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Estimating individual consumption

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ESTIMATING INDIVIDUAL CONSUMPTION

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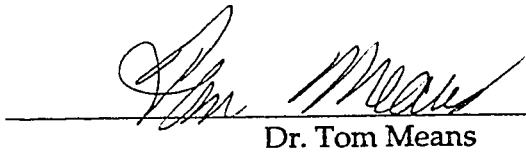

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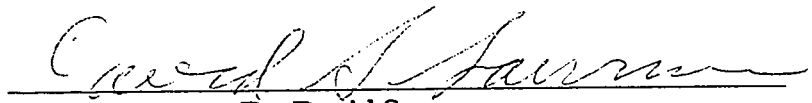

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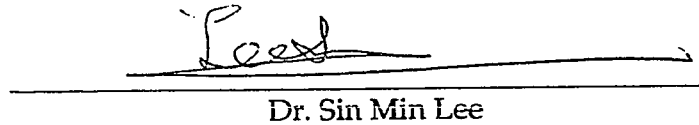

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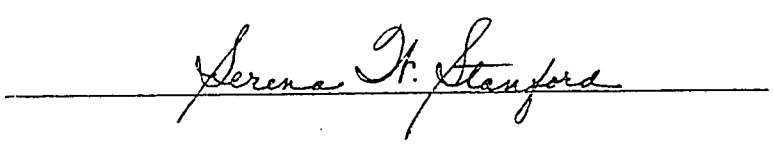

ABSTRACT

ESTIMATING INDIVIDUAL CONSUMPTION

by Gurmeet S. Batra

In recent years, a series of consumption expenditure estimates have been performed by a variety of researchers. The purpose of this study is to analyze the econometric models used in Trout and Foster (1993) paper in an attempt to examine the basic assumptions made and identify the sources of possible error. The data used are from the Consumer Expenditure Survey 1989-90 published by Bureau of Labor Statistics. The regression model is used to estimate the consumption function in various household categories. This modified version of the regression model examines the effect of the consumption expenditure on the disposable income, age, and family size. The ordinary least squares method is used to estimate the structural parameters. Decedent consumption ratios, μ_M and μ_F are computed for a given family size and age of particular sex. The results from the estimation techniques reveal that μ_M and μ_F are very sensitive to changes in age and family size.

ACKNOWLEDGMENTS

First of all I must thank my sister and my mother, for their love and encouragement throughout my career. Their constant support has truly been instrumental in bringing my student career to a close.

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Finally, I am indebted to my grandfather and my uncle who have been an immeasurable source of inspiration. Without their encouragement, I would not be where I am today. I dedicate this thesis to the memory of my father.

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INTRODUCTION

Economists have been perplexed by the problems of isolating the personal consumption of a single individual within a family. A wide variety of procedures to estimate personal consumption expenditures have been used by various experts and accepted in different courts. Use of various approaches to estimate a decedent's personal expenditure have led to substantial differences in awards in cases which are otherwise similar. Unfortunately, various procedures which have been used to make personal consumption estimates do not follow any consistent pattern.

Data pertaining to average family consumption patterns in the United States are available through the Bureau of the Census, which collects and summarizes expenditures data for consumer units by means of the Consumer Expenditure Survey[1]. The procedures demonstrated in this paper provide a means by which personal expenditure estimates can be reasonably made. Data from the Consumer Expenditure Survey, 1989-90, published by Bureau of Labor Statistics, have been used in this paper.

This paper does not advance on a new methodology for this problem. It aims at measuring the dollar value of loss associated with the death in question. It becomes important to know the value of consumption expenditure that would have been absorbed by the deceased if he or she had lived. The purpose of this research is to examine these studies in detail, particularly the econometric models used in the Trout and Foster (1993) paper and basic assumptions made, in an attempt to identify similarities and sources of possible error.

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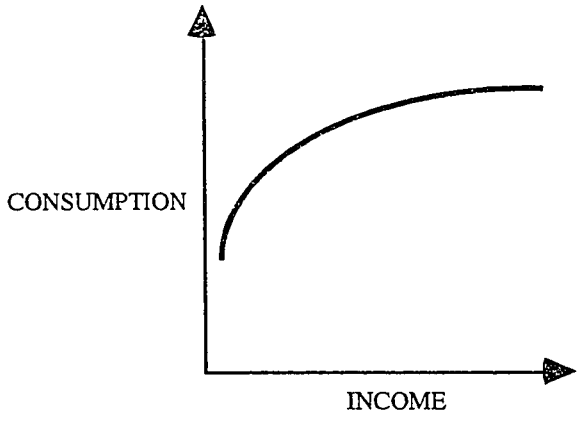
[1] One of the most comprehensive data on consumer expenditure is "Consumer Expenditure Survey." This survey is the only comprehensive source of detailed information on family expenditures and income related to socioeconomic and demographic characteristics of U.S. families.

This paper follows through the similar assumptions made in the Trout and Foster (1993) in order to replicate the data for analysis. An attempt has been made to modify the regression models for Husband-Wife category, so that the ages of both the male and female individual are taken into account. Male/Female consumption is estimated by comparing the regression models on Husband-Wife category and Male/Female head category for the same age. Finally, values for μ_M and μ_F, the proportion of household consumption flowing in a typical adult male and female, are determined and compared with those presented by Trout and Foster.

THE CONSUMPTION THEORY

The theory of the consumption function was changed radically in the mid-1950s with the emergence of various theories of the consumption - that is, the permanent income theory, the life cycle hypothesis, and related theories. This theory was first introduced by Keynes in 1936, after which it was fairly obvious that a key relationship in macroeconomic analysis for some time to come would be the relationship between income and consumer expenditure. The consumption function shown in figure 1. reflects the observation that as income increases people tend to spend more, but at a decreasing rate.



The Consumption Function
FIGURE 1

What makes the consumption function so important that a substantial amount of literature is devoted in this area. For one, the consumption function helps to estimate the decedent's personal expenditure in order to estimate the loss to surviving family members in case of wrongful deaths. Also the consumption data aids economists in establishing poverty lines. This is needed for at least two reasons: to determine the eligibility for receiving government assistance and to enable the government to make accurate counts of the poor in order to assess the success of antipoverty

programs and the need for further efforts. For some purposes, estimates are needed of amounts consumed by individual family members. This need has been especially urgent with respect to children in order to implement awards for child support effectively. The consumption function also assists with the issues that concern with the type and level of taxes that should be levied on consuming units.

Personal Consumption Expenditure is measured as the aggregate household spending. From the beginning of the study of household consumption, the need was felt for standards with which actual consumption behavior could be compared. Consumption standards are used to (1) measure the level of well-being of an individual or household; (2) make comparisons between or among individuals or households; and (3) guide the consumption choices of individuals or households. Consumption expenditure include some items which are consumed by an individual household such as tobacco, clothing, and alcohol. These expenditures can be properly treated as "private" consumption by the family members. There are other categories of consumer expenditure that are not all personal consumption since they give rise to asset accumulation. These can be categorized as "public" items and include purchase of major home appliances, vehicles, furniture, musical instruments, and sporting goods.

A budget or "cross-section" study of consumption collects income and consumption spending data, along with other information, from a sample of families over a given time period. The principal objective of such studies has been to determine how consumption levels vary with various income levels. The relevant measure of income is "Disposable Personal Income," defined as income from all sources (wages, salaries, interest and dividends, welfare, pensions, gifts, capital gains), less all income taxes paid (federal, state and local). Thus defined, this is the amount of income that a family can dispose off as it chooses, with the two choices being consumption spending or saving.

Facts of consumption as summarized by Trout and Foster from the research to date:

1. Consumption spending by an individual or household depends on the spending unit's income.
2. If a spending unit receives an additional dollar of income, it will increase its level of consumption spending, but by less than an additional dollar. The change in consumption as a fraction or percentage, of change in income is the marginal propensity to consume or MPC, and the stylized fact says that $0 < MPC < 1$.(The portion of the additional dollar not spent on consumption is saved or is paid as taxes.)
3. Average consumption (consumption divided by income) tends to fall as income rises.

A central question, and a classical one, is how to measure equivalence in consumption levels. A convenient way of summarizing the impact of household size and member characteristics is the "equivalence scale." Equivalence scales are numbers indexing the consumption levels that make families of different size and compositions equally well-off. According to Frances M. Magrabi, an equivalence scale for individuals is an index in which the consumption quantity or expenditure deemed appropriate of that of a base person. The earliest example of such a scale was developed by Ernst Engel (1883). His scale expressed in units of expenditure he called "quets." The base person in his scale was an infant, whose level of consumption was assumed to be 100 quets. He estimated that expenses would increase by 10 quets each year until the age of 20 to 25. More recent estimates of consumption equivalent scales have been computed using large data sets and more sophisticated analytic methods.

Senceca and Taussig (1971) estimated equivalence scales for households of different sizes using data from the 1960 Survey of Consumer Expenditure. They divided the sample of household into 16 income groups, each subdivided according to the size of the household. For each income-size group, they computed an Engel function: expenditure in a given category as a function of income. The estimated expenditures were then converted into a set of equivalence scales, one scale for each income group, by expressing the estimate for each household size as a percentage of the estimate for a four-

person household. Because these scales have many important applications, economists have been working on their development for decades. Unfortunately, despite the substantial literature on this subject, research has reached no consensus about the single best methodology for creating these equivalence scales. Although larger families clearly require more resources than smaller families to achieve a given standard of living, there are substantial economies of scale with family size. For example, a household with four members does not have to be twice the size of a household with two members, and a given number of refrigerators, washing machines and furniture can serve larger families almost as well as smaller ones.

As might be expected, because of these "scale" economies, the percentage of family income devoted to consumption expenditure generally rises as family size increases and falls as income increases. Sex and age provide another basis that affect consumption. For example, young children consume less than adults, but during the growing period they often consume more per pound of weight than do adults.

Estimates are needed of amounts consumed by individual family members in order to determine damages arising from personal injury, wrongful death, and malpractice claims. A "wrongful death" action arises when an individual dies and the decedent's survivors file suit charging that the death was caused by some negligence on the part of one or more defendants. In such cases involving a deceased earner, it is common practice to estimate the loss to surviving members by making an adjustment for the decedent's personal consumption. In determining economic loss[2] to the survivors in wrongful death cases, some personal expenditures of the decedent must be subtracted from his or her gross income. The reason is that survivors would not have had access to that portion of income used for the decedent's personal expenditures even had the decedent lived. The critical economic

[2] The economic loss to survivors is defined as the dollar value of consumption opportunities which the survivors would have enjoyed if the death had not occurred, but will now have to be foregone.

determination in wrongful death recovery is the net income lost by the household due to the death of an earner. In some cases, such as where only one household member smokes, it is rather easy to attribute spending for tobacco to a single individual. In other cases, where all family members consume an item (such as food), it becomes more difficult to estimate how much of that consumption can be attributed to the deceased. The problem is the definition and measurement of the decedent's personal expenditures. A recovery can range from 5% to 50% or more of the decedent's gross income depending on the expenditure theory adopted.

There are three basic elements to this calculation. Assuming no death occurred, total family income is measured as the sum of wages and salaries, employer contributions to fringe benefits, and outside income brought in by the household and/or wife. To this is added the value of household production (washing dishes, mowing lawns etc.) generated by adult family members. A deduction is then made for the personal consumption which would have flowed exclusively to the decedent. The net loss to survivors consists of the deceased's contribution to income and household production. less his or her personal consumption. Mathematically, the loss in any year can be expressed as follows:

(1) $$L = Y_d - C_d$$

where $C_d = \mu_d(Y_t)$

In the above equation, Y = income, subscript d = decedent and t = total. C_d, the decedent's own consumption, is written as a proportion (μ_d) of the intact family's total consumption opportunities. The assumption made is that the decedent fringe benefits and household production are integral part of the income.

The consumption proportion μ_d in equation (1) depends on whether the decedent is male or female, in which case it is denoted μ_M or μ_F, respectively. It may also depend on the level of family income, the number of persons or children in the household, and the ages of the heads of the family. What this paper attempts to do is evaluate μ_M and μ_F as measured in the Trout and Foster paper and point out the sources of possible errors.

REVIEW OF THE LITERATURE

Earl Cheit (1961) estimated the percentage of income consumed by the family head. Cheit's study used data from the mid-1950s based on personal interviews of widows, and his study has been used for years as the most authoritative work on the subject of personal consumption.

Depperschmidt in 1991, described three approaches to estimating a decedent's proportion of family consumption: (1) personal consumption, (2) personal maintenance, and (3) survivor standard of living. These three methods differ from each other essentially in the assignment of certain kinds of household expenses to the decedent's share of household consumption.

Under the personal consumption method, the decedent's net income contribution is gross income minus some percentage of all household expenditures assigned to the personal consumption of (a) common costs such as shelter, (b) joint variable costs such as food, and (c) member specific costs such as clothing and personal effects. The disadvantage of this method is that the factual determination of household consumption shared by each member is difficult due to the scarcity of sufficiently refined public consumption based on household member's age, sex, size, etc.

The personal maintenance method stresses the expenditures necessary to keep the decedent alive and working. This method requires deduction of a decedent's "necessary" expenditures only from the decedent's total income. Adoption of this method does not in itself define which maintenance items to include in the deduction.

Most economists support the third method, namely an expenditure percentage based on the survivors' standard of living. Given the decedent's gross earnings, plaintiffs are allowed maintenance of their standard of living that existed prior to the decedent's demise. This approach is based on "economies of scale," suggesting that there are cost savings associated with

increased size of a household. Specifically, the additional consumption by one more household member is less than for the previous member in each case and less than the average member's consumption out of the household total. Therefore, only the member specific, incremental expenses of the decedent should be deducted from the decedent's gross income. However, in this method there is difficulty in measuring an individual's member specific consumption in a multi-consumer household.

Peterson's (1990) analysis of decedent's proportion of family consumption revolves around two fundamental concepts: consumption and personal maintenance. According to him, consumption focuses on total family expenditures, while personal maintenance focuses on the expenditure necessary to maintain the individual decedent had he or she lived. He mentions an important problem in measuring jointly consumed goods among family members.

The best-known studies of decedent consumption based on CES data are those by Nelson and Patton. The Consumer Expenditure Survey (CES), conducted periodically by the Bureau of Labor Statistics (BLS) is one of the major sources of data for determining decedent consumption. The authors subjectively divided expenses into fixed (those that do not change with family size) and variable categories, then examined average variable consumption ratios by family size and income class. Their research conclude the following:

1. Both μ_M and μ_F fall as family size increases.
2. Both μ_M and μ_F rise as family income rises.
3. Generally, $\mu_M > \mu_F$.

Gilbert (1991) reviewed the Nelson and Patton studies and the use of BLS Equivalence Scales in measuring decedent consumption. He suggested that the true marginal consumption is lower than previously observed as the presence of public goods within a household is likely to bias these estimates upwards. Harju and Adams (1991) followed the general model of Nelson and Patton in estimating a decedent's proportion of family consumption. Their results are presented by family size and income quintile. Like Nelson and

Patton, they found that the incremental consumption declines with family size, and increases slightly with income.

There seems to be disagreement among economists as to the best method to use in computing the decedent's proportion of family income to use as an offset to the other economic losses. Recently, economists believe that the survivor's standard of living method is most closely related to economic theory, since it focuses on the incremental change in family consumption resulting from the removal of a single family member, while not disturbing the consumption patterns of the remaining family members.

In regard to the components of income figure in the decedent's consumption, Peterson, Cheit and Speiser (1975), all believe that the consumption percentage should be applied to total family income. This seems appropriate as the BLS data most economists rely on to estimate the consumption percentage is compiled on a total family basis. Hence one cannot segregate components of income within a family and assert that particular family members consume only the income from a single source. Indeed, Fitzpatrick (1984, p.40) has noted "the amount of personal consumption expenditure is always a function of total family after-tax income, treating the family as a spending unit, rather than allocating personal consumption expenditures to individual earnings."

Another issue is consumption of uncompensated household services provided by various members. The complex part of the analysis is that a significant portion of household services are "public" goods that are "jointly" consumed within the family unit. Nevertheless, a significant portion of household services are consumed entirely by the individual providing the service. There has been no reliable study completed on how to allocate these uncompensated services among the categories of public or jointly consumed goods and individually consumed goods. Trout and Foster (1993) use the same proportion for total family income and apply it to total family uncompensated services, as no better benchmark seems to exist.

THE CONSUMPTION EQUATION

The objective of this research is to examine the econometric models used in Trout and Foster (1993) and to determine a way to compute values for μ_M and μ_F, the proportion of household consumption flowing attributable to the adult male and female. To do this, cross-sectional household budget data from the CES has been used and econometric regression analysis have been performed on the data. Data, methodology and results are summarized below:

The estimates of decedent's consumption are based on 1989-90 CES conducted by the BLS and released in 1991. The survey recorded information from about 5,000 households for each quarter from 1989-I through 1990-I, inclusive. This provided over 25,000 initial observations. For this study all quarters were combined, but certain observations were eliminated for a variety of reasons:

1. Households with very low incomes often consume more than their disposable income, with the difference being made up from unreported income sources. Many such households fall below the poverty line and exhibit life styles and consumption patterns which differ markedly from a typical family. Hence, households with disposable incomes less than $12,000 were discarded. This reduced the sample size to 16,643.
2. Households with disposable incomes of greater than $100,000 per year represented only a few cases. These cases were eliminated by Trout and Foster because all income greater than $100,000 was coded at $100,000, at the Bureau of Labor Statistics. Such cases were discarded so that the data is comparable with that used by Trout and Foster.
3. The observations can be partitioned by family type into four categories: (1) Husband-Wife; (2) Female-Head; (3) Male-Head; and (4) Other. The fourth category includes cases that are not representative of the first three categories. The fourth category was eliminated from the sample because of the data reporting problems by the Bureau of Labor Statistics.

4. Cases having consumption greater than 100,000 were discarded as in such cases the consumption was greater than the reported income and hence were not representative of a typical family consumption.

Eliminating the households as listed above resulted in a sample of 14,176 observations on the following variables:

A_M	=	age of principal male in household.
A_F	=	age of principal female in household.
C	=	consumption expenditure on all items (in thousands of dollars).
Fmltype	=	type of family in the household.
N	=	family size (number of adults and children).
Sex	=	1 if male; Sex = 0 if female.
U	=	1 if urban household; U = 0 if rural.
Y	=	after-tax income from all sources (in thousands of dollars).

Income and consumption variables are measured in thousands of dollars, age in years and family size in number of persons. Table 1 summarizes the descriptive statistics of the data base. As can be seen from table 1, the Husband-Wife household category describes the ages of both husband and wife.

TABLE 1

STATISTICS FOR SAMPLE DATA IN VARIOUS CATEGORIES

Variable	Mean	Std Dev	Minimum	Maximum	N
Husband - Wife + Female Head + Male Head					
AM	39.31	21.23	.00	90.00	14176
AF	38.82	20.02	.00	90.00	14176
C	29.42	16.93	1.67	99.91	14176
Fmltype	3.80	2.60	1	8	14176
N	2.81	1.52	1	18	14176
Sex	1.23	.42	1	2	14176
U	.90	.30	.00	1.00	14176
Y	34.02	18.16	12	100	14176
Husband - Wife Household					
AM	46.40	15.27	18.00	90.00	10564
AF	43.84	14.71	15.00	90.00	10564
C	32.09	17.26	3.53	99.91	10564
Fmltype	2.44	1.32	1	5	10564
N	3.31	1.37	2	18	10564
Sex	1.12	.33	1	2	10564
U	.88	.33	.00	1.00	10564
Y	37.11	18.57	12	100	10564
Female Head Household					
AM	.00	.00	.00	.00	1950
AF	44.71	16.90	20.00	90.00	1950
C	20.47	12.04	1.67	91.27	1950
Fmltype	7.72	.45	7	8	1950
N	1.53	1.00	1	8	1950
Sex	2.00	.00	2	2	1950
U	.96	.19	.00	1.00	1950
Y	22.89	11.13	12	96	1950
Male Head Household					
AM	40.34	15.17	18.00	90.00	1662
AF	.00	.00	.00	.00	1662
C	22.98	14.15	2.32	99.91	1662
Fmltype	7.82	.57	6	8	1662
N	1.14	.52	1	5	1662
Sex	1.00	.00	1	1	1662
U	.95	.23	.00	1.00	1662
Y	27.47	15.09	12	100	1662

THE REGRESSION MODEL

The identification of consumption equivalence between households in terms of equal well-being must, at a minimum, take into account the number of persons consuming from the household and other variables such as age, sex and perhaps other characteristics, like location (urban or rural). A simple quadratic consumption function was created: $C = f(Y, N, A_{M/F}, U)$[3] and based on this function the regression model was generated:

$$C = \beta_1 + \beta_2 Y + \beta_3 Y^2 + \beta_4 N + \beta_5 N^2 + \beta_6 A_{M/F} + \beta_7 A^2_{M/F} + \beta_8 N^* Y + \beta_9 A_{M/F}^* Y + \beta_{10} U$$

The regression coefficients ($\beta_1 .. \beta_{10}$) and other parameters of the equation above were estimated using Ordinary Least Squares (OLS). Two regression models were created with the Husband-Wife category for 10,564 observations. For the first model, the age of the male was taken into consideration and in the second model, the age of the female was used in the analysis.

A regression similar to the above equation was run with the other two categories - the Male-Head household and the Female-head household. The results of the regression are given in the appendix. As can be seen from the regression analysis, the household consumption (C) depends on the disposable income (Y), family size (N), age ($A_{M/F}$) and location of household (U). This can be verified by the statistical significance of coefficients β_1 through β_{10}. The regression results also indicate that for a given level of the disposable income, consumption rises (at a decreasing rate) with an increase in the size of the family and age of the principal head of the household.

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[3] The Consumption function, C is the same as the one generated by Trout and Foster (1993).

Unlike the regression analysis in the Trout and Foster (1993) paper, the husband-Wife household category is regressed twice[4] - once taking into consideration the age of the male and in the second case, the age of the female. For example, when the Husband-Wife household and Female-Head household equations are compared for a given disposable income and age, the age is representative of the same sex. The regression analysis by Trout and Foster is unclear as to whose age is being considered.

The significance of coefficients for the Male-Head household and the Female-Head household indicate the different dependence on income, age, family size and interaction of income and family size as can be seen from the appendix. The four consumption functions of interest are estimated as:

<u>For Husband-Wife household with age of male in analysis</u>

$$C_{HW(AM)} = -9.129 + 0.720Y - 0.002Y^2 + 2.143N - 0.197N^2 + 0.628A_M - 0.006A^2_M + 0.007N^*Y - 0.002A_M^*Y + 1.591U$$

<u>For Husband-Wife household with age of female in analysis</u>

$$C_{HW(AF)} = -9.579 + 0.751Y - 0.002Y^2 + 2.158N - 0.194N^2 + 0.659A_F - 0.007A^2_F + 0.006N^*Y - 0.003A_F^*Y + 1.563U$$

For Female-Head household

$$C_{FH} = -5.237 + 0.962Y - 0.004Y^2 + 4.122N - 0.598N^2 + 0.247A_F - 0.002A^2_F - 0.010N^*Y - 0.003A_F^*Y - 0.580U$$

<u>For Male-Head household</u>

$$C_{MH} = 7.802 + 0.626Y - 0.004Y^2 - 2.814N + 0.451N^2 + 0.031A_M - 0.001A^2_M + 0.082N^*Y + 0.001A_M^*Y + 1.749U$$

[4] The equation was run with age of male (A_M) and age of female (A_F) and was found to be highly collinear indicating that the predictive powers of the equation are the same.

ESTIMATING THE DECEDENT'S CONSUMPTION

Trout and Foster (1993) describe a method to determine the decedent's consumption and estimate the process with a male decedent in an urban household, with the age of the decedent equal to 35 and the pre-death family size of three. In their illustration, consumption of a Husband-Wife household (C_{HW}) (with family size of N) is compared with the Female-Head household (C_{FH}) (with a family size of N-1). In other words, the Female-Head household represents a case where the husband is absent resulting in a family size of N-1. The absence of the husband causes a decrease in income, consumption and saving. As a result of the death, the income level of the Husband-Wife household will fall to a level of income perceived by the Female-Head household.

To estimate the consumption of the husband, the income of the Female-Head household is brought up to the level of the Husband-Wife household. From the consumption theory, this increase or change in income would result in (1) additional consumption (dC_{FH}) and (2) increased saving (dS_{FH}). The change in saving is measured by comparing the consumption functions C_{HW} and C_{FH} i.e.

$$dS_{FH} = C_{HW} - C_{FH}$$

The consumption attributed to the husband in Husband-Wife household is perceived as the change in disposable income (dY). This change of disposable income is divided between the additional consumption (dC_{FH}) and increased saving (dS_{FH}) and hence

$$C_M = dY = dC_{FH} + dS_{FH}$$

The change in consumption (dC_{FH}) is given by the differential of Female-Head consumption (dC_{FH}/dY) i.e.

$$dC_{FH}/dY = 0.962 - 0.007Y - 0.009(N-1) - 0.0027A$$

or

$$dC_{FH} = [0.962 - 0.007Y - 0.009(N-1) - 0.0027A]\, dY$$

In the above equation, "A" represents the age of the female in the Female-Head household. The study by Trout and Foster has replaced this age by the age of the male decedent whose consumption is being estimated. Their study therefore assumes that the age of the adult male and female is the same in a Husband-Wife household. This is not true as the data in table 1 indicates that in various categories, the age of the female is different from the age of the male. Hence the decedent consumption ratios μ_M and μ_F determined by Trout and Foster are misleading in terms of whose age is determining consumption.

In order to correct the above problem, the Husband-Wife household category is regressed twice - once with the age of the male member and the second with the age of the female. So, when the Husband-Wife household and Female-Head household consumption functions are compared, the variable age is representative of the age of the female. Similarly, in evaluating the change in consumption (dC_{FH}) the age variable is replaced with the age of the Female-Head household being considered. Hence

$$dC_{FH} = [0.962 - 0.007Y - 0.009(N-1) - 0.0027A_F]\, dY$$

For example, consider an urban family consisting of a 46 year old male , his wife and two children (A_M=46,N=4), and with a disposable income of $70,000 (Y=70). From the appendix for A=46, N=4, and corresponding to Y=$70,000, we have C_M = $4,960 and C_F = $1,680 approximately.

The male/female decedent consumption ratio is given by the dollar value of the consumption attributable to a male/female divided by the household disposable income. i.e.

$$\mu_M = C_M/Y \quad \text{and} \quad \mu_F = C_F/Y.$$

The decedent consumption ratio is found as μ_M = 6.2% and μ= 2.1%.

CONCLUSION

In the estimation of the decedent consumption ratios Nelson and Patton (1984) are probably cited very often. Trout and Foster (1993) apply regression analysis to individual household consumption data for over 15,000 cases. Their work like that of Nelson and Patton, suggests that the ratios depend on the total disposable family income, family size and gender of the decedent. In addition, Trout and Foster introduce age explicitly in their analysis. They probably assume in their analysis that the ages of both the genders are the same. For example, in specifying the consumption of a male decedent using the Female-Head household equation, they use the age of the male decedent. This is misleading, as the data samples indicate that the ages of male and female members are different (typically, on an average, the female member in a Husband-Wife household is two years younger than her male counterpart).

The objective of this paper is to follow through the analysis of Trout and Foster (1993) paper, particularly the econometric models used and the basic assumptions made and uncover the sources of errors. To correct the error observed in Trout and Foster paper of using one age for both the genders, the Husband-Wife household equation is regressed twice thus taking into account the ages of both the genders separately. Hence, while specifying the consumption of an individual decedent, the correct age of the gender is taken into account.

In the process of following through the analysis of Trout and Foster paper, the average age and family size of a typical Husband-Wife household was selected. From table 1, the average age of a male in a Husband-Wife household was selected as 46 (A_M=46.40) and the family size was selected as 4 (N=3.31). The graph displaying the male and female decedent consumption ratio for A_M=46 and N=4 is shown in figure 2. Table 2 indicates the results obtained for a certain range of income values.

TABLE 2 Decedent Consumption Ratio for Y = 40 to 60 (A_M = 46 and N = 4)

Income	Age Of		Family Size		Household Consumption				Saving		Consumption		Consumption Ratio	
	Male	Female			Husband - Wife		Male/Female head		Male/Female head		Male	Female	Male	Female
(Y)	(AM)	(AF)	(N)	(N-1)	C_hwm	C_hwf	c_fh	c_mh	s_fh	s_mh	M_con	F-con	delta_m	delta_f
40.00	46.00	44.00	4.00	3.00	37.11	35.48	33.76	34.79	1.71	2.33	3.45	5.97	4.32	7.47
41.00	46.00	44.00	4.00	3.00	37.61	35.96	34.24	35.38	1.72	2.22	3.41	5.60	4.26	7.00
42.00	46.00	44.00	4.00	3.00	38.10	36.43	34.71	35.97	1.73	2.13	3.38	5.25	4.22	6.56
43.00	46.00	44.00	4.00	3.00	38.58	36.91	35.17	36.55	1.74	2.04	3.35	4.92	4.19	6.15
44.00	46.00	44.00	4.00	3.00	39.07	37.38	35.62	37.12	1.76	1.95	3.34	4.62	4.17	5.77
45.00	46.00	44.00	4.00	3.00	39.54	37.84	36.06	37.68	1.78	1.86	3.33	4.34	4.16	5.42
46.00	46.00	44.00	4.00	3.00	40.02	38.30	36.50	38.23	1.80	1.79	3.33	4.07	4.16	5.09
47.00	46.00	44.00	4.00	3.00	40.49	38.76	36.93	38.78	1.83	1.71	3.33	3.83	4.17	4.79
48.00	46.00	44.00	4.00	3.00	40.95	39.21	37.35	39.32	1.87	1.64	3.35	3.60	4.18	4.50
49.00	46.00	44.00	4.00	3.00	41.42	39.66	37.76	39.85	1.90	1.57	3.37	3.39	4.21	4.24
50.00	46.00	44.00	4.00	3.00	41.87	40.11	38.16	40.37	1.94	1.51	3.39	3.20	4.24	4.00
51.00	46.00	44.00	4.00	3.00	42.33	40.55	38.56	40.88	1.99	1.45	3.42	3.02	4.28	3.77
52.00	46.00	44.00	4.00	3.00	42.78	40.98	38.95	41.39	2.04	1.39	3.46	2.85	4.33	3.57
53.00	46.00	44.00	4.00	3.00	43.22	41.42	39.33	41.89	2.09	1.34	3.51	2.70	4.38	3.38
54.00	46.00	44.00	4.00	3.00	43.67	41.85	39.70	42.38	2.15	1.29	3.56	2.56	4.45	3.20
55.00	46.00	44.00	4.00	3.00	44.10	42.27	40.06	42.86	2.21	1.25	3.61	2.43	4.52	3.04
56.00	46.00	44.00	4.00	3.00	44.54	42.69	40.42	43.33	2.27	1.21	3.67	2.32	4.59	2.90
57.00	46.00	44.00	4.00	3.00	44.97	43.11	40.77	43.80	2.34	1.17	3.74	2.22	4.67	2.77
58.00	46.00	44.00	4.00	3.00	45.39	43.52	41.11	44.26	2.42	1.14	3.81	2.12	4.76	2.65
59.00	46.00	44.00	4.00	3.00	45.82	43.93	41.44	44.71	2.49	1.11	3.88	2.04	4.85	2.55
60.00	46.00	44.00	4.00	3.00	46.23	44.34	41.76	45.15	2.57	1.09	3.96	1.97	4.95	2.46

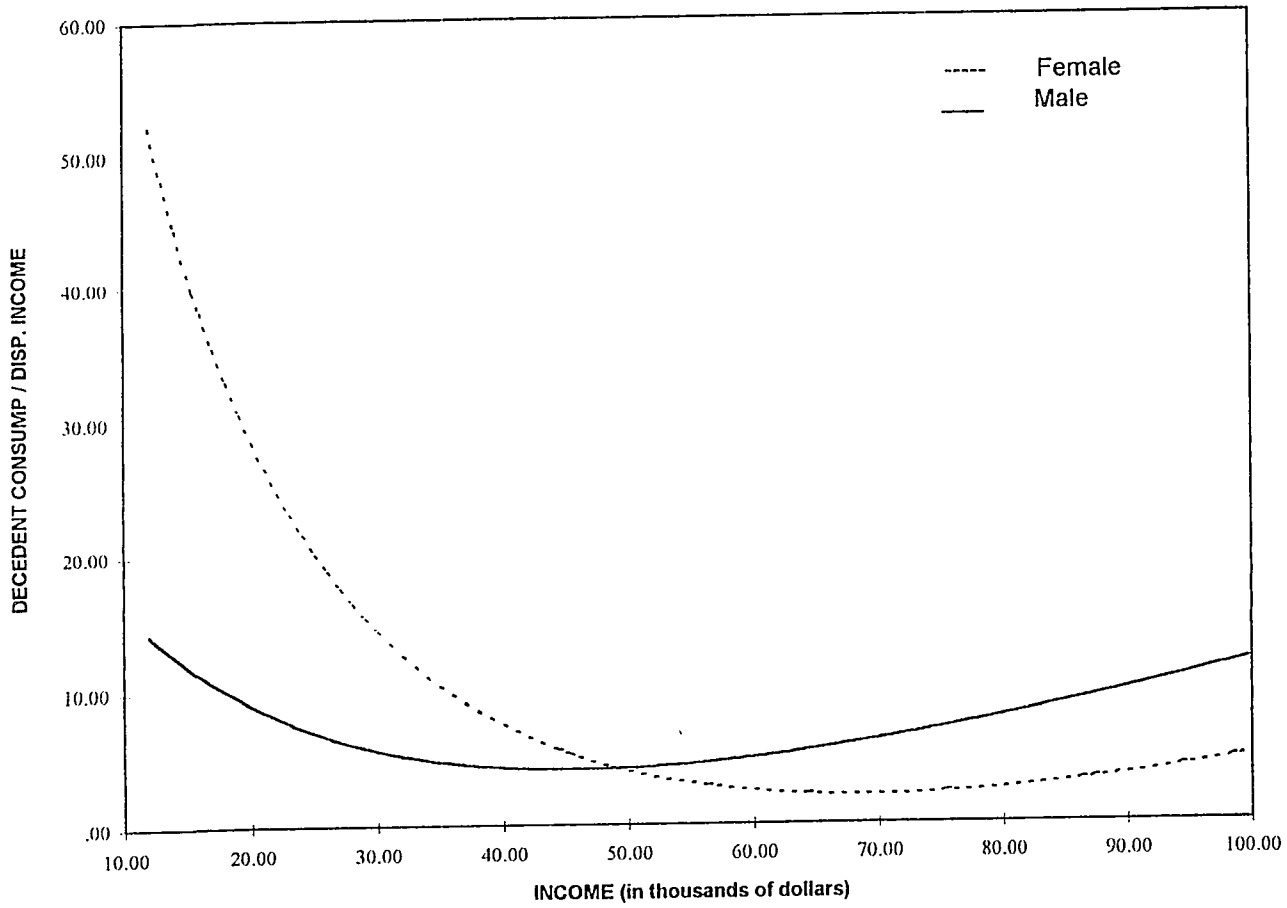

Figure 2 : DECEDENT CONSUMPTION RATIOS ($A_M = 46$, $N = 4$)

As can be seen from figure 2, the graphs of μ_M and μ_F cross each other for an personal disposable income of $49,000. For income greater than $49,000, it is seen that $\mu_M > \mu_F$ (for A_M=46 and N=4). This is consistent with the observations made by Nelson and Patton (1984) in their study. The decedent consumption ratio for various age groups (A_M=30,46 and 60) and family size (N=2,3,4 and 7) are given in the appendix. The graphs indicate that μ_M and μ_F are very sensitive to changes in age groups and family size.

1. It is seen from the graphs that for family size less than 4, as income increases $\mu_F > \mu_M$.
2. For family size of 4, $\mu_M > \mu_F$ after the cross over point (this is observed for A_M=30,46).
3. For family size greater than 4, the results for μ_M and μ_F are quite unexpected (not shown). This would probably indicate that the decedent consumption ratios are not very stable.
4. In some cases, (A_M=30, N=3) the decedent consumption ratio are typically U-shaped not intersecting one another in the entire income region, with $\mu_F > \mu_M$.

Given all the graphs for various age groups and family size, the decedent consumption ratios are quite unpredictable for certain range of values indicating the probability of other factors influencing them. Various restrictions were imposed on the variables with respect to their effective range. For example, personal disposable income of less than $12,000 and greater than $100,000 were discarded. This probably is due to very few cases supporting such data as they represent extreme outlines of the sample data. Further research with more recent and detailed data is encouraged in order to determine better econometric models for decedents consumption ratios.

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APPENDIX

The appendix contains list of tables showing the regression results for various household categories. The regression analysis were performed using SPSS for windows. Table 3 and 4 indicate regression analysis for Husband-Wife category with the age of the male and the age of the female, respectively in the analysis. Table 5 and 6 indicate the regression analysis for the Female-Head and Male-Head respectively.

The appendix also includes figures for the decedent consumption ratios for different values of age of male and family size.

TABLE 3

REGRESSION ANALYSIS (Husband - Wife / Age of male in analysis)

Multiple R	.57925
R Square	.33553
Adjusted R Square	.33496
Standard Error	14.07276

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	9	1055411.88534	117267.98726
Residual	10554	2090139.95619	198.04244

F = 592.13563 Signif F = .0000

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
Y	.719851	.049554	.774613	14.527	.0000
YSQ	-.001825	3.1852E-04	-.185056	-5.729	.0000
N	2.142857	.411145	.170007	5.212	.0000
NSQ	-.197199	.037767	-.139022	-5.221	.0000
AGE_M	.628206	.067251	.555828	9.341	.0000
AGE_MSQ	-.006206	6.3146E-04	-.557672	-9.829	.0000
N_Y	.007180	.005833	.035944	1.231	.2184
AGE_M_Y	-.002103	5.9147E-04	-.118603	-3.555	.0004
U	1.591075	.426145	.029987	3.734	.0002
(Constant)	-9.129066	2.167159		-4.212	.0000

TABLE 4

REGRESSION ANALYSIS (Husband - Wife / Age of female in analysis)

Multiple R	.57970
R Square	.33606
Adjusted R Square	.33549
Standard Error	14.06712

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	9	1057085.90840	117453.98982
Residual	10554	2088465.93312	197.88383

F = 593.55022 Signif F = .0000

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
Y	.751321	.049257	.808478	15.253	.0000
YSQ	-.001877	3.1833E-04	-.190358	-5.897	.0000
N	2.158418	.411226	.171241	5.249	.0000
NSQ	-.193745	.037781	-.136586	-5.128	.0000
N_Y	.006070	.005802	.030389	1.046	.2955
U	1.562941	.425918	.029457	3.670	.0002
AGE_F	.659223	.068104	.561910	9.680	.0000
AGE_FSQ	-.006668	6.6820E-04	-.549681	-9.979	.0000
AGE_F_Y	-.002768	6.1822E-04	-.147291	-4.477	.0000
(Constant)	-9.579173	2.121149		-4.516	.0000

TABLE 5

REGRESSION ANALYSIS (Female-Head)

Multiple R	.55311
R Square	.30593
Adjusted R Square	.30271
Standard Error	10.05139

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	9	86392.29100	9599.14344
Residual	1940	195999.00979	101.03042

F = 95.01241 Signif F = .0000

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
Y	.962287	.099222	.889591	9.698	.0000
YSQ	-.003846	8.7976E-04	-.267528	-4.372	.0000
N	4.122018	1.012620	.340917	4.071	.0000
NSQ	-.597746	.151033	-.267295	-3.958	.0001
A_REF	.246800	.091694	.346465	2.692	.0072
ASQ	-.002394	8.5538E-04	-.349146	-2.799	.0052
N_Y	-.009865	.020907	-.024874	-.472	.6371
A_Y	-.002748	.001378	-.147824	-1.994	.0462
U	-.579942	1.198269	-.009208	-.484	.6285
(Constant)	-5.236564	2.974348		-1.761	.0785

TABLE 6

REGRESSION ANALYSIS (Male-Head)

Multiple R	.50643
R Square	.25647
Adjusted R Square	.25242
Standard Error	12.23587

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	9	85314.40445	9479.37827
Residual	1652	247331.60770	149.71647

F = 63.31553 Signif F = .0000

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
Y	.626305	.096773	.667734	6.472	.0000
YSQ	-.004071	7.9385E-04	-.384904	-5.128	.0000
N	-2.813295	2.959364	-.103628	-.951	.3419
NSQ	.451046	.551164	.077515	.818	.4133
A_REF	.031445	.122917	.033718	.256	.7981
ASQ	-.001428	.001246	-.147874	-1.147	.2517
N_Y	.082055	.035522	.154866	2.310	.0210
A_Y	.001389	.001467	.081211	.947	.3438
U	1.749228	1.340629	.027983	1.305	.1921
(Constant)	7.802107	3.839686		2.032	.0423

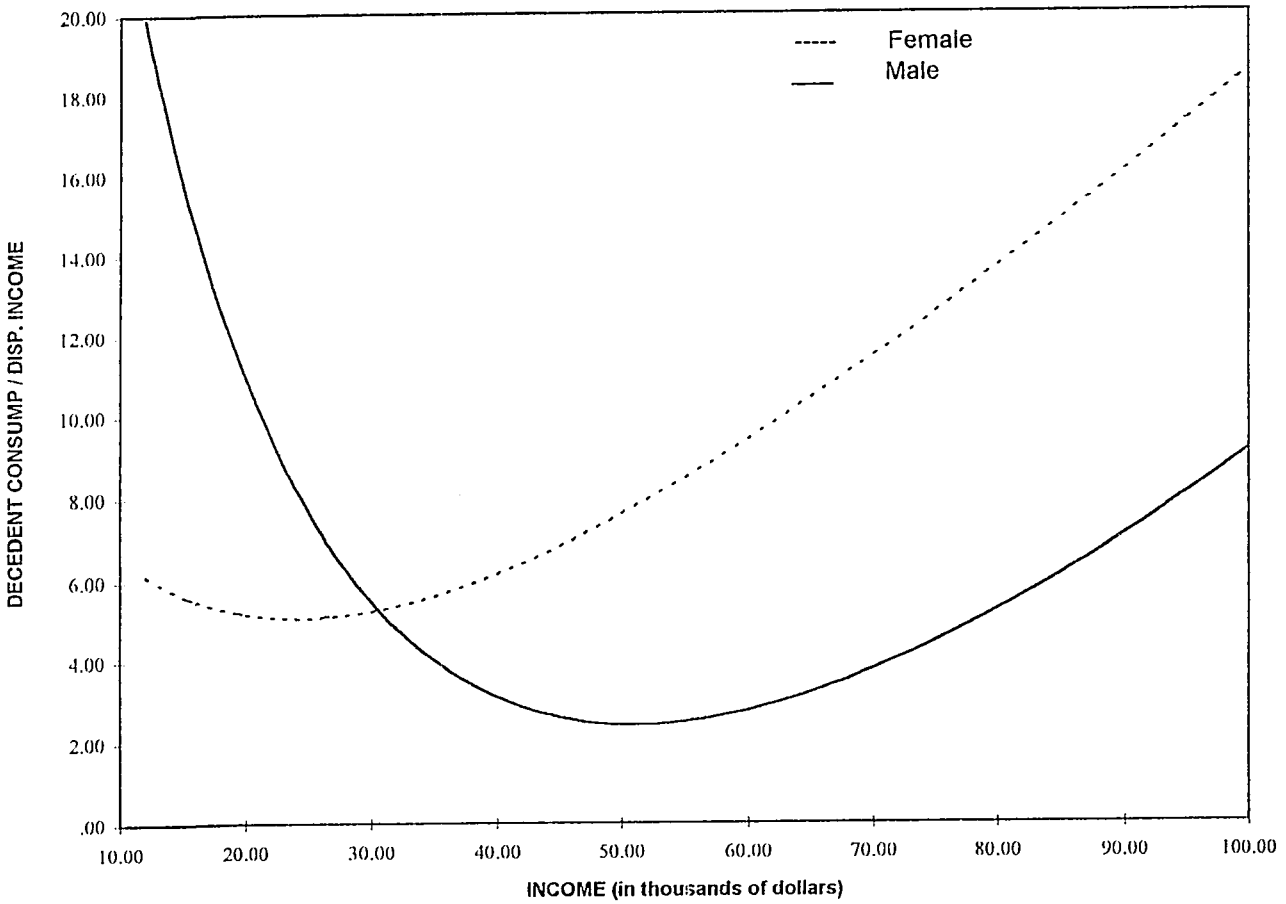

Figure 3 : DECEDENT CONSUMPTION RATIOS ($A_M = 30$, $N = 2$)

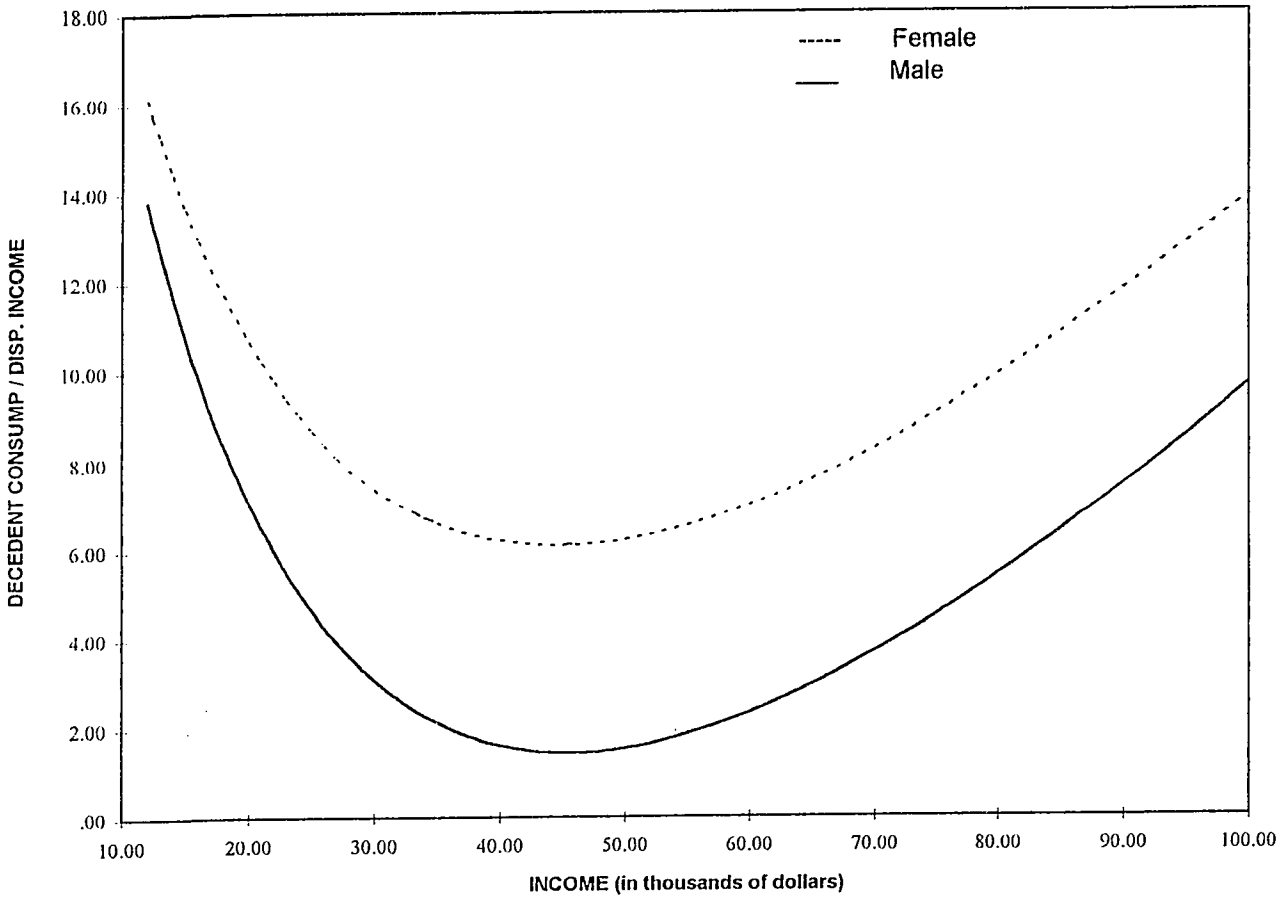

Figure 4 : DECEDENT CONSUMPTION RATIOS ($A_M = 30$, $N = 3$)

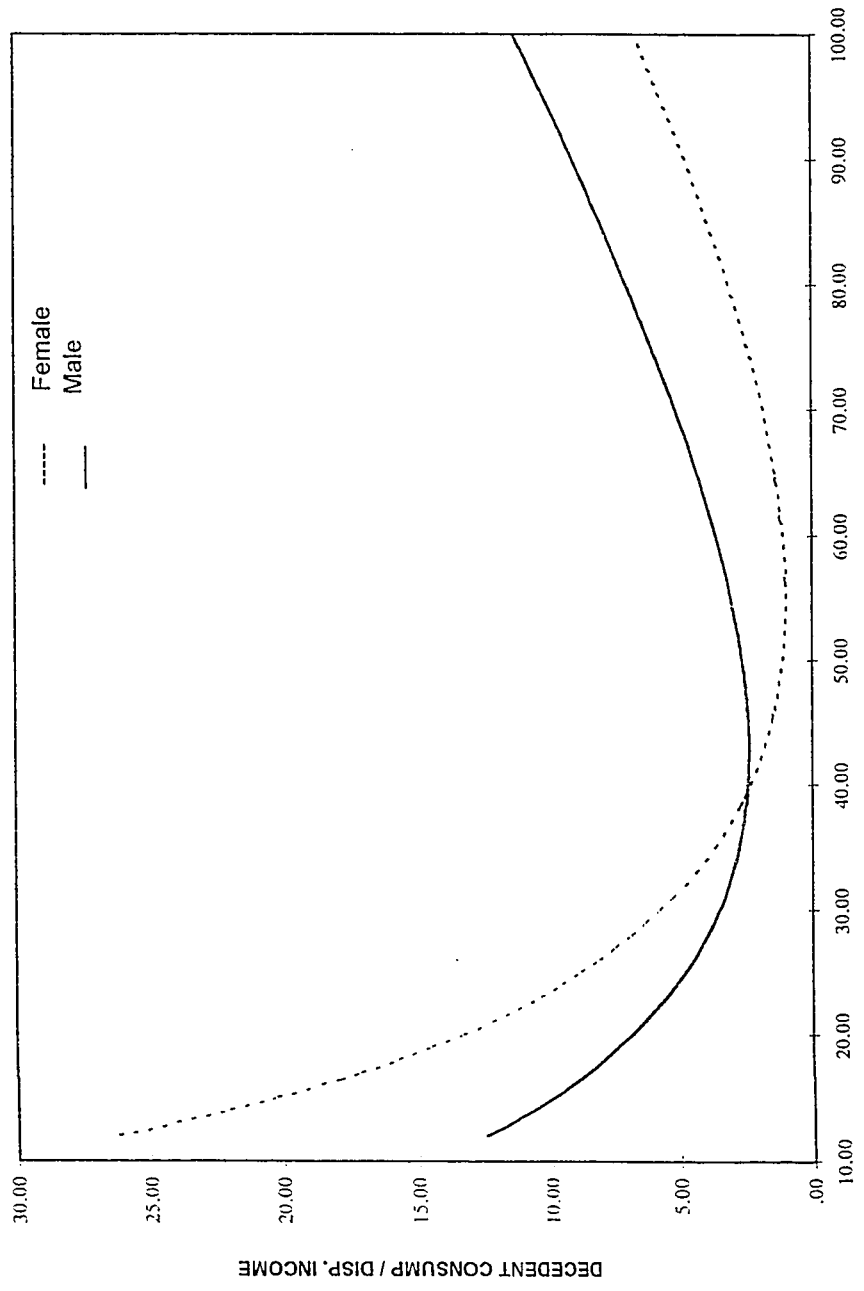

Figure 5 : DECEDENT CONSUMPTION RATIOS ($A_M = 30$, $N = 4$)

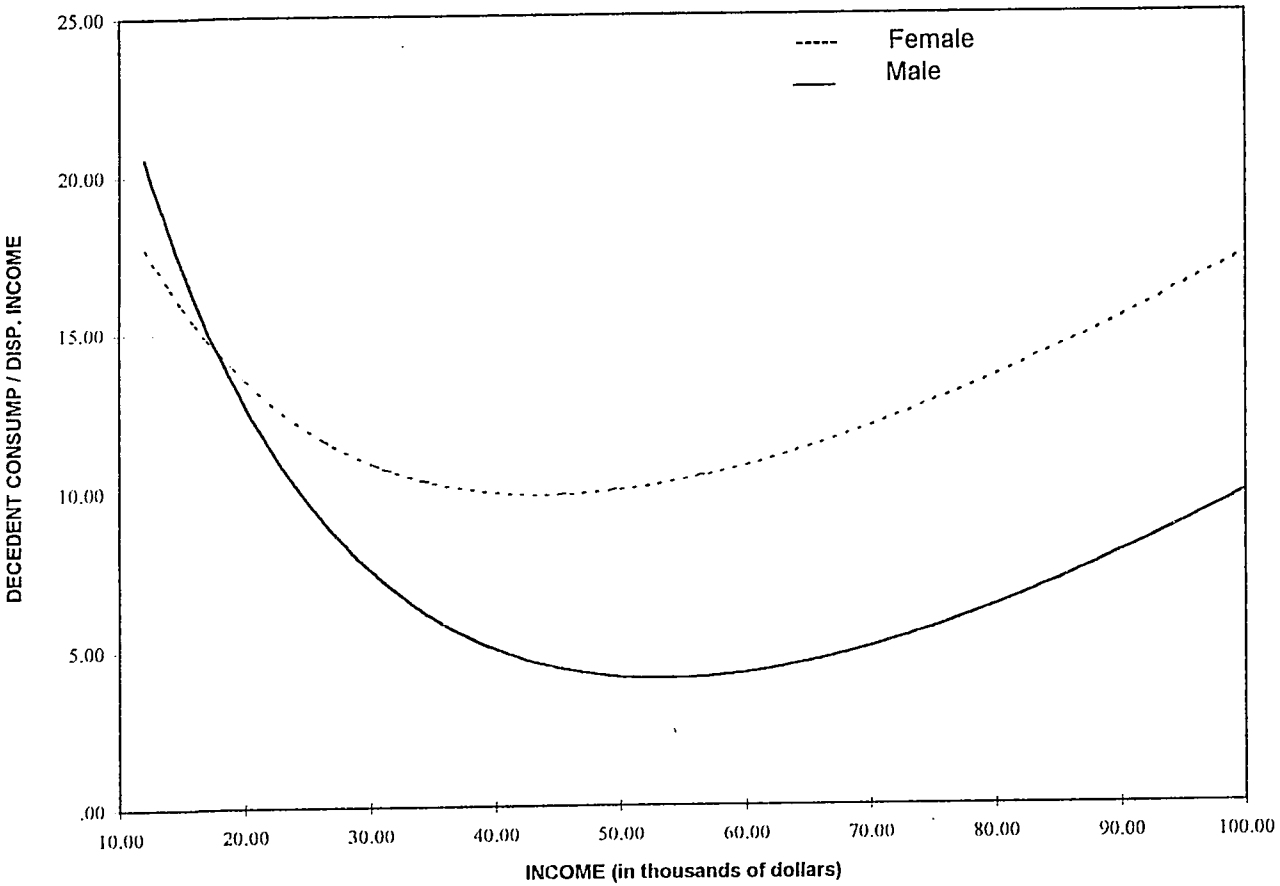

Figure 6 : DECEDENT CONSUMPTION RATIOS ($A_M = 46$, $N = 2$)

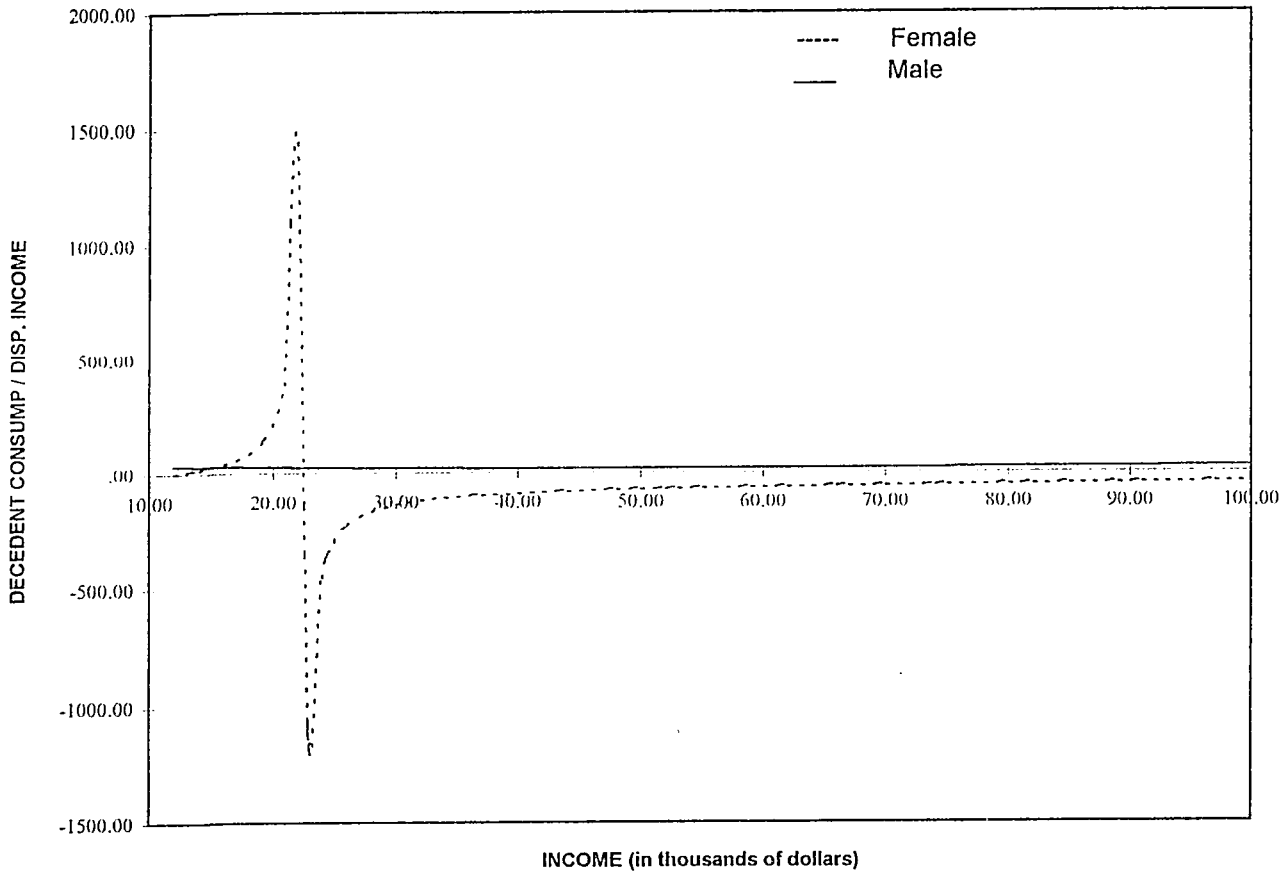

Figure 7 : DECEDENT CONSUMPTION RATIOS ($A_M = 46$, $N = 7$)

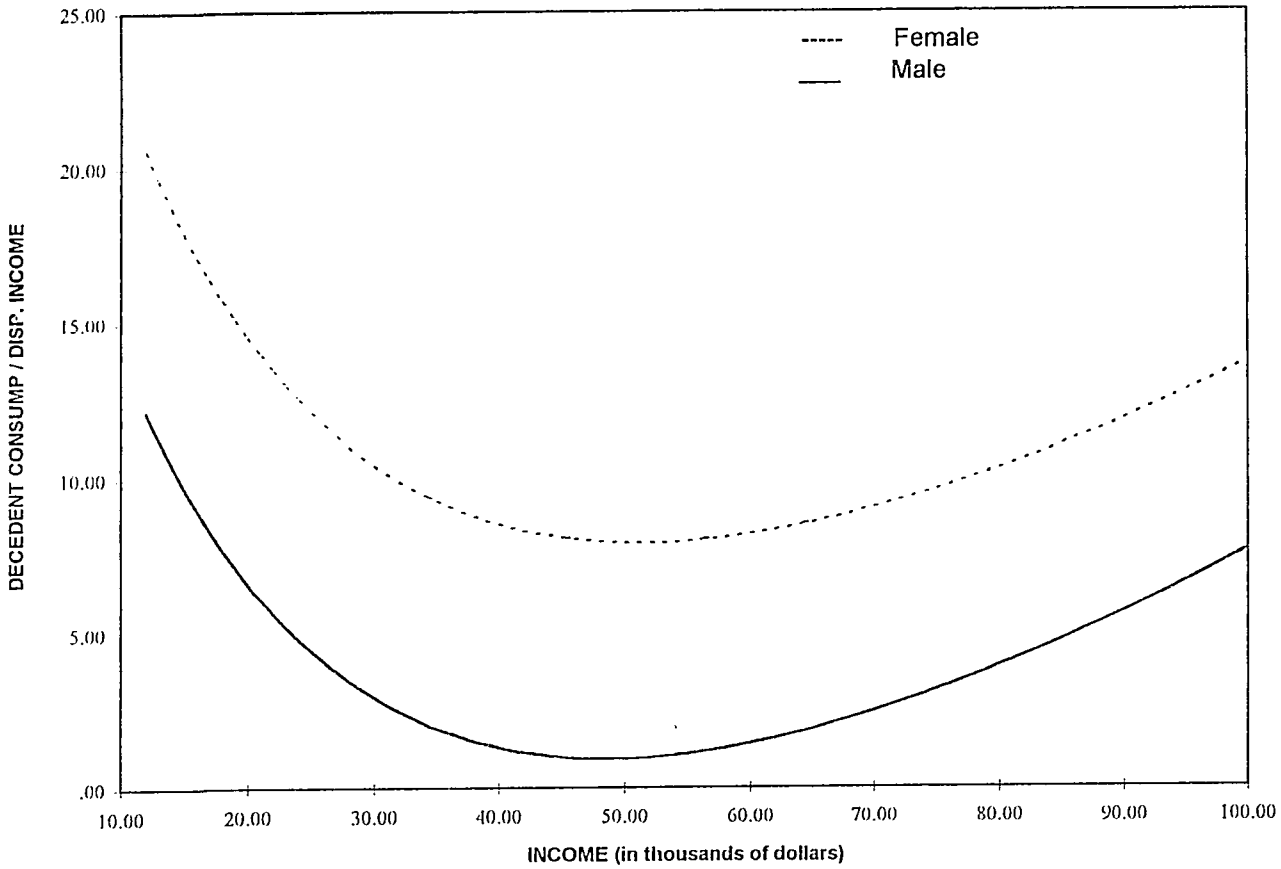

Figure 8 : DECEDENT CONSUMPTION RATIOS ($A_M = 60$, $N = 2$)

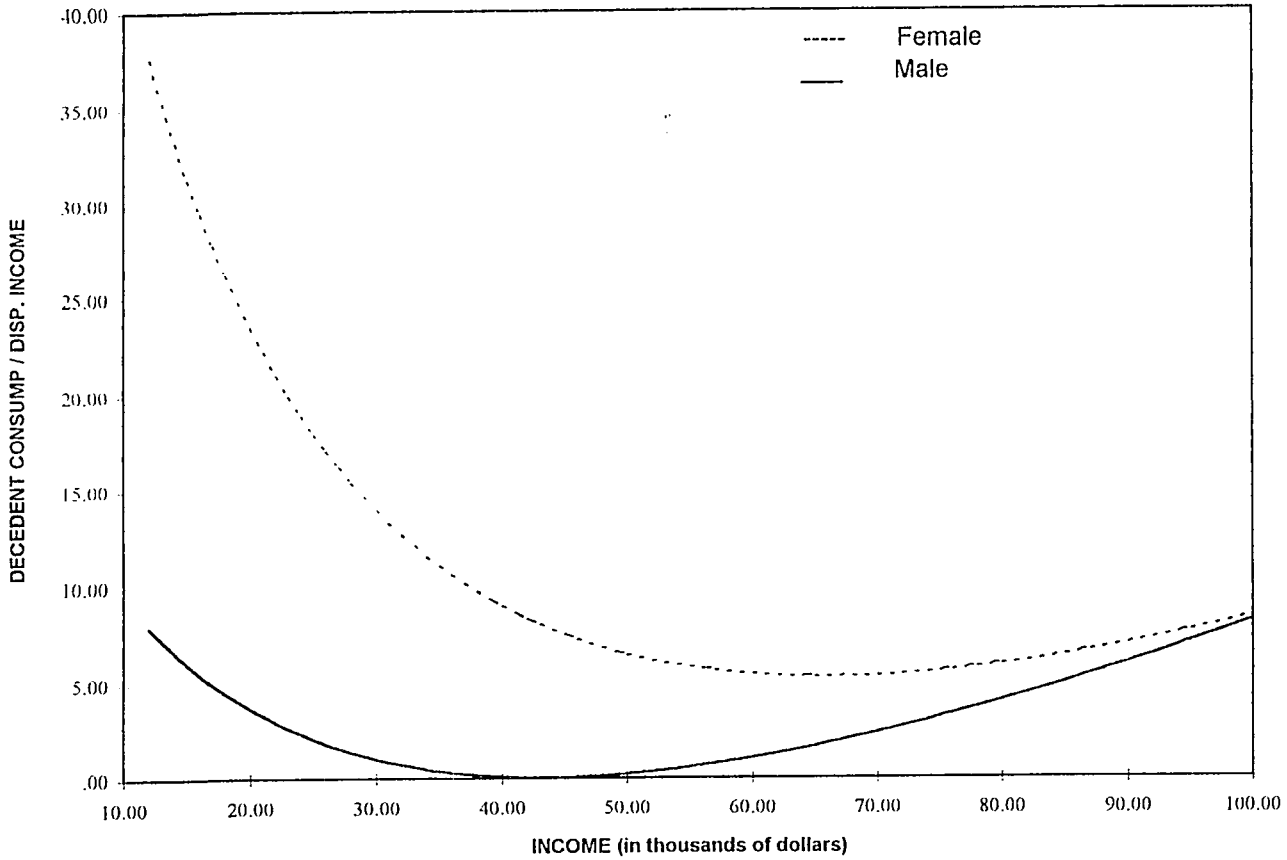

Figure 9 : DECEDENT CONSUMPTION RATIOS ($A_M = 60$, $N = 3$)