Patterns of Spending Behavior and the Relative Position in the Income Distribution: Some Empirical Evidence

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ABSTRACT: A model integrating the permanent income and relative income hypotheses was employed to explain consumer expenditure behavior in the U.S. The model was empirically tested using data from the interview survey portion of the 1996 and 1997 *Consumer Expenditure Survey.* The results indicate that household expenditure behavior is generally explained by both hypotheses when integrated in one model.

KEY WORDS: relative income; permanent income; consumer expenditure; budget allocation.

The household as a decision-making unit is a key unit of analysis in consumer expenditure and saving behavior. Early models of household expenditure and saving postulated that poor households acted in a fundamentally different way compared to rich households. The most extensive of the early models was formulated by James Duesenberry in 1949. He argued that demonstration effects in consumption weighed less heavily on rich households, and so savings rates should rise with position in the income distribution (Kosicki, 1987a). The motivation for higher consumption standards, according to Duesenberry (1949), stems from the desire to emulate the behavior of others. Such motivation is particularly strong if the household in question is located toward the bottom of the income distribution. Households which emulate the higher consumption levels of their neighbors sacrifice future consumption for current consumption. Therefore, consumers do not spend their money on the basis of current income, but on the basis of

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its relationship to their previous peak income and/or to the income of the community in which they live. Thus the underlying consumption function under the relative income hypothesis is

$$C = f\,(\,G\,(\,M\,)\,), \tag{1}$$

where C is consumption, M is income, and $G(M)$ is income rank.

Although Duesenberry's relative income hypothesis held up well under cross-sectional evidence, it was supplanted by the life cycle (Ando & Modigliani, 1963) and permanent income (Friedman, 1957) models that followed (Ferber, 1973; Hirshleifer, 1985; Kosicki, 1987a). The essence of these theories is that consumers adjust consumption according to their long-term income prospects and initial stock of wealth. These theories state that consumers attempt to allocate a lifetime stream of income to an optimum lifetime consumption pattern. The underlying consumption function under the permanent income hypothesis is:

$$C = f\,(\,M_1,\ldots,\,M_{\mathrm{i}},\,\ldots\,M_{\mathrm{n}}\,) = g\,(\,PI), \tag{2}$$

where M_{i} is total income for period *i,* and PI is permanent income, a function of a person's lifetime income.

While not directly contradicting the relative income hypothesis, the underlying assumption in these early intertemporal models represents a rejection of the sociological and psychological factors stressed by Duesenberry (Kosicki, 1987a). According to Kosicki (1987a), the originators of the permanent income and life cycle approaches may have thought that it was unnecessary to use relative income to explain the cross-sectional empirical evidence existing at that time.

Subsequent findings suggest that a model including relative income would outperform the standard life-cycle and permanent income models. This implies that relative income plays a role in addition to permanent income (Kosicki, 1987a). Kosicki (1987a) called for a more complete synthesis of the permanent income hypothesis and the life cycle approaches with the relative income model and more direct testing of the combined model. The consumption function underlying the combined model is

$$C = f\,(\,G\,(\,M\,),\,PI\,). \tag{3}$$

While both the relative income hypothesis and the permanent income hypothesis focus on consumers' saving behavior, implications for

consumers' budget allocation behavior have also been investigated. For example, Brady and Friedman (1947) suggested that consumption and savings were dependent on the relation of individual family income to the average income level of the city or town in which the family lived. Their results indicated that consumption expenditure is positively correlated with community income. That is, consumption expenditures are greater in communities with higher incomes. At given income brackets, food and housing expenditures were positively correlated with this community income. As a consequence, expenditures depend on the household's relative position in the income distribution, not on the absolute level of income.

Expanding on Duesenberry's relative income hypotheses and incorporating psychological and sociological theories, Frank (1985) introduced a utility-maximizing model of consumer demand for positional and nonpositional goods. Following Hirsh (1976), Frank (1985) used the term "positional goods" to mean those things whose value depends relatively strongly on how they compare with things owned by others. Goods that depend relatively less strongly on such comparisons are called "nonpositional goods." With fairly unrestrictive assumptions, he proposed that budget shares for nonpositional goods are an increasing function of an individual's rank in the income hierarchy of the population of which he or she is a member, while budget shares for positional goods are a decreasing function of an individual's income rank.

Specifically, Frank (1985) assumed a population of individuals in which all have identical utility functions:

$$U = U\,(\,X,\,Y,\,R(\,X\,)\,), \tag{4}$$

where X is consumption on positional goods and Y is consumption on nonpositional goods. $R(X)$ is a number between 0 and 1 indicating the percentile ranking of X in the population of X values, $f(\mathrm{X})$ representing the density function for X values. Individuals maximize their utility under the budget constraint

$$P_{\mathrm{x}}\,X + P_{\mathrm{y}}\,Y = M, \tag{5}$$

where P_{x} and P_{y} are prices, and M is income.

Solving for first-order conditions and denoting the elasticity of $R(X)$ with respect to X as E_{RX}, where E_{RX} equals to $Xf(X)R(X)$, both Frank (1985) and Kosicki (1987b) stated that E_{RX} decreases in $R(X)$ for any $f(X)$ likely to be observed in practice. Kosicki further proved that if E_{RX}

is decreasing in R(x), it also decreases in income rank G(M). Furthermore, as E_{RX} and E_{GM} (the elasticity of $G(M)$ with respect to income) are positively correlated, E_{GM} deceases also in $G(M)$. This implies a negative relationship between the consumption on positional goods and income rank. By the virtue of budget constraint, consumption on nonpositional goods increases as income rank increases.

Frank (1985) modeled saving as a nonpositional good and showed that as an individual's income rank increases, his or her saving rate also increases. This is consistent with Duesenberry's relative income hypothesis. As further examples of applications of his model, Frank (1985) suggested that spending on children might be considered a positional good, while insurance and leisure might be nonpositional goods.

Extending Frank (1985)'s work, Kosicki (1987b, 1990) presented a utility maximization framework in which concern for the relative standing in the current consumption hierarchy was integrated with a permanent income framework. The results revealed that permanent income as well as income rank, are important determinants of saving rates.

Whereas the Kosicki studies (1987b, 1990) were limited to explaining saving behavior, the purpose of this paper is to further apply the Frank (1985) and Kosicki (1987b, 1990) model and test the importance of the integrated permanent and relative income model in explaining consumer expenditure behavior, specifically in determining major expenditure categories in the U.S. In addition, this study follows Frank (1985)'s framework and attempts to identify positional and nonpositional goods using U.S. consumer expenditure data. Due to a lack of empirical evidence in this area, specific directional hypotheses were not formed. However, it was expected that budget shares for nonpositional goods are an increasing function of an individual's rank in the income hierarchy of the population of which he or she is a member, while budget shares for positional goods are a decreasing function of an individual's income rank.

Method

Data

The data used in this study are from the interview survey portion of the 1996 and 1997 Consumer Expenditure Survey, collected by the U.S. Bureau of the Census under contract from the U.S. Bureau of Labor Statistics (U.S.

Bureau of Labor Statistics [BLS], 1996, 1997). This data set is the most comprehensive source of detailed information on household expenditure, income, and other socioeconomic and demographic characteristics of the U.S. population. The survey is conducted quarterly with rotating panels of approximately 5,000 households that are interviewed for five consecutive quarters. One-fifth of the sample is new each quarter.

For this study, consumer units that have completed interviews for four consecutive quarters during 1996, 1997, or the first quarter of 1998 were included since annual expenditure data were used. There were six panels of respondents included in this study. The first panel was interviewed between the first and last quarter of 1996. The second panel was interviewed between the second quarter of 1996 and the first quarter of 1997. The last panel was interviewed between the second quarter of 1997 and the first quarter of 1998. These six panels were pooled to increase the sample size for this study to increase the robustness of the estimates. Because income was an important variable in this study, only households that were complete income reporters were included in our sample.[1] The resulting sample size was 4,462.

Definition of Consumption Expenditures

Because permanent income hypothesis is based on consumption instead of expenditure outlays, only non-durable consumer expenditures were included in this study.[2] This approach has been commonly used in permanent income hypothesis or life-cycle income hypothesis models (e.g., Attanasio & Weber 1995; Attanasio, Banks, Meghir, & Weber, 1999). After reviewing data availability and past literature, we used a level of commodity aggregation similar to that in Fan (2000) and Paulin (1995). After deleting the durable categories, 21 expenditure categories were used: food at home, fuel and utilities, household operations, apparel and services, medical services, prescription drugs, health insurance, personal care products, gasoline and vehicle maintenance, local public transportation, out-of-town public transportation, entertainment, food away from home, vacation and out-of-town lodging, reading, education, alcoholic beverages, tobacco, miscellaneous items, cash contributions, and personal insurance/pensions. The durables excluded were shelter, furnishings and equipment, and car purchases. In addition, TV and stereo equipment was excluded from the entertainment category. See Appendix Table A.1 for a list of commodities and services included in each category. The total non-durable expenditure was defined as the sum of expenditures of these 21 categories.

Estimation of Permanent Income

Because permanent income is not directly observable, the instrumental variables approach was used to estimate the household's permanent income. The idea behind the technique is to find a variable that is correlated with permanent income to replace measured income in the expenditure function. Total non-durable expenditure, as a proxy for permanent income, was regressed on the following variables: age, race, education, occupation of the reference person (or, in the case of married couples, of the person who had the

higher education), family type, number of earners, region, and population size of the residing Standard Metropolitan Statistical Area (SMSA). The results of this regression are presented in Table 1. The predicted values from this regression then became the estimates of the average permanent income of households encompassing those specific characteristics. These permanent income estimates were then used in the expenditure functions to test the impor-

TABLE 1

Regression Results Predicting Permanent Income (in $1,000) (Dependent variable: total non-durable expenditure as a proxy for permanent income)

Independent variable	Coefficient
Intercept	4.99***
Age	0.51***
Age squared	–0.01***
Ethnicity (Caucasian):	
Afro-American	–2.25***
Hispanic	–3.83***
Other race	–4.57***
Education (Less than high school):	
High school graduate	2.85***
More than high school	8.90***
Family composition (Married):	
Single female headed	–6.48***
Single male headed	–5.72***
Other types of families	–3.98***
Occupation (Administration):	
Other white collar	–2.33***
Blue collar	–4.96***
Retired	–3.83***
Not employed	–4.55***
Self employed	3.51***
Number of earners	3.55***
Housing tenure (renter):	
Owner with mortgage	5.65***
Owner without mortgage	3.61***
Region (Urban Northeast):	
Urban Midwest	–0.96*
Urban South	0.00
Urban West	0.27
Rural	–1.95***
Population size of SMSA (>4 million):	
1.2–4 million	–0.94*
0.33–1.19 million	–2.19***
125–329.9 thousand	–2.76***
<125 thousand	–3.66***
Adjusted R^2	0.42

*$p < .10$, **$p < .05$, ***$p < .01$.

tance of permanent income in household expenditures on various expenditure categories.

Estimation of Relative Income

Relative income was estimated by creating a rank variable *G,* which was the rank in the subgroup after-tax income, adjusted by household size using an equivalence scale with an equivalence elasticity of 0.5 (Buhmann, Rainwater, Schmaus, & Smeeding, 1988). These subgroups were created based on the region and population size of the SMSA. There were five regions and five SMSA sizes available in the CE data set, resulting in a total of 25 subgroups. These five regions included urban Northeast, urban Midwest, urban South, urban West, and rural areas. The population sizes were, respectively, more than 4 million, between 1.2 and 4 million, between 0.33 and 1.19 million, between 125 and 329.9 thousand, and less than 125 thousand. Within each subgroup, the household-size-adjusted after-tax income values were ordered and then assigned a relative rank equal to the household's rank divided by the total number of households in that subgroup. For example, suppose that 200 households in the sample resided in Northeast metropolitan areas with population sizes between 1.2 to 4 million. Suppose household A's household-size-adjusted after-tax income was the 50^{th} lowest among these 200 households. Then Household A's relative income rank would be (50/200)*100 = 25.

Model Specification Issues

A system of equations was estimated, with the budget share for each of the 21 expenditure categories as the dependent variables. Budget shares were used as dependent variables in order to correct for heteroskedasticity problems commonly found in demand equations using expenditures as dependent variables (Maddala, 1992). The form of the equation is as follows:

$$W_i = \beta_0 + \beta_1 lnG + \beta_2(HP) + \beta_3(HP)^2 + \beta' D + e_i, \quad (6)$$

where W_i is the budget share of a particular expenditure category *i, lnG* the natural log of the income ranking variable, *HP* the estimated permanent income, and *D* a vector of demographic variables representing household preferences. The β's are regression coefficients. Finally, e_i is the error term.

Below is a list of the preference shifters in the *D* vector in Equation (6): age and age squared, education (less than high school, high school graduates [reference group], and more than high school), race/ethnicity (Caucasian American [reference group], African American, Hispanic American, and other race/ethnicity), family type (husband/wife family [reference group], single-female head, single-male head, and other family), family size, occupation and employment (administration [reference group], other white collar occupations, blue-collar occupations, retired, not working, and self-employed), region (urban Northeast [reference group], urban Midwest, urban South, urban West, and rural areas), and population size of the residing SMSA (more than 4 million [reference group], between 1.20 to 4 million, between 0.33 to 1.19 million,

between 125 to 329.9 thousand, and less than 125 thousand). When appropriate, information for the reference person was used. For husband-wife families, the reference person was recoded as the person with a higher educational attainment. For details of coding of these independent variables, see Appendix Table A.2.

Many of the expenditure categories included in this study have a large number of zero expenditure observations. To correct for this limited dependent variable problem, a two-stage Tobit method was used (Fan, 1997; Greene, 1997; Maddala, 1983) for any expenditure categories with more than 10% of zero observations. Specifically, probit models were estimated first with the probability of non-zero expenditure on relevant categories as the dependent variables. The probit estimates were then used to compute a sample-selection bias correction term that would be included in the second stage regression analysis. Fourteen expenditure categories needed correction for limited dependent variable problems: household operations, medical services, prescription drugs, health insurance, out-of-town public transportation, local public transportation, vacation lodging, reading, education, alcoholic beverages, tobacco, cash contributions, personal insurance/pensions, and miscellaneous items.

In addition, because this study selected only households with four consecutive quarters of data, there was a potential for a second sample selection bias. Simple t-tests and chi-square tests showed that the group with all four quarters of information was statistically significantly different from the group without all four quarters of data in age, race, and population size variables. Thus, a Heckman two-stage type of sample selection bias correction technique was used. An inverse Mill's ratio, estimated from a probit equation with whether the household had all four quarters of data as the dependent variable, was included in the second stage expenditure equations to correct for this second sample selection bias.

The error terms in the demand equation system were assumed to be correlated. The system was thus estimated using an iterated seeming unrelated regression method with the SAS PROC MODEL procedure (SAS Institute Inc., 1988). Weights were used to reflect the total population under study. The weights were calculated by the BLS and were used to compute all means, standard errors, frequencies, and regression results.

Results and Discussions

Regression estimates of the income-related parameters are presented in Table 2. Due to space limitations, only selected results are presented. Full estimation results are available from the authors upon request. The average R^2 for the demand system is about 0.15.

For the sample selection corrections for limited dependent variables, only one out of the 14 categories has a coefficient of the correction term that was not statistically significant at the 90% level. That expenditure category is local public transportation. Among the signifi-

TABLE 2

Selected Regression Results for 21 Expenditure Categories (dependent variables: budget share [in percent])

Expenditure categories	Log (G)	Permanent income	Permanent income squared
Food at home	–1.72***	–1.27***	1.27×10^{2}***
Primary housing/services:			
Fuel and utilities	–1.22***	–0.42***	0.33×10^{2}***
Household operations	0.18**	–0.13**	0.04×10^{2}
Apparel	0.27***	–0.01	0.00×10^{2}
Health/personal care:			
Medical services	0.06	–0.02	-0.15×10^{2}*
Prescription drugs/ supplies	–0.05	–0.05	-0.02×10^{2}
Health insurance	–0.17**	–0.06	-0.07×10^{2}
Personal care	–0.03	0.02	-0.02×10^{2}
Transportation:			
Gasoline/maintenance	–0.30***	0.48***	-0.52×10^{2}***
Out-of-town public transp.	–0.02	0.11***	-0.14×10^{2}***
Local public transportation	–0.07***	–0.03**	0.03×10^{2}
Recreational expenditures:			
Entertainment	0.13	0.10*	-0.01×10^{2}
Food away from home	0.11	0.18***	-0.17×10^{2}**
Vacation lodging	0.08*	–0.01	0.11×10^{2}
Reading	0.01	0.03***	-0.06×10^{2}***
Other expenditures:			
Education	–0.22***	0.09**	0.13×10^{2}*
Alcoholic beverages	–0.00	–0.01	0.03×10^{2}
Tobacco	–0.06	–0.05	0.06×10^{2}
Cash contributions	0.76***	0.14*	-0.32×10^{2}**
Personal insurance/pensions	2.24***	0.62***	0.09×10^{2}
Miscellaneous	0.01	0.27***	-0.53×10^{2}

Note. lnG is the log of relative ranking of household-size adjusted income.
*$p < .10$, **$p < .05$, ***$p < .01$.

cant coefficients, medical services, out-of-town public transportation, vacation lodging, reading, and cash contributions have positive coefficients, indicating that a higher probability of non-zero expenditures on these categories is correlated to a lower budget share for these categories. On the other hand, household operations, prescription drugs, health insurance, education, alcoholic beverages, tobacco, personal insurance/pensions, and miscellaneous items have negative coefficients, indicating a higher probability of non-zero expenditure on these categories is correlated to a higher budget share for these categories.[3]

For the sample selection correction for selecting only households with four consecutive quarters of data in the sample, 14 out of the 21 expenditure categories have a coefficient of the correction term that is not statistically significant at the 90% level. These expenditure categories are food at home, apparel, personal care, gasoline/maintenance, out-of-town public transportation, entertainment, vacation lodging, reading, alcoholic beverages, tobacco, and miscellaneous items. Among the significant coefficients, local public transportation, food away from home, education, and cash contributions have positive coefficients on the correction terms, indicating that a higher probability of having four consecutive quarters of data is positively associated with a lower budget share for these expenditure categories. On the other hand, fuel and utilities, household operations, and personal insurance/pensions have negative coefficients on the correction terms, indicating a higher probability of having four consecutive quarters of data is associated with a higher budget share for these expenditure categories.[4]

The data are consistent with the hypothesis that relative income can be an important determinant of household expenditure behavior, after permanent income is controlled. The variable income rank has a statistically significant effect on the expenditure variable for 11 out of the 21 categories. It has a positive effect on the categories household operations, apparel, vacation lodging, cash contributions, and personal insurance/pensions. On the other hand, it has a negative effect on the categories food at home, fuel and utilities, health insurance, gasoline and car maintenance, local public transportation, and education.

The results also show that predicted permanent income has a statistically significant effect on the budget shares for 15 out of the 21 categories. As the results indicate, when permanent income increases, household budget shares for entertainment, vacation lodging, education, and personal insurance/pensions increase, and household budget shares for household operations, medical services, and local public transportation decrease. Two expenditure categories have a U-shaped relationship with permanent income: food at home, and fuel and utilities. Six expenditure categories have an inverse-U relationship with permanent income. They are: gasoline and car maintenance, out-of-town public transportation, food away from home, reading, cash contributions, and miscellaneous items.

Of the 21 expenditure categories, nine have significant coefficients for both the permanent income and relative income variables. These nine categories are: food at home, fuel and utilities, household opera-

tions, gasoline and car maintenance, local public transportation, vacation lodging, education, cash contributions, and personal insurance/pensions. Only the coefficients for the relative income variable are significant in two expenditure equations: apparel and health insurance. On the other hand, permanent income was the only income variable significant in six expenditure equations: medical services, out-of-town public transportation, entertainment, food away from home, reading, and miscellaneous.

While the general notion of the importance of income rank in consumers' expenditure decisions is supported by the data, the results regarding the specific effects of income rank on positional vs. nonpositional goods are quite mixed.

According to Frank's (1985) positional goods vs. nonpositional goods model, positional goods were hypothesized as having a negative coefficient on the income rank variable, while nonpositional goods were hypothesized to have a positive coefficient on the income rank variable. If our data were consistent with Frank's model, then food at home, fuel and utilities, health insurance, gasoline and maintenance, local public transportation, and education would all be considered as positional goods or services, while household operations, apparel, vacation lodging, cash contributions, and personal insurance/pensions would all be considered as nonpositional goods. Some of these classifications seem to make sense, such as education being classified as a positional good and personal insurance/pensions as a nonpositional good, both of which are supported by Frank (1985) and Kosicki (1987b, 1990). However, many other classifications seem to be counterintuitive. For example, most people would probably consider food at home as a nonpositional good and apparel a positional good, but the result found in this paper suggests otherwise.

There are two possibilities to explain such a counterintuitive result. While it is possible that the theory on positional and nonpositional goods along with the model derived from this theory is flawed, it is also possible that our empirical specification of expenditure categories cannot capture the differences between positional and nonpositional goods. For example, the expenditure category "apparel" used in this study can include many subcategories, with some of them being positional goods (outerwear) while some others being nonpositional goods (underwear). It seems that more detailed expenditure categories may be needed in future analyses to test if the specification of expenditure categories is indeed a contributing factor to this counterintuitive result.

This study covered only consumer expenditures on non-durables because the relative and permanent income hypotheses were proposed to explain consumption expenditures. Future studies may proceed to construct service flow values from durables in order to provide better measures of consumption expenditures.

Concluding Remarks

The permanent income and relative income hypotheses have made important contributions to understanding of the expenditure function. However, in past research on consumer expenditures, they were mostly treated as mutually exclusive concepts. In this paper, a synthesis of the permanent income hypothesis with the relative income hypothesis in one model was directly tested as an explanation of household expenditure behavior.

The results of the integrated model prove that both hypotheses are important determinants of household expenditure behavior. Even in the presence of the other, each has an important contribution in understanding the expenditure function. Detailed investigations show that the role of relative income and permanent income is different for various expenditure categories. Such differences seem to be somewhat inconsistent with Frank's (1985) model regarding positional goods vs. non-positional goods. Although it is possible that the original theory and model have flaws, it is also possible that our empirical specification of expenditure categories has contributed to such a counterintuitive result. Future studies need to delve into more detailed expenditure categories.

Nevertheless, the finding that relative income is also important in affecting consumer expenditure decisions in addition to permanent income has some important implications, particularly on the debate over income distribution and the importance of the marginal valuation placed on upward social mobility in various ranges of income distribution. Boskin and Sheshinski (1978) explored the structure of optimal income taxation-redistribution in an economy where the welfare of individuals depends not only on absolute income but also on relative after-tax consumption expenditure. Hence, the results of this study encourage the revisiting of the design of optimal redistribution of income schemes based on absolute income as well as relative income.

Appendix

TABLE A.1

Definitions of Expenditure Categories

Expenditures	Definition
Food at home	Food and nonalcoholic beverages purchased and prepared by the household on trips or purchased at grocery stores or convenience or specialty stores
Primary housing /services	
Fuel and utilities	Natural gas, electricity, fuel oil, telephone, water and other public services
Household operations	Housekeeping, gardening/lawn care, water softening, non-clothing laundry, care for invalids or elderly, termite/pest control, child care
Apparel	Clothing and services, footwear and services
Health/personal care	
Medical services	Out-of-pocket expenses for medical services
Prescription drugs	Out-of-pocket expenses for prescription drugs
Health insurance	Out-of-pocket expenses for health insurance
Personal care	Personal care supplies and services, electronic personal care appliances
Transportation	
Gasoline/maintenance	Gasoline and motor oil, vehicle maintenance and repair, insurance
Out-of-town public transp.	Public transportation on trips
Local public transportation	Local public transportation
Recreational expenditures	
Entertainment	Fees and admissions, pets, toys and playground equipment, other fees such as docking/landing fees for boats and planes
Food away from home	Food away from home, excluding alcoholic beverages
Vacation lodging	Lodging away from home, housing for school, vacation home expenses
Reading	Newspapers, magazines, books
Other expenditures	
Education	School books, supplies and equipment, tuition (other than day care)
Alcoholic beverages	Alcoholic beverages
Tobacco	Tobacco and smoking supplies
Cash contributions	Cash contributions for persons not in CU, to charity, church, educational, or political organizations
Personal insurance/pensions	Life insurance, retirement, pensions and social security, personal insurance not mentioned in other categories
Miscellaneous	Credit card fees, legal fees (excluding real estate), funeral expenses, safety deposit boxes, bank account fees, accounting fees, interest on home equity loans on properties other than primary housing unit, finance and interest charges excluding mortgage, car loans and home equity loans

TABLE A.2

Definitions and Measurements of Independent Variables in the Expenditure System

Independent variables	Definition and measurement
Income:	
Log (G)	Log of income rank
Permanent income	Predicted permanent income (in thousand dollars)
Permanent income squared	Square of predicted permanent income
Age:	
Age	Age of the reference person (or the spouse with the higher education)
Age squared	Square of age
Race/ethnicity:	
Caucasian (reference)	Non-Hispanic Caucasian = 1, else = 0 (omitted category)
Afro-American	Non-Hispanic African American = 1, else = 0
Hispanics	Hispanics = 1, else = 0
Others	Other races/ethnicity = 1, else = 0
Education:	
Less then high school	Less than high school = 1, else = 0
High school graduates (reference)	High school graduate = 1, else = 0 (omitted category)
More than high school	More than high school = 1, else = 0
Family composition:	
Married (reference)	Married households = 1, else = 0 (omitted category)
Single female headed	Single female headed households = 1, else = 0
Single male headed	Single male headed households = 1, else = 0
Other types	Other types of families = 1, else = 0
Family size	Family size
Occupation:	
Administration (reference)	Administrative type of job = 1, else = 0 (omitted category)
Other white collar	White collar jobs other than administrative type of jobs = 1, else = 0
Blue collar	Blue collar jobs = 1, else = 0;
Retired	Retired = 1, else = 0
Not employed	Not employed = 1, else = 0
Self employed	Self employed = 1, else = 0
Housing tenure:	
Owner with mortgage	Owner with mortgage = 1, else = 0
Owner w/o mortgage	Owner without mortgage = 1, else = 0
Renter (reference)	Renter = 1, else = 0 (omitted category)
Region:	
Urban Northeast (reference)	Urban Northwest = 1, else = 0 (omitted category)
Urban Midwest	Urban Midwest = 1, else = 0
Urban South	Urban South = 1, else = 0
Urban West	Urban West = 1, else = 0
Rural	Rural = 1, else = 0

TABLE A.2 (*continued*)

Independent variables	Definition and measurement
Population size of SMSA:	
>4 million (reference)	SMSA >4 million = 1, else = 0 (omitted category)
1.2–4 million	SMSA between 1.2 and 4 million = 1, else = 0
0.33–1.19 million	SMSA between 0.33 and 1.19 million = 1, else = 0
125–329.9 thousand	SMSA between 125 to 329.9 thousand = 1, else = 0
<125 thousand	SMSA less than 125 thousand = 1, else = 0
Sample selection bias corrections:	
Lambda	Inverse Mills-ratio correcting for selection of having data for all four quarters
T	Tobit correction term for zero expenditures on some expenditure categories

Notes

1. The CEX definition of "complete income reporter" is not a strict definition. According to Garner and Blanciforti (1994), the strict definition of "complete income reporter" would cause a loss of about 35% of the sample size, while the CEX definition caused a 15% loss of the sample. Garner and Blanciforti (1994) stated that previous studies found that the income distribution of the CEX sample using the CEX complete income reporter definition is similar to the Current Population Survey (CPS) income distribution. Thus it seems to us that using the CEX definition is an acceptable tradeoff given the sample size advantage and population representativeness. In addition, most past studies using the CEX data have used the CEX complete income reporter definition. Following this tradition can allow comparison of our results with results from previous studies.
2. A model including the BLS-defined expenditures for the three durable expenditure categories—shelter, furnishing and equipment, and car purchase—yielded almost identical results in terms of directions of the coefficients and their significance levels.
3. The predicted probability of non-zero expenditure and the correction terms entered into the demand equations have a monotonic but non-linear negative relationship.
4. The probability of having four consecutive quarters of data and the correction terms for such bias, lambda (inverse mills ratio), have a monotonic and non-linear negative relationship.

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