home, food away from home, beverages, and other expenditures related to food, so that consumption patterns could also affect the results.
Table 5.4: Food and Beverages

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>ESTIMATE</th>
<th>STANDARD ERROR</th>
<th>T_VALUE</th>
<th>SIGNIFICANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERCEPT</td>
<td>0.847938</td>
<td>0.061826</td>
<td>13.715</td>
<td>***</td>
</tr>
<tr>
<td>ENTER_PRICE</td>
<td>0.077517</td>
<td>0.116390</td>
<td>0.666</td>
<td></td>
</tr>
<tr>
<td>UTILITY_PRICE</td>
<td>-0.008486</td>
<td>0.030860</td>
<td>-0.275</td>
<td></td>
</tr>
<tr>
<td>FOOD_PRICE</td>
<td>0.074533</td>
<td>0.029649</td>
<td>2.514</td>
<td>**</td>
</tr>
<tr>
<td>HOUSING_PRICE</td>
<td>-0.341018</td>
<td>0.057025</td>
<td>-5.980</td>
<td>***</td>
</tr>
<tr>
<td>HEALTH_PRICE</td>
<td>-0.007435</td>
<td>0.004518</td>
<td>-1.646</td>
<td>*</td>
</tr>
<tr>
<td>TRANS_PRICE</td>
<td>-0.088516</td>
<td>0.067397</td>
<td>-1.313</td>
<td></td>
</tr>
<tr>
<td>APPAREL_PRICE</td>
<td>0.179230</td>
<td>0.055576</td>
<td>3.225</td>
<td>***</td>
</tr>
<tr>
<td>TOTAL_EXPENSE</td>
<td>-0.065926</td>
<td>0.002371</td>
<td>-27.808</td>
<td>***</td>
</tr>
<tr>
<td>A2</td>
<td>-0.005597</td>
<td>0.002251</td>
<td>-2.486</td>
<td>**</td>
</tr>
<tr>
<td>A3</td>
<td>0.005981</td>
<td>0.002415</td>
<td>2.477</td>
<td>**</td>
</tr>
<tr>
<td>A4</td>
<td>0.011470</td>
<td>0.002437</td>
<td>4.706</td>
<td>***</td>
</tr>
<tr>
<td>A5</td>
<td>0.009822</td>
<td>0.002313</td>
<td>4.246</td>
<td>***</td>
</tr>
<tr>
<td>A6</td>
<td>0.000924</td>
<td>0.002263</td>
<td>0.408</td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td>0.021300</td>
<td>0.002055</td>
<td>10.365</td>
<td>***</td>
</tr>
<tr>
<td>F3</td>
<td>0.033982</td>
<td>0.002170</td>
<td>15.658</td>
<td>***</td>
</tr>
<tr>
<td>F4</td>
<td>0.054142</td>
<td>0.002308</td>
<td>23.454</td>
<td>***</td>
</tr>
<tr>
<td>F5</td>
<td>0.065719</td>
<td>0.002377</td>
<td>27.650</td>
<td>***</td>
</tr>
<tr>
<td>WE</td>
<td>-0.022193</td>
<td>0.001700</td>
<td>-13.053</td>
<td>***</td>
</tr>
<tr>
<td>SO</td>
<td>-0.032529</td>
<td>0.001704</td>
<td>-19.087</td>
<td>***</td>
</tr>
<tr>
<td>MW</td>
<td>-0.016303</td>
<td>0.001775</td>
<td>-9.186</td>
<td>***</td>
</tr>
<tr>
<td>B</td>
<td>-0.018472</td>
<td>0.001488</td>
<td>-12.413</td>
<td>***</td>
</tr>
</tbody>
</table>

*** Significant at $\alpha = 0.01$
**  Significant at $\alpha = 0.05$
*   Significant at $\alpha = 0.10$
5.3.2 Housing and Housing Service

The price variable for housing, HOUSING_PRICE has a positive relation with the expenditure share for housing. As the price increases by one unit the expenditure share increases by 0.050 (Table 5.5). Expenditure on housing is a long term planned commitment and one cannot react to changes in prices right away. If the prices of maintenance goes up, the owner has little choice, except to pay for it in order to protect his or her investment and/or life style. On the other hand, the effect of data aggregation might have resulted in positive estimate than a negative one, since expenditure share for housing includes the mortgage/rent, expenditure on furniture and related items, housing maintenance, and domestic serves. While prices for utilities, health care, and total expenditures have negative coefficient estimates, prices for transportation and apparel have positive coefficients. The coefficients of the other price variables are not statistically significant.

Dummy variables representing the age category indicate that expenditure share for housing and housing related services is relatively higher for households headed by individuals aged 25-34 and 35-44 when compared with the head of a household age 16-24. In most cases people between 25-55 maintain a larger family and make investments in housing and real estate. So, increases in the age of the head of the household, at least until 50, may be one possible factor for the increase in expenditure share for housing and housing related services such as rent, mortgage, maintenance, and other services. Also, the two age groups mentioned were buying homes in an era when costs increasing. The fact that 16-24 age group is a typical low income group, may be one more reason for having less expenditure share than the next two age groups. Estimates for the variables representing ages 45-54, 55-64 and 65 or over are not statistically significant.

Increases in the family size have negative effects on expenditure share for housing. From the
simple inspection of this expenditure data we observe that housing takes a high share of the household’s budget. Households with more family members may be forced to allocate their resources for other basic necessities rather than to bigger or more expensive homes and services. Also, the more people in the family the greater the possibility that some of the services could be rendered by the family members, which may help reduce the cost of housing.

Expenditure share for housing and housing related services is less in the West and South geographic regions than the Northeast. This phenomenon could be attributed to the difference in the climatic conditions of the regions, especially during winter. Also, the differences in prices of housing and the wages rate may be a factor, as well as differences in land values. Households living in the mid-west geographical region have a higher expenditure share than those living in the northeast region.

The relative expenditure share on housing and housing related services by a household headed by a black person is less than the household headed by a white individual. This can be directly attributed to the low proportion of income distribution for blacks. According to Charles Nelson (1994) in 1967 the Black-White household income ratio was 0.58. In 1990, 23 years later, this ratio was only slightly higher (0.62). This fact directly supports the our findings regarding expenditure inequality between blacks and whites on housing and housing related investments with its root cause being inequality in earnings. Since blacks earn less and spend a smaller share of that on housing, probably means that they 1. live in inferior housing, and 2. a greater proportion live in government subsidized housing.

5.3.3 Apparel

The own price for apparel is not statistically significant (Table 5.6). While estimates for the prices of entertainment, and housing are positive, estimate for the price of health care is negative. As
Table 5.5: Housing and Housing Services

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>ESTIMATE</th>
<th>STANDARD ERROR</th>
<th>T_VALUE</th>
<th>SIGNIFICANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERCEPT</td>
<td>0.294487</td>
<td>0.104539</td>
<td>2.817</td>
<td>***</td>
</tr>
<tr>
<td>ENTER_PRICE</td>
<td>-0.008486</td>
<td>0.030860</td>
<td>-0.275</td>
<td></td>
</tr>
<tr>
<td>UTILITY_PRICE</td>
<td>-0.113629</td>
<td>0.031441</td>
<td>-3.614</td>
<td>***</td>
</tr>
<tr>
<td>FOOD_PRICE</td>
<td>-0.028550</td>
<td>0.018834</td>
<td>-1.516</td>
<td></td>
</tr>
<tr>
<td>HOUSING_PRICE</td>
<td>0.050135</td>
<td>0.023511</td>
<td>2.132</td>
<td>**</td>
</tr>
<tr>
<td>HEALTH_PRICE</td>
<td>-0.015791</td>
<td>0.004999</td>
<td>-3.159</td>
<td>***</td>
</tr>
<tr>
<td>TRANS_PRICE</td>
<td>0.145934</td>
<td>0.054527</td>
<td>2.676</td>
<td>***</td>
</tr>
<tr>
<td>APPAREL_PRICE</td>
<td>0.048422</td>
<td>0.028591</td>
<td>1.694</td>
<td>*</td>
</tr>
<tr>
<td>TOTAL_EXPENSE</td>
<td>-0.031175</td>
<td>0.004430</td>
<td>-7.037</td>
<td>***</td>
</tr>
<tr>
<td>A2</td>
<td>0.044804</td>
<td>0.004111</td>
<td>10.900</td>
<td>***</td>
</tr>
<tr>
<td>A3</td>
<td>0.040076</td>
<td>0.004408</td>
<td>9.092</td>
<td>***</td>
</tr>
<tr>
<td>A4</td>
<td>0.004809</td>
<td>0.004418</td>
<td>1.089</td>
<td></td>
</tr>
<tr>
<td>A5</td>
<td>-0.006514</td>
<td>0.004214</td>
<td>-1.546</td>
<td></td>
</tr>
<tr>
<td>A6</td>
<td>-0.006008</td>
<td>0.004175</td>
<td>-1.439</td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td>-0.009668</td>
<td>0.003829</td>
<td>-2.525</td>
<td>**</td>
</tr>
<tr>
<td>F3</td>
<td>-0.009329</td>
<td>0.004032</td>
<td>-2.314</td>
<td>**</td>
</tr>
<tr>
<td>F4</td>
<td>-0.010969</td>
<td>0.004291</td>
<td>-2.557</td>
<td>**</td>
</tr>
<tr>
<td>F5</td>
<td>-0.026052</td>
<td>0.004435</td>
<td>-5.875</td>
<td>***</td>
</tr>
<tr>
<td>WE</td>
<td>-0.023951</td>
<td>0.003256</td>
<td>-7.355</td>
<td>***</td>
</tr>
<tr>
<td>SO</td>
<td>-0.035285</td>
<td>0.003253</td>
<td>-10.484</td>
<td>***</td>
</tr>
<tr>
<td>MW</td>
<td>0.016101</td>
<td>0.003381</td>
<td>4.762</td>
<td>***</td>
</tr>
<tr>
<td>B</td>
<td>-0.005210</td>
<td>0.002844</td>
<td>-1.832</td>
<td>*</td>
</tr>
</tbody>
</table>

*** Significant at $\alpha = .01$

**  Significant at $\alpha = .05$

*   Significant at $\alpha = .10$
Expenditure increases the share of budget for apparel decreases. The estimates for the other variables are statistically insignificant.

Expenditure shares on apparel tend to decrease as the age of the head of the household increases except for the 55-64 age group. Since apparel is an expendable and non-basic item, people may shift their resource to something more important or to something which has a return. Also, the life styles of people in different age groups are different. It appears households between age 55-64 spend more and those age 65 or over spend relatively less than the household between age 16-24. Households with two or three family members spend a smaller share of their income on apparel than household with a single individual, which is contrary to expectations in that families with more members would seem to need more clothing, but they also need more food, medical services, etc. Households living in the Western geographical region allocate relatively more and those living in the south have relatively less expenditure shares than those living in the Northeastern geographical region. This phenomenon may be attributed to differences in life style of people living in different regions and also differences in climate of the geographical regions. In the case of race, blacks tend to have relatively larger expenditure shares on apparel than whites.

5.3.4 Entertainment

Table 5.7 illustrates the estimates for entertainment. Entertainment is a fast growing industry, both in terms demand and supply. As the price of entertainment increases by a unit the expenditure share for entertainment decreases by 0.341 and its significant level is over 99%. Coefficients for prices of food and beverages, housing, and apparel indicate that they are complements for entertainment, i.e., they have positive coefficients. When the entertainment activity takes place at home, more is allocated to pay for domestic services or for furniture or electronic appliances. Differences in the age of the head of a
Table 5.6: Apparel

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>ESTIMATE</th>
<th>STANDARD ERROR</th>
<th>T_VALUE</th>
<th>SIGNIFICANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERCEPT</td>
<td>-0.233550</td>
<td>0.048494</td>
<td>-4.816</td>
<td>***</td>
</tr>
<tr>
<td>ENTER_PRICE</td>
<td>0.075533</td>
<td>0.029649</td>
<td>2.514</td>
<td>**</td>
</tr>
<tr>
<td>UTILITY_PRICE</td>
<td>-0.028550</td>
<td>0.018834</td>
<td>-1.516</td>
<td></td>
</tr>
<tr>
<td>FOOD_PRICE</td>
<td>0.000767</td>
<td>0.023324</td>
<td>0.033</td>
<td></td>
</tr>
<tr>
<td>HOUSING_PRICE</td>
<td>0.035884</td>
<td>0.021538</td>
<td>1.666</td>
<td>*</td>
</tr>
<tr>
<td>HEALTH_PRICE</td>
<td>-0.008108</td>
<td>0.003502</td>
<td>-2.315</td>
<td>**</td>
</tr>
<tr>
<td>TRANSPRICE</td>
<td>0.028252</td>
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<td>0.001210</td>
<td>7.765</td>
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</tr>
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</table>

*** Significant at $\alpha = .01$
**  Significant at $\alpha = .05$
*    Significant at $\alpha = .10$
household is a factor in the allocation of resources for entertainment purpose. People in the age groups 25-34 and 35-44 tend to have relatively more expenditure shares for entertainment than people between the age 16-24. It is not uncommon for people between 25-45 to have a family and choose a form of entertainment like traveling, outdoor entertainment and others which are more expensive. The coefficients for households aged 45 to 64 are not significant, whereas the coefficient for those households aged 65 or older is negative. Households residing in the west and mid-west tend to allocate relatively more money for entertainment than those living in northeast and the south. The environments which these households live under could be a factor in the difference. Again, blacks allocate relatively less resources for entertainment than whites. On one hand, differences in income could be a factor but, on the other hand, preference and tastes may determine the kind of entertainment blacks tend consume.

5.3.5 Heath Care and Health Related Services

We can easily observe from the data set used in this study that in the last fifteen years alone the prices for health care and health care related services have doubled. Government expenditures on medicare and medicaid, and health insurance rates also have increased. Table 5.8 shows that almost all estimates except one for personal care and education have negative coefficients, which indicates that their expenditure shares can be substituted for the expenditure share of health care. The coefficient for price of health care is not significant, a surprising finding since rising health care costs have been blamed for increasing expenditures. However, insurance, medicare, and medicaid pay for a large share of health care.

The coefficients for age variables between 25-45 are not statistically significant, however ages 45 and over spend relatively more on health care as their age increases. Naturally, as a person gets older the chance of having a health problem also increases. By almost any measure, the elderly comprise the
Table 5.7: Entertainment

<table>
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<th>T_VALUE</th>
<th>SIGNIFICANCE</th>
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*** Significant at $\alpha = .01$

** Significant at $\alpha = .05$

* Significant at $\alpha = .10$
age group most affected by problems of ill health. According to Viscusi (1979) only 20% of those aged 65 to 75 are free of chronic illness and less than 13% of those aged 75 and older are classified healthy. In terms of limitations on their normal activities, far fewer elderly are affected. Less than one fourth of those aged 75 and over are not physically able to carry out their daily activities. These assertions directly and indirectly support the findings concerning the increase in share of expenditures on health as the individual gets older. The results also show that as the number of people in the family increases the amount of expenditure shares also increases. For family size two and three the estimated coefficients are statistically significant, but not for larger family size. Health care expenditure shares for households living in the western and mid-western geographical regions are relatively less than the ones living in the northeastern geographical region. This difference can be attributed at least in part to the higher price index for medical services in the northeastern geographical region. The race variable indicates that blacks allocate less on health care services than whites. Households earning below certain amount of income get free health benefits from the government and other public programs. A good proportion of the black population may rely on these programs for their health care services.

5.3.6 Transportation

The need of transportation has become a basic necessity in the life styles of industrialized societies. The information age might be able to reverse this phenomenon in the future. As indicated in table 5.9, as the price of transportation goes up the expenditure shares for transportation also increase. This is probably due to transportation being vital to the household’s livelihood, making the response inelastic. The prices of food and personal care and education are negatively related to the share of expenditures on transportation, while the remainder of the price variables, and the total expenditures are positively related.
Table 5.8: Health and Health Related Services

<table>
<thead>
<tr>
<th>PARAMETER</th>
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<th>STANDARD ERROR</th>
<th>T_VALUE</th>
<th>SIGNIFICANCE</th>
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<td>0.003502</td>
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*** Significant at $\alpha = .01$
**  Significant at $\alpha = .05$
*   Significant at $\alpha = .10$
Expenditure shares on transportation decrease as both the age and the number of people in the household increase. As both age and family size increase, people may find ways to reduce the transportation costs such as trading vehicle less frequently and by doing more things at home. Households residing in the west and south have a higher expenditure shares on transportation than people living in the northeast. This could be attributed to a difference in public transportation where the west and the south may be lagging behind the northeast. Distances also tend to be higher since the Northeast is a relatively compact region compared to the others. In terms of race, blacks have relatively higher expenditure shares on transportation than whites, which may be related to social and cultural differences between blacks and whites.

5.3.7 Utilities

Utilities are another important category of commodity which is essential for life and Americans tend to spend a large amounts of money for the consumption of energy and energy related items. As table 5.10 illustrates, the expenditure shares for utilities increase as the price increases. Energy is a vital ingredient of a household system. The prices for housing, transportation, and apparel have a negative relations with the utility expenditure share. The economic rationale is that when prices increase people tend to select smaller and more energy efficient homes, use cheaper forms of transportation, drive less, and buy less or cheaper clothes.

Households headed by people over the age of 35 spend more on utilities than those below the age of 25. Usually people older than 30 live in larger houses that require more energy during the summer and winter seasons. Also, households with three or five family members allocate relatively more expenditure shares on utilities than families with a single individual, since large numbers of people require more heat, light and water. Blacks tend to have relatively larger expenditure shares
on utilities than whites, since with lower income they must spend a higher proportion towards the consumption of energy for the purpose of heating, cooling, and cooking. It requires a good understanding in the efficient use of energy and utility related items. Even though blacks earn less than whites, a higher proportion of their income may be allocated towards the consumption of energy for the purpose of heating, cooling, and cooking. These could be some of the factors for the difference between the expenditure shares of blacks and whites on the consumption of energy items.

5.4 Summary and Conclusions

We have implemented an econometric model by combining time-series and cross-section data for the years between 1980 and 1994. The model allocates personal consumption expenditures among eight commodity groups: food and beverages, housing, apparel, entertainment, health, transportation, utility, and personal items and education. Households are classified by four sets of demographic characteristics: age of the head of the household, family size, region of residence, and race. The impacts of changes in total expenditures as related to demographic characteristics of the individual household are estimated very precisely.

The results of the estimation clearly show that prices and demographic characteristics of households have an effect on the expenditure patterns of households. There is a clear difference and pattern in the allocation of resources for the consumption of food and beverages based on the age of the head of the family, the size of the household, the race of the head of the family, and the geographical location of the residence of the household. We summarize the effect of each household characteristic on expenditure by category.
Table 5.9: Transportation

<table>
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*** Significant at $\alpha = .01$
**  Significant at $\alpha = .05$
*   Significant at $\alpha = .10$
### Table 5.10: Utilities

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<td>***</td>
</tr>
<tr>
<td>A6</td>
<td>0.057905</td>
<td>0.003597</td>
<td>16.099</td>
<td>***</td>
</tr>
<tr>
<td>F2</td>
<td>0.003027</td>
<td>0.003282</td>
<td>0.922</td>
<td></td>
</tr>
<tr>
<td>F3</td>
<td>0.009527</td>
<td>0.003471</td>
<td>2.745</td>
<td>***</td>
</tr>
<tr>
<td>F4</td>
<td>0.003702</td>
<td>0.003688</td>
<td>1.004</td>
<td></td>
</tr>
<tr>
<td>F5</td>
<td>0.010809</td>
<td>0.003800</td>
<td>2.844</td>
<td>***</td>
</tr>
<tr>
<td>WE</td>
<td>0.017589</td>
<td>0.002729</td>
<td>6.446</td>
<td>***</td>
</tr>
<tr>
<td>SO</td>
<td>0.064373</td>
<td>0.002734</td>
<td>23.550</td>
<td>***</td>
</tr>
<tr>
<td>MW</td>
<td>-0.001499</td>
<td>0.002845</td>
<td>-0.527</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>0.020208</td>
<td>0.002390</td>
<td>8.455</td>
<td>***</td>
</tr>
</tbody>
</table>

**Significant at α = .01**

**Significant at α = .05**

*Significant at α = .10
5.4.1 The Impacts of the Age of the Head of the Household

There is a clear difference and pattern in the allocation of resources for the consumption of food and beverages based on the age of the head of the family. It appears that as the age increases the expenditure share for food also increases. Expenditure on housing increases at the earlier ages of the head of the household. One reason for the increase on the share of expenditure on housing might be that expenditure on housing is considered as a long term investment. People tend to make major investment decisions in their earlier age. The budget share for apparel generally decreases as age increases and it is significant at 99%. It is reasonable to say that people allocate more for entertainment and leisure services during their prime age. The results indicate that the older the head of the household the less the budget share for entertainment. As people get older their health the state of their health deteriorates and more is allocated towards health care and health related expenditures. This fact is supported by this result at 99% level of confidence. While the share of budget for transportation decreases as age increases, on the contrary the expenditure on utilities increases. The summary of the effects of the age of the head of the household on the share of expenditure for food is illustrated in Table 5.11.

5.4.2 The Impact of the Size of Household

It appears that as age and family size increase the expenditure shares for food and beverages also increases. The more the number of people in a household the more food consumed causing an increase in the share of expenditure for food. The effect of the size of household has a positive effect on goods and services which are considered basic necessities; goods such as food, health and utilities. The margin of expenditure decreases for housing, apparel, entertainment, and transportation and the size of the household increases. The priorities of household consumption are reflected in the amount of resources allocated for certain commodities and services as the size of the household grows. Table 5.12 just
reflects this notion of priorities.

Table 5.11: The Impact of Age of the Household (Compared to age 16-24 household)

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>25-34</th>
<th>35-44</th>
<th>45-54</th>
<th>55-64</th>
<th>65 &amp; Over</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food_Share</td>
<td>-0.0056**</td>
<td>0.0060**</td>
<td>0.0115***</td>
<td>0.0098***</td>
<td>0.0009</td>
</tr>
<tr>
<td>Housing_Share</td>
<td>0.0448***</td>
<td>0.0400***</td>
<td>0.0048</td>
<td>-0.0065</td>
<td>-0.0060</td>
</tr>
<tr>
<td>Apparel_Share</td>
<td>-0.0074***</td>
<td>-0.0048**</td>
<td>-0.0088***</td>
<td>0.0113***</td>
<td>-0.0180***</td>
</tr>
<tr>
<td>Enter_Share</td>
<td>0.0031*</td>
<td>0.0037*</td>
<td>0.0010</td>
<td>-0.0014</td>
<td>-0.0075***</td>
</tr>
<tr>
<td>Health_Share</td>
<td>0.0008</td>
<td>0.0001</td>
<td>0.0018*</td>
<td>0.0068***</td>
<td>0.0214***</td>
</tr>
<tr>
<td>Trans_Share</td>
<td>-0.0269***</td>
<td>-0.0508***</td>
<td>-0.0400***</td>
<td>-0.0281***</td>
<td>-0.0357***</td>
</tr>
<tr>
<td>Utility_Share</td>
<td>0.0002</td>
<td>0.0114***</td>
<td>0.0246***</td>
<td>0.0368***</td>
<td>0.0579***</td>
</tr>
</tbody>
</table>

*** Significant at $\alpha = .01$
**  Significant at $\alpha = .05$
*   Significant at $\alpha = .10$

Table 5.12: The Impact of Size of the Household (Compared to single member household)

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food_Share</td>
<td>0.0213***</td>
<td>0.0340***</td>
<td>0.0541***</td>
<td>0.0657***</td>
</tr>
<tr>
<td>Housing_Share</td>
<td>-0.0097**</td>
<td>-0.0093**</td>
<td>-0.0110**</td>
<td>-0.0261***</td>
</tr>
<tr>
<td>Apparel_Share</td>
<td>-0.00040**</td>
<td>-0.0011</td>
<td>-0.0044**</td>
<td>-0.0023</td>
</tr>
<tr>
<td>Enter_Share</td>
<td>-0.0054***</td>
<td>-0.0072***</td>
<td>-0.0060***</td>
<td>-0.0066***</td>
</tr>
<tr>
<td>Health_Share</td>
<td>0.0017*</td>
<td>0.0018*</td>
<td>0.0008</td>
<td>-0.0001</td>
</tr>
<tr>
<td>Trans_Share</td>
<td>-0.0068***</td>
<td>-0.0295***</td>
<td>-0.0433***</td>
<td>-0.0468***</td>
</tr>
<tr>
<td>Utility_Share</td>
<td>0.0030</td>
<td>0.0095***</td>
<td>0.0037</td>
<td>0.0108***</td>
</tr>
</tbody>
</table>

*** Significant at $\alpha = .01$
**  Significant at $\alpha = .05$
*   Significant at $\alpha = .10$
5.4.3 The Impacts of Geographic Location

Geographic location of residence of a household has an effect on the share of expenditure allocated for the consumption of goods and services. Households living in the east tend to allocate more for food and beverages than those living in the west, south, and midwest. Households residing in the southern geographic regions of the country allocate relatively less resources to those living in the northeast. The Western region residents allocate marginally more on apparel, entertainment, transportation and utilities while the south spends more on health, transportation, utilities, and less on apparel, entertainment. Households in the midwestern geographic region spend relatively less on food, apparel, health and utilities while more is allocated for housing, entertainment, and transportation. Table 5.13 illustrates the relationship and the level of significance.

Table 5.13: Impacts of Geographic Location of a Household (Compared to the Northeast)

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Geographic Location</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>West</td>
</tr>
<tr>
<td>Food_Share</td>
<td>-0.0222***</td>
</tr>
<tr>
<td>Housing_Share</td>
<td>-0.0240***</td>
</tr>
<tr>
<td>Apparel_Share</td>
<td>0.0005</td>
</tr>
<tr>
<td>Enter_Share</td>
<td>0.0002</td>
</tr>
<tr>
<td>Health_Share</td>
<td>-0.0014*</td>
</tr>
<tr>
<td>Trans_Share</td>
<td>0.0273***</td>
</tr>
<tr>
<td>Utility_Share</td>
<td>0.00176***</td>
</tr>
</tbody>
</table>

*** Significant at \( \alpha = .01 \)
**  Significant at \( \alpha = .05 \)
*   Significant at \( \alpha = .10 \)
5.4.4 The Impacts of Race

The regression coefficients for the dummy variable race are all statistically significant, indicating that share of income spent on the different categories vary significantly between white and black households. Households with a black head of household spend smallest shares of their incomes on food, housing, health and entertainment, but larger shares on clothing, transportation and utilities. People whose income is critically small usually receive government assistance in the form of food stamps, housing rent subsidies and health care services. If blacks allocate less on food, housing and health care it could be possible that substantial part of their expenditure is covered by public assistance programs. The assistance received from the public program would free some of these resources, enabling them to increase the budget shares for apparel, transportation and utilities. Table 5.14 illustrates this relationship with the degree of statistical significance level.

Table 5.14: The Impact of Race (Compared to white)

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Black</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food_Share</td>
<td>-0.0185***</td>
</tr>
<tr>
<td>Housing_Share</td>
<td>-0.0005*</td>
</tr>
<tr>
<td>Apparel_Share</td>
<td>0.0094***</td>
</tr>
<tr>
<td>Enter_Share</td>
<td>-0.0126***</td>
</tr>
<tr>
<td>Health_Share</td>
<td>-0.0018***</td>
</tr>
<tr>
<td>Trans_Share</td>
<td>0.0064**</td>
</tr>
<tr>
<td>Utility_Share</td>
<td>0.0202***</td>
</tr>
</tbody>
</table>

*** Significant at α = .01  
** Significant at α = .05  
* Significant at α = .10
5.4.5 Total Expenditure

Table 5.15 shows the relation between expenditure and budget shares for various types of goods and services. The interpretation has to be handled with greater care, because expenditures in this case does not replace income. To some degree expenditures may indicate whether the good or service is normal or superior. Most goods and services classified as basic necessity goods are normal goods. Such goods and services are indicated by negative signs, where as the budget shares for transportation, utilities and apparel increase as expenditures increase. This is a very interesting finding for understanding the consumption patterns of households.

The impact of demographic characteristics has a wide range of implications for both private organizations, which have a business interest in understanding the distribution of expenditure patterns of households, and government agencies which help determine the economic well-being of the nation and make long term and short term planning to improve the welfare of especially the less fortunate.

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Total Expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food_Share</td>
<td>-0.0659***</td>
</tr>
<tr>
<td>Housing_Share</td>
<td>-0.0312***</td>
</tr>
<tr>
<td>Apparel_Share</td>
<td>0.0046**</td>
</tr>
<tr>
<td>Enter_Share</td>
<td>-0.0007</td>
</tr>
<tr>
<td>Health_Share</td>
<td>-0.0068***</td>
</tr>
<tr>
<td>Trans_Share</td>
<td>0.1075***</td>
</tr>
<tr>
<td>Utility_Share</td>
<td>0.0027</td>
</tr>
</tbody>
</table>

*** Significant at $\alpha = .01$
**  Significant at $\alpha = .05$
*    Significant at $\alpha = .10$
CHAPTER 6: INEQUALITY IN HOUSEHOLD CONSUMPTION EXPENDITURES

6.1 Introduction

Following the methodology and formulas laid out in section 3.3 of chapter 3, this chapter is an analysis of inequality in the household consumption expenditures, where relationships are examined between various expenditure budget components using the consumer expenditure data from 1980 to 1994. Identifying the impact of marginal changes in expenditures for specific commodities on the inequality of total expenditures can provide useful information concerning the effect that certain policies, such as the introduction of percentage commodity taxes and subsidies, may have on the spending patterns of consumers. Section 6.2 addresses the use of the Gini coefficient and its decomposition. Then, the results are presented and discussed in section 6.3. Conclusions are presented in section 6.4.

6.2 The Gini Coefficient and Its Decomposition

The overall Gini coefficient is applied to produce an estimate of the inequality in the distribution of total household consumption expenditure over the population. Following the derivation by Lerman and Yitzhaki (1984), we can express the formula for the Gini coefficient as:

\[ G = \frac{2 \, \text{cov}(X, F)}{m} \]  \hspace{2cm} (6.1)

This formula is expressed in terms of the covariance between total expenditures (X) and the commutative distribution of X (F), and the mean of X (m). The lower the value of the Gini, the lower the inequality in the distribution of expenditures; zero represents absolute equality. The overall Gini is decomposed by expenditure budget components as: Let \( x_1, \ldots, x_k \) represent the level of expenditure for budget components. The Gini coefficient for component k is:
Following the derivation by Lerman and Yitzhaki (1985) it can be shown that the overall Gini coefficient of the total expenditures based upon the budget components is expressed as:

\[
G = \frac{2 \sum_{k=1}^{K} \text{cov}(x_k, F) m_k}{m}
\]  

(6.3)

Where \( \text{cov}(x_k, F) \) is the concentration index of expenditures for budget component \( k \) with respect to the commutative distributions of the total expenditures, \( X \). Multiplying and dividing each component \( k \) in equation (6.3) by \( \text{cov}(x_k, F_k) \) and by \( m_k \) yields the sum of the budget components decomposed as:

\[
G = \sum_{k=1}^{K} \left( \frac{\text{cov}(x_k, F)}{\text{cov}(x_k, F_k)} \cdot \frac{2 \text{cov}(x_k, F_k)}{m_k} \cdot \frac{m_k}{m} \right)
\]

(6.4)

\[
= \sum_{k=1}^{K} R_k G_k S_k
\]

Where \( R_k \) is defined as the Gini correlation between the expenditure component \( k \) and the rank of total consumption expenditure, \( G_k \) is the relative Gini of component \( k \) (the index of concentration for component \( k \)), and \( S_k \) is component \( k \)'s share of total expenditures (Lerman and Yitzhaki, 1984). One good reason for using the decomposition approach is its usefulness in examining how marginal changes in expenditures for particular components can affect overall inequality. Let us assume that there is a change in each household’s expenditure for a particular component \( k \) equal to \( \epsilon x_k \). If \( \epsilon \) represents a percentage change in expenditures for component \( k \) that is identical for all households, the component’s
marginal effect relative to the overall Gini coefficient can be represented as (Garner, 1989):

$$\frac{\partial G}{\partial e_k} = \frac{R_k G S_k}{G} - S_k$$

(6.5)

The interpretation of the above equation is that the percentage change in the overall Gini, caused by a small change in a commodity expenditure is equal to the commodity’s contribution to overall inequality (named as $I_k$ in the results column). The overall Gini would remain unchanged if all components are multiplied by $e$ (Lerman and Yitzhaki, 1985). The result from equation (8.5) may help to determine the distributional effect of imposing a commodity percentage tax or raising the tax rate, where the tax leads to a small change in commodity expenditures. When the relative marginal effect is positive, taxing a commodity would decrease overall inequality (Garner, 1993). Such a tax would be progressive since it affects the rich more than it affects the poor at the margin. When the relative marginal effect is negative, taxing the commodity would increase inequality, as would be expected from a tax which is regressive (Garner, 1993).

The above method and approach is implemented using total expenditures which are disaggregated into eight categories: food and beverages, housing, apparel, entertainment, health care, transportation, utilities, and personal care and education. Also, inequality in the distribution of expenditures is measured within each of the age categories of 16-24, 25-34, 35-44, 45-54, 55-64, and 65 and above, as well as within each of the two racial subgroups.

As described in chapter 6, microlevel data from the U.S. Consumer Expenditure Interview Survey for the years 1980-1994 are analyzed. Table 6.1 gives descriptions of the measures of inequality.
Table 6.1: Descriptions of Measures of Inequality

<table>
<thead>
<tr>
<th>NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_k$</td>
<td>CONTRIBUTION TO TOTAL INEQUALITY FOR COMPONENT K</td>
</tr>
<tr>
<td>$R_k$</td>
<td>CORRELATION TO RANK OF TOTAL EXPENDITURE</td>
</tr>
<tr>
<td>$G$</td>
<td>OVERALL Gini COEFFICIENT FOR THE WHOLE POPULATION</td>
</tr>
<tr>
<td>$G_k$</td>
<td>Gini OF COMPONENT k</td>
</tr>
<tr>
<td>$S_k$</td>
<td>EXPENDITURE SHARE FOR COMPONENT K</td>
</tr>
<tr>
<td>$I_k$</td>
<td>SHARE EXPENDITURE INEQUALITY FOR COMPONENT K</td>
</tr>
<tr>
<td>$I_k, S_k$</td>
<td>RELATIVE EXPENDITURE INEQUALITY FOR COMPONENT K</td>
</tr>
<tr>
<td>$I_k - S_k$</td>
<td>RELATIVE MARGINAL EFFECT FOR COMPONENT K</td>
</tr>
</tbody>
</table>

6.3 Results and Discussions

The expenditure inequality effects by budget component are presented in tables 6.3 - 6.17 for the years 1980 - 1994. In the discussion of the results, the focus is mainly on the result for the year 1980. There are two reasons for doing this: first, the differences in the Gini inequality in consumption expenditures, among the years from 1980 to 1994 is small. There are no clear patterns or trends of inequality from year to year. Second, by showing how to interpret the results for one year, the reader can make his/her interpretations for the rest, using the same approach.

The first column in the table 6.3 presents the contribution of each budget component to total inequality as identified by $C_k$. This measure is the product of three terms: the Gini correlation between the budget component and the rank of total expenditures ($R_k$), the component’s Gini ($G_k$), and its share of total expenditures ($S_k$). The higher the value of each factor, the greater is the contribution of the budget component to total inequality. The proportion of inequality to total expenditures attributable to each commodity is given in column five as $I_k$, and is defined as $C_k$ divided by $G$. Relative effects are presented in columns six and seven.
The overall Gini based on the total annual consumption expenditure for the last 15 year is between 0.195 the lowest and 0.281 the highest. The overall Gini ratio (from the total row Table 6.3) of household expenditure inequality for the year 1980 calculated as 0.214. The Gini coefficient for total expenditure inequality is graphically illustrated in figure 6.1. These numbers indicate a relatively low household inequality in expenditures. Nelson (1994) calculated the Gini for family income inequality as 0.365 (see table 6.19) and a study by Garner (1993) calculated the Gini for income and expenditure inequalities for the 1987 as 0.435 and 0.330 respectively. In both cases the differences between expenditure and income inequalities is around 0.100. The smaller expenditure inequality can be attributed to the consumption and expenditure patterns based on the permanent income theory. Expenditures in one year do not depend only on the income of that year. People with reduced incomes tend to spend from their savings or they may borrow and spend against their expected future income. Also, there are numerous government and community based programs which provide food, energy, medical even cash assistance to millions who are in the lower income brackets. Above all, the major factor for the difference in inequality between consumption and expenditure is that in normal years people usually do not consume everything they earn, some of it goes to savings and investment. As a result of the inequality in consumption is smaller than inequality in income. In general, the overall Gini for expenditure inequality has not changed much through the years from 1980 to 1994.

Expenditures shares for food and beverages, housing, and transportation account for over 50% of the inequality in total expenditures. Their share of total expenditures is about the same as their share of inequality. Housing and transportation have the highest shares of expenditure inequality as represented by \( I_h \), 0.229 and 0.234, respectively for 1980.

A high Gini correlation indicates higher total expenditures with greater spending on the
individual commodity. Expenditures for food, housing, and transportation are more highly correlated with the rank of total expenditures. High $G_k$’s are an indication that there are differences in consumption expenditures. The results in general imply that there are relatively large differences in spending for health care, entertainment, utilities, transportation, and personal care and education. Expenditures for food and beverages, apparel, and housing are fairly equally distributed, relative to expenditures for other commodities.

Relative expenditure inequality ($I_k/S_k$) measures the inequality for components as a percentage of expenditure shares. These estimates are calculated as the ratio of the proportional contribution to the share of total expenditures. Expenditures for food, housing, entertainment, transportation, and personal care and education contribute more to the inequality in total expenditures than they contribute to total expenditures in terms of their shares.

Changes in expenditures which would lead to reductions in inequality are associated with expenditures categories for which the expenditure shares are greater than the shares of inequality. The direction of the relative marginal relationship indicates the effect at the margin of an increase in expenditures for a component for overall inequality ($I_k - S_k$). These results reveal that increases in expenditures in 1980 for food and beverages, housing, apparel, entertainment, health care, utilities, and personal care and education would have decreased overall inequality in total expenditures, holding all else constant. Table 6.2 illustrates the signs for the overall inequality ($I_k - S_k$) for all commodities for the year between 1980-1994. Food, apparel. And housing expenditures had negative signs in all fifteen years, while transportation had a positive sign in 13 of the 15 years, entertainment was positive about half the time. The other categories all had 13 to 14 years with negative signs. From a policy perspective, increases in overall inequality could be achieved by reducing taxes on these goods and services or by
exempting them from the tax base. Of the 45 states that levy a general retail sales tax, many exemptions from the tax base apply, serving as a mechanism for providing relief through tax base modification. Food for home consumption, utilities for heating and cooling, and prescription drugs and medical services are exempt from taxation in over half of the states (Case and Ebel, 1989; ACIR, 1990; Garner, 1993). Reductions in overall inequality could also result from introducing or increasing a percentage tax on a commodity for which the relative marginal effect is positive, i.e., on transportation and, possibly, entertainment. These results Thus, taxes could be increased or implemented on specific commodities not only to reduce the degree of inequality, but the improve the welfare households.

Table 6.2: Signs for $I_k - S_k$

<table>
<thead>
<tr>
<th></th>
<th>FB</th>
<th>HSNG</th>
<th>APP</th>
<th>ENT</th>
<th>HLTH</th>
<th>TRAN</th>
<th>UTIL</th>
<th>TPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>-</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>1981</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1982</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
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<td>1983</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
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<td>1984</td>
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<td>-</td>
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<td>0</td>
<td>+</td>
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<td>+</td>
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<tr>
<td>1985</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
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<td>1986</td>
<td>-</td>
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<td>-</td>
<td>-</td>
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<td>+</td>
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<td>1987</td>
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<td>1988</td>
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<tr>
<td>1989</td>
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<td>-</td>
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<td>-</td>
<td>+</td>
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<td>-</td>
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<td>1990</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
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<td>-</td>
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<tr>
<td>1991</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1992</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1993</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1994</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>All (-)</td>
<td>All (-)</td>
<td>All (-)</td>
<td>8(-)/5(+)</td>
<td>13(-)/2(1)</td>
<td>2(-)/13(+)</td>
<td>14(-)/1(+)</td>
<td>13(-)/1(+)</td>
</tr>
</tbody>
</table>
Inequality in expenditures by age is computed and presented in table 6.18. The categories are made up of ages 16-24, 25-34, 35-44, 45-54, 55-64, and 65 and over. The overall Gin is within each group are extremely low (all under 0.08) implying that expenditures are fairly equal within each group. Table 6.19 illustrates expenditure inequality based on race: black and white. Again, the overall Gini is for both races are relatively low, and are similar to those for all consumers. The highest Gini for whites is 0.284 in 1988 and the lowest 0.176 in 1981. For blacks the highest Gini is 0.244 in 1984 and the lowest 0.166 in 1991. These results do not, however, indicate that expenditures are equal between the races; this was not measured. Table 6.20 is included to show the difference between the income and expenditure inequalities.

6.4 Conclusion

The focus of this chapter has been to measure inequality in the distribution of consumption expenditures across consumer units in general, consumers grouped based on age, and consumers categorized by race. The overall Gini coefficient and other forms of inequality measures were produced as estimates to shed light on the state of consumer expenditures for the years 1980-1994. These results reveal very important information which can be used in the formulation of policy initiatives. The inequality of household consumption expenditures in particular commodity categories suggests possible targets for additional consumption taxation introduced to reduce the social impact created by other economic inequalities.
Figure 6.1: Gini Coefficient for Total Expenditure, 1980-1994

Table 6.3: Expenditure Inequality Effects by Expenditure Component for Year 1980

<table>
<thead>
<tr>
<th>Component</th>
<th>$C_k$</th>
<th>$R_k$</th>
<th>$G_k$</th>
<th>$S_k$</th>
<th>$I_k$</th>
<th>$I_k/S_k$</th>
<th>$I_k - S_k$</th>
</tr>
</thead>
<tbody>
<tr>
<td>FB</td>
<td>0.039</td>
<td>0.839</td>
<td>0.209</td>
<td>0.224</td>
<td>0.182</td>
<td>0.813</td>
<td>-0.042</td>
</tr>
<tr>
<td>HSNG</td>
<td>0.049</td>
<td>0.810</td>
<td>0.192</td>
<td>0.316</td>
<td>0.229</td>
<td>0.725</td>
<td>-0.087</td>
</tr>
<tr>
<td>APP</td>
<td>0.006</td>
<td>0.203</td>
<td>0.447</td>
<td>0.062</td>
<td>0.028</td>
<td>0.452</td>
<td>-0.034</td>
</tr>
<tr>
<td>ENT</td>
<td>0.008</td>
<td>0.508</td>
<td>0.319</td>
<td>0.049</td>
<td>0.037</td>
<td>0.755</td>
<td>-0.012</td>
</tr>
<tr>
<td>HLTH</td>
<td>0.001</td>
<td>0.192</td>
<td>0.370</td>
<td>0.016</td>
<td>0.005</td>
<td>0.313</td>
<td>-0.011</td>
</tr>
<tr>
<td>TRAN</td>
<td>0.050</td>
<td>0.814</td>
<td>0.298</td>
<td>0.205</td>
<td>0.234</td>
<td>1.142</td>
<td>0.029</td>
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<tr>
<td>UTIL</td>
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<td>0.101</td>
<td>0.051</td>
<td>0.505</td>
<td>-0.050</td>
</tr>
<tr>
<td>TPE</td>
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<td>0.519</td>
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<td>1.000</td>
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</tr>
<tr>
<td>TOTAL</td>
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<td>0.214</td>
<td>1.000</td>
<td>1.00</td>
<td>1.000</td>
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Table 6.4: Expenditure Inequality Effects by Expenditure Component for Year 1981

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<tr>
<th>Component</th>
<th>C_k</th>
<th>R_k</th>
<th>G_k</th>
<th>S_k</th>
<th>I_k</th>
<th>I_k/S_k</th>
<th>I_k - S_k</th>
</tr>
</thead>
<tbody>
<tr>
<td>FB</td>
<td>0.038</td>
<td>0.813</td>
<td>0.222</td>
<td>0.211</td>
<td>0.195</td>
<td>0.924</td>
<td>-0.016</td>
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<td>HSNG</td>
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<td>0.770</td>
<td>0.211</td>
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<td>0.272</td>
<td>0.842</td>
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<tr>
<td>APP</td>
<td>0.012</td>
<td>0.740</td>
<td>0.277</td>
<td>0.063</td>
<td>0.062</td>
<td>0.984</td>
<td>-0.001</td>
</tr>
<tr>
<td>ENT</td>
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<td>0.563</td>
<td>0.328</td>
<td>0.048</td>
<td>0.046</td>
<td>0.958</td>
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<td>HLTH</td>
<td>0.010</td>
<td>0.218</td>
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<td>TRAN</td>
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<td>0.037</td>
</tr>
<tr>
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<td>0.088</td>
<td>0.830</td>
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</tr>
<tr>
<td>TPE</td>
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<td>0.420</td>
<td>0.028</td>
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<td>0.929</td>
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Table 6.5: Expenditure Inequality Effects by Expenditure Component for Year 1982

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<tr>
<th>Component</th>
<th>C_k</th>
<th>R_k</th>
<th>G_k</th>
<th>S_k</th>
<th>I_k</th>
<th>I_k/S_k</th>
<th>I_k - S_k</th>
</tr>
</thead>
<tbody>
<tr>
<td>FB</td>
<td>0.036</td>
<td>0.860</td>
<td>0.220</td>
<td>0.192</td>
<td>0.180</td>
<td>0.938</td>
<td>-0.012</td>
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<tr>
<td>HSNG</td>
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<td>0.858</td>
<td>0.205</td>
<td>0.333</td>
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<td>0.871</td>
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<td>0.060</td>
<td>0.984</td>
<td>-0.001</td>
</tr>
<tr>
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<td>0.722</td>
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<td>0.055</td>
<td>1.120</td>
<td>0.006</td>
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<td>0.097</td>
<td>0.303</td>
<td>0.017</td>
<td>0.005</td>
<td>0.294</td>
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<td>0.776</td>
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<td>0.201</td>
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<td>0.534</td>
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<td>0.080</td>
<td>0.702</td>
<td>-0.034</td>
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<tr>
<td>TPE</td>
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<td>0.385</td>
<td>0.432</td>
<td>0.034</td>
<td>0.030</td>
<td>0.882</td>
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<tr>
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<td>0.200</td>
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<td>1.000</td>
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</table>
Table 6.6: Expenditure Inequality Effects by Expenditure Component for year 1983

<table>
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<tr>
<th>Component</th>
<th>$C_k$</th>
<th>$R_k$</th>
<th>$G_k$</th>
<th>$S_k$</th>
<th>$I_k$</th>
<th>$I_k/S_k$</th>
<th>$I_k - S_k$</th>
</tr>
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<tr>
<td>FB</td>
<td>0.037</td>
<td>0.881</td>
<td>0.227</td>
<td>0.186</td>
<td>0.155</td>
<td>0.833</td>
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<td>0.447</td>
<td>0.262</td>
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<td>0.164</td>
<td>0.488</td>
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<td>0.434</td>
<td>0.296</td>
<td>0.060</td>
<td>0.034</td>
<td>0.567</td>
<td>-0.026</td>
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<td>0.437</td>
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<td>0.034</td>
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<td>0.195</td>
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<td>0.286</td>
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<td>0.805</td>
<td>0.323</td>
<td>0.204</td>
<td>0.223</td>
<td>1.100</td>
<td>0.019</td>
</tr>
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<td>0.453</td>
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<td>0.116</td>
<td>0.223</td>
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<td>0.025</td>
<td>0.714</td>
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<td>0.238</td>
<td>1.000</td>
<td>1.000</td>
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Table 6.7: Expenditure Inequality Effects by Expenditure Component for Year 1984

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<th>Component</th>
<th>$C_k$</th>
<th>$R_k$</th>
<th>$G_k$</th>
<th>$S_k$</th>
<th>$I_k$</th>
<th>$I_k/S_k$</th>
<th>$I_k - S_k$</th>
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<tr>
<td>FB</td>
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<td>0.793</td>
<td>0.248</td>
<td>0.181</td>
<td>0.146</td>
<td>0.807</td>
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<td>0.444</td>
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<td>0.686</td>
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<td>0.055</td>
<td>0.045</td>
<td>0.818</td>
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<td>0.049</td>
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<td>0.000</td>
</tr>
<tr>
<td>HLTH</td>
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<td>0.251</td>
<td>0.398</td>
<td>0.024</td>
<td>0.008</td>
<td>0.333</td>
<td>-0.016</td>
</tr>
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<td>0.722</td>
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<td>0.210</td>
<td>0.215</td>
<td>1.020</td>
<td>0.005</td>
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<tr>
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### Table 6.8: Expenditure Inequality Effects by Expenditure Component for Year 1985

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<th>G&lt;sub&gt;k&lt;/sub&gt;</th>
<th>S&lt;sub&gt;k&lt;/sub&gt;</th>
<th>I&lt;sub&gt;k&lt;/sub&gt;</th>
<th>I&lt;sub&gt;k&lt;/sub&gt;/S&lt;sub&gt;k&lt;/sub&gt;</th>
<th>I&lt;sub&gt;k&lt;/sub&gt; - S&lt;sub&gt;k&lt;/sub&gt;</th>
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<td>0.872</td>
<td>-0.023</td>
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<td>0.301</td>
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<td>0.202</td>
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<td>1.252</td>
<td>0.051</td>
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<td>0.588</td>
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### Table 6.9: Expenditure Inequality Effects by Expenditure Component for Year 1986

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<th>G&lt;sub&gt;k&lt;/sub&gt;</th>
<th>S&lt;sub&gt;k&lt;/sub&gt;</th>
<th>I&lt;sub&gt;k&lt;/sub&gt;</th>
<th>I&lt;sub&gt;k&lt;/sub&gt;/S&lt;sub&gt;k&lt;/sub&gt;</th>
<th>I&lt;sub&gt;k&lt;/sub&gt; - S&lt;sub&gt;k&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0.841</td>
<td>0.223</td>
<td>0.176</td>
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</tr>
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Table 6.10: Expenditure Inequality Effects by Expenditure Component for Year 1987

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<th>G_k</th>
<th>S_k</th>
<th>I_k</th>
<th>I_k/S_k</th>
<th>I_k - S_k</th>
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<tbody>
<tr>
<td>FB</td>
<td>0.032</td>
<td>0.0858</td>
<td>0.0212</td>
<td>0.175</td>
<td>0.156</td>
<td>0.891</td>
<td>-0.019</td>
</tr>
<tr>
<td>HSNG</td>
<td>0.049</td>
<td>0.618</td>
<td>0.235</td>
<td>0.335</td>
<td>0.239</td>
<td>0.713</td>
<td>-0.096</td>
</tr>
<tr>
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<td>0.010</td>
<td>0.620</td>
<td>0.246</td>
<td>0.063</td>
<td>0.049</td>
<td>0.778</td>
<td>-0.014</td>
</tr>
<tr>
<td>ENT</td>
<td>0.011</td>
<td>0.665</td>
<td>0.295</td>
<td>0.054</td>
<td>0.054</td>
<td>1.000</td>
<td>0.000</td>
</tr>
<tr>
<td>HLTH</td>
<td>0.002</td>
<td>0.267</td>
<td>0.313</td>
<td>0.021</td>
<td>0.010</td>
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</tr>
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<td>UTIL</td>
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</tr>
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<td>0.024</td>
<td>0.750</td>
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Table 6.11: Expenditure Inequality Effects by Expenditure Component for Year 1988

<table>
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<tr>
<th>Component</th>
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<th>R_k</th>
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<th>S_k</th>
<th>I_k</th>
<th>I_k/S_k</th>
<th>I_k - S_k</th>
</tr>
</thead>
<tbody>
<tr>
<td>FB</td>
<td>0.031</td>
<td>0.782</td>
<td>0.224</td>
<td>0.179</td>
<td>0.110</td>
<td>0.615</td>
<td>-0.069</td>
</tr>
<tr>
<td>HSNG</td>
<td>0.014</td>
<td>0.390</td>
<td>0.307</td>
<td>0.339</td>
<td>0.146</td>
<td>0.0431</td>
<td>-0.193</td>
</tr>
<tr>
<td>APP</td>
<td>0.010</td>
<td>0.677</td>
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<td>0.036</td>
<td>0.632</td>
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</tr>
<tr>
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<td>0.609</td>
<td>0.349</td>
<td>0.052</td>
<td>0.039</td>
<td>0.750</td>
<td>-0.013</td>
</tr>
<tr>
<td>HLTH</td>
<td>0.002</td>
<td>0.225</td>
<td>0.338</td>
<td>0.023</td>
<td>0.007</td>
<td>0.304</td>
<td>-0.016</td>
</tr>
<tr>
<td>TRAN</td>
<td>0.023</td>
<td>0.245</td>
<td>0.464</td>
<td>0.205</td>
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</tr>
<tr>
<td>UTIL</td>
<td>0.017</td>
<td>0.432</td>
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<td>0.061</td>
<td>0.521</td>
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</tr>
<tr>
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<td>0.643</td>
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</tr>
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### Table 6.12: Expenditure Inequality Effects by Expenditure Component for Year 1989

<table>
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<tr>
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<th>$C_k$</th>
<th>$R_k$</th>
<th>$G_k$</th>
<th>$S_k$</th>
<th>$I_k$</th>
<th>$I_k/S_k$</th>
<th>$I_k - S_k$</th>
</tr>
</thead>
<tbody>
<tr>
<td>FB</td>
<td>0.032</td>
<td>0.812</td>
<td>0.209</td>
<td>0.189</td>
<td>0.149</td>
<td>0.788</td>
<td>-0.040</td>
</tr>
<tr>
<td>HSNG</td>
<td>0.063</td>
<td>0.839</td>
<td>0.221</td>
<td>0.341</td>
<td>0.293</td>
<td>0.859</td>
<td>-0.048</td>
</tr>
<tr>
<td>APP</td>
<td>0.010</td>
<td>0.597</td>
<td>0.282</td>
<td>0.060</td>
<td>0.017</td>
<td>0.283</td>
<td>-0.043</td>
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<td>0.562</td>
<td>0.378</td>
<td>0.049</td>
<td>0.047</td>
<td>0.959</td>
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<tr>
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<td>0.350</td>
<td>0.025</td>
<td>0.009</td>
<td>0.360</td>
<td>-0.016</td>
</tr>
<tr>
<td>TRAN</td>
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<td>0.778</td>
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<td>0.187</td>
<td>0.228</td>
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<td>0.017</td>
<td>0.441</td>
<td>0.322</td>
<td>0.117</td>
<td>0.079</td>
<td>0.675</td>
<td>-0.038</td>
</tr>
<tr>
<td>TPE</td>
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<td>0.366</td>
<td>0.433</td>
<td>0.034</td>
<td>0.023</td>
<td>0.677</td>
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</tr>
<tr>
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### Table 6.13: Expenditure Inequality Effects by Expenditure Component for Year 1990

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<th>$R_k$</th>
<th>$G_k$</th>
<th>$S_k$</th>
<th>$I_k$</th>
<th>$I_k/S_k$</th>
<th>$I_k - S_k$</th>
</tr>
</thead>
<tbody>
<tr>
<td>FB</td>
<td>0.030</td>
<td>0.784</td>
<td>0.211</td>
<td>0.183</td>
<td>0.107</td>
<td>0.585</td>
<td>-0.076</td>
</tr>
<tr>
<td>HSNG</td>
<td>0.055</td>
<td>0.782</td>
<td>0.217</td>
<td>0.324</td>
<td>0.196</td>
<td>0.605</td>
<td>-0.128</td>
</tr>
<tr>
<td>APP</td>
<td>0.011</td>
<td>0.693</td>
<td>0.259</td>
<td>0.060</td>
<td>0.039</td>
<td>0.650</td>
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</tr>
<tr>
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<td>0.615</td>
<td>0.338</td>
<td>0.051</td>
<td>0.039</td>
<td>0.765</td>
<td>-0.012</td>
</tr>
<tr>
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<td>0.298</td>
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<td>0.026</td>
<td>0.001</td>
<td>0.039</td>
<td>0.025</td>
</tr>
<tr>
<td>TRAN</td>
<td>0.021</td>
<td>0.213</td>
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<td>0.185</td>
<td>0.075</td>
<td>0.405</td>
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</tr>
<tr>
<td>UTIL</td>
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<td>0.345</td>
<td>0.442</td>
<td>0.130</td>
<td>0.071</td>
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</tr>
<tr>
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<td>0.496</td>
<td>0.395</td>
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<td>0.021</td>
<td>0.656</td>
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Table 6.14: Expenditure Inequality Effects by Expenditure Component for Year 1991

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<th>$C_k$</th>
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<th>$G_k$</th>
<th>$S_k$</th>
<th>$I_k$</th>
<th>$I_k/S_k$</th>
<th>$I_k - S_k$</th>
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</thead>
<tbody>
<tr>
<td>FB</td>
<td>0.033</td>
<td>0.844</td>
<td>0.216</td>
<td>0.181</td>
<td>0.159</td>
<td>0.879</td>
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</tr>
<tr>
<td>HSNG</td>
<td>0.064</td>
<td>0.861</td>
<td>0.218</td>
<td>0.339</td>
<td>0.308</td>
<td>0.909</td>
<td>-0.031</td>
</tr>
<tr>
<td>APP</td>
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<td>0.701</td>
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<td>0.060</td>
<td>0.053</td>
<td>0.883</td>
<td>-0.007</td>
</tr>
<tr>
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<td>0.053</td>
<td>0.018</td>
<td>0.340</td>
<td>-0.035</td>
</tr>
<tr>
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<td>0.324</td>
<td>0.322</td>
<td>0.030</td>
<td>0.014</td>
<td>0.467</td>
<td>-0.016</td>
</tr>
<tr>
<td>TRAN</td>
<td>0.042</td>
<td>0.783</td>
<td>0.291</td>
<td>0.183</td>
<td>0.202</td>
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<td>0.019</td>
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<td>0.274</td>
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<td>0.365</td>
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<td>0.012</td>
<td>0.353</td>
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<td>0.208</td>
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Table 6.15: Expenditure Inequality Effects by Expenditure Component for Year 1992

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<th>$I_k$</th>
<th>$I_k/S_k$</th>
<th>$I_k - S_k$</th>
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</thead>
<tbody>
<tr>
<td>FB</td>
<td>0.030</td>
<td>0.804</td>
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</tr>
<tr>
<td>HSNG</td>
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<td>0.807</td>
<td>0.222</td>
<td>0.336</td>
<td>0.263</td>
<td>0.783</td>
<td>-0.073</td>
</tr>
<tr>
<td>APP</td>
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<td>0.465</td>
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<td>0.059</td>
<td>0.035</td>
<td>0.593</td>
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<td>0.676</td>
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<td>0.053</td>
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<td>0.001</td>
</tr>
<tr>
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<td>0.483</td>
<td>0.350</td>
<td>0.028</td>
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<tr>
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Table 6.16: Expenditure Inequality Effects by Expenditure Component for Year 1993

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<th>$I_k/S_k$</th>
<th>$I_k - S_k$</th>
</tr>
</thead>
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<td>0.234</td>
<td>0.344</td>
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<td>-0.034</td>
</tr>
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<td>0.042</td>
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<tr>
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<td>0.052</td>
<td>0.056</td>
<td>1.08</td>
<td>0.004</td>
</tr>
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<td>0.509</td>
<td>0.324</td>
<td>0.030</td>
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<td>0.767</td>
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</tr>
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<td>0.088</td>
<td>0.677</td>
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Table 6.17: Expenditure Inequality Effects by Expenditure Component for Year 1994

<table>
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<th>$G_k$</th>
<th>$S_k$</th>
<th>$I_k$</th>
<th>$I_k/S_k$</th>
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</tr>
</thead>
<tbody>
<tr>
<td>FB</td>
<td>0.029</td>
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<td>0.216</td>
<td>0.168</td>
<td>0.146</td>
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<td>-0.022</td>
</tr>
<tr>
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<td>0.213</td>
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<td>-0.046</td>
</tr>
<tr>
<td>APP</td>
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<td>0.604</td>
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<td>0.054</td>
<td>0.040</td>
<td>0.741</td>
<td>-0.014</td>
</tr>
<tr>
<td>ENT</td>
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<td>0.732</td>
<td>0.295</td>
<td>0.048</td>
<td>0.050</td>
<td>1.042</td>
<td>0.002</td>
</tr>
<tr>
<td>HLTH</td>
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<td>0.547</td>
<td>0.336</td>
<td>0.029</td>
<td>0.025</td>
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</tr>
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<td>0.201</td>
<td>0.216</td>
<td>1.075</td>
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</tr>
<tr>
<td>UTIL</td>
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<td>0.106</td>
<td>0.848</td>
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<td>1.000</td>
<td>1.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>
Table 6.18: Expenditure Inequality by Age Using the Gini Coefficient.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>16-24</th>
<th>25-34</th>
<th>35-44</th>
<th>45-54</th>
<th>55-64</th>
<th>&gt;=65</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>0.035</td>
<td>0.020</td>
<td>0.028</td>
<td>0.041</td>
<td>0.037</td>
<td>0.032</td>
</tr>
<tr>
<td>1981</td>
<td>0.022</td>
<td>0.025</td>
<td>0.028</td>
<td>0.034</td>
<td>0.030</td>
<td>0.036</td>
</tr>
<tr>
<td>1982</td>
<td>0.022</td>
<td>0.026</td>
<td>0.030</td>
<td>0.033</td>
<td>0.040</td>
<td>0.030</td>
</tr>
<tr>
<td>1983</td>
<td>0.025</td>
<td>0.030</td>
<td>0.035</td>
<td>0.036</td>
<td>0.054</td>
<td>0.041</td>
</tr>
<tr>
<td>1984</td>
<td>0.033</td>
<td>0.035</td>
<td>0.052</td>
<td>0.036</td>
<td>0.035</td>
<td>0.045</td>
</tr>
<tr>
<td>1985</td>
<td>0.032</td>
<td>0.034</td>
<td>0.033</td>
<td>0.032</td>
<td>0.044</td>
<td>0.038</td>
</tr>
<tr>
<td>1986</td>
<td>0.025</td>
<td>0.031</td>
<td>0.036</td>
<td>0.036</td>
<td>0.039</td>
<td>0.038</td>
</tr>
<tr>
<td>1987</td>
<td>0.023</td>
<td>0.029</td>
<td>0.028</td>
<td>0.033</td>
<td>0.038</td>
<td>0.035</td>
</tr>
<tr>
<td>1988</td>
<td>0.026</td>
<td>0.028</td>
<td>0.044</td>
<td>0.052</td>
<td>0.032</td>
<td>0.078</td>
</tr>
<tr>
<td>1989</td>
<td>0.023</td>
<td>0.029</td>
<td>0.033</td>
<td>0.037</td>
<td>0.042</td>
<td>0.029</td>
</tr>
<tr>
<td>1990</td>
<td>0.026</td>
<td>0.076</td>
<td>0.034</td>
<td>0.033</td>
<td>0.051</td>
<td>0.037</td>
</tr>
<tr>
<td>1991</td>
<td>0.020</td>
<td>0.027</td>
<td>0.040</td>
<td>0.034</td>
<td>0.029</td>
<td>0.040</td>
</tr>
<tr>
<td>1992</td>
<td>0.025</td>
<td>0.033</td>
<td>0.035</td>
<td>0.043</td>
<td>0.035</td>
<td>0.038</td>
</tr>
<tr>
<td>1993</td>
<td>0.021</td>
<td>0.027</td>
<td>0.034</td>
<td>0.038</td>
<td>0.042</td>
<td>0.026</td>
</tr>
<tr>
<td>1994</td>
<td>0.021</td>
<td>0.029</td>
<td>0.031</td>
<td>0.034</td>
<td>0.034</td>
<td>0.036</td>
</tr>
</tbody>
</table>
Table 6.19: Expenditure Inequality Effects by Race Using the Gini Coefficient

<table>
<thead>
<tr>
<th>YEAR</th>
<th>WHITE</th>
<th>BLACK</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>0.204</td>
<td>0.197</td>
</tr>
<tr>
<td>1981</td>
<td>0.176</td>
<td>0.207</td>
</tr>
<tr>
<td>1982</td>
<td>0.177</td>
<td>0.196</td>
</tr>
<tr>
<td>1983</td>
<td>0.212</td>
<td>0.196</td>
</tr>
<tr>
<td>1984</td>
<td>0.212</td>
<td>0.244</td>
</tr>
<tr>
<td>1985</td>
<td>0.180</td>
<td>0.207</td>
</tr>
<tr>
<td>1986</td>
<td>0.183</td>
<td>0.197</td>
</tr>
<tr>
<td>1987</td>
<td>0.179</td>
<td>0.182</td>
</tr>
<tr>
<td>1988</td>
<td>0.284</td>
<td>0.214</td>
</tr>
<tr>
<td>1989</td>
<td>0.181</td>
<td>0.211</td>
</tr>
<tr>
<td>1990</td>
<td>0.281</td>
<td>0.203</td>
</tr>
<tr>
<td>1991</td>
<td>0.234</td>
<td>0.166</td>
</tr>
<tr>
<td>1992</td>
<td>0.200</td>
<td>0.206</td>
</tr>
<tr>
<td>1993</td>
<td>0.187</td>
<td>0.200</td>
</tr>
<tr>
<td>1994</td>
<td>0.187</td>
<td>0.172</td>
</tr>
</tbody>
</table>
Table 6.20: Income Inequality

<table>
<thead>
<tr>
<th>YEAR</th>
<th>GINI RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>0.365</td>
</tr>
<tr>
<td>1981</td>
<td>0.369</td>
</tr>
<tr>
<td>1982</td>
<td>0.380</td>
</tr>
<tr>
<td>1983</td>
<td>0.382</td>
</tr>
<tr>
<td>1984</td>
<td>0.383</td>
</tr>
<tr>
<td>1985</td>
<td>0.389</td>
</tr>
<tr>
<td>1986</td>
<td>0.392</td>
</tr>
<tr>
<td>1987</td>
<td>0.393</td>
</tr>
<tr>
<td>1988</td>
<td>0.395</td>
</tr>
<tr>
<td>1989</td>
<td>0.401</td>
</tr>
<tr>
<td>1990</td>
<td>0.396</td>
</tr>
</tbody>
</table>

Source: Nelson (1994)
CHAPTER 7. SUMMARY AND CONCLUSION

7.1 Background

The measurement of inequality has long concerned writers in the field of personal income distribution. A casual examination the menu of government programs reveals that distributional considerations play an important role in the formulation of public policy in the United States. There are many different expenditures on social insurance and transfer programs that are designed both to provide a minimal standard of living for the poor as well as reduce the level of inequality, however, there also are some tax and other policies that increase inequality. There are traditional methods of measuring income inequality that help to shed light on the situation in the labor market. However, many issues in the distribution of well-being have remained unanswered.

Using family income as a measure of well-being without taking into account prices and other characteristics may lead to erroneous conclusions about the general welfare of households. Each household has its own characteristics in which its consumption and expenditure patterns are a function of its composition and other demographic factors. A household with five members differs from a household with two members in its expenditure and consumption patterns, given the same amount of resources. Using earnings alone to measure welfare ignores the effects of prices and the impacts of demographic characteristics and may not be a good indicator of welfare disparity.

Economic well-being can be defined in terms of the command individuals or households have over potential consumption. Official income statistics are produced to reflect the consumption potential of individuals or families with money income used most frequently to proxy this consumption potential. However, consumption, rather than income, may be a better indicator of the actual economic welfare of a household. The value of consumption may be much greater than annually reported income to the extent
that households have accumulated savings or accounting losses from businesses, or because they are able to borrow against future income (Garner, 1993). Thus, one could argue that consumption reflects material well-being in terms of past, current, and expected future income. How a household allocates its income across different consumption categories can affect the overall economic well-being of households differently. Identifying the effects of demographic characteristics of a household, the impact of marginal changes in different expenditures on the inequality of total expenditures can provide useful information, especially for policy makers.

This study addresses two important issues related to measures of economic well-being. The first part analyzes the impacts of demographic characteristics on the expenditure patterns of households using an econometric approach. In this model a system of individual demand functions depend of the prices faced by all households, total expenditures, and attributes such as demographic characteristics that vary among households. There are four categories of demographic characteristics included in the model. These characteristics are represented with a dummy variable valued 1 if true or 0 if false. Consumer expenditures are divided among eight commodity groups and with the share of expenditures of each used as the dependent variable.

1. Food and Beverages: Expenditures on food and beverages at home and away from home.
2. Housing: Expenditures on housing and housing services.
3. Apparel: Expenditures on clothing
4. Entertainment: Expenditures on all forms entertainment.
5. Heath: Expenditures on health and health services.
6. Transportation: Expenditures on transportation.
8. Personal care and education: Expenditures on personal care and education.

The following demographic characteristics are employed as attributes of individual households; to avoid perfect collinearity the first dummy variable from each group is omitted.

1. Family size: 1, 2, 3, 4, 5 persons.
2. Age of the head of the family: 16-24, 25-34, 35-44, 45-54, 55-64, 65 or greater.
3. Region of residence: Northeast, West, Midwest, South.
4. Race: White, black.

The logarithmic indirect translog functional form is used in the application of the model. Aggregate demand functions are obtained by summing over individual functions. Yearly consumer expenditure data for the years 1980-1994 are used in this analysis and combined cross section-time series are used in the econometric estimation.

The second part of this study evaluates inequality in consumption expenditures across consumer units including inequality within time, age and race categories. Gini coefficients are calculated for the total population sample and for demographic subgroups for the years 1980-1994. In addition, the Gini coefficients are decomposed by budget components, using the Lerman-Yitzhaki covariance method, to examine the effects of changes in expenditures on overall inequality. The same data set, the consumer expenditure survey, used in the econometric analysis is also used in estimating inequality in expenditures.

7.2 Empirical Analysis

The next two sections summarize the analyses conducted in this study. Section 7.2.1 addresses the econometric model and estimations to measure the impact of demographic characteristics of households on expenditures. Section 7.2.2 presents the summary of the measurement of inequality in the distribution of expenditures.
7.2.1 The Impact of Demographic Characteristics

Based on the conceptual framework discussed in chapter three and the econometric model specified in chapter five, seven equations with eight expenditure shares as endogenous variables, eight explanatory variables representing commodity prices and total expenditures, and fifteen dummy variables for demographic characteristics were estimated using the seemingly unrelated regression method. To avoid perfect multicollinearity, one dummy variable from each category of the demographic attributes is necessarily omitted. All required conditions such as homogeneity, symmetry, and non-negativity conditions were imposed on the system of equations.

In general there is statistically conclusive evidence that demographic characteristics affect the expenditures of households on goods and services. In this section, we discusses the results for three commodities. For detailed discussion of the results please see chapter five. As the age of the head a household and the size of the household increases the rate of expenditure on food and beverages also increases. People living in the western, midwestern, and southern geographical regions spend relatively less money on food and beverages when compared with households living in the northeastern geographical region. The variables representing the race attribute show that blacks spend relatively less on food and beverages than whites which, since, they also have lower incomes indicate lower expenditures too.

The estimates on expenditures on housing and housing related services indicate that a head of a household aged between 25 and 45 spends relatively more than the head of a household aged 16-24. While families living in the west and south spends relatively less money on housing than those in northeast, the variable representing the midwest shows that typical families living in that region have higher relative expenditures than households in the northeast. A household headed by a black relatively
spends less than a household headed by a white person.

Another interesting result obtained from this analysis is the impact of demographic attributes on health care expenditures. Heads of households who are 45 years old or older spend more money on health care services than younger heads of households. Also families with two or three members have relatively larger health expenditures than families with a single member. Households residing in the western and midwestern regions allocate relatively more resources for health care services than families living in the northeastern geographical region. At a 95% level of statistical significance, the analysis confirms that the expenditures for the consumption of health care services by households headed by blacks are relatively less than the expenditures by households headed by whites, and by implication also absolutely lower.

These results confirm that demographic characteristics are important factors in the decision of households to allocate resources for the consumption of goods and services. One may not reach the right conclusions about well being without the inclusion of prices and demographic attributes in the process of measuring inequality. The impact of geographic location of residence has clearly an impact on the patterns of household expenditures. This is directly attributed to differences in the cost of living, but may also be affected by other factors.

All these household attributes have very significant implications not only on the well-being of individuals, but also on the design and implementation of public policy measures to improve the quality of life. For example, low income people spend a major portion of their income on the consumption of food and other basic necessity and the elderly might allocate substantial portion of their income on health care and other health related items. Programs such as the ones financed by the government must identify the expenditure patterns of each subgroup in order to provide right assistance and services.
7.2.2 Inequality in the Distribution of Consumption Expenditures

The overall Gini coefficient is used to produce an estimate of the inequality in the distribution of total household consumption expenditures for the U.S. population based on the consumer expenditure survey; Gini coefficients are also calculated for age and racial subgroups, and by expenditure budget components. The following parameters are used to measure the inequality:

- \( G \): Overall Gini Coefficient.
- \( G_k \): Gini coefficient for component \( k \), age \( k \) or race \( k \).
- \( C_k \): Contribution to total inequality of component \( k \).
- \( R_k \): Correlation with rank of total expenditures of component \( k \).
- \( S_k \): Expenditure share of component \( k \).
- \( I_k \): Share expenditure inequality of component \( k \).
- \( I_k / S_k \): Relative expenditure inequality of component \( k \).
- \( I_k - S_k \): Relative marginal effect of component \( k \).

All of these parameters are calculated for the years 1980 through 1994. The expenditure categories are the same as the ones in the econometric analysis and the same data are used to measure inequality. The results only for the year 1980 are discussed in this section, for a more detailed discussion see chapter 6.

The overall Gini coefficient of the whole population for 1980 is 0.214, with 0 being the lowest (no inequality) and 1 the highest. The disparity in consumption expenditures appears to be high for the following goods and services: apparel = 0.447, entertainment = 0.319, heath care = 0.370, utility = 0.330, and personal care and education = 0.416. Four commodities: food = 0.224, housing = 0.316, transportation = 0.205, and personal care and education make up over 65% of the total share of expenditures and contribute over 50% of the inequality in the total expenditures.
To determine the contribution of each budget component to the overall Gini, the column under $I_k$ (in tables 6.3-6.17) presents the proportion of inequality of total expenditures attributable to the component. This proportion is given by the ratio of each component’s contribution to total inequality to the overall Gini ($C_k$ divided by $G$). Expenditures on food, housing, and transportation exhibit the highest correlations with the rank of total expenditures. A high Gini correlation means that the higher the total expenditures the greater the spending on an individual commodity. Relative measures of inequality are presented in the last two columns of tables 6.3-6.17. The relative expenditure inequality ($I_k / S_k$) measures the inequality for components as a percentage of expenditure shares. Relative expenditure inequalities are calculated as the ratio of proportional contribution to the share of total expenditures. Expenditures for food, housing, entertainment, transportation, and personal care and education contribute greater, proportionally, to the inequality in total expenditures than they contribute to total expenditures in terms of their shares. The last column presents the relative effect of marginal increase in each budget component. The component would exert a negative effect on inequality if the relative marginal effect is negative. For 1980, all components have this negative effect except for expenditures on transportation and personal care and education.

Overall Ginis were also calculated for expenditures based on age and race. The Gini measuring inequality within each age group indicate nearly equal expenditures, implying that incomes are probably relatively uniform within each age group. Also disparity in expenditures within black and white groups is similar to that for the entire sample, but the measures do not reflect the degree of inequality between the two groups.

The material well-being of the population, as defined in terms of expenditures, is evaluated in terms of the inequality across consumer units in the United States in 1980-1994. Results presented in this
study shed light about the state of our well-being through measuring inequality in expenditures. From these measures one may be able to deduce broader implications, especially in terms of designing the right government policies towards improving the welfare of the lower income class. Slesnick (1994) pointed out that an indicator of well-being that is consistent with economic theory should be based on consumption. In spite of this, the preponderance of empirical evidence on inequality in the United States is based on the income distribution (Slesnick, 1994). Income might have performed poorly as a proxy for household welfare in measuring inequality.

7.3 Conclusions and Policy Implications

This study has addressed two important issues, the impact of demographic attributes on expenditures and inequality in expenditures which are directly related to economic well being. Household’s ability to improve its state of well-being is very much affected by its ability to increase its level of consumption through increasing expenditure. The level of expenditure is influenced by the compositions and demographic characteristics of a household. The impacts of demographic characteristics of households on consumption expenditures was fully examined using an econometric model. The results of the analysis reveal that demographic characteristics of households such as age, family size, geographic location of residence, and race have direct effects on the consumption patterns of households. For example, as the age of the head of the household increases the share expenditures allocated for medical services also increases. The implications of this phenomenon is that a relatively high proportion of income of the elderly goes to medical services instead of entertainment or transportation. The allocation of resources for food and beverages depend on the size of the family. As the number of people in the household increases so does the expenditure share. From the interpretations and inspections of the results one can clearly see a well defined patterns in expenditure distributions given
the demographic characteristics of households. The second main objective of this study is to measure inequality in consumption expenditures using the Gini coefficient method. The results obtained from this analysis show that while there is little change in the overall Gini ratio and fairly low inequality in expenditures when compared to incomes from 1980 to 1994, there is ample evidence that there exist bigger disparity in consumption expenditures for commodities such as apparel, health care, entertainment, transportation, and personal care and education. There is very little differences in inequality within age and race groups, but there might be between groups. Comparisons also are made between expenditure and income inequalities to confirm that the Gini for expenditure is smaller than the Gini for income. While no evidence is available from this study, one reason for the difference is that people may not spend all their earnings on consumption of goods and services. A part of their previous income could have been saved or invested; they use those savings when their incomes decline. In general, the method applied to measure inequality has provided a comprehensive framework for analyzing not only the inequality in expenditures; but the marginal effects of the consumption of each commodity on inequality.

An indicator of well-being that is consistent with economic theory should be based on consumption. In this study we have shown that consumption is affected by demographic characteristics of a household, prices, geographic location of residence, and race which are major factors that should be included in measuring welfare. Without taking these factors into account, putting a household into a certain income groups and making comparisons among households can cause erroneous conclusions. As a result, income inequality overstates consumption-based inequality measures by a substantial amount (Slesnick, 1994). While income inequality measures inequality based on current income, expenditure inequality may not reflect inequality based on the current income. Without some of the expenditures coming from life time savings and future income, expenditure inequality based on current income could
be larger than what is presented in this study. Future income is not earned income.

Results presented from measuring inequality in consumption expenditures substantiate the importance of evaluating the differential impacts of proposed policies on subgroups of the population and differences in inequality which can result when expenditures for budget components change.

7.4 Limitations and Future Research

This study does not answer all the questions related to demographic attributes and expenditure inequality. There are numerous unanswered question towards identifying the core sources of inequality in expenditures and the effects on demographic characteristics. One major limitation of the data set is that price does not vary adequately if a study uses a yearly data. Price is a measure factor affecting household expenditure. This problem could affect the precision of the parameters estimated. Also, price differences between urban and rural areas is not desegregated. Using the average price for both rural and urban consumers may not reflect the real price the consumers face at the market place. Households may not pay the same price for the same quantity and quality of goods consumed. Price data should be obtained from households instead of using the labor statistics aggregated price. Pseudo prices may be considered as a proxy for price which can be calculated from expenditure and quantity of goods and services.

It is important that one not get the impression that income inequality and consumption inequality are the same. In terms of measuring the well-being of households income or expenditure inequality or both can be employed. But income must be comprised of current income, income from assets, benefits gained from existing properties such as old cars, houses and other facilities used by the household free of charge. These benefits must be translated into income to reflect how well off the household is. Basically, it is the same as using the permanent income approach. Current income alone may not reflect
the well-beingness of a household and inequality measurement based on current income alone is inadequate. Rather, inequality based on expenditures is better than the inequality measured based on current income. Current consumption of goods and services does not solely depend on current income. Besides depending on current income, current consumption of goods and services depends on direct and indirect monetary and non-monetary benefits including future income and current government cash and in-kind assistance. Future studies on inequality and well-beingness must consider these and other sources on incomes and benefits.

This study can be expanded to learn more about economic of well-being by using a better methodology and data set. The impact of demographic characteristics can be analyzed more effectively using true panel data. The main advantage of panel data, compared to a single cross-section or a time-series, is that it allows one to control for temporally persistent differences among individuals or firms that in many instances may bias estimates obtained from cross-sections. Hsiao (1985, 1986), Klivmarken (1989), and Solon (1989), and Baltagi (1995) list several advantages and benefits from using panel data. The most visible advantages are the following:

1. Controlling for individual heterogeneity. Panel data treats individuals firms, states or countries as heterogenous. Time series and cross-section studies are not adequately capable of controlling for this heterogeneity and run the risk of obtaining biased results (Moulton, 1986, 1987).
2. Panel data give more informative data, more variation, less collinearity among variables, more degrees of freedom and more efficiency compared to time series. Multicollinearity is a common problem in time series studies. Panel data usually give researchers a large number of data points, increasing the degree of freedom and reducing the collinearity among independent variables, hence improving the efficiency of econometric estimates. With this more informative data one
can produce more reliable parameter estimates.

3. Panel data are more convenient in the study of dynamic adjustments. Cross-sectional distributions that look relatively stable, do not fully reveal a multitude of changes. Spells of unemployment, job turnover, residential and income mobility are better studied with panels. Panel data are also well suited in the study of the duration of economic states like unemployment and poverty, and if these panels cover a long enough time period, they can shed light on the speed of adjustments to economic policy changes (Baltagi, 1995). Panel data are also useful for the estimation of inter-temporal relations, life-cycle and inter-generational models.

4. Panel data are useful in identifying and measuring some effects that are not detectable in cross-sectional and time-series data. Based on the example given by Ben-Porath, suppose we have a cross-section of women with a 50% average yearly labor force participation rate. This may be the results of:

   a. Each woman having a 50% chance of being in the labor force, in any given year,
   b. 50% of the women work all the time and 50% do not.

Case (a) has higher turnover, while case (b) has no turnover. Only panel data could make distinctions between these two cases. Another example is the determination of whether union membership increases or decreases wages. This can be better answered as we observe a worker moving from union to nonunion jobs or vice versa. Holding the individual characteristics constant, we can determine whether union membership affects wages and by how much (Freeman, 1984).

5. Panel data models allow the constructing and testing of more complicated behavioral models than regular cross-sectional and time series data. Also, fewer restrictions need to be imposed on
a distributed lag model than in a purely time series study (Hsiao, 1986).

Panel data has its own limitations. Some of the limitations include:

1. Problems of Survey Design and Data Collection: These include problems of coverage (incomplete account of the population of interest), non-response (due to lack of cooperation of the respondent or errors in framing the questions to solicit information), recall (respondent not remembering clearly), frequency of interviewing, interview spacing, reference period, the use of bounding and the time-in-sample bias (Bailar, 1989).

2. Distortions of Measurement Errors: Measurement errors may arise as a result of faulty responses due to unclear questions, memory errors, deliberate distortion responses, inappropriate informants, mis-recording of responses and interviewer effects (Kalton, Kasprzyk and McMillen, 1989).

3. Short Time-Series Dimension: Typical panels involve annual data covering a short panel of time for each individual (Baltagi, 1995). This means that asymptotic arguments depend crucially on the number of individuals tending ti infinity. Increasing the time span of the panel is not without cost.

Future research in the area of measuring expenditure inequality must include out-of-pocket expenditures, including expenditures for savings and taxes paid. This approach would provide information more related to permanent income which ultimately would help us to narrow down differences between income and expenditures.
REFERENCES


Barten, A.P., (1964), "Family Composition, Prices and Expenditure Patterns", in Colston Papers 16,277-293.


Kaldor, Nicholas, (1939), "Welfare Proposition of Economics and Interpersonal Comparisons of
Utility", The Economic Journal, 49, No. 195(September), 549-52.


Appendix
Appendix P-1: Program to Download Data and Create Data Set

********************************************************************
* This SAS program downloads data from tape to carteledge and creates SAS data set. It also Merges the family characteristics file with the expenditure file.
********************************************************************

// JOB,'READ CONSUMER',TIME=10
/*WVNET TAPE
/*EXEC PGM=IEFBR14
/*CONSCHR4 DD DSN=UN.BERHSAM.CONSCHR4.Q894,UNIT=DISK,
/*   DISP=(OLD,DELETE)
/*EXPSUM4 DD DSN=UN.BERHSAM.EXPSUM4.X894,UNIT=DISK,
/*   DISP=(OLD,DELETE)
/*EXEC SAS,REGION=2000K
//FMLYQ894 DD DSN=BLS.INT.FMLY.Q894,UNIT=TAPE,VL=,(RETAI,SE=C07611),
//   DISP=(OLD,KEEP),LABEL=(1,NL),
//   DCB=(LRECL=255,BLKSIZE=11275)
//MTAB894 DD DSN=BLS.INT.MTAB.Q894,UNIT=TAPE,VL=,(RETAI,SE=C07611),
//   DISP=(OLD,KEEP),LABEL=(3,NL),
//   DCB=(LRECL=33,BLKSIZE=11550)
//CONSCHR4 DD DSN=UN.BERHSAM.CONSCHR4.Q894,UNIT=DISK,
//   DISP=(NEW,CATLG),
//   SPACE=(TRK,(150,50),RLSE)
//EXPSUM4 DD DSN=UN.BERHSAM.EXPSUM4.X894,UNIT=DISK,
//   DISP=(NEW,CATLG),
//   SPACE=(TRK,(150,50),RLSE)
//FEEZ DD DSN=UN.BERHSAM.FEEZ.L894,UNIT=CART,
//   DISP=(NEW,CATLG),EXPDT=99365
//   SPACE=(TRK,(150,50),RLSE)
//SYSIN DD *
LIBNAME FEEZ V606SEQ;
* THIS PROGRAM READS SELECTED DATA FROM THE CONSUMER EXPENDITURE TAPES FROM THE BUREAU OF LABOR STATISTICS AND CREATES SAS DATA SETS IN A DISKAGE FILE FOR 1989 QUARTER 4 ITERVIEW
;
OPTIONS NOCENTER;
********************************************************************
* STEP 1: 4TH QUARTER FILE*
********************************************************************

*************************************************************************
* STEP 1.A: GET CONSUMER CHARACTERISTICS *
*************************************************************************

DATA CONSCHR4.Q894 (LABEL='CONSUMER CHR DATA 4TH QTR 1989'
KEEP=NEWID AGE_REF AGE_REF_ AGE2 AGE2_ BLS_URBN BSINVSTX BSIN_STX CBSGFTX CBSGFTX_ CKBKACTX CKBK_CTX COMPNDX COMP_NDX COMPCKGX COMP_KGX COMPNSX COMP_NSX COMPWDX COMP_WDX COMPSAVX COMP_AVX COMPSCEX COMP_FCX CUTFNRE CUTE_URE EARNCOMP EARN_OMP EDUC_REF EDUCOREF EDUC1 EDUC2 EDUC2_ ERANK ERANK_ FAM_SIZE FAM__IZE FAM__YPE FAMTFEDX FAM_EDX FEDRNDX FEGRNDX FEGRNDX FEPTAXX FEPTAXX_ FFRMINCX FFRM_NCX FGVORETX FGVO_ETX FINCATAX FINCAT_X 142
FINCBTAX  FINCBT_X  FINDRETX  FIND_ETX  FININCX  
FININCX_ FINLWT21  FJSSDEDX  FJSS_EDX  FNONFRMX  
FNON_RXM  FPRIENPX  FPR_ENX  FRREDX  FRRDEDX_  
FRRETIX  FRRE_TXX  FSALARYX  FSAL_RYX  FSLTXAX  
FSLTXAX_ FSSIX_ GOVTCOST GOVT_OST  
INC_HRS1  INC__RS1  INC_HRS2  INC__RS2  INC_RANK  
INCCONTX  INCC_NTX  INCLASS  INCLOSSA  INCL_SSA  
INCLOSSB  INCN_SSB  INCNOW1  INCN_W1  INCNOW2  
INCN_NW2  INCOMEY1  INCO_EY1  INCOMEY2  INCO_EY2  
INCRAT1  INCS_AT1  INCRT2  INCS_AT2  INCWEEK1  
INCW_EK1  INCEWEEK2  INCR_EK2  INSR_NDX  INSRFX  
INTEARNX INTE_RNX  JFDSMPX  JFDS_MPX  JOTAXNET  
JOTA_NET  LUMPSUMX  LUMP_UIX  MARI_AL1  MARI_AL1  
MISCTRNX  MISC_TRX  MONYOWDX  MONY_WDX  NO_EARNR  
NO_E_RNR  NO_EARNX  NONINCmx  NONI_CMX  
NUM_AUM  NUM_UOM  OCCUPRE1  OCCU_RE1  OCCUPRE2  
OCCU_RE2  ORIGIN2_ ORIGIN2  ORIGIN2_  ORIGIN2_  
OTHNFDX  OTHR_NDX  OTHINCX  OTHR_NCX  PENSIONX  
PENS_ONX  PERSLT18  PERS_T18  PERSOT64  PERS_T64  
POPSIZEx  PRNEARN  PRIN_ARX  PTAXRFDX  PTAX_FDX  
PURSSECX  PURS_ECX  QINTRVMO  QINTRVYR  RACE2  
RACE2_ REF_RACE  REF_ACE  REGION  RESPSTAT  
RESP_TAT  SALEINCX  SALE_NCX  SAVACCTX  SAVA_CTX  
SECESTX  SECESTX_  SEL_SECX  SEL_ECX  SETLINSX  
SETLNSX  SEX_REF  SEX_RES_ SEX2  SEX2_  
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SSOFRPX  SSOV_RPX  TAXPROPX  TAXP_OPX  TOTXPDX  
TOTTPDX  UNEMPULX  UNEMPLX_  USBDNX  USBDNX_  
VEHQ  VEHQ_  WDBSASTX  WDBS_STX  WDBSGDX  
WBDS_DXX  WELFAERE  WELF_RXX  TOTEXPPQ  TOTEXPQ  
FOODPP  FOODCQ  FDHOMEPC  FDHOMEQ  FDATAWAYQ  
FDWAYQ  FALCEPQ  ALCBEVCP  HOUSPQ  HOUSCPQ  
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RENWECQ  OTHLDPQ  OTHLOCQ  UTILPQ  UTILCP  
HOUSOPQ  HOUSEQCP  HOUSEQPC  APPARPQ  APPARCPQ  
APPSQ  TRANSPQ  TRANSCQ  VEHICLPQ  VEHICLCQ  
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PERSCAQ  PERSDQ  READDQ  READCC  EDUCAPQ  
EDUCACQ  TOBACCPQ  TOBACCCQ  MISCPQ  MISCCQ  
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ATTRIB AGE_REFX  LENGTH= 3  LABEL='AGE OF REFERENCE PERSON';  
ATTRIB AGE_REF  LENGTH= $1  LABEL='FLAG - AGE OF REFERENCE PERSON';  
ATTRIB AGE2  LENGTH= $1  LABEL='FLAG - AGE OF SPOUSE';  
ATTRIB BLS_URBN  LENGTH= $1  LABEL='URBAN(1) OR RURAL(0)';  
ATTRIB BSINSTX  LENGTH= 8  LABEL='INVESTMENT-OWN FARM/BUSINESS';  
ATTRIB BSIN_VSTX  LENGTH= $1  LABEL='FLAG - BSINSTX';  
ATTRIB CBSGFTX  LENGTH= 8  LABEL='GIFTS IN CASH,BONDS OR STOCKS';  
ATTRIB CBSGFTX  LENGTH= $1  LABEL='FLAG - CBSGFTX';  
ATTRIB CBKACTX  LENGTH= 8  LABEL='AMT IN CHKG, BROK, OTH ACCTS';  
ATTRIB CBKACTX  LENGTH= $1  LABEL='FLAG - CBKACTX';  
ATTRIB COMPBNDX  LENGTH= 8  LABEL='CHANGE IN SAVINGS BONDS';  
ATTRIB COMP_NDX  LENGTH= $1  LABEL='FLAG - COMPBNDX';  
ATTRIB COMPCKGX  LENGTH= 8  LABEL='CHANGE IN CHKG ACCTS';  
ATTRIB COMP_KGX  LENGTH= $1  LABEL='FLAG - COMPCKGX';  
ATTRIB COMPNSX  LENGTH= 8  LABEL='WORK COMP/VETS PYMTS';  
ATTRIB COMP_NSX  LENGTH= $1  LABEL='FLAG - COMPNSX';
ATTRIB COMPOWDX LENGTH= 8 LABEL='CHANGE IN MONEY OWED CU';
ATTRIB COMP_WDX LENGTH= $1 LABEL='FLAG - COMPOWDX';
ATTRIB COMPSAVX LENGTH= 8 LABEL='CHANGE IN SVGS ACCT';
ATTRIB COMP_AVX LENGTH= $1 LABEL='FLAG - COMPSAVX';
ATTRIB COMPSECX LENGTH= 8 LABEL='CHANGE IN STKS, BNDS';
ATTRIB COMP_ECX LENGTH= $1 LABEL='FLAG - COMPSECX';
ATTRIB CUTE_URE LENGTH= $1 LABEL='HOUSING TENURE: 1-6';
ATTRIB CUTENURE LENGTH= $1 LABEL='FLAG - CUTE_URE';
ATTRIB EARNCOMP LENGTH= $1 LABEL='COMPOSITION OF EARNERS 1-8';
ATTRIB EARNOMP LENGTH= $1 LABEL='FLAG - EARNCOMP';
ATTRIB EDUC_REF LENGTH= $1 LABEL='EDUCATION OF REF. PERSON 1-7';
ATTRIB EDUC0REF LENGTH= $1 LABEL='FLAG - EDUC_REF';
ATTRIB EDUCA2 LENGTH= $1 LABEL='EDUCATION OF SPOUSE 0-32';
ATTRIB EDUCA2_ LENGTH= $1 LABEL='FLAG - EDUCA2';
ATTRIB ERANK LENGTH= 8 LABEL='WTD. RANKING BY EXPENDS. (9.7)';
ATTRIB ERANK_ LENGTH= $1 LABEL='FLAG - ERANK';
ATTRIB FAM_SIZE LENGTH= 2 LABEL='NO. OF MEMBRS IN CONS. UNIT';
ATTRIB FAM_IZE LENGTH= $1 LABEL='FLAG - FAM_SIZE';
ATTRIB FAM_TYPE LENGTH= 8 LABEL='CONS. UNIT TYPE 1-9';
ATTRIB FAMYPE LENGTH= $1 LABEL='FLAG - FAM_TYPE';
ATTRIB FAMTFEDX LENGTH= 8 LABEL='FED Y TX WHLD LAST CHK-ANNUAL.';
ATTRIB FAMTEDX LENGTH= $1 LABEL='FLAG - FAMTFEDX';
ATTRIB FEDRFNDX LENGTH= 8 LABEL='REFUND FROM FED INCOME TAX';
ATTRIB FEDR_NDX LENGTH= $1 LABEL='FLAG - FEDRFNDX';
ATTRIB FEDTAXX LENGTH= 8 LABEL='FEDERAL TAX PAID';
ATTRIB FEDTAXX_ LENGTH= $1 LABEL='FLAG - FEDTAXX';
ATTRIB FFRMINCX LENGTH= 8 LABEL='INCOME/LOSS FROM OWN FARM';
ATTRIB FFRM_NCX LENGTH= $1 LABEL='FLAG - FFRMINCX';
ATTRIB FGovretX LENGTH= 8 LABEL='GOVT RETIREMT DEDUCTED';
ATTRIB FGOV_ETX LENGTH= $1 LABEL='FLAG - FGOVETX';
ATTRIB FINCATA tax LENGTH= 8 LABEL='CONS. UNIT INCOME AFTER TAXES';
ATTRIB FINCATAX LENGTH= $1 LABEL='FLAG - FINCATA';
ATTRIB FNCBTA X LENGTH= 8 LABEL='CONS. UNIT INCOME BEFORE TAXES';
ATTRIB FNCBTAX LENGTH= $1 LABEL='FLAG - FNCBTA';
ATTRIB FNDRET X LENGTH= 8 LABEL='SELF-EMPLOYED RETIREMENT PLAN';
ATTRIB FNDRETX LENGTH= $1 LABEL='FLAG - FNCRETAX';
ATTRIB FININ CX LENGTH= 8 LABEL='DIVID/ROYALTIES/ESTATES/TRUSTS';
ATTRIB FININCX LENGTH= $1 LABEL='FLAG - FININCX';
ATTRIB FINLWT21 LENGTH= 8 LABEL='CONS. UNIT WEIGHT (11.3)';
ATTRIB FJSSDEDX LENGTH= 8 LABEL='SOC SEC PAYMENT';
ATTRIB FJSS_EDX LENGTH= $1 LABEL='FLAG - FJSSDEDX';
ATTRIB FNONFRMX LENGTH= 8 LABEL='INC. FROM NONFARM BUSINESS';
ATTRIB FNONRMX LENGTH= $1 LABEL='FLAG - FNONRMX';
ATTRIB FPRIPENX LENGTH= 8 LABEL='PRIV. PENS. DEDUCT. FR LAST PAY';
ATTRIB FPRIPENX LENGTH= $1 LABEL='FLAG - FPRIPENX';
ATTRIB FRRDEDX LENGTH= 8 LABEL='RAIL. RETIR. DEDUCT FR LAST PAY';
ATTRIB FRRDEDX LENGTH= $1 LABEL='FLAG - FRRDEDX';
ATTRIB FRRETIRX LENGTH= 8 LABEL='AMT. FROM RRR AND SS';
ATTRIB FRRE_IRX LENGTH= $1 LABEL='FLAG - FRREIRX';
ATTRIB FSALARYX LENGTH= 8 LABEL='WAGE AND SALARY INCOME';
ATTRIB FSAL_RXY LENGTH= $1 LABEL='FLAG - FSALARYX';
ATTRIB FSLTAXX LENGTH= 8 LABEL='ST. AND LOCAL INCOME TAXES';
ATTRIB FSLTAXX LENGTH= $1 LABEL='FLAG - FSLTAXX';
ATTRIB FSSIX LENGTH= 8 LABEL='COMBINES SSI CHECKS';
ATTRIB FSSIX_ LENGTH= $1 LABEL='FLAG - FSSIX';
ATTRIB GOVT_COST LENGTH= $1 LABEL='GOVT. PAYS HOUSING 1-2';
ATTRIB GOVT_OCT LENGTH= $1 LABEL='FLAG - GOVT_COST';
ATTRIB INC_HRS1 LENGTH= 3 LABEL='HOURS WORKED/WK BY REF. PERSON';
ATTRIB INC_RS1 LENGTH= $1 LABEL='FLAG - INC_HRS1';
ATTRIB INC_HRS2 LENGTH= 3 LABEL='HOURS WORKED/WEEK BY SPOUSE';
ATTRIB INC_RS2 LENGTH= $1  LABEL='FLAG - INC_HRS2';
ATTRIB INC_RANK LENGTH=  8  LABEL='WEIGHTED % INCOME RANKING(9.7)';
ATTRIB INCCONTX LENGTH=  8  LABEL='REGULAR CONTRIB. RECEIVED';
ATTRIB INCC_NTX LENGTH= $1  LABEL='FLAG - INCCONTX';
ATTRIB INCLASS LENGTH= $1  LABEL='INCOME CLASS 1-8';
ATTRIB INCLOSSA LENGTH=  8  LABEL='LOSS FROM RENTERS';
ATTRIB INCL_SSA LENGTH= $1  LABEL='FLAG - INCLOSSA';
ATTRIB INCLOSSB LENGTH=  8  LABEL='LOSS FROM OTHER RENTAL UNITS';
ATTRIB INCL_SSB LENGTH= $1  LABEL='FLAG - INCLOSSB';
ATTRIB INCNONW1 LENGTH= $1  LABEL='REAS. REF PER NOT WORKING 1-6';
ATTRIB INCN_NW1 LENGTH= $1  LABEL='FLAG - INCNONW1';
ATTRIB INCNONW2 LENGTH= $1  LABEL='REAS. SPOUSE NOT WORKING 1-6';
ATTRIB INCN_NW2 LENGTH= $1  LABEL='FLAG - INCNONW2';
ATTRIB INCOMEY1 LENGTH= $1  LABEL='PREV TYPE EMPLOYEE-REF PERS 1-6';
ATTRIB INCO_EY1 LENGTH= $1  LABEL='FLAG - INCOMEY1';
ATTRIB INCOMEY2 LENGTH= $1  LABEL='PREV TYPE EMPLOYEE-SPOUSE 1-6';
ATTRIB INCO_EY2 LENGTH= $1  LABEL='FLAG - INCOMEY2';
ATTRIB INCSTAT1 LENGTH= $1  LABEL='WORK STATUS-REF PERS 1-2';
ATTRIB INCSTAT2 LENGTH= $1  LABEL='WORK STATUS-SPOUSE 1-2';
ATTRIB INCWEEK1 LENGTH=  2  LABEL='WEEKS WORKED-REF PERS';
ATTRIB INCW_EK1 LENGTH= $1  LABEL='FLAG - INCWEEK1';
ATTRIB INCWEEK2 LENGTH=  2  LABEL='WEEKS WORKED-SPOUSE';
ATTRIB INCW_EK2 LENGTH= $1  LABEL='FLAG - INCWEEK2';
ATTRIB INSRFNDX LENGTH=  8  LABEL='REFUND FROM INSURANCE POL.';
ATTRIB INSR_NDX LENGTH= $1  LABEL='FLAG - INSRFNDX';
ATTRIB INTEARNX LENGTH=  8  LABEL='INTEREST-SVGS ACCTS OR BONDS';
ATTRIB INTE_RNX LENGTH= $1  LABEL='FLAG - INTEARNX';
ATTRIB JFDSTMPA LENGTH=  8  LABEL='ANNUAL VALUE OF FOOD STAMPS';
ATTRIB JFDS_MPA LENGTH= $1  LABEL='FLAG - JFDSTMPA';
ATTRIB JOTAXNET LENGTH=  8  LABEL='OTH TAXES PD DURING PAST YR';
ATTRIB JOTA_NET LENGTH= $1  LABEL='FLAG - JOTAXNET';
ATTRIB LUMPSUMX LENGTH=  8  LABEL='LUMP SUM RECEIPTS';
ATTRIB LUMP_UMX LENGTH= $1  LABEL='FLAG - LUMPSUMX';
ATTRIB MARITAL1 LENGTH= $1  LABEL='MARITAL STATUS OF REF PER 1-5';
ATTRIB MARI_AL1 LENGTH= $1  LABEL='FLAG - MARITAL1';
ATTRIB MISCNTRX LENGTH=  8  LABEL='CONTRIBS. TO OTH. ORGS.';
ATTRIB MISC_TRX LENGTH= $1  LABEL='FLAG - MISCNTRX';
ATTRIB MONYOWDX LENGTH=  8  LABEL='MONEY OWED TO CU';
ATTRIB MONY_WDX LENGTH= $1  LABEL='FLAG - MONYOWDX';
ATTRIB NO_EARNR LENGTH=  2  LABEL='NO. EARNERS';
ATTRIB NO_E_RNR LENGTH= $1  LABEL='FLAG - NO_EARNR';
ATTRIB NO_EARNX LENGTH=  8  LABEL='INCOME OTHER THAN EARNINGS';
ATTRIB NO_E_RNX LENGTH= $1  LABEL='FLAG - NO_EARNX';
ATTRIB NONINCMX LENGTH=  8  LABEL='OTH. MONEY EXCL FR FINCBFRTX';
ATTRIB NONI_CMX LENGTH= $1  LABEL='FLAG - NONINCMX';
ATTRIB NUM_AUTO LENGTH=  2  LABEL='NO. OR AUTOS';
ATTRIB NUM_UUTO LENGTH= $1  LABEL='FLAG - NUMAUTO';
ATTRIB OCCUPRE1 LENGTH= $2  LABEL='REF PER OCCUPATION 01-11';
ATTRIB OCCU_RE1 LENGTH= $1  LABEL='FLAG - OCCUPRE1';
ATTRIB OCCUPRE2 LENGTH= $2  LABEL='SPOUSES OCCUPATION 01-11';
ATTRIB OCCU_RE2 LENGTH= $1  LABEL='FLAG - OCCUPRE2';
ATTRIB ORIGIN1 LENGTH= $1  LABEL='ORIGIN OF REF. PERSON (1-4)';
ATTRIB ORIGIN1_ LENGTH= $1  LABEL='FLAG - ORIGIN1';
ATTRIB ORIGIN2 LENGTH= $1  LABEL='ORIGIN OF SPOUSE (1-4)';
ATTRIB ORIGIN2_ LENGTH= $1  LABEL='FLAG - ORIGIN2';
ATTRIB OTHRNDNX LENGTH=  8  LABEL='REFUND FROM OTHER SOURCES';
ATTRIB OTHR_NDX LENGTH= $1  LABEL='FLAG - OTHRNDNX';
ATTRIB OTHRINCX LENGTH=  8  LABEL='OTHER MONEY INCOME';
ATTRIB OTHR_NC1 LENGTH= $1  LABEL='FLAG - OTHRNINCX';
ATTRIB PENSIONX LENGTH=  8  LABEL='AMT. FROM PENSIONS/ANNUITIES';
ATTRIB PENS_ONX LENGTH= $1  LABEL='FLAG - PENSIONX';
ATTRIB PERSONLT8 LENGTH=  2  LABEL='NO. PERSONS LESS THAN 18';
ATTRIB PERSONT18 LENGTH= $1  LABEL='FLAG - PERSONLT18';
ATTRIB PERSONT64 LENGTH=  2  LABEL='NO. PERSONS OVER 64';
ATTRIB PERSOT64 LENGTH= $1  LABEL='FLAG - PERSOT64';
ATTRIB POPSIZEx LENGTH= $1  LABEL='CODES-URBAN(NO PSUS-W. OR RUR)';
ATTRIB PRINRNEANx LENGTH= $2  LABEL='MEMBER NO. OF PRINCIPAL EARNER';
ATTRIB PRINRNEARx LENGTH= $1  LABEL='FLAG - PRINRNEANx';
ATTRIB PTAXRFDX LENGTH=  8  LABEL='PROPERTY TAX REFUNDS IN PAST YR';
ATTRIB PTAXFDX LENGTH= $1  LABEL='FLAG - PTAXRFDX';
ATTRIB PURSSECX LENGTH=  8  LABEL='PURCHASE PRICE OF STOCKS, BONDS';
ATTRIB PURSECX LENGTH= $1  LABEL='FLAG - PURSSECX';
ATTRIB QINTRVMO LENGTH= $2  LABEL='INTERVIEW MONTH';
ATTRIB QINTRVYR LENGTH= $2  LABEL='INTERVIEW YEAR';
ATTRIB RACE2 LENGTH= $1  LABEL='RACE OF SPOUSE (1-5)';
ATTRIB RACE2_ LENGTH= $1  LABEL='FLAG - RACE2';
ATTRIB REF_RACE LENGTH= $1  LABEL='RACE OF REF. PERSON (1-5)';
ATTRIB REF_RACE_ LENGTH= $1  LABEL='FLAG - REF_RACE';
ATTRIB REGION LENGTH= $1  LABEL='CENSUS REGION(URBAN ONLY) (1-4)';
ATTRIB RESPSTAT LENGTH= $1  LABEL='1=COMPLETE Y RESP, 2=INCOMPLETE';
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ATTRIB SALEINCX LENGTH=  8  LABEL='SALE OF HH FURN & EQUIP';
ATTRIB SALENCX LENGTH= $1  LABEL='FLAG - SALEINCX';
ATTRIB SAVACCTX LENGTH=  8  LABEL='AMT IN SAVINGS ACCT';
ATTRIB SAVA_CTX LENGTH= $1  LABEL='FLAG - SAVACCTX';
ATTRIB SECETIME LENGTH= $2  LABEL='INTERVIEW MONTH';
ATTRIB SECETIME_ LENGTH= $1  LABEL='FLAG - SECETIME';
ATTRIB SETLINSX LENGTH= $1  LABEL='FLAG - SETLINSX';
ATTRIB SEX_AI LENGTH= $1  LABEL='SEX-REF PERSON 1=MALE 2=FEMALE';
ATTRIB SEX_AI_ LENGTH= $1  LABEL='FLAG - SEX_AI';
ATTRIB SEXRECT LENGTH=  8  LABEL='MARKET VALUE OF STOCKS/BONDS';
ATTRIB SEXRECTX LENGTH= $1  LABEL='FLAG - SEXRECTX';
ATTRIB SELFINCX LENGTH=  8  LABEL='AMT FROM SALE OF STOCKS/BONDS';
ATTRIB SELFECX LENGTH= $1  LABEL='FLAG - SELFECX';
ATTRIB SETLINSX LENGTH=  8  LABEL='INSURANCE SETTLEMENTS';
ATTRIB SLOCTAXX LENGTH=  8  LABEL='ADDITIONAL ST/LOCAL TAXES PAID';
ATTRIB SLOCTAXX LENGTH= $1  LABEL='FLAG - SLOCTAXX';
ATTRIB SLOCTAXX LENGTH=  8  LABEL='ST/LOCAL INCOME TAX REFUND';
ATTRIB SLOCTAXX LENGTH= $1  LABEL='FLAG - SLOCTAXX';
ATTRIB SMSASTAT LENGTH= $1  LABEL='1=INSIDE MSA 2=OUTSIDE';
ATTRIB SSOVERPX LENGTH=  8  LABEL='REFUND OF OVERPAY ON SOC SEC';
ATTRIB SSOVERPX LENGTH= $1  LABEL='FLAG - SSOVERPX';
ATTRIB TAXPROPX LENGTH=  8  LABEL='PERSONAL PROP TAXES PAID';
ATTRIB TAXPROPX LENGTH= $1  LABEL='FLAG - TAXPROPX';
ATTRIB TOTTXPDX LENGTH=  8  LABEL='TOTAL AMT PERSONAL TAXES';
ATTRIB TOTTPDX LENGTH= $1  LABEL='FLAG - TOTTPDX';
ATTRIB UNEMPLAX LENGTH=  8  LABEL='AMT FROM UNEMPLOYMENT COMP';
ATTRIB UNEMPLAX LENGTH= $1  LABEL='FLAG - UNEMPLAX';
ATTRIB USBNDX LENGTH=  8  LABEL='AMT. OF SAVINGS BONDS';
ATTRIB USBNDX LENGTH= $1  LABEL='FLAG - USBNDX';
ATTRIB VEHQ LENGTH=  2  LABEL='NUMBER OF VEHICLES OWNED';
ATTRIB VEHQ LENGTH= $1  LABEL='FLAG - VEHQ';
ATTRIB WDBSASTX LENGTH=  8  LABEL='ASSETS WITHDRAWN FROM BUSINESS';
ATTRIB WDBS_ASTX LENGTH= $1  LABEL='FLAG - WDBSASTX';
ATTRIB WDBS_ASTX LENGTH=  8  LABEL='GOODS WITHDRAWN FROM BUSINESS';
ATTRIB WDBS_ASTX LENGTH= $1  LABEL='FLAG - WDBSASTX';
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<tr>
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<td>'GASOLINE/MOTOR OIL LAST QTR'</td>
</tr>
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<tr>
<td>LIFINSPQ</td>
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<td>'LIFE/OTHER PERS INSUR LAST QTR'</td>
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<td>'LIFE/OTHER PERS INSUR THIS QTR'</td>
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<tr>
<td>RETPENCQ</td>
<td>8</td>
<td>'RETIRE/PENSIONS/SOC SEC THIS QTR'</td>
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</table>
**STEP 1.B: GET EXPENDITURE DETAIL**

DATA EXPHLTH  
(LABEL='HEALTH EXPENDITURE DATA 4TH QTR 1989'  
KEEP=NEWID HLTH_INS MED_SRVS PRS_DRGS CODE_ERR);

ATTRIB NEWID LENGTH=$8 LABEL='CONS. UNIT ID';
ATTRIB UCC LENGTH=$6 LABEL='UCC CODE';
ATTRIB HLTH_INS LENGTH=8 LABEL='580110-580902 HEALTH INSUR';
ATTRIB MED_SRVS LENGTH=8 LABEL='560110-570230 MEDICAL SERV';
ATTRIB PRS_DRGS LENGTH=8 LABEL='540000-550330,570901 DRGS/MD SUP';
ATTRIB CODE_ERR LENGTH=8 LABEL='CODE IN RANGE, NOT IDENT';
ATTRIB COST_ LENGTH=$1 LABEL='FLAG-COST_';

INFILE MTAB894 RECFM=FB LRECL=33 EOF=ENDEXP;
DROP INID INUCC INEXPEND EXPEND UCC;
RETAIN NEWID 'AAAAAAAA' UCC 'AAAAAA' EXPEND 0 HLTH_INS MED_SRVS
PRS_DRGS CODE_ERR COST_;

INPUT INID $ 1-8 INUCC $ 9-14 INEXPEND 15-26 .4 COST_ $ 27;
/*
IF COST_ = 'T' THEN DO; PUT NEWID UCC;
END; */
IF '540000' <= INUCC <= '580902';
IF NEWID = 'AAAAAAAA'
THEN DO;
    NEWID=INID;
    UCC=INUCC;
    EXPEND=INEXPEND;
    LINK ZROFLDS;
    RETURN;
END;
IF INID ^= NEWID
THEN DO;
    LINK CODE_CLS;
    NEWID=RIGHT(NEWID);
    OUTPUT EXPHLTH;
    NEWID=INID;
    UCC=INUCC;
    EXPEND=INEXPEND;
    LINK ZROFLDS;
    RETURN;
END;
IF INUCC = UCC
THEN DO;
    EXPEND=EXPEND+INEXPEND;
    RETURN;
END;

*****************************************************************************
* FALL THRU WHEN UCC IS UNEQUAL TO PREVIOUS
*****************************************************************************

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LINK CODE_CLS;
EXPEND=INEXPEND;
UCC=INUCC;
RETURN;
******************************************************************************
* EXECUTE FOLLOWING AT END OF FILE                                           *
******************************************************************************;
ENDEXP:
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPHLTH;
RETURN;
******************************************************************************
* ZERO EXPENDITURE ACCUMULATORS                                             *
******************************************************************************;
ZROFLDS:
HLTH_INS  = 0;  MED_SRVS  = 0;  PRS_DRGS  = 0;  CODE_ERR = 0;
RETURN;
******************************************************************************
* ADD UNIT'S EXPENSE TO ACCUMULATOR*                                          *
******************************************************************************;
CODE_CLS:
IF UCC = '580110' OR UCC = '580210' OR UCC = '580310' OR
    UCC = '580901' OR UCC = '580902' THEN DO;
    HLTH_INS = HLTH_INS + EXPEND; RETURN; END;
IF UCC = '560110' OR UCC = '560210' OR UCC = '560310' OR
    UCC = '560320' OR UCC = '560330' OR UCC = '560900' OR
    UCC = '570110' OR UCC = '570210' OR UCC = '570220' OR
    UCC = '570230' THEN DO;
    MED_SRVS = MED_SRVS + EXPEND; RETURN; END;
IF UCC = '540000' OR UCC = '550110' OR UCC = '550320' OR
    UCC = '550330' OR UCC = '570901' THEN DO;
    PRS_DRGS = PRS_DRGS + EXPEND; RETURN; END;
******************************************************************************
* IN UNLIKELY CASE THAT CODE IS UNMATCHED, ADD TO *                        *
* SPECIAL ACCUMULATOR*                                                      *
******************************************************************************;
CODE_ERR=CODE_ERR+EXPEND;
RETURN;
RUN;/*
DATA;SET;
IF CODE_ERR ^= 0 THEN DO;
PUT NEWID HLTH_INS MED_SRVS PRS_DRGS CODE_ERR;
END; */
******************************************************************************
* AGGREGATING FOOD EXPENDITURE.                                             *
******************************************************************************;
DATA EXPFOOD     (LABEL='FOOD EXPENDITURE'
KEEP=NEWID FOOD_HOM FOOD_AWY CODE_FUD);
ATTRIB NEWID LENGTH=$8 LABEL='CONS. UNIT ID';
ATTRIB UCC   LENGTH=$6 LABEL='UCC CODE';
ATTRIB FOOD_HOM LENGTH=8 LABEL='FOOD AT HOME';
ATTRIB FOOD_AWY LENGTH=6 LABEL='FOOD AWAY FROM HOME';
ATTRIB CODE_FUD LENGTH=8 LABEL='CODE IN RANGE, NOT IDENT';
ATTRIB COST_ LENGTH=$1 LABEL='FLAG-COST_';
INFILE MTAB894 RECFM=FB LRECL=33 EOF=ENDEXP;
DROP FDID FDUCC FDEXPEND EXPEND UCC;
RETAIN NEWID 'AAAAAAAA' UCC 'AAAAAA' EXPEND 0 FOOD_HOM FOOD_AWY CODE_FUD COST_;
INPUT FDID $ 1-8 FDUCC $ 9-14 FDEXPEND 15-26 .4 COST_ $ 27;
/*
IF COST_ = 'T' THEN DO; PUT NEWID UCC;
*/
IF '190901'<= FDUCC <= '190904'
OR '790220'<= FDUCC <= '790230'
OR FDUCC = '790430'
OR FDUCC = '790410'
OR FDUCC = '800700';
IF NEWID = 'AAAAAAAA'
    THEN DO;
NEWID=FDID;
UCC=FDUCC;
EXPEND=FDEXPEND;
LINK ZROFLDS;
RETURN;END;
IF FDID ^= NEWID
    THEN DO;
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPFOOD;
NEWID=FDID;
UCC=FDUCC;
EXPEND=FDEXPEND;
LINK ZROFLDS;
RETURN;
END;
IF FDUCC = UCC
    THEN DO;
    EXPEND=EXPEND+FDEXPEND;
    RETURN;
END;
LINK CODE_CLS;
EXPEND=FDEXPEND;
UCC=FDUCC;
RETURN;
ENDEXP:
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPFOOD;
RETURN;
ZROFLDS:
FOOD_HOM=0; FOOD_AWY=0; CODE_FUD=0;
RETURN;
CODE_CLS:
IF UCC = '190904' OR UCC = '790220' OR UCC = '790230' THEN DO;
FOOD_HOM = FOOD_HOM + EXPEND;
RETURN;
END;
IF UCC = '190901' OR UCC = '190902' OR UCC = '190903' OR UCC = '790410' 
    OR UCC = '800700' OR UCC = '790430' THEN DO;
FOOD_AWY =FOOD_AWY + EXPEND;
RETURN;
END;
CODE_FUD = CODE_FUD +EXPEND;
RETURN;RUN; /*
DATA;SET;
IF CODE_FUD ^= 0 THEN DO;
PUT NEWID FOOD_HOM FOOD_AWY CODE_FUD;
END; */
******************************************************************************
* AGGREGATING EXPENDITURE FOR ALCOHOLIC BEVERAGES *
******************************************************************************;
DATA EXPBEVER (LABEL='ALCOHOL EXPENDITURE'
KEEP=NEWID ALCH_BVG CODE_BVG);
ATTRIB NEWID LENGTH=$8 LABEL='CONS. UNIT ID';
ATTRIB UCC LENGTH=$6 LABEL='UCC CODE';
ATTRIB ALCH_BVG LENGTH=8 LABEL='ALCHOLIC BEVERAGES';
ATTRIB CODE_BVG LENGTH=8 LABEL='CODE IN RANGE, NOT IDENT';
ATTRIB COST_ LENGTH=$1 LABEL='FLAG-COST_';
INFILE MTAB894 RECFM=FB LRECL=33 EOF=ENDEXP;
DROP ALID ALUCC ALEXPEND EXPEND UCC;
RETAIN NEWID 'AAAAAAAA' UCC 'AAAAAA' EXPEND 0 ALCH_BVG CODE_BVG COST_;
INPUT ALID $ 1-8 ALUCC $ 9-14 ALEXPEND 15-26 .4 COST_ $ 27;
/*
IF COST_ = 'T' THEN DO; PUT NEWID UCC;
END; */
IF ALUCC = '200900'
OR ALUCC = '790310'
OR ALUCC = '790320'
OR ALUCC = '790420';
IF NEWID = 'AAAAAAAA'
THEN DO;
NEWID=ALID;
UCC=ALUCC;
EXPEND=ALEXPEND;
LINK ZROFLDS;
RETURN;END;
IF ALID ^= NEWID
THEN DO;
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPBEVER;
NEWID=ALID;
UCC=ALUCC;
EXPEND=ALEXPEND;
LINK ZROFLDS;
RETURN;
END;
IF ALUCC = UCC
THEN DO;
EXPEND=EXPEND+ALEXPEND;
RETURN;
END;
LINK CODE_CLS;
EXPEND=ALEXPEND;
UCC=ALUCC;
RETURN;
ENDEXP:
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPBEVER;
RETURN;
ZROFLDS:
ALCH_BVG=0; CODE_BVG=0;
RETURN;
CODE_CLS:
IF UCC = '200900' OR UCC = '790310' OR UCC = '790320' OR UCC = '790420'
THEN DO;
ALCH_BVG = ALCH_BVG + EXPEND;
RETURN; END;
CODE_BVG = CODE_BVG + EXPEND;
RETURN;RUN; /*
DATA;SET;
IF CODE_BVG ^= 0 THEN DO;
PUT NEWID ALCH_BVG CODE_BVG;
END; */
* AGGREGATING HOUSING EXPENDITURE.                       *
* *********************************************************************
DATA EXPHOUS     (LABEL='HOUSING EXPENDITURE'
KEEP=NEWID OWND_DWL RENT_DWL OTHR_DWL CODE_DWL);
ATTRIB NEWID LENGTH=$8 LABEL='CONS. UNIT ID';
ATTRIB UCC   LENGTH=$6 LABEL='UCC CODE';
ATTRIB OWND_DWL LENGTH=8 LABEL='OWNED DWELLING';
ATTRIB RENT_DWL LENGTH=8 LABEL='RENTED DWELLING';
ATTRIB OTHR_DWL LENGTH=8 LABEL='OTHER LODGING';
ATTRIB CODE_DWL LENGTH=8 LABEL='CODE IN RANGE, NOT IDENT';
ATTRIB COST_    LENGTH=$1 LABEL='FLAG-COST_';
INFILE MTAB894 RECFM=FB LRECL=33 EOF=ENDEXP;
DROP HSID HSUCC HSEXPEND EXPEND UCC;
RETAIN NEWID 'AAAAAAAA' UCC 'AAAAAA' EXPEND 0 OWND_DWL RENT_DWL OTHR_DWL
CODE_DWL COST_; 
INPUT HSID $ 1-8 HSUCC $ 9-14 HSEXPEND 15-26 .4 COST_ $ 27;
/*
IF COST_ = 'T' THEN DO; PUT NEWID UCC;
END; */
IF '210110' <= HSUCC <= '220322' 
OR '220901' <= HSUCC <= '270214' 
OR '270411' <= HSUCC <= '300412' 
OR '320110' <= HSUCC <= '340530' 
OR '340620' <= HSUCC <= '340901' 
OR '340903' <= HSUCC <= '340904' 
OR '340906' <= HSUCC <= '350110' 
OR HSUCC = '430130' 
OR HSUCC = '670310' 
OR '690110' <= HSUCC <= '690245' 
OR HSUCC = '790600' 
OR HSUCC = '790690' 
OR HSUCC = '800710' 
OR '990900' <= HSUCC <= '990950';
IF NEWID = 'AAAAAAAA'
   THEN DO;
   NEWID=HSID;
   UCC=HSUCC;
   EXPEND=HSEXPEND;
   LINK ZROFLDS;
   RETURN;
END;
IF HSID ^= NEWID
   THEN DO;
   LINK CODE_CLS;
   NEWID=RIGHT(NEWID);
   OUTPUT EXPHOUS;
   NEWID=HSID;
   UCC=HSUCC;
   EXPEND=HSEXPEND;
   LINK ZROFLDS;
   RETURN;
END;
IF HSUCC = UCC
   THEN DO;
   EXPEND=EXPEND+HSEXPEND;
   RETURN;
END;
LINK CODE_CLS;
EXPEND=HSEXPEND;
UCC=HSUCC;
RETURN;
ENDEXP:
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPHOUS;
RETURN;
ZROFLDS:
OWND_DWL=0; RENT_DWL=0; OTHR_DWL=0; CODE_DWL=0;
RETURN;
CODE_CLS:
IF UCC = '220311' OR UCC = '220321' OR UCC = '220211' OR UCC = '230901'
OR UCC = '340911' OR UCC = '220121' OR UCC = '220111' OR UCC = '210901'
OR UCC = '230112' OR UCC = '230113' OR UCC = '230114' OR UCC = '230115'
OR UCC = '230116' OR UCC = '220901' OR UCC = '230122' OR UCC = '230142'
OR UCC = '240112' OR UCC = '240122' OR UCC = '240312' OR UCC = '240322'
OR UCC = '320622' OR UCC = '240212' OR UCC = '240213' OR UCC = '240222'
OR UCC = '320632' OR UCC = '320612' OR UCC = '990930'
THEN DO;
OWND_DWL = OWND_DWL + EXPEND;
RETURN;
END;
IF UCC = '230111' OR UCC = '230121' OR UCC = '230141' OR UCC = '350110'
OR UCC = '240111' OR UCC = '240121' OR UCC = '240211' OR UCC = '240221'
OR UCC = '240311' OR UCC = '240321' OR UCC = '320611' OR UCC = '990910'
OR UCC = '990920' OR UCC = '790690' OR UCC = '320621' OR UCC = '320631'
OR UCC = '210110' OR UCC = '800710' OR UCC = '990950'
THEN DO;
RENT_DWL = RENT_DWL + EXPEND;
RETURN;
END;
IF UCC = '220212' OR UCC = '220122' OR UCC = '220112' OR UCC = '210902'
OR UCC = '230119' OR UCC = '230123' OR UCC = '240113' OR UCC = '240123'
OR UCC = '240214' OR UCC = '240223' OR UCC = '240313' OR UCC = '240323'
OR UCC = '320613' OR UCC = '990940' OR UCC = '320623' OR UCC = '320633'
OR UCC = '230902' OR UCC = '340912' OR UCC = '220902' OR UCC = '790600'
OR UCC = '220322' OR UCC = '220312' OR UCC = '210310' OR UCC = '210210'
THEN DO;
OTHR_DWL = OTHR_DWL + EXPEND;
RETURN;
END;
CODE_DWL = CODE_DWL + EXPEND;
RETURN;RUN; /*
DATA;SET;
IF CODE_DWL ^= 0 THEN DO;
PUT NEWID OWND_DWL RENT_DWL OTHR_DWL CODE_DWL;
END; */
***********************************************************************
* AGGREGATING EXPENDITURE ON UTILITY                                 *
***********************************************************************;
DATA EXPUTIL (LABEL='UTILITY EXPENDITURE' KEEP=NEWID NATL_GAS ELEC_ITY FUEL_OIL TELE_PHN WATR_PLS CODE_UTL);
ATTRIB NEWID LENGTH=$8 LABEL='CONS. UNIT ID';
ATTRIB UCC LENGTH=$6 LABEL='UCC CODE';
ATTRIB NATL_GAS LENGTH=8 LABEL='NATURAL GAS';
ATTRIB ELEC_ITY LENGTH=8 LABEL='ELECTRICITY';
ATTRIB FUEL_OIL LENGTH=8 LABEL='FUEL OIL';
ATTRIB TELE_PHN LENGTH=8 LABEL='TELEPHONE';
ATTRIB WATR_PLS LENGTH=8 LABEL='WATER AND OTHER SERVICES';
ATTRIB CODE_UTL LENGTH=8 LABEL='CODE IN RANGE, NOT IDENT';
ATTRIB COST_ LENGTH=$1 LABEL='FLAG-COST_';
INFILE MTAB894 RECFM=FB LRECL=33 EOF=ENDEXP;
DROP UTID UTUCC UTEXPEND EXPEND UCC;
RETAIN NEWID 'AAAAAAAA' UCC 'AAAAAA' EXPEND 0 NATL_GAS ELEC_ITY FUEL_OIL TELE_PHN WATR_PLS CODE_UTL COST_;
INPUT UTID $ 1-8 UTUCC $ 9-14 UTEXPEND 15-26 .4 COST_ $ 27;

/*
  IF COST_ = 'T' THEN DO; PUT NEWID UCC;
  END; */
IF '250111' <= UTUCC <= '270214'
OR '270411' <= UTUCC <= '270904';
IF NEWID = 'AAAAAAAA'
  THEN DO;
  NEWID=UTID;
  UCC=UTUCC;
  EXPEND=UTEXPEND;
  LINK ZROFLDS;
  RETURN;END;
IF UTID ^= NEWID
  THEN DO;
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPUTIL;
NEWID=UTID;
UCC=UTUCC;
EXPEND=UTEXPEND;
LINK ZROFLDS;
RETURN;
END;
IF UTUCC = UCC
  THEN DO;
  EXPEND=EXPEND+UTEXPEND;
  RETURN;
END;
LINK CODE_CLS;
EXPEND=UTEXPEND;
UCC=UTUCC;
RETURN;
ENDEXP:
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPUTIL;
RETURN;
ZROFLDS:
NATL_GAS=0; ELEC_ITY=0; FUEL_OIL=0; TELE_PHN=0; WATR_PLS=0; CODE_UTL=0;
RETURN;
CODE_CLS:
IF UCC = '260211' OR UCC = '260212' OR UCC = '260213' OR UCC = '260214'
  THEN DO;
  NATL_GAS = NATL_GAS + EXPEND;
  RETURN;
  END;
IF UCC = '260111' OR UCC = '260112' OR UCC = '260113' OR UCC = '260114'
  THEN DO;
  ELEC_ITY = ELEC_ITY + EXPEND;
  RETURN;
  END;
IF UCC = '250111' OR UCC = '250112' OR UCC = '250113' OR UCC = '250114'
OR UCC = '250211' OR UCC = '250212' OR UCC = '250213' OR UCC = '250214'
OR UCC = '250221' OR UCC = '250222' OR UCC = '250223' OR UCC = '250224'
OR UCC = '250901' OR UCC = '250902' OR UCC = '250903' OR UCC = '250904'
  THEN DO;
  FUEL_OIL = FUEL_OIL + EXPEND;
  RETURN;
  END;
IF UCC = '270000'
  THEN DO;
TELE_PHN = TELE_PHN + EXPEND;
RETURN;
END;
IF UCC = '270211' OR UCC = '270212' OR UCC = '270213' OR UCC = '270214'
OR UCC = '270411' OR UCC = '270412' OR UCC = '270413' OR UCC = '270414'
OR UCC = '270901' OR UCC = '270902' OR UCC = '270903' OR UCC = '270904'
THEN DO;
WATR_PLS + WATR_PLS + EXPEND;
RETURN;END;
CODE_UTL = CODE_UTL + EXPEND;
RETURN;RUN; /*
DATA;SET;
IF CODE_UTL ^= 0 THEN DO;
PUT NEWID NATL_GAS ELEC_ITY FUEL_OIL TELE_PHN WATR_PLS CODE_UTL;
END; */
*******************************************************************************
* AGGREGATING EXPENDITURE ON HOUSEHOLD OPERATION. *
*******************************************************************************;
DATA EXPHHOLD (LABEL='HOUSEHOL OPERATION EXPENDITURE'
KEEP=NEWID DOME_SER OTHR_SER CODE_SER);
ATTRIB NEWID LENGTH=$8 LABEL='CONS. UNIT ID';
ATTRIB UCC LENGTH=$6 LABEL='UCC CODE';
ATTRIB DOME_SER LENGTH=8 LABEL='DOMESTIC SERVICES';
ATTRIB OTHR_SER LENGTH=8 LABEL='OTHER HOUSEHOLD EXPENSES';
ATTRIB CODE_SER LENGTH=8 LABEL='CODE IN RANGE, NOT IDENT';
ATTRIB COST_ LENGTH=$1 LABEL='FLAG-COST_';
INFILE MTAB894 RECFM=FB LRECL=33 EOF=ENDEXP;
DROP HHID HHUCC HHEXPEND EXPEND UCC;
RETAIN NEWID 'AAAAAAAA' UCC 'AAAAAA' EXPEND 0 DOME_SER OTHR_SER CODE_SER
COST_; INPUT HHID $ 1-8 HHUCC $ 9-14 HHEXPEND 15-26 .4 COST_ $ 27;
/*
IF COST_ = 'T' THEN DO; PUT NEWID UCC;
END; */
IF HHUCC = '330511'
or '340210' <= HHUCC <= '340530'
or '340620' <= HHUCC <= '340901'
or HHUCC = '340903'
or '340906' <= HHUCC <= '340908'
or HHUCC = '670310'
or HHUCC = '990900'
or HHUCC = '690113';
IF NEWID = 'AAAAAAAA'
THEN DO;
NEWID=HHID;
UCC=HHUCC;
EXPEND=HHEXPEND;
LINK ZROFLDS;
RETURN;END;
IF HHID ^= NEWID
THEN DO;
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPHHOLD;
NEWID=HHID;
UCC=HHUCC;
EXPEND=HHEXPEND;
LINK ZROFLDS;
RETURN;
END;
IF HHUCC = UCC
THEN DO;
EXPEND = EXPEND + HHEXPEND;
RETURN;
END;
LINK CODE_CLS;
EXPEND = HHEXPEND;
UCC = HHUCC;
RETURN;
ENDEXP:
LINK CODE_CLS;
NEWID = RIGHT (NEWID);
OUTPUT EXPHHOLD;
RETURN;
ZROFLDS:
DOME_SER = 0; OTHR_SER = 0; CODE_SER = 0;
RETURN;
CODE_CLS:
IF UCC = '340210' OR UCC = '340310' OR UCC = '340410' OR UCC = '340420'
OR UCC = '340520' OR UCC = '340530' OR UCC = '340903' OR UCC = '340906'
OR UCC = '670310'
THEN DO;
DOME_SER = DOME_SER + EXPEND;
RETURN;
END;
IF UCC = '330511' OR UCC = '340510' OR UCC = '340620' OR UCC = '340630'
OR UCC = '340901' OR UCC = '990900' OR UCC = '340907' OR UCC = '340908'
OR UCC = '690113'
THEN DO;
OTHR_SER = OTHR_SER + EXPEND;
RETURN; END;
CODE_SER = CODE_SER + EXPEND;
RETURN; RUN; /*
DATA; SET;
IF CODE_SER ^= 0 THEN DO;
PUT NEWID DOME_SER OTHR_SER CODE_SER;
END; */
*******************************************************************************************
* AGGREGATING EXPENDITURE ON HOUSEFURNISHING.                                           *
*******************************************************************************************;
DATA EXPFURN    (LABEL='HOUSEFURNISHING EXPENDITURE'
KEEP=NEWID HOUS_FUR CODE_FUR);
ATTRIB NEWID LENGTH=$8 LABEL='CONS. UNIT ID';
ATTRIB UCC LENGTH=$6 LABEL='UCC CODE';
ATTRIB HOUS_FUR LENGTH=8 LABEL='HOUSEFURNISHINGS';
ATTRIB CODE_FUR LENGTH=8 LABEL='CODE IN RANGE, NOT IDENT';
ATTRIB COST_ LENGTH=$1 LABEL='FLAG-COST_';
INFILE MTAB894 RECFM=FB LRECL=33 EOF=ENDEXP;
DROP HFID HFUCC HFEXPEND EXPEND UCC;
RETAIN NEWID 'AAAAAAAA' UCC 'AAAAAA' EXPEND 0 HOUS_FUR CODE_FUR COST_;
INPUT HFID $ 1-8 HFUCC $ 9-14 HFEXPEND 15-26 .4 COST_ $ 27;
/*
IF COST_ = 'T' THEN DO; PUT NEWID UCC;
END; */
IF '230117' <= HFUCC <= '230118'
OR '230131' <= HFUCC <= '230132'
OR '280110' <= HFUCC <= '300412'
OR '320110' <= HFUCC <= '320522'
OR '320901' <= HFUCC <= '320904'
OR HFUCC <= '340904'
OR HFUCC <= '430130'
OR '690110' <= HFUCC <= '690230';
IF NEWID = 'AAAAAAAA'
THEN DO;
NEWID=HFID;
UCC=HFUCC;
EXPEND=HFEXPEND;
LINK ZROFLDS;
RETURN;END;
IF HFID ^= NEWID
   THEN DO;
      LINK CODE_CLS;
      NEWID=RIGHT(NEWID);
      OUTPUT EXPFURN;
      NEWID=HFID;
      UCC=HFUCC;
      EXPEND=HFEXPEND;
      LINK ZROFLDS;
      RETURN;
   END;
IF HFUCC = UCC
   THEN DO;
      EXPEND=EXPEND+HFEXPEND;
      RETURN;
   END;
LINK CODE_CLS;
EXPEND=HFEXPEND;
UCC=HFUCC;
RETURN;
ENDEXP:
   LINK CODE_CLS;
   NEWID=RIGHT(NEWID);
   OUTPUT EXPFURN;
   RETURN;
ZROFLDS:
HOUS_FUR=0; CODE_FUR=0;
RETURN;
CODE_CLS:
IF UCC = '280110' OR UCC = '280120' OR UCC = '280130' OR UCC = '280210'
   OR UCC = '280220' OR UCC = '280230' OR UCC = '280900' OR UCC = '290110'
   OR UCC = '290120' OR UCC = '290310' OR UCC = '290320'
   OR UCC = '290410' OR UCC = '290420' OR UCC = '290430' OR UCC = '290440'
   OR UCC = '300111' OR UCC = '300112' OR UCC = '300211' OR UCC = '300212'
   OR UCC = '300221' OR UCC = '300222' OR UCC = '300311' OR UCC = '300312'
   OR UCC = '300321' OR UCC = '300322' OR UCC = '300331' OR UCC = '300332'
   OR UCC = '300411' OR UCC = '300412' OR UCC = '300421' OR UCC = '300422'
   OR UCC = '320110' OR UCC = '320120' OR UCC = '320130' OR UCC = '320150'
   OR UCC = '320161' OR UCC = '320162' OR UCC = '320210' OR UCC = '320220'
   OR UCC = '320231' OR UCC = '320232' OR UCC = '320310' OR UCC = '320320'
   OR UCC = '320330' OR UCC = '320340' OR UCC = '320350' OR UCC = '320360'
   OR UCC = '320370' OR UCC = '320410' OR UCC = '320420' OR UCC = '320511'
   OR UCC = '320512' OR UCC = '320521' OR UCC = '320522' OR UCC = '320523'
   OR UCC = '320531' OR UCC = '320541' OR UCC = '320610' OR UCC = '340904'
   OR UCC = '690210' OR UCC = '690220' OR UCC = '690230'
   OR UCC = '430130' OR UCC = '320901' OR UCC = '320902' OR UCC = '320903'
   OR UCC = '320904'
      THEN DO;
      HOUS_FUR = HOUS_FUR + EXPEND;
      RETURN;END;
CODE_FUR = CODE_FUR +EXPEND;
RETURN;RUN; /*
DATA;SET;
IF CODE_FUR ^= 0 THEN DO;
   PUT NEWID HOUS_FUR CODE_FUR;
END;*/
******************************************************************************
* AGGREGATING EXPENDITURE ON APPAREL AND SERVICES. *

 DATA EXAPRL (LABEL='APPAREL EXPENDITURE');
K EEP=NEWID BOYS_MEN WOME_GIR CHIL_TWO FOOT_WER OTHR_APP CODE_APP);

 ATR I BIF NEWID LENGTH=$8 LABEL='CONS. UNIT ID';
 ATR I BIF UCC LENGTH=$6 LABEL='UCC CODE';
 ATR I BIF BOYS_MEN LENGTH=8 LABEL='MEN AND BOYS';
 ATR I BIF WOME_GIR LENGTH=8 LABEL='WOMEN AND GIRLS';
 ATR I BIF CHIL_TWO LENGTH=8 LABEL='CHILDREN UNDER TWO';
 ATR I BIF FOOT_WER LENGTH=8 LABEL='FOOTWEAR';
 ATR I BIF OTHR_APP LENGTH=8 LABEL='OTHER APPAREL PRODUCTS';
 ATR I BIF CODE_APP LENGTH=8 LABEL='CODE IN RANGE, NOT IDENT';
 ATR I BIF COST_ LENGTH=$1 LABEL='FLAG-COST_';

 I NFILE MTAB894 RECFM=FB LRECL=33 EOF=ENDEXP;
 D RO P APID APUCC APEXPEND EXPEND UCC;
 R E T A I N NEWID 'AAAAAAAA' UCC 'AAAAAA' EXPEND 0 BOYS_MEN WOME_GIR CHIL_TWO
 FOOT_WER OTHR_APP CODE_APP COST_;
 I NPU T APID $ 1-8 APUC C $ 9-14 APEXPEND 15-26 .4 C O S T_ $ 27;

 /*
 IF COST_ = 'T' THEN DO; PUT NEWID UCC;
 END; */
 IF '360110' <= APUCC <= '430120'
 OR '440110' <= APUCC <= '440900';
 IF NEWID = 'AAAAAAAA'
 THEN DO;
 NEWID=APID;
 UCC=APUCC;
 EXPEND=APEXPEND;
 LINK ZROFLDS;
 RETURN;END;
 IF APID ^= NEWID
 THEN DO;
 LINK CODE_CLS;
 NEWID=RIGHT(NEWID);
 OUTPUT EXAPRL;
 NEWID=APID;
 UCC=APUCC;
 EXPEND=APEXPEND;
 LINK ZROFLDS;
 RETURN;
 END;
 IF APUCC = UCC
 THEN DO;
 EXPEND=EXPEND+APEXPEND;
 RETURN;
 END;
 LINK CODE_CLS;
 EXPEND=APEXPEND;
 UCC=APUCC;
 RETURN;
 ENDEXP:
 LINK CODE_CLS;
 NEWID=RIGHT(NEWID);
 OUTPUT EXAPRL;
 RETURN;
 ZROFLDS:
 BOYS_MEN=0; WOME_GIR=0; CHIL_TWO=0; FOOT_WER=0; OTHR_APP=0; CODE_APP=0;
 RETURN;
 CODE_CLS:
 I F UCC = '360110' OR UCC = '360120' OR UCC = '360210' OR UCC = '360311'
 OR UCC = '360312' OR UCC = '360320' OR UCC = '360330' OR UCC = '360340'
 OR UCC = '360350' OR UCC = '360410' OR UCC = '360511' OR UCC = '360512'
DATA; SET;
IF CODE_APP ^= 0 THEN DO;
   PUT NEWID BOYS_MEN WOME_GIR CHIL_TWO FOOT_WER OTHR_APP CODE_APP;
END;
****************************************************
* AGGREGATING EXPENDITURE ON TRANSPORTATION.       *
*****************************************************;
DATA EXPTRANS    (LABEL='TRANSPORT EXPENDITURE'
KEEP=NEWID NCAR_TRC UCAR_TRC OTHR_VCL VHCL_FIN GALN_OIL MAIN_RPR VHCL_INS
   PUBL_TRA VHCL_RET CODE_TRA);
ATTRIB NEWID LENGTH=$8 LABEL='CONS. UNIT ID';
ATTRIB UCC    LENGTH=$6 LABEL='UCC CODE';
ATTRIB NCAR_TRC LENGTH=8 LABEL='NEW CARS AND TRUCKS';
ATTRIB UCAR_TRC LENGTH=8 LABEL='USED CARS AND TRUCKS';
ATTRIB OTHR_VCL LENGTH=8 LABEL='OTHER VEHICLES';
ATTRIB VHCL_FIN LENGTH=8 LABEL='VEHICLE FINANCE CHARGES';
ATTRIB GALN_OIL LENGTH=8 LABEL='GASOLINE AND OIL';
ATTRIB MAIN_RPR LENGTH=8 LABEL='MAINTENANCE AND REPAIRS';
ATTRIB VHCL_INS LENGTH=8 LABEL='VEHICLE INSURANCE';
ATTRIB PUBL_TRA LENGTH=8 LABEL='PUBLIC TRANSPORTATION';
ATTRIB VHCL_RET LENGTH=8 LABEL='VEHICLE RENTAL';
ATTRIB CODE_TRA LENGTH=8 LABEL='CODE IN RANGE, NOT IDENT';

ATTRIB COST_ LENGTH=$1 LABEL='FLAG-COST_';
INFILE MTAB894 RECFM=FB LRECL=33 EOF=ENDEXP;
DROP TRID TRUCC TREXPEND EXPEND UCC;
RETAIN NEWID 'AAAAAAAA' UCC 'AAAAAA' EXPEND 0 NCAR_TRC UCAR_TRC OTHR_VCL
VHCL_FIN GALN_OIL MAIN_RPR VHCL_INS PUBL_TRA VHCL_RET CODE_TRA COST_;
INPUT TRID $ 1-8 TRUCC $ 9-14 TREXPEND 15-26 .4 COST_ $ 27;
  /*
  IF COST_ = 'T' THEN DO; PUT NEWID UCC;
  END; */
IF TRUCC = '450110'
  OR TRUCC = '450210'
  OR TRUCC = '450220'
  OR TRUCC = '460110'
  OR TRUCC = '450900'
  OR '460901' <= TRUCC <= '460903'
  OR '470111' <= TRUCC <= '470212'
  OR '470220' <= TRUCC <= '530902'
  OR '620906' <= TRUCC <= '620907'
  OR TRUCC = '850300'
  OR TRUCC = '620902';
IF NEWID = 'AAAAAAAA'
  THEN DO;
  NEWID=TRID;
  UCC=TRUCC;
  EXPEND=TREXPEND;
  LINK ZROFLDS;
  RETURN;END;
IF TRID ^= NEWID
  THEN DO;
  LINK CODE_CLS;
  NEWID=RIGHT(NEWID);
  OUTPUT EXPTRANS;
  NEWID=TRID;
  UCC=TRUCC;
  EXPEND=TREXPEND;
  LINK ZROFLDS;
  RETURN;
  END;
IF TRUCC = UCC
  THEN DO;
  EXPEND=EXPEND+TREXPEND;
  RETURN;
  END;
LINK CODE_CLS;
EXPEND=TREXPEND;
UCC=TRUCC;
RETURN;
ENDEXP:
  LINK CODE_CLS;
  NEWID=RIGHT(NEWID);
  OUTPUT EXPTRANS;
  RETURN;
ZROFLDS:
NCAR_TRC=0; UCAR_TRC=0; OTHR_VCL=0; VHCL_FIN=0; GALN_OIL=0; MAIN_RPR=0;
VHCL_INS=0; PUBL_TRA=0; VHCL_RET=0; CODE_TRA=0;
RETURN;
CODE_CLS:
  IF UCC = '450110' OR UCC = '450210'
    THEN DO;
    NCAR_TRC = NCAR_TRC + EXPEND;
    RETURN;
  END;
IF UCC = '460110' OR UCC = '460901'
THEN DO;
UCA_R_TRC = UCA_R_TRC + EXPEND;
RETURN;
END;
IF UCC = '450900' OR UCC = '460902' OR UCC = '460903'
THEN DO;
OTH_VCL = OTH_VCL + EXPEND;
RETURN;
END;
IF UCC = '510110' OR UCC = '510901' OR UCC = '510902' OR UCC = '850300'
THEN DO;
VHCL_FIN = VHCL_FIN + EXPEND;
RETURN;
END;
IF UCC = '470111' OR UCC = '470112' OR UCC = '470113' OR UCC = '470211'
OR UCC = '470212'
THEN DO;
GALN_OIL = GALN_OIL + EXPEND;
RETURN;
END;
IF UCC = '470220' OR UCC = '480110' OR UCC = '480211' OR UCC = '490110'
OR UCC = '490211' OR UCC = '490212' OR UCC = '490220' OR UCC = '490231'
OR UCC = '490314' OR UCC = '490315' OR UCC = '490317' OR UCC = '490318'
OR UCC = '490411' OR UCC = '490412' OR UCC = '490413' OR UCC = '490900'
THEN DO;
MAIN_RPR = MAIN_RPR + EXPEND;
RETURN;
END;
IF UCC = '500110'
THEN DO;
VHCL_INS = VHCL_INS + EXPEND;
RETURN;
END;
IF UCC = '530110' OR UCC = '530210' OR UCC = '530311' OR UCC = '530312'
OR UCC = '530411' OR UCC = '530412' OR UCC = '530510' OR UCC = '530901'
OR UCC = '530902'
THEN DO;
PUBL_TRA = PUBL_TRA + EXPEND;
RETURN;
END;
IF UCC = '520110' OR UCC = '520310' OR UCC = '520410' OR UCC = '520511'
OR UCC = '520512' OR UCC = '520521' OR UCC = '520522' OR UCC = '520530'
OR UCC = '520542' OR UCC = '520550' OR UCC = '520901' OR UCC = '520902'
OR UCC = '520903' OR UCC = '520904' OR UCC = '520905' OR UCC = '520906'
OR UCC = '520907' OR UCC = '620906' OR UCC = '620907' OR UCC = '620902'
THEN DO;
VHCL_RET = VHCL_RET + EXPEND;
RETURN;
END;
CODE_TRA = CODE_TRA + EXPEND;
RETURN;RUN;/*
DATA;SET;
IF CODE_TRA ^= 0 THEN DO;
PUT NEWID NCAR_TRC UCA_R_TRC OTH_VCL VHCL_FIN GALN_OIL MAIN_RPR VHCL_INS
PUBL_TRA VHCL_RET CODE_TRA;
END; */
*****************************************************************************
* AGGREGATING EXPENDITURE ON ENTERTAINMENT.                              *
*****************************************************************************
162
DATA EXPENMT (LABEL='ENTERTAINMENT EXPENDITURE');
KEEP=NEWID ADMS_FEE ELEC_NIC OTHR_EQP CODE_ENT;
ATTRIB NEWID LENGTH=$8 LABEL='CONS. UNIT ID';
ATTRIB UCC LENGTH=$6 LABEL='UCC CODE';
ATTRIB ADMS_FEE LENGTH=8 LABEL='FEES AND ADMISSIONS';
ATTRIB ELEC_NIC LENGTH=8 LABEL='ELECTRONICS';
ATTRIB OTHR_EQP LENGTH=8 LABEL='OTHER EQUIPMENT AND SERVICES';
ATTRIB CODE_ENT LENGTH=8 LABEL='CODE IN RANGE, NOT IDENT';
ATTRIB COST_ LENGTH=$1 LABEL='FLAG-COST_';
INFILE MTAB894 RECFM=FB LRECL=33 EOF=ENDEXP;
DROP ETID ETUCC ETEXPEND EXPEND UCC;
RETAIN NEWID 'AAAAAAAA' UCC 'AAAAAA' EXPEND 0 ADMS_FEE ELEC_NIC OTHR_EQP CODE_ENT COST_;
INPUT ETID $ 1-8 ETUCC $ 9-14 ETEXPEND 15-26 .4 COST_ $ 27;
/*
IF COST_ = 'T' THEN DO; PUT NEWID UCC;
END;*/
IF ETUCC = '270310'
OR '310110' <= ETUCC <= '310342'
OR ETUCC = '340610'
OR ETUCC = '340902'
OR ETUCC = '340905'
OR ETUCC = '520901'
OR ETUCC = '520904'
OR ETUCC = '520907'
OR '600110' <= ETUCC <= '600122'
OR '600131' <= ETUCC <= '600132'
OR '600210' <= ETUCC <= '620420'
OR '620902' <= ETUCC <= '620912';
IF NEWID = 'AAAAAAAA'
THEN DO;
NEWID=ETID;
UCC=ETUCC;
EXPEND=ETEXPEND;
LINK ZROFLDS;
RETURN;END;
IF ETID ^= NEWID
THEN DO;
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPENMT;
NEWID=ETID;
UCC=ETUCC;
EXPEND=ETEXPEND;
LINK ZROFLDS;
RETURN;
END;
IF ETUCC = UCC
THEN DO;
EXPEND=EXPEND+ETEXPEND;
RETURN;
END;
LINK CODE_CLS;
EXPEND=ETEXPEND;
UCC=ETUCC;
RETURN;
ENDEXP:
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPENMT;
RETURN;
ZROFLDS:
  ADMS_FEE=0; ELEC_NIC=0; OTHR_EQP=0; CODE_ENT=0;
  RETURN;
CODE_CLS:
  IF UCC = '610900' OR UCC = '620110' OR UCC = '620121' OR UCC = '620122'
    OR UCC = '620211' OR UCC = '620212' OR UCC = '620221' OR UCC = '620222'
    OR UCC = '620310' OR UCC = '620903'
    THEN DO;
    ADMS_FEE = ADMS_FEE + EXPEND;
    RETURN;
  END;
  IF UCC = '310110' OR UCC = '310120' OR UCC = '310130' OR UCC = '310210'
    OR UCC = '310220' OR UCC = '310230' OR UCC = '310311' OR UCC = '310312'
    OR UCC = '310313' OR UCC = '310320' OR UCC = '310330' OR UCC = '310341'
    OR UCC = '310342' OR UCC = '340902' OR UCC = '340610' OR UCC = '620912'
    OR UCC = '270310' OR UCC = '620904' OR UCC = '340905' OR UCC = '610130'
    THEN DO;
    ELEC_NIC = ELEC_NIC + EXPEND;
    RETURN;
  END;
  IF UCC = '600210' OR UCC = '600310' OR UCC = '600410' OR UCC = '600420'
    OR UCC = '600430' OR UCC = '600900' OR UCC = '610110' OR UCC = '610120'
    OR UCC = '610210' OR UCC = '610230' OR UCC = '610320' OR UCC = '620905'
    OR UCC = '620906' OR UCC = '620907' OR UCC = '620908' OR UCC = '520901'
    OR UCC = '520904' OR UCC = '520907' OR UCC = '620902' OR UCC = '620330'
    OR UCC = '620410' OR UCC = '620420' OR UCC = '600110' OR UCC = '600122'
    OR UCC = '600131' OR UCC = '600132'
    THEN DO;
    OTHR_EQP = OTHR_EQP + EXPEND;
    RETURN;
  END;
  CODE_ENT = CODE_ENT + EXPEND;
  RETURN;
END;  /*
DATA;SET;
IF CODE_ENT ^= 0 THEN DO;
  PUT NEWID ADMS_FEE ELEC_NIC OTHR_EQP CODE_ENT;
END;  */
*/

**************************************************
* AGGREGATING EXPENDITURE ON PERSONAL CARE.        *
**************************************************;
DATA EXPPCARE   (LABEL='PERSONAL CARE EXPENDITURE'
KEEP=NEWID PERS_CAR CODE_CAR);
  ATTRIB NEWID LENGTH=$8 LABEL='CONS. UNIT ID';
  ATTRIB UCC   LENGTH=$6 LABEL='UCC CODE';
  ATTRIB PERS_CAR LENGTH=8 LABEL='PERSONAL CARE';
  ATTRIB CODE_CAR LENGTH=8 LABEL='CODE IN RANGE, NOT IDENT';
  ATTRIB COST_ LENGTH=$1 LABEL='FLAG-COST_';
INFILE MTAB894 RECFM=FB LRECL=33 EOF=ENDEXP;
DROP PCID PCUCC PCEXPEND EXPEND UCC;
RETAIN NEWID 'AAAAAAAA' UCC 'AAAAAA' EXPEND 0 PERS_CAR CODE_CAR COST_;
INPUT PCID $ 1-8 PCUCC $ 9-14 PCEXPEND 15-26 .4 COST_ $ 27;
  /*
  IF COST_ = 'T' THEN DO; PUT NEWID UCC;
  END;*/
  IF '640130' <= PCUCC <= '650900';
  IF NEWID = 'AAAAAAAA'
    THEN DO;
  NEWID=PCID;
  UCC=PCUCC;
  EXPEND=PCEXPEND;
  LINK ZROFLDS;
RETURN; END;
IF PCID ^= NEWID
   THEN DO;
   LINK CODE_CLS;
   NEWID=RIGHT(NEWID);
   OUTPUT EXPPCARE;
   NEWID=PCID;
   UCC=PCUCC;
   EXPEND=PCEXPEND;
   LINK ZROFLDS;
   RETURN;
   END;
IF PCUCC = UCC
   THEN DO;
   EXPEND=EXPEND+PCEXPEND;
   RETURN;
   END;
LINK CODE_CLS;
EXPEND=PCEXPEND;
UCC=PCUCC;
RETURN;
ENDEXP:
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPPCARE;
RETURN;
ZROFLDS:
PERS_CAR=0; CODE_CAR=0;
RETURN;
CODE_CLS:
IF UCC = '640130' OR UCC = '640420' OR UCC = '650110' OR UCC = '650210'
   OR UCC = '650900'
   THEN DO;
PERS_CAR = PERS_CAR + EXPEND;
RETURN;
END;
CODE_CAR = CODE_CAR + EXPEND;
RETURN; RUN; /*
DATA;SET;
IF CODE_CAR ^= 0 THEN DO;
PUT NEWID PERS_CAR CODE_CAR;
END; */
****************************************************
* AGGREGATING EXPENDITURE ON READING.               *
*****************************************************;
DATA EXPREAD    (LABEL='READING EXPENDITURE SUMMARY'
KEEP=NEWID READ_EXP CODE_RID);
ATTRIB NEWID LENGTH=$8 LABEL='CONS. UNIT ID';
ATTRIB UCC LENGTH=$6 LABEL='UCC CODE';
ATTRIB READ_EXP LENGTH=8 LABEL='READING';
ATTRIB CODE_RID LENGTH=8 LABEL='CODE IN RANGE, NOT IDENT';
ATTRIB COST_ LENGTH=$1 LABEL='FLAG-COST_';
INFILE MTAB894 RECFM=FB LRECL=33 EOF=ENDEXP;
DROP RDID RDUCC RDEXPEND EXPEND UCC;
RETAIN NEWID 'AAAAAAAA' UCC 'AAAAAA' EXPEND 0 READ_EXP CODE_RID COST_;
INPUT RDID $ 1-8 RDUCC $ 9-14 RDEXPEND 15-26 .4 COST_ $ 27;
/ *
IF COST_ = 'T' THEN DO; PUT NEWID UCC;
END; */
IF '590110' <= RDUCC <= '590230'
OR RDUCC = '660310';   *LOOK HERE AGAIN!;
IF NEWID = 'AAAAAAAA'
THEN DO;
NEWID=RDID;
UCC=RDUCC;
EXPEND=RDEXPEND;
LINK ZROFLDS;
RETURN;END;
IF RDID ^= NEWID THEN DO;
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPREAD;
NEWID=RDID;
UCC=RDUCC;
EXPEND=RDEXPEND;
LINK ZROFLDS;
RETURN;
END;
IF RDUCC = UCC THEN DO;
EXPEND=EXPEND+RDEXPEND;
RETURN;
END;
LINK CODE_CLS;
EXPEND=RDEXPEND;
UCC=RDUCC;
RETURN;
ENDEXP:
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPREAD;
RETURN;
ZROFLDS:
READ_EXP=0; CODE_RID=0;
RETURN;
CODE_CLS:
IF UCC = '590110' OR UCC = '590210' OR UCC = '590220' OR UCC = '590230'
OR UCC = '660310'
THEN DO;
READ_EXP = READ_EXP + EXPEND;
RETURN;
END;
CODE_RID = CODE_RID +EXPEND;
RETURN;RUN; /*
DATA;SET;
IF CODE_RID ^= 0 THEN DO;
PUT NEWID READ_EXP CODE_RID;
END; */
******************************************************************************
* AGGREGATING EXPENDITURE ON EDUCATION. *
******************************************************************************;
DATA EXPEDUC (LABEL='EDUCATION EXPENDITURE');
KEEP=NEWID EDUC_EXP CODE_EDU)
ATTRIB NEWID LENGTH=$8 LABEL='CONS. UNIT ID';
ATTRIB UCC LENGTH=$6 LABEL='UCC CODE';
ATTRIB EDUC_HANDLE LENGTH=8 LABEL='EDUCATION';
ATTRIB CODE_HANDLE LENGTH=8 LABEL='CODE IN RANGE, NOT IDENT';
ATTRIB COST_ LENGTH=$1 LABEL='FLAG-COST_';
INFILE MTAB894 RECFM=FB LRECL=33 EOF=ENDEXP;
DROP EDID EDUC EDEXPEND EXPEND UCC;
RETAIN NEWID 'AAAAAAAA' UCC 'AAAAAA' EXPEND 0 EDUC_EXP CODE_EDU COST_;
INPUT EDID $ 1-8 EDUC $ 9-14 EDEXPEND 15-26 .4 COST_ $ 27;
/*
IF COST_ = 'T' THEN DO; PUT NEWID UCC;
END; /*
IF '660110' <= EDUCC <= '660210'
OR '660900' <= EDUCC <= '670210'
OR '670901' <= EDUCC <= '670902';
IF NEWID = 'AAAAAAAA'
   THEN DO;
   NEWID=EDID;
   UCC=EDUCC;
   EXPEND=EDEXPEND;
   LINK ZROFLDS;
   RETURN;END;
IF EDID ^= NEWID
   THEN DO;
   LINK CODE_CLS;
   NEWID=RIGHT(NEWID);
   OUTPUT EXPEDUC;
   NEWID=EDID;
   UCC=EDUCC;
   EXPEND=EDEXPEND;
   LINK ZROFLDS;
   RETURN;
   END;
IF EDUCC = UCC
   THEN DO;
   EXPEND=EDEXPEND;
   RETURN;
   END;
LINK CODE_CLS;
EXPD = EDUCC;
RETURN;
ENDEXP:
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPEDUC;
RETURN;
ZROFLDS:
EDUC_EXP=0; CODE_EDU=0;
RETURN;
CODE_CLS:
IF UCC = '670901' OR UCC = '670902' OR UCC = '660110' OR UCC = '660210'
   OR UCC = '660900' OR UCC = '670210' OR UCC = '670110'
   THEN DO;
   EDUC_EXP = EDUC_EXP + EXPEND;
   RETURN;
   END;
CODE_EDU = CODE_EDU + EXPEND;
RETURN;
DATA;SET;
IF CODE_EDU ^= 0 THEN DO;
   PUT NEWID EDUC_EXP CODE_EDU;
END; /*
******************************************************************************
* AGGREGATING EXPENDITURE TOBACCO AND SMOKING SUPPLIES. *
******************************************************************************;
DATA EXPTOBAC (LABEL='TOBACCO EXPENDITURE'
KEEP=NEWID TOBC_EXP CODE_SMK);
   ATTRIB NEWID LENGTH=$8 LABEL='CONS. UNIT ID';
   ATTRIB UCC LENGTH=$6 LABEL='UCC CODE';
   ATTRIB TOBC_EXP LENGTH=8 LABEL='ETOBCACCO AND SMOKING';
   ATTRIB CODE_SMK LENGTH=8 LABEL='CODE IN RANGE, NOT IDENT';
ATTRIB COST_ LENGTH=$1 LABEL='FLAG-COST_';
INFILE MTAB894 RECFM=FB LRECL=33 EOF=ENDEXP;
DROP TBID TBUCC TBEXPEND EXPEND UCC;
RETAIN NEWID 'AAAAAAAA' UCC 'AAAAAA' EXPEND 0 TOBC_EXP CODE_SMK COST_;
INPUT TBID $ 1-8 TBUCC $ 9-14 TBEXPEND 15-26 .4 COST_ $ 27;
/*
IF COST_ = 'T' THEN DO; PUT NEWID UCC;
END; */
IF '630110' <= TBUCC <= '630210';
IF NEWID = 'AAAAAAAA'
    THEN DO;
    NEWID=TBID;
    UCC=TBUCC;
    EXPEND=TBEXPEND;
    LINK ZROFLDS;
    RETURN; END;
IF TBID ^= NEWID
    THEN DO;
    LINK CODE_CLS;
    NEWID=RIGHT(NEWID);
    OUTPUT EXPTOBAC;
    NEWID=TBID;
    UCC=TBUCC;
    EXPEND=TBEXPEND;
    LINK ZROFLDS;
    RETURN;
END;
IF TBUCC = UCC
    THEN DO;
    EXPEND=EXPEND+TBEXPEND;
    RETURN;
END;
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPTOBAC;
RETURN;
ZROFLDS:
TOBC_EXP=0; CODE_SMK=0;
RETURN;
CODE_CLS:
IF UCC = '630110' OR UCC = '630210'
    THEN DO;
    TOBC_EXP = TOBC_EXP + EXPEND;
    RETURN;
END;
CODE_SMK = CODE_SMK + EXPEND;
RETURN;RUN; /*
DATA;SET;
IF CODE_SMK ^= 0 THEN DO;
PUT NEWID TOBC_EXP CODE_SMK;
END; */
*****************************************************************
* AGGREGATING EXPENDITURE ON MISCELLANEOUS SUPPLIES. *
*****************************************************************
DATA EXPMISC (LABEL='MISCELLANEOUS EXPENDITURE'
KEEP=NEWID MISC_EXP CODE_MSC);
ATTRIB NEWID LENGTH=$8 LABEL='CONS. UNIT ID';
ATTRIB UCC LENGTH=$6 LABEL='UCC CODE';
ATTRIB MISC_EXP LENGTH=8 LABEL='MISCELLANEOUS EXPENCE';
ATTRIB CODE_MSC LENGTH=8 LABEL='CODE IN RANGE, NOT IDENT';
ATTRIB COST_ LENGTH=$1 LABEL='FLAG-COST_';
INFILE MTAB894 RECFM=FB LRECL=33 EOF=ENDEXP;
DROP MSID MSUCC MSEXPEND EXPEND UCC;
RETAIN NEWID 'AAAAAAAA' UCC 'AAAAAA' EXPEND 0 MISC_EXP CODE_MSC COST_;
INPUT MSID $ 1-8 MSUCC $ 9-14 MSEXPEND 15-26 .4 COST_ $ 27;
/*
IF COST_ = 'T' THEN DO; PUT NEWID UCC;
END; */
IF '680110' <= MSUCC <= '680902'
OR MSUCC = '710110'
OR MSUCC = '900001';
IF NEWID = 'AAAAAAAA'
THEN DO;
NEWID=MSID;
UCC=MSUCC;
EXPEND=MSEXPEND;
LINK ZROFLDS;
RETURN;END;
IF MSID ^= NEWID
THEN DO;
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPMISC;
NEWID=MSID;
UCC=MSUCC;
EXPEND=MSEXPEND;
LINK ZROFLDS;
RETURN;
END;
IF MSUCC = UCC
THEN DO;
EXPEND=EXPEND+MSEXPEND;
RETURN;
END;
LINK CODE_CLS;
EXPEND=MSEXPEND;
UCC=MSUCC;
RETURN;
ENDEXP:
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPMISC;
RETURN;
ZROFLDS:
MISC_EXP=0; CODE_MSC=0;
RETURN;
CODE_CLS:
IF UCC = '680110' OR UCC = '680140' OR UCC = '680210' OR UCC = '680220'
OR UCC = '680901' OR UCC = '680902' OR UCC = '710110' OR UCC = '900001'
THEN DO;
MISC_EXP = MISC_EXP + EXPEND;
RETURN;
END;
CODE_MSC = CODE_MSC +EXPEND;
RETURN;RUN; /*
DATA;SET;
IF CODE_MSC ^= 0 THEN DO;
PUT NEWID MISC_EXP CODE_MSC;
END; */

*********************************************************
* AGGREGATING EXPENDITURE ON CASH CONTRIBUTIONS.        *
**********************************************************;
DATA EXPCASH (LABEL='CONTRIBUTIONS EXPENDITURE'
KEEP=NEWID CASH_CON CODE_CON);
ATTRIB NEWID LENGTH=$8 LABEL='CONS. UNIT ID';
ATTRIB UCC LENGTH=$6 LABEL='UCC CODE';
ATTRIB CASH_CON LENGTH=8 LABEL='CASH CONTRIBUTIONS';
ATTRIB CODE_CON LENGTH=8 LABEL='CODE IN RANGE, NOT IDENT';
ATTRIB COST_ LENGTH=$1 LABEL='FLAG-COST_';
INFILE MTAB894 RECFM=FB LRECL=33 EOF=ENDEXP;
DROP CSID CSUCC CSEXPEND EXPEND UCC;
RETAIN NEWID 'AAAAAAAA' UCC 'AAAAAA' EXPEND 0 CASH_CON CODE_CON COST_;
INPUT CSID $ 1-8 CSUCC $ 9-14 CSEXPEND 15-26 .4 COST_ $ 27;
/*
  IF COST_ = 'T' THEN DO; PUT NEWID UCC;
END; */
IF CSUCC = '800801'
OR '800810' <= CSUCC <= '800870';
IF NEWID = 'AAAAAA'
  THEN DO;
NEWID=CSID;
UCC=CSUCC;
EXPEND=CSEXPEND;
LINK ZROFLDS;
RETURN;END;
IF CSID ^= NEWID
  THEN DO;
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPCASH;
NEWID=CSID;
UCC=CSUCC;
EXPEND=CSEXPEND;
LINK ZROFLDS;
RETURN;
END;
IF CSUCC = UCC
  THEN DO;
  EXPEND=EXPEND+CSEXPEND;
RETURN;
END;
LINK CODE_CLS;
EXPEND=CSEXPEND;
UCC=CSUCC;
  RETURN;
ENDEXP:
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPCASH;
RETURN;
ZROFLDS:
CASH_CON=0; CODE_CON=0;
RETURN;
CODE_CLS:
IF UCC = '800801' OR UCC = '800810' OR UCC = '800820' OR UCC = '800830'
OR UCC = '800840' OR UCC = '800850' OR UCC = '800860' OR UCC = '800870'
  THEN DO;
CASH_CON = CASH_CON + EXPEND;
RETURN;
END;
CODE_CON = CODE_CON +EXPEND;
RETURN;run; /*
DATA;SET;
IF CODE_CON ^= 0 THEN DO;
PUT NEWID CASH_CON CODE_CON;
END;
***************************************************************
* AGGREGATING EXPENDITURE ON PERSONAL INSURANCE AND PENSIONS. *
***************************************************************;
DATA EXPPENS   (LABEL='PERSONAL INSURANCE AND PENSION'
KEEP=NEWID RPSS_EXP PIPE_EXP CODE_PIP);
ATTRIB NEWID LENGTH=$8 LABEL='CONS. UNIT ID';
ATTRIB UCC   LENGTH=$6 LABEL='UCC CODE';
ATTRIB RPSS_EXP LENGTH=8 LABEL='EXPENSE FOR ALL RETIREMENT BENEFIT';
ATTRIB PIPE_EXP LENGTH=8 LABEL='PERSONAL INSURANCE AND PENSION';
ATTRIB CODE_PIP LENGTH=8 LABEL='CODE IN RANGE, NOT IDENT';
ATTRIB COST_ LENGTH=$1 LABEL='FLAG-COST_';
INFILE MTAB894 RECFM=FB LRECL=33 EOF=ENDEXP;
DROP PPID PPUCC PPEXPEND EXPEND UCC;
RETAIN NEWID 'AAAAAAAA' UCC 'AAAAAA' EXPEND 0 PIPE_EXP RPSS_EXP CODE_PIP
COST_; INPUT PPID $ 1-8 PPUCC $ 9-14 PPEXPEND 15-26 .4 COST_ $ 27;
/*
IF COST_ = 'T' THEN DO; PUT NEWID UCC;
END; */
IF PPUCC = '002120'
OR PPUCC = '700110'
OR '800910' <= PPUCC <= '800940';
IF NEWID = 'AAAAAAAA'
THEN DO;
NEWID=PPID;
UCC=PPUCC;
EXPEND=PPEXPEND;
LINK ZROFLDS;
RETURN;END;
IF PPID ^= NEWID
THEN DO;
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPPENS;
NEWID=PPID;
UCC=PPUCC;
EXPEND=PPEXPEND;
LINK ZROFLDS;
RETURN;
END;
IF PPID = UCC
THEN DO;
EXPEND=EXPEND+PPEXPEND;
RETURN;
END;
LINK CODE_CLS;
EXPEND=PPEXPEND;
UCC=PPUCC;
RETURN;
ENDEXP:
LINK CODE_CLS;
NEWID=RIGHT(NEWID);
OUTPUT EXPPENS;
RETURN;
ZROFLDS:
PIPE_EXP=0; CODE_PIP=0;
RETURN;
CODE_CLS:
IF UCC = '700110' OR UCC = '002120' THEN DO;
P pipe_EXP = pipe_EXP + EXPEND;
RETURN;
END;
IF UCC = '800910' OR UCC = '800920' OR UCC = '800931' OR UCC = '800932' OR UCC = '800940'
THEN DO;
RPSS_EXP = RPSS_EXP + EXPEND;
RETURN;
END;
CODE_PIP = CODE_PIP + EXPEND;
RETURN;
RUN; /*
DATA;SET;
IF CODE_PIP ^= 0 THEN DO;
PUT NEWID RPSS_EXP PIPE_EXP CODE_PIP;
END; */
**********************************************************************************************************************
* MERGE ALL THE OUTPUTS.                                                                                           *
**********************************************************************************************************************;
DATA EXPSUM4.X894;
MERGE EXPHLTH EXPFOOD EXPBEVER EXPHOUS EXPUTIL EXPHHOLD EXPFURN EXPAPRL EXPTRANS EXPMEN EXPFUSE EXPREAD EXPETOBAC EXPMISC EXPCCASH
EXPPENS; BY NEWID;
RUN;
**********************************************************************************************************************
* STEP 1.C: MERGE CHARACTERISTICS AND EXPENDITURE DETAIL *                                                          *
**********************************************************************************************************************;
DATA FEEZ.L894;
ATTRIB QTR_YEAR LENGTH= $3 LABEL='YEAR AND QUARTER OF OBS';
QTR_YEAR='894';
MERGE CONSCHR4.Q894(IN=CONS) EXPSUM4.X894(IN=EXPN);
BY NEWID;
IF EXPN=0 THEN DO;
*********************************************************************
* ZERO EXPENDITURE ACCUMULATORS                                    *
*********************************************************************;
HLTH_INS  = 0;  MED_SRVS  = 0;  PRS_DRGS  = 0;  CODE_ERR  = 0;
FOOD_HOM=0; FOOD_AWY=0; CODE_FUD=0;
A LCH_BVG=0; CODE_BVG=0;
OWND_DWL=0; RENT_DWL=0; OTHR_DWL=0; CODE_DWL=0;
NATL_GAS=0; ELEC_ITY=0; FUEL_OIL=0; TELE_PHN=0; WATR_PLS=0; CODE_UTL=0;
DOME_SER=0; OTHR_SER=0; CODE_SER=0;
HOUS_FUR=0; CODE_FUR=0;
BOYS_MEN=0; WOME_GIR=0; CHIL_TWO=0; FOOT_WER=0; OTHR_APP=0; CODE_APP=0;
NCAR_TRC=0; UCAR_TRC=0; OTHR_VCL=0; VHCL_FIN=0; GALN_OIL=0; MAIN_RPR=0;
VHCL_INS=0; PUBL_TRA=0; VHCL_RET=0; CODE_TRA=0;
ADMS_FEE=0; ELEC_NIC=0; OTHR_EQP=0; CODE_ENT=0;
PERS_CAR=0; CODE_CAR=0;
READ_EXP=0; CODE_RID=0;
EDUC_EXP=0; CODE_EDU=0;
TOBC_EXP=0; CODE_SMK=0;
MISC_EXP=0; CODE_MSC=0;
CASH_CON=0; CODE_CON=0;
P pipe_EXP=0; RPSS_EXP=0; CODE_PIP=0;
END;
RUN;
*********************************************************************;
*PROC COPY IN=EXPMRG1 OUT=CONSEXP1;*RUN;
PROC CONTENTS DATA=EXPSUM4.X894;RUN;
PROC CONTENTS DATA=FEEZ.L894;RUN;
/* EXEC PGM=IEFBR14
  /*CONSCHR4 DD DSN=UN.BERHSAM.CONSCHR4,UNIT=DISK,
  /* DISP=(OLD,DELETE)
  /*EXPSUM4 DD DSN=UN.BERHSAM.EXPSUM4,UNIT=DISK,
  /* DISP=(OLD,DELETE)
Appendix P-2: Program to Compute Expenditures by Month and Year
******************************************************
* This Program computes monthly expenditures from quarterly and *
* yearly expenditures.                                       *
******************************************************

//BUILD93  JOB (BERHSAM),'BUILD DB',MSGCLASS=T,NOTIFY=BERHSAM
/*ROUTE PRINT WVNVM.BERHSAM
//****************************************************************
//* Buildb: will build a summary database for 1 year from the    */
//* quarterly government data                                   */
//****************************************************************/
//* need to change dsn on DB statement to reflect correct year   */
//*                                                              */
//****************************************************************/
//STEP1    EXEC SAS
//DB       DD DSN=BERHSAM.CONSUMER.SASDB,DISP=OLD
//****************************************************************/
//* need to change dsn on TAPE to reflect quarters worth of data  */
//* you would like to load to database                          */
//SOURCLIB DD DSN=BERHSAM.SAS.JCL,DISP=SHR
//*APE     DD DSN=UN.BERHSAM.DOPI.L931,DISP=SHR
//*TAPE    DD DSN=UN.BERHSAM.FOPI.L932,DISP=SHR
//*TAPE    DD DSN=UN.BERHSAM.GOPI.L933,DISP=SHR
//*TAPE    DD DSN=UN.BERHSAM.HOPI.L934,DISP=SHR
//*TAPE    DD DSN=UN.BERHSAM.BARNEY.L925,DISP=SHR
//*SYSIN    DD *
data mark(drop=i);
/***********************************************************/
/* you must also change the SAS dataset on the line below */
/* should equal the last node of the tape filename */
/***********************************************************/
set tape.1925(
    keep=NEWID   AGE_REF   AGE2
    BLS_URBN
    EARNCOMP  EARN_OMP   EDUC_REF
    EDUCA2   EDUCA2_   FAM_SIZE
    FINCATAx
    FINCBTAX
    FINLWT21
    GOVTCOST
    ORIGIN1
    PERSLT18  PERSOT64
    PRINEARN
    QINTRVMO  QINTRVYR
    REF_RACE   REGION
    HLTH_INS  CODE_ERR  FOOD_HOM  FOOD_AWY
    CODE_FUD  ALCH_BVG  CODE_BVG  OWND_DWL
    RENT_DWL  OTHR_DWL  CODE_DWL  NATL_GAS
ELEC_ITY FUEL_OIL TELE_PHN WATR_PLS
CODE_UTL DOME_SER OTHR_SER CODE_SER
BOYS_MEN WOME_GIR CHIL_TWO FOOT_WER
OTHR_APP CODE_APP NCAR_TRC UCAR_TRC
OTHR_VCL VHCL_FIN GALN_OIL MAIN_RPR
VHCL_INS PUBL_TRA VHCL_RET CODE_TRA
ADMS_FEE ELEC_NIC OTHR_EQP CODE_ENT
PERS_CAR CODE_CAR READ_EXP CODE_RID
EDUC_EXP CODE_EDU

*/
 /****************************************************************************************/
 /* Create new variables which will be aggregated */
 /* */
 /* */
 /****************************************************************************************/

Tothlth  = hlth_ins + code_err;
totfood  = food_hom + food_awy + code_fud;
totalhl  = alch_bvg + code_bvg;
tothous  = ownd_dwl + rent_dwl + othr_dwl + code_dwl;
totutil  = natl_gas + elec_ity + fuel_oil + tele_phn
 + watr_pls + code_utl;
totdomes = dome_ser + othr_ser + code_ser;
totapp   = boys_men + wome_gir + chil_two + foot_wer
 + othr_app + code_app;
tottran  = ncar_trc + ucar_trc + othr_vcl + vhcl_fin
 + galn_oil + main_rpr + vhcl_ins
 + publ_tra + vhcl_ret + code_tra;
TOTEXP  = TOTHLTH + TOTUTIL + FB + HSNG +
 TPE + TOTTRAN + TOTENT + TOTAPP;
totent   = adms_fee + elec_nic + othr_eqp + code_ent;
tpercar  = pers_car + code_car;
tread    = read_exp + code_edu;
totedu   = educ_exp + code_edu;
fb       =totfood + totalhl;
hsng     = tothous + totdomes;
tpe      = tpercar + totedu;

/****************************************************************************************/
 /* now perform the divisions */
 /* */
 /* */
 /****************************************************************************************/

nfincatx = fincatax / 12;
fincbtx  = fincbtax / 12;
fnlwt21  = finlwt21 / 12;
ntothlth = tothlth / 3;
ntotutil = totutil / 3;
fb         = fb / 3;
hsng       = hsng / 3;
tpe        = tpe / 3;
tottran = tottran / 3;
totent  =otent / 3;
totapp  = totapp / 3;

*format intdate realdate monyy.;
format intdate realdate date9.;
label
    intdate = "Interview Date"
    realdate = "Simulated Date"
intdate = mdy(qintrvmo,1,qintrvyr);

/**************************************************************/
/* now create 3 new obs for each original obs. This is needed */
/* because variable will be aggregated. Each single obs is */
/* actually a summary of the previous 3 months */
/* i.e: Jan95 shows --> Oct, Nov, Dec for 1994 */
/**************************************************************/

do i=-3 to -1 by 1;
   realect = intnx('month',intdate,i);
   if year(realect)=1993 then do;
      if month(realect) = 1 then output;
      if month(realect) = 2 then output;
   end;
end;  /* end of do */ /*

proc print data=mark;
var realect intdate
   nfinctx finctx nfinctx finttcx fintcttax
   nfnlwt21 finlwt21 ntotlth tothlth ntotutil totutil
   nfb fb nhsng hsg ntp tpe
   ntottran tottran ntotent totent ntotapp totapp
   totfood tothlth tothous totdomes
   tpercar tread totedu;
run;

proc append data=mark base=db.fix(compress=yes reuse=yes) FORCE;
run;

%include sourclib(freq);
run;
/*
Appendix P-3: Rearrange the Month with the Year

* This Program arranges expenditure month with expenditure year *

DATA DB.FIX1(COMPRESS=YES REUSE=YES DROP=YR MONTH DAY);

SET DB.FIXMERGE;
IF (MONTH(REALDATE)=5) AND (YEAR(REALDATE)=1980) THEN DELETE;
IF (MONTH(REALDATE)=6) AND (YEAR(REALDATE)=1980) THEN DELETE;
IF (MONTH(REALDATE)=7) AND (YEAR(REALDATE)=1980) THEN DELETE;
IF (MONTH(REALDATE)=10) AND (YEAR(REALDATE)=1985) THEN DELETE;
IF (MONTH(REALDATE)=11) AND (YEAR(REALDATE)=1985) THEN DELETE;
IF (MONTH(REALDATE)=12) AND (YEAR(REALDATE)=1985) THEN DELETE;
IF (MONTH(REALDATE)=1) AND (YEAR(REALDATE)=1986) THEN DELETE;
IF (MONTH(REALDATE)=2) AND (YEAR(REALDATE)=1986) THEN DELETE;
IF (MONTH(REALDATE)=10) AND (YEAR(REALDATE)=1987) THEN DELETE;
IF (MONTH(REALDATE)=11) AND (YEAR(REALDATE)=1987) THEN DELETE;
IF (MONTH(REALDATE)=12) AND (YEAR(REALDATE)=1987) THEN DELETE;
IF (MONTH(REALDATE)=1) AND (YEAR(REALDATE)=1988) THEN DELETE;
IF (MONTH(REALDATE)=2) AND (YEAR(REALDATE)=1988) THEN DELETE;
IF (MONTH(REALDATE)=10) AND (YEAR(REALDATE)=1988) THEN DELETE;
IF (MONTH(REALDATE)=11) AND (YEAR(REALDATE)=1988) THEN DELETE;
IF (MONTH(REALDATE)=12) AND (YEAR(REALDATE)=1988) THEN DELETE;
IF (MONTH(REALDATE)=1) AND (YEAR(REALDATE)=1989) THEN DELETE;
IF (MONTH(REALDATE)=2) AND (YEAR(REALDATE)=1989) THEN DELETE;
IF (MONTH(REALDATE)=10) AND (YEAR(REALDATE)=1992) THEN DELETE;
IF (MONTH(REALDATE)=11) AND (YEAR(REALDATE)=1992) THEN DELETE;
IF (MONTH(REALDATE)=12) AND (YEAR(REALDATE)=1992) THEN DELETE;
IF (MONTH(REALDATE)=1) AND (YEAR(REALDATE)=1993) THEN DELETE;
IF (MONTH(REALDATE)=2) AND (YEAR(REALDATE)=1993) THEN DELETE;

RUN;
PROC FREQ DATA=DB.FIX1;
   TABLE REALDATE;
   FORMAT REALDATE DATE9.;
RUN;
/*

YR = YEAR(REALDATE);
MONTH = MONTH(REALDATE);
DAY = DAY(REALDATE);

SELECT;
  WHEN (YR = 1995) DELETE;
  OTHERWISE;
END;
RUN;
Appendix P-4: Program to Merge the Price File With the Expenditure Master File

***********************************************************************************************************
* This program merges the price index file with the data set.*
* It also sorts data and produces the frequency.                                           *
***********************************************************************************************************

//BERHSAMA  JOB  (BERHSAM),'PROC CONTENTS',MSGCLASS=T,NOTIFY=BERHSAM
//       TIME=15
//ONE EXEC SAS
//WORK     DD UNIT=SYSDA,SPACE=(CYL,(900,50)),DISP=(NEW,DELETE)
//*ORTWK01 DD SPACE=(CYL,(&SORT)),UNIT=SYSDA  ALWAYS HAVE REAL SORTWORK
//*SORTWK02 DD SPACE=(CYL,(&SORT)),UNIT=SYSDA  DD CARDS (DONT USE DYNAM
//*SORTWK03 DD SPACE=(CYL,(&SORT)),UNIT=SYSDA  ALLOCATION OF SORTWORK).
//DB        DD  DSN=BERHSAM.CONSUMER.SASDB,DISP=OLD
//*TAPE       DD  DSN=BERSHAM.CONSUMER.FINAL.SASDB.TAPE,DISP=SHR
//PRINDEX   DD  DSN=BERHSAM.PRINDEX.SASDB,DISP=OLD
//SYSIN DD *

PROC SORT DATA=PRINDEX.PRINDEX;
  BY REALDATE;
RUN;
PROC SORT DATA=DB.FIX NODUP;
  BY REALDATE NEWID;
RUN;

/***************************************************************/
/* WILL MERGE THE MASTER CONSUMER DATABASE WITH THE INDEX FILE */
/* CONSUMER DB IS ON TAPE IN THE VIRTUAL TAPE SUBSYSTEM        */
/***************************************************************/

DATA DB.FIXMERGE(COMPRESS=YES REUSE=YES);

MERGE DB.FIX(IN=MASTER) PRINDEX.PRINDEX(IN=INDEX);
  BY REALDATE;
/*
  IF MASTER=0
    THEN PUT 'NOTE: DATA MISSING FROM MASTER:' REALDATE DATE9.;

  IF INDEX=0 THEN PUT 'NOTE: DATA MISSING FROM INDEX:' REALDATE DATE9. ;
*/
RUN;
/*
PROC FREQ DATA=DB.FIX;
  TABLES REALDATE;
  FORMAT REALDATE DATE9.;
RUN;

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Appendix P-5: Program to Display the Content of the Data Set
***********************************************************
* This program prints the content of the data set.      *
***********************************************************

//BERHSAMA JOB (BERHSAM), 'PROC CONTENTS', MSGCLASS=T, NOTIFY=BERHSAM
//ONE EXEC SAS
//DSN1 DD DSN=BERHSAM.CONSUMER.SASDB, DISP=SHR
//SYSIN DD *
PROC CONTENTS DATA=DSN1._ALL_; Run;*/
Appendix P-6: Program to Copy File

*****************************************************************************************
* This program is used to copy a file to another file*
*****************************************************************************************

//BERHSAMA JOB (BERHSAM), 'PROC CONTENTS', MSGCLASS=T, NOTIFY=BERHSAM,
//      TIME=1440
// * WILL COPY DISK CONSUMER DATABASE TO TAPE
// *
// ONE EXEC SAS
// * WORK DD UNIT=SYSDA, SPACE=(CYL, (500, 50)), DISP=(NEW, DELETE)
// * ORTWK01 DD SPACE=(CYL, (&SORT)), UNIT=SYSDA ALWAYS HAVE REAL SORTWORK
// * SORWK02 DD SPACE=(CYL, (&SORT)), UNIT=SYSDA DD CARDS (DON'T USE DYNAM
// * SORWK03 DD SPACE=(CYL, (&SORT)), UNIT=SYSDA ALLOCATION OF SORTWORK)
// TAPE DD DSN=BERHSAM.CONSUMER.SURVEY.NOV0197, DISP=(NEW, CATLG),
//      UNIT=VTS
// DB DD DSN=BERHSAM.CONSUMER.SASDB, DISP=SHR
// SYSIN DD *

    PROC COPY IN=DB OUT=TAPE;

    RUN;
ENDSAS;
RUN;
Appendix P-7: Program to Sort the Data Set

***********************************************************************
* This program is used to sort the data set. It also*
* removes duplicates.                                              *
***********************************************************************

//BERHSAMA JOB (BERHSAM),'PROC CONTENTS',MSGCLASS=T,NOTIFY=MARK,
//       TIME=15
//ONE EXEC SAS
//WORK DD UNIT=SYSDA,SPACE=(CYL,(900,50)),DISP=(NEW,DELETE)
//*SORTWK01 DD SPACE=(CYL,(&SORT)),UNIT=SYSDA ALWAYS HAVE REAL SORTWORK
//*SORTWK02 DD SPACE=(CYL,(&SORT)),UNIT=SYSDA DD CARDS (DONT USE DYNAM
//*SORTWK03 DD SPACE=(CYL,(&SORT)),UNIT=SYSDA ALLOCATION OF SORTWORK).
//CONSUMER DD DSN=BERHSAM.CONSUMER.SASDB,DISP=SHR
//TAPE DD DSN=BERHSAM.CONSUMER.MASTER.SASDB.TAPE,
//       UNIT=VTS,DISP=(NEW,CATLG)
//SYSIN DD *
/*
PROC SORT DATA=CONSUMER.SUMMARYF OUT=TAPE.MASTER NODUP;
   BY REALDATE NEWID;
RUN;

PROC FREQ DATA=CONSUMER.SUMMARYF;
   TABLES REALDATE;
   FORMAT REALDATE DATE9.;
RUN;
ENDSAS;

PROC CONTENTS DATA=TAPE._ALL_;RUN;
/*
Appendix P-8: Program to Compute Mean and Frequency

This program produces the means, frequency and content of the data.

//BERHMEAN JOB (BERHSAM),'PROC CONTENTS',MSGCLASS=T,NOTIFY=BERHSAM,
// TIME=15
//ONE EXEC SAS
//WORK DD UNIT=SYSDA,SPACE=(CYL, (800,50)),DISP=(NEW,DELETE)
//*ORTWK01 DD SPACE=(CYL, (&SORT)),UNIT=SYSDA  ALWAYS HAVE REAL SORTWORK
//*ORTWK02 DD SPACE=(CYL, (&SORT)),UNIT=SYSDA  DD CARDS (DONT USE DYNAM
//*ORTWK03 DD SPACE=(CYL, (&SORT)),UNIT=SYSDA  ALLOCATION OF SORTWORK).
//MASTER DD DSN=BERHSAM.CONSUMER.SASDB,DISP=SHR
//SYSIN DD *
PROC FREQ DATA=MASTER.SUMMARY;
  TABLES REALDATE;
  FORMAT REALDATE DATE9.;
RUN;

PROC CONTENTS DATASET=MASTER._ALL_;RUN;

PROC MEANS DATA=NEWDB.SUMMARY1;
  *BY REALDATE;
  CLASS REALDATE;
  VAR TOTEXP;
  FORMAT REALDATE DATE9.;
RUN;
RUN;
### Appendix P-9: Program to Display Frequency Table

**-----------------------------------**
* This file shows the frequency table and the content of the*
* data set by month from 1980-1994                           *
**-----------------------------------**

```plaintext
1 OPTIONS NOCENTER;
2
3 PROC FREQ DATA=CONSUMER.SUMMARY;
4   TABLES REALDATE;
5   FORMAT REALDATE DATE9.;
6   RUN;
```

NOTE: The PROCEDURE FREQ printed pages 1-4.
NOTE: The PROCEDURE FREQ used 14.23 CPU seconds and 3377K.

```plaintext
8
9
10 PROC CONTENTS DATA=CONSUMER.SUMMARY;
11 NOTE: The PROCEDURE CONTENTS printed pages 5-7.
12 NOTE: The PROCEDURE CONTENTS used 0.06 CPU seconds and 3542K.
13
14 NOTE: The SAS session used 14.55 CPU seconds and 3542K.
15 NOTE: SAS Institute Inc., SAS Campus Drive, Cary, NC USA 27513-2414
16 The SAS System
17 18:52 Thursday, November 6, 1997  1
```

#### Simulated Date

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