Expenditure patterns of retired and nonretired persons

There are significant differences in spending habits between retired and nonretired persons over age 50, as well as differences among their households by marital status, and educational attainment

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Adjustment to retirement and the consequent economic changes make "the golden years" one of the more difficult, yet interesting phases of the entire life cycle. Increasing numbers of people are retiring earlier in life and, at the same time, many are living longer. These events, coupled with demographic changes in the elderly population, make the consumption and savings behavior of the retired increasingly noteworthy.

This article compares the expenditure functions of retired and nonretired persons aged 50 and older, using the Bureau of Labor Statistics Consumer Expenditure Survey. It explicitly acknowledges the heterogeneity of older Americans by analyzing the effect of age, education, family status, race, income, and assets on 27 standard Consumer Expenditure categories.[1]

Previous studies

Although the elderly are commonly referred to as if they were one group, they are as diverse as the general population. The elderly population can be viewed as several distinct market groups[2]: the young-old (65–74 years) who are generally active and still married; the old (75–84 years) who are slowing down and often widowed; and the very old (age 85 and older) who often need help in daily activities. The income and expenditures of the young-old and the older age group are quite different. For example, the young-old benefit from higher Social Security (as a result of their higher earnings levels) and have better pensions and asset income.[3] Another reason for looking at different age groups is to determine the trend toward early retirement. Because Social Security income can start at age 62, today's average age at retirement has declined, as shown by the change in the age distribution of men receiving Social Security benefits. In 1967, 35 percent of retired male Social Security beneficiaries were in the 62–64 age group, but by 1987, the figure had risen to 67.1 percent.

A limited number of researchers have examined the impact of the work status of the elderly. For those aged 55 to 65, income after taxes is almost twice as much for the employed ($32,873) as it is for the retired ($17,595).[4] Charles E. McConnel and Firooz Deljavan categorized the elderly into retired and nonretired (or working elderly) groups. They analyzed expenditure data on the basis of two age groups, with the average age of nonretired persons being 67 years, and the average age of retired, 74 years.[5] Richard J. Harris found that earnings of the elderly have clearly increased over time when examined by disaggregated cohort groups.[6] Thomas Moehrle used the 1986–87 Consumer Expenditure Survey to analyze spending patterns of older households by income level and also by work status for those aged 62 to 74. He found that nonworking elderly spent more on food at home and health care, while working elderly spent more on retirement pensions and Social Security. James H. Schulz suggested three work status categories could be used: full-time workers, part-time and unem-

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ployed workers, and the fully retired.[7] He reported dramatic differences in the median income between those who worked some part of the year and those retired.

Researchers have found significant differences in expenditures between retired and nonretired elderly and differences among age groups as well. In a review of data from the Consumer Expenditure Survey, Beth Harrison reported that the 65–74 age group spent a larger share of their income for food away from home, transportation, entertainment, reading materials, apparel, and personal insurance and pensions, while the 75 and older age group spent higher shares for housing and health care.[8] McConnel and Deljavan found that, on average, retired persons spent a significantly larger portion of income on housing, food at home, and medical care than did nonretired households, and a much smaller portion on transportation and food away from home. As income increased, elderly persons spent a smaller proportion on necessities (such as food at home, household utilities, and medical care), a larger share on gifts and contributions, and the same proportion on transportation; but medical care and energy-related expenses were major budgetary problems for all elderly households.[9] Moehrle found that nonworking elderly households spent more on food at home and health care, while the working elderly, who had higher levels of education and owned more vehicles, spent larger shares on transportation and pensions.[10] Suhas Ketkar and Whewa Cho determined that age was positively related with expenditures on food-at-home, fuel, utilities, household operations, health and personal care, and reading and education.[11]

The "life cycle hypothesis" and the "permanent income hypothesis," are the classical theories of consumption and saving behavior, and are often used in the analysis of elderly consumption patterns.[12] These hypotheses indicate that to maintain a relatively stable level of consumption during their lifetimes, families make decisions based on their expected lifetime income. They save during the peak earning years and dissave during retirement years.

Considerable research has been generated concerning the savings and dissavings of the elderly in retirement. Many of these studies have reported that the elderly dissave less than the life-cycle hypothesis would indicate.[13] James B. Davies found that the retired elderly dissaved at a rate of 2.9 percent to 3.7 percent per year, while Sheldon Danziger and others, using 1972–73 data from the Consumer Expenditure Survey and the Inventory of Consumer Durables, found that the elderly spent less than the nonelderly at the same level of income and that the very oldest have the lowest average propensities to consume.[14] Further, the elderly maintain their wealth by reducing consumption, which may result from uncertainty about their health, length of life, and their ability to maintain independent households. Jeanne M. Hogarth reported findings from the Longitudinal Retirement History Survey that focused on characteristics of households which were savers and dissavers during the first 8 years of retirement.[15] While nearly half the retired households continued to save and build assets in retirement, she found that 20 percent dissaved at rates that they could not sustain over their expected lifetimes.

Nevertheless, only a few articles have explicitly compared expenditure patterns of the retired and nonretired elderly and only one article econometrically estimated the expenditure functions.[16] Therefore, there is clearly a need for current analysis of the spending patterns of the retired and nonretired elderly. This article updates and expands the previous studies, comparing the retired and nonretired by distinguishing among households by family status, age groups, education levels, and by applying Tobit regression analysis.

The sample

This research uses cross-sectional data from the BLS Consumer Expenditure Survey interview tapes for 1986 and 1987.[17] Data for the two years are merged because the data are limited to the fifth interview in which detailed financial information (particularly assets) is obtained. Files containing consumption expenditures, income sources, savings, taxes, assets, and selected demographic data were developed. We do not use weights in any of our tests of differences in shares or Tobit regression analysis, because it is often found that the weights cause the t-statistics to be overly significant.

Our sample consists of retirees and nonretirees who are age 50 or older; in single men, single women, or husband-wife couple households; and who completed the survey's questions on income. Age 50 was selected as the minimum cutoff in order to encompass early retirees in the study, as the age of early retirement has declined in recent times. The Consumer Expenditure data include only consumer units in independent living status (including retirement communities) and not in long-term care facilities. Our retired persons sample consisted of Consumer Expenditure respondents who reported that they were retired and the nonretired sample consisted of Consumer Expenditure respondents who reported that they had some type of occupation. We excluded those in the military or unemployed. The study sample presented in table 1, describes the characteristics of 2,607 households.

Findings

The mean after tax income of retired married couples is 58 percent of the income of working couples. Retired single women have 53 percent of the income of working single women, and retired single men have 48 percent of that for working single men. Although the differences in income (between retired and working) are somewhat comparable for the three groups, the income level of single women in absolute amount was much lower. Retired single women in 1987 had a mean income level of only about 150 percent of the poverty level for a single person over 65 years old. We find after-tax income of retired single men to be 44 percent less than that of married couples and that of retired single women, 55 percent less.

For each of the three groups, the education level shows considerably higher attainment for the nonretired than for the retired. Approximately one-fourth to one-third of the retired have only an elementary education. About 45 percent of the nonretired have a college degree or more education, compared with about 20 percent of the retired.

Home ownership varies among the three groups, with single men having the lowest ownership status and couples, the highest. Nearly half of all single men aged 50 and older are renters. For each group, many more of the retired than the nonretired have a home without a mortgage. About two-thirds of retired married couples report ownership without a mortgage, as do half of retired single women and 42 percent of nonretired single women.

Income, taxes, and assets. The major source of income for retirees is Social Security, followed by pension income. (See table 2.) Notably, retired single women receive only about half as much pension income as retired single men and less than one-third as much as retired married couples. Similar relationships hold for financial assets.

Expenditures. In the survey, expenditures "consist of the transaction costs, including excise and sales taxes, of goods and services acquired during the interview period."[18] In this study, we do not use pensions and Social Security contributions in calculating total expenditures or expenditure shares.

Table 1. **Characteristics of retired and nonretired persons age 50 and older, 1986–87**

Characteristic	Married couple		Single men		Single women	
	Retired	Nonretired	Retired	Nonretired	Retired	Nonretired
Number of observations	692	622	218	141	687	247
Mean age:						
Men	70.9	61.2	71.8	59.9	...	...
Women	67.5	57.8	...	...	73.9	60.6
Mean income:						
Before tax	$19,461	$36,091	$11,241	$23,620	$8,665	$17,614
After tax	$18,374	$31,894	$10,142	$21,272	$8,363	$15,679
Total expenditures	$17,540	$25,340	$11,340	$18,652	$9,369	$14,048
Average propensity to consume (in percent)	95	79	112	88	112	90
Mean number of vehicles	1.8	2.4	1.1	1.4	.5	1.0
Percent reporting—						
Race (of reference person):						
White	92.6	93.1	83.0	87.9	89.2	88.7
Nonwhite	7.4	6.9	17.0	12.1	10.8	11.3
Educational attainment (of reference person):						
No school	1.3	0.5	2.3	0.0	1.0	0.4
Elementary (1-8 years)	24.1	12.7	36.7	14.2	31.3	9.3
High school (9-12 years)	49.1	43.4	43.6	40.4	47.9	46.2
College (13-16 years)	20.7	32.2	12.8	32.6	16.0	32.8
More than college (16 years or more)	4.8	11.3	4.6	12.8	3.8	11.3
Housing tenure:						
Home with mortgage	20.8	46.3	6.4	23.4	6.7	27.5
Home without mortgage	65.2	44.1	49.5	27.0	53.0	41.7
Renter	14.0	9.0	43.1	48.9	39.7	30.0
Other	.0	.6	.9	.7	.6	.8

SOURCE: Data derived from U.S. Department of Labor, Bureau of Labor Statistics, "Consumer Expenditure Survey," interview tapes, 1986–87.

Table 2. **Mean income, taxes, and assets of retired and nonretired households age 50 and older, 1986–87**

Income source	Total		Married couple		Single men		Single women	
	Retired	Nonretired	Retired	Nonretired	Retired	Nonretired	Retired	Nonretired
Number of observations	1,597	1,010	692	622	218	141	687	247
Wage and salary	$846	$20,405	$1,953	$24,322	$0	$17,215	$0	$12,364
Nonfarm business	42	2,745	96	3,744	0	1,539	0	917
Social Security and railroad retirement	6,507	2,192	8,416	2,588	5,191	1,367	5,001	1,666
Supplemental Security Income	119	11	85	12	218	6	122	12
Dividends, royalties, and interest	2,692	2,104	3,760	2,538	2,777	1,512	1,590	1,351
Pensions and annuities	2,982	1,841	4,621	2,357	2,594	1,552	1,454	706
Welfare	23	6	19	0	48	18	19	15
Other	485	525	511	528	413	411	481	452
Income before tax	13,695	29,831	19,462	36,090	11,241	23,620	8,665	17,614
Income after tax	12,943	26,446	18,373	31,894	10,142	21,272	8,363	15,679
Total taxes	775	3,482	1,113	4,319	1,106	2,409	330	1,985
Value of various assets:								
Checking accounts	2,308	3,143	3,109	3,268	3,288	5,162	1,191	1,677
Savings accounts	10,900	11,626	15,655	14,016	10,454	9,632	6,251	6,745
Stocks and bonds	5,487	9,320	7,894	10,463	4,217	8,929	3,465	6,665
U.S. Government bonds	499	613	847	660	270	316	222	663
Total selected assets	19,194	24,702	27,505	28,407	18,229	24,039	11,129	15,750

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, Consumer Expenditure Survey, interview tapes, 1986–87.

We exclude them to analyze discretionary spending decisionmaking and to compare the propensity to consume of the retired and nonretired. Because pension and Social Security contributions make up 11 to 14 percent of total expenditures (in the Consumer Expenditure Survey) for the nonretired and are fairly negligible for the retired, their inclusion would skew the expenditure share results shown in table 3.

Overall, we find that nonretired married couples spend 45 percent more than retired couples, while nonretired single men spend 65 percent more than retired men, and nonretired women spend 50 percent more than retired women. For retired groups, single men spend 21 percent more than single women, and married couples spend 87 percent more than single women. Among the nonretired groups over age 50, single men spend 33 percent more than single women, and married couples spend 80 percent more than single women.

All three retired groups spend a significantly greater share of their total expenditures than the nonretired groups, on food, food at home, utilities, and health care, but spend a smaller share on food away from home and entertainment. Retired married couples and single women also spend a significantly greater share on rented dwelling, while retired single women spend more on household operations. In contrast to the retired, working married couples and single women allocate a significantly greater share to the work-related categories of apparel and services, transportation (including vehicles, gasoline and motor oil, and other vehicles), alcoholic beverages, and insurance. While working single women spend significantly more on owned dwelling and public transportation than their retired counterparts, nonretired married couples spend a significantly greater share on owned dwelling, education, and miscellaneous, compared with their counterparts.

Table 3 also reveals that almost all shares differed significantly between the retired and nonretired. The retired spend a significantly greater share on food, food at home, housing, rented dwelling, utilities, household operations, and health care. The nonretired allocate a greater share to food away from home, alcoholic beverages, owned and other dwellings, house-furnishings, apparel and services, all transportation categories (except public), entertainment, education, miscellaneous gifts, and insurance.

Regression results

The 27 expenditure variables for nonretired and retired households were regressed on two continuous independent variables (financial assets and income) and dummy variables for family status, age group, race, and education level. The base case is single black women, in age group 50–59, with 8 years of education or fewer, as used by McConnel and Deljavan.[19] Table 4 presents the coefficients and summary statistics for each of the expenditure regressions, with indication of the significant variables. (The models for vehicles and education could not be estimated because most of the dependent variables' values were zero.) The Chow tests indicate that there is a significant difference between the coefficients in the retired and

Table 3. **Mean annual expenditure shares of retired and nonretired households, 1986–87**

Expenditure category	Total		Married couple		Single men		Single women	
	Retired	Nonretired	Retired	Nonretired	Retired	Nonretired	Retired	Nonretired
Number of observations	1,597	1,010	692	622	218	141	687	247
Total average expenditures	$13,180	$21,648	$17,540	$25,340	$11,340	$18,652	$9,368	$14,048
Food	[1]20.3	17.7	[1]21.1	18.2	[1]21.2	18.2	[1]19.4	16.4
Food at home	[1]15.6	12.0	[1]15.9	12.4	[1]15.6	11.1	[1]15.5	11.6
Food away from home	[1]4.7	5.7	[1]5.2	5.8	[1]5.6	7.1	[1]3.9	4.8
Alcoholic beverage	[1].9	1.5	[1]1.1	1.4	2.0	2.7	[1].4	1.0
Housing	[1]38.0	34.3	32.0	31.4	36.5	36.7	[1]44.6	40.5
Shelter	19.1	18.3	14.9	15.5	21.3	24.1	22.7	22.1
Owned dwelling	[1]8.1	10.3	[1]9.0	10.9	6.0	8.0	[1]8.1	10.3
Rented dwelling	[1]9.7	6.0	[1]4.1	2.3	14.5	14.6	[1]13.9	10.5
Other dwelling	[1]1.2	1.9	[1]1.8	2.3	.9	1.5	[1].8	1.3
Utilities, fuels, and public service	[1]14.1	10.9	[1]12.3	10.4	[1]11.8	9.1	[1]16.5	13.4
Household operations	[1]1.7	1.2	1.2	1.2	1.3	.8	[1]2.4	1.5
Housefurnishing and equipment	[1]3.1	3.9	[1]3.6	4.3	2.1	2.7	[1]3.0	3.5
Apparel and services	[1]3.4	4.8	[1]3.6	4.8	2.7	3.3	[1]3.4	5.7
Transportation	[1]10.6	16.2	[1]13.5	17.1	14.5	16.0	[1]6.9	13.9
Vehicles	[1]1.2	3.2	[1]1.7	3.8	2.5	3.1	[1].4	1.6
Gasoline and motor oil	[1]3.7	5.1	[1]4.8	5.5	5.1	4.7	[1]2.3	4.2
Other vehicle	[1]4.6	6.5	[1]5.7	6.7	5.9	6.4	[1]3.1	6.0
Public transportation	1.1	1.4	1.3	1.1	1.0	1.8	[1]1.1	2.1
Health care	[1]2.6	7.4	[1]13.2	8.5	[1]9.7	5.5	[1]12.8	6.1
Entertainment	[1]2.9	4.5	[1]3.5	4.6	[1]2.5	4.1	[1]2.4	4.4
Personal care	1.4	1.3	1.5	1.4	.8	0.7	1.6	1.7
Reading	1.0	.9	.9	.9	1.0	.9	1.0	1.0
Education	[1].1	.3	[1].1	.3	[1].01	.1	.02	.1
Tobacco	1.4	1.5	1.5	1.5	2.1	1.7	[1]1.0	1.6
Miscellaneous	[1]1.6	2.2	[1]1.5	2.2	2.0	3.4	1.7	2.0
Cash gifts and contributions	[1]4.2	5.1	4.9	5.4	3.6	5.0	3.8	4.4
Insurance and pension:								
Life and personal insurance	[1]1.3	2.2	[1]1.7	2.5	1.3	1.9	[1]1.1	1.5

[1]Significantly different retired versus nonretired shares [10 percent level (two tailed)].

SOURCE: Data derived from U.S. Department of Labor, Bureau of Labor Statistics, Consumer Expenditure Survey, interview tapes 1986–87.

nonretired models for all of the expenditure categories. For all of the 50 models, the likelihood ratio tests were statistically significant at the .01 level, indicating that the models explain the variation in the dependent variables.

The marginal propensity to spend (labeled permanent income coefficient) for each expenditure category is shown in table 4. The marginal propensity to spend indicates how much of an additional dollar of income would be spent for a particular item or service. The retired have a higher marginal propensity to spend for food, alcohol, housefurnishings, apparel, transportation, gas and motor oil, other vehicles, public transportation, health care, entertainment, and cash gifts. Notably, their higher marginal propensity to spend for transportation indicates a greater tendency to travel. The nonretired have a higher marginal propensity to spend for housing, shelter, dwellings, and life insurance.

Those items with expenditure elasticities greater than one, generally referred to as luxury goods, for retired households shown in table 4 are: food away from home, alcohol, housefurnishings and equipment, apparel, other vehicles (for example, recreational vehicles), and reading materials. The only luxury goods for the working households are other dwellings, household operations, and reading materials.

Analysis of the assets coefficients reveals many different effects on the consumption categories for both working and retired households over age 50. For the retired household, expenditures on rented dwelling, other dwelling, other vehicles, public transportation, and cash gifts and contributions are positively affected by the level of financial assets, while food, food at home, housing, apparel, transportation, personal care, and reading materials have a negative impact. For the working households, spending on alcohol, housefurnishings, public transportation, and entertainment are positively affected by the level of financial assets, while food at home, gasoline and motor oil, and tobacco are negatively affected.

Marital status. The effects of marital status (married couple, single men, or single women), race, education, and age on expenditures are also pre-

sented in table 4. The effect of being a married couple influences the majority of expenditure categories similarly for both the retired and working. For eight categories (food, food at home, utilities, gasoline and motor oil, other vehicles, health care, tobacco, and life insurance), both retired and working married couples spend significantly more than single women (the base case), all other things being equal; and for six categories (housing, shelter, rented dwellings, household operations, apparel, and public transportation), they spend less. Retired married couples spend more on alcohol, owned dwellings, other dwellings, and transportation, and they spend less on housefurnishings, and cash gifts and contributions than single women. Working married couples spend less on reading materials than single women.

The expenditure pattern for retired single men differs more markedly from single women (the base case) than that for married couples. Retired single men spend significantly more on food away from home, alcohol, all transportation areas (except public transportation), and tobacco; and they spend less on housing, shelter, and cash gifts and contributions than single women. Working single men spend significantly more on alcohol and rented dwellings (which relates to their greater share of renters) in comparison with single women (table 1). Single retired women allocate $505 more to gifts than married couples and $933 more than single men. Perhaps by coincidence, a single man spends $400 more on tobacco and $483 more on alcohol than a single retired woman, which is almost equal to her larger spending on cash gifts and contributions. Both retired and working single men spend less on utilities, household operations, housefurnishings, apparel and services, and personal care than single females. All of this suggests that single females spend more time and income at home, compared with single men.

Among the retired, only married couples are not dissaving, that is, they have income greater than their expenditures. Both retired single men and women spend 12 percent more than their after-tax income (table 1). Nonretired couples and single men spend less than their income after tax even when pension and Social Security contributions are accounted for; however, this is not the case for single women whose expenditures plus pension and Social Security contributions slightly exceed after tax income.

Once eligibility age is reached, Social Security is the mainstay of retired single women, as their pension income is low and their low level of financial assets generates little income. For retired women, a large share of spending is devoted to housing. This large share is not caused by spending on shelter, but by utilities and household operations.

Tobit regression analysis reveals that the retired have a higher marginal propensity to spend (than the nonretired) for all categories of food, alcohol, housefurnishings, apparel, transportation, health care, entertainment, and gifts. These findings indicate that the retired have the desire to lead active lifestyles by traveling and entertaining. The nonretired have a higher marginal propensity to spend for owned dwellings, compared with the retired who tend to own their homes without a mortgage.

Retired households allocate spending which involves time intensive entertainment and travel activities as revealed in the high income elasticities ($\varepsilon > 1$) of some key items (food away from home, alcohol, housefurnishings and equipment, apparel, recreational vehicles, and reading materials). Such goods with income elasticities greater than one are referred to as luxury goods. In contrast, the nonretired appear to have very few goods considered to be luxury goods (vacation homes, household operations, and reading materials).

Race. With all other variables being equal, race has a smaller explanatory value for household expenditures than the other demographic variables analyzed. For those limited areas affected by race, whites spend less on public transportation and more on gasoline and motor oil, entertainment, and alcohol than nonwhites, both retired and working. Retired white households spend more on owned dwellings, household operations, heath care, entertainment, and life insurance; and less on cash gifts and contributions, and rented dwellings than retired nonwhite households. In contrast, for the working groups, whites spend less on apparel and life insurance and more on gasoline and motor oil.

Education. The effect of the level of education on expenditures is most notable for both categories of college educated and college plus more years of schooling. Retired highly educated households spend significantly more on alcohol, shelter, owned dwelling, gasoline and motor oil, health care, and reading materials; and less for transportation than households with an eighth grade education. In addition, households who work and have high educational attainment spend more on alcohol, transportation, other vehicles, entertainment, and life insurance; and less on public transportation, and tobacco. Retired high-school educated households spend more on personal care and apparel, while high school educated households who work, spend less on public transportation.

Furthermore, our findings confirm that spending on health care is positively correlated with education levels. This may be attributed to better recognition of the importance of health care or better in-

Table 4. **Tobit Expenditure regressions of households with persons aged 50 and older, nonretired and retired, 1986–87**

Variables	Food		Food at home		Food away from home	
	Nonretired[1]	Retired[2]	Nonretired[1]	Retired[1]	Nonretired[1]	Retired[1]
Constant	10.76	269.48	**491.48	*749.2	**–1,314.8	*–1,718.5
Permanent income	*.11	*0.15	*.04	*.06	*.09	*.12
Elasticity	0.62	0.73	.41	.45	.80	1.11
Married couple	***692.45	*594.79	*670.56	*581.70	67.34	–8.95
Single men	130.34	170.72	–144.48	–36.12	275.20	***294.69
Race (white)	385.76	7.67	290.48	–115.66	248.33	**509.80
Education (high school)	196.44	86.43	194.34	37.43	77.82	181.53
Education (college)	–111.64	–90.12	11.54	–114.30	–57.93	134.97
Education (college plus)	–306.65	238.67	–47.42	134.92	–172.92	264.21
Age 60–64	406.69	–86.10	–36.87	–13.67	***496.28	–65.16
Age 65–74	305.12	47.32	24.31	26.15	342.59	34.77
Age 75 and older	386.10	–246.61.	154.40	–142.70	95.29	–194.09
Assets	0.00046	**–.0041	***–.0018	** –.0022	.0027	–.0022
Likelihood ratio test	*203.48	*438.46	*247.54	*400.27	*126.50	*251.48
Log–likelihood	–4,173.33	–5,349.01	–3,405.12	–4,634.20	–3,983.39	–5,123.24
Chow test (X^2_{12})	*437.04	—	*249.36	—	*344.62	—
Φ	0.90	0.92	0.96	0.94	0.67	0.57
Limit observations	0	6	9	37	174	517

Variables	Alcholic beverage		Housing		Shelter	
	Nonretired[1]	Retired[1]	Nonretired[1]	Retired[1]	Nonretired[1]	Retired[2]
Constant	*–894.93	*–1,147.00	1,740.40	**1,905.80	369.44	*1,403.3
Permanent Income	*.025	*.04	*.34	*.31	*.21	*.14
Elasticity	.96	1.27	.91	.79	.86	.53
Married couple	88.76	**161.84	**–1,311.10	*–1,100.80	*–1,274.70	*–620.00
Single men	*382.80	*482.89	–1,055.00	*–1,273.50	–122.13	**–625.25
Race (white)	***206.67	**273.84	–369.34	–306.39	–20.78	–296.51
Education (high school)	66.65	6.08	–402.23	–132.03	–394.94	–130.71
Education (college)	***121.47	3.98	–483.77	–64.55	–347.59	–60.34
Education (college plus)	124.74	**160.91	–624.01	449.87	–120.74	*685.81
Age 60–64	14.64	–85.02	–531.82	6.99	–398.90	–46.19
Age 65–74	30.29	–77.22	–76.04	–549.68	–141.42	**–749.95
Age 75 and older	–141.26	*–304.97	–436.88	–263.91	***–1,516.20	–527.56
Assets	**.0015	.00012	.00076	**–.0088	–.00048	.0024
Likelihood ratio test	*173.19	*307.74	*222.90	*183.53	*136.21	*84.79
Log–likelihood.	–3,095.707	–4,237.079	–4,839.89	–6,470.20	–4,633.10	–3,666.64
Chow test (X^2_{12})	*228.18	—	*406.10	—	*361.96	—
Φ	.52	.27	.93	.91	.80	.75
Limit observations	459	1,083	1	3	100	235

Variables	Owned dwelling		Rented dwelling		Other dwelling	
	Nonretired[1]	Retired[2]	Nonretired[1]	Retired[2]	Nonretired[1]	Retired[2]
Constant	**–2,315.30	*–2,281.00	–862.18	433.35	*–4,231.60	*–4,286.10
Permanent Income	*.19	*.12	–.07	.005	*.10	*.06
Elasticity	.91	.56	–.45	.022	1.15	.62
Married couple	12.44	**530.21	*–3,095.00	*–2,527.50	36.31	*936.01
Single men	*–1,916.60	*–974.10	*2,357.00	181.94	–527.25	–94.12
Race (white)	286.33	***642.89	–688.71	*–1,274.00	790.47	575.58
Education (high school)	–313.71	–4.15	–411.40	–250.06	–87.66	79.46
Education (college)	–246.25	338.00	–406.12	–524.35	–317.55	269.45
Education (college plus)	–237.18	*880.40	495.72	119.95	105.62	355.40
Age 60–64	–614.55	13.97	–375.38	–235.35	–16.63	122.50
Age 65–74	–304.15	–507.83	–1,106.70	–855.81	445.09	82.29
Age 75 and older	–1,394.30	–724.48	–1,093.70	–112.12	–699.72	–340.72
Assets	.0014	.00041	.00241	**.0109	.0026	*.0067
Likelihood ratio test	*139.33	*140.43	*107.44	*124.88	*107.21	*151.01
Log–likelihood	–4,372.44	–2,760.87	–3,505.00	–1,857.80	–3,610.54	–1,089.13
Chow test (X^2_{12})	*265.88	—	*243.78	—	*239.82	—
Φ	.60	.46	.19	.28	.31	.15
Limit observations	344	751	800	1,124	648	1,286

See footnotes at end of table.

Table 4. **Continued—Tobit expenditure regressions of households with persons aged 50 and older, nonretired and retired, 1986–87**

Variables	Utilities		Household operations		Housefurnishings and equipment	
	Nonretired[1]	Retired[1]	Nonretired[1]	Retired[2]	Nonretired[1]	Retired[1]
Constant	*1,114.40	*888.72	*–1,630.70	*–2,819.10	*–1,377.00	*1,379.70
Permanent Income	*.04	*.03	*.06	*.06	*.079	*.12
Elasticity	.42	.27	1.12	.46	.77	1.06
Married couple	**202.65	*225.42	**–503.29	*–789.84	–171.04	***–342.80
Single men	*–498.57	*–270.17	***–512.02	*–746.13	**–794.32	*–656.45
Race (nonblack)	–104.63	–89.84	27.36	*1,034.60	240.68	264.36
Education (high school)	51.39	23.19	10.02	–266.52	312.49	–66.97
Education (college)	–32.73	66.96	–84.12	287.16	136.33	–80.17
Education (college plus)	**–177.30	90.74	–150.80	237.80	71.02	–148.83
Age 60–64	108.07	117.89	36.02	–365.55	–149.61	–169.64
Age 65–74	–14.40	79.18	**396.07	279.30	–234.46	–309.23
Age 75 and older	3.41	35.90	*1,339.30	***625.27	–701.04	–673.34
Assets	–.00081	–.00027	.00072	.0016	**.0052	–.0017
Likelihood ratio test	*207.96	*203.60	*88.53	*79.74	*111.29	*154.30
Log–likelihood	–3,173.97	–4,212.52	–3,504.91	–2,109.40	–3,974.917	–5,214.269
Chow test (X^2_{12})	*267.44	—	*312.84	—	*256.04	—
Φ	.97	.95	.36	.32	.56	.43
Limit observations	10	26	550	875	286	725

Variables	Apparel and services		Transportation		Gasoline and motor oil	
	Nonretired[1]	Retired[1]	Nonretired[1]	Retired[2]	Nonretired[2]	Retired[2]
Constant	89.45	*–636.57	–1,198.10	*–3,501.00	**237.17	*–267.79
Permanent Income	*.08	*.10	*.22	*.35	*.009	*.017
Elasticity	.95	1.40	.58	1.00	.17	.31
Married couple	***–329.11	**–250.33	966.35	**682.87	*565.88	*577.42
Single men	*–785.10	**–227.90	1,029.30	*1,805.50	133.43	*422.60
Race (white)	***–401.10	16.01	511.73	695.19	**194.12	*257.05
Education (high school)	138.14	*186.02	–175.00	128.98	–1.53	30.57
Education (college)	–85.33	25.21	812.29	***–549.81	66.60	**93.79
Education (college plus)	109.59	–5.81	**1,750.30	–359.59	52.77	*221.21
Age 60–64	–163.56	–59.55	–308.41	–488.51	**–155.66	–67.68
Age 65–74	–12.65	–8.80	–1,455.50	–249.72	*–288.52	–114.46
Age 75 and older	–148.53	–111.10	–2,019.80	–754.35	*–364.31	*–422.99
Assets	.00042	*–.0046	–.0069	*–.0092	**–.0012	–.00049
Likelihood ratio test	*162.29	*234.46	*64.48	*162.44	*201.98	*577.56
Log–likelihood	–3,702.47	–4,535.52	–5,240.06	–4,215.98	–1,148.72	–1,522.33
Chow test (X^2_{12})	*563.24	—	*430.46	—	*63.48	—
Φ	.73	.65	.72	.61	.86	.68
Limit observations	101	329	24	252	70	434

Variables	Other vehicle		Public transportation		Health care	
	Nonretired[1]	Retired[1]	Nonretired[2]	Retired[2]	Nonretired[1]	Retired[2]
Constant	–69.56	*–1,671.00	*–1,281.40	*–2,545.90	–179.36	*–1,097.00
Permanent Income	*.05	*11	*.04	*.07	–.01	*.06
Elasticity	.57	1.15	.54	.49	–.10	.31
Married couple	*434.53	*417.60	*–1058.40	*–687.71	*1,209.94	*600.34
Single men	66.80	*466.54	–230.36	–411.83	218.84	–110.70
Race (white)	–71.59	283.17	**–818.50	*–895.47	396.63	**519.03
Education (high school)	175.37	117.58	**–941.23	–28.12	–219.08	26.83
Education (college)	218.29	80.99	–439.40	14.60	–196.19	**292.66
Education (college plus)	*539.10	83.53	201.21	423.34	217.86	–4.39
Age 60–64	–175.17	59.04	155.22	243.22	254.64	248.09
Age 65–74	***–271.42	124.05	355.08	300.03	*885.96	*911.64
Age 75 and older	–535.03	–199.41	–71.03	193.66	*2,491.00	*1,220.00
Assets	–.00064	***.0029	*.0062	**.0062	.0031	–.0022
Likelihood ratio test	*154.33	*339.66	*98.21	*95.01	*121.86	*137.81
Log–likelihood	–3,653.98	–4,976.60	–988.09	–1,495.96	–4,035.88	–3,473.18
Chow test (X^2_{12})	*277.96	—	*20.04	—	*258.76	—
Φ	.78	.55	.25	.21	.69	.73
Limit observations	143	599	717	1,182	115	75

See footnotes at end of table.

Table 4. **Continued—Tobit expenditure regressions of households with persons aged 50 and older, nonretired and retired, 1986–87**

Variables	Entertainment		Personal care		Reading materials	
	Nonretired[1]	Retired[1]	Nonretired[1]	Retired[1]	Nonretired[1]	Retired[1]
Constant	*–1,170.50	*–1,884.20	37.65	*–187.85	**–142.17	*–164.90
Permanent Income	*.05	*.10	*.010	*.018	*.015	*.015
Elasticity	.35	.87	.69	.92	1.10	1.17
Married couple	292.79	7.15	–17.85	3.98	***–70.23	–17.25
Single men	–336.85	–123.08	*–178.54	**–69.06	–75.02	–8.36
Race (white)	*477.15	***595.11	–29.09	53.75	9.23	38.92
Education (high school)	67.25	141.07	–4.64	**49.60	–4.03	26.39
Education (college)	349.75	–30.92	16.45	19.88	–.12	**30.92
Education (college plus)	*1,124.10	231.06	–25.11	21.79	–7.08	***35.96
Age 60–64	–131.69	86.09	10.48	10.12	18.74	–14.83
Age 65–74	–372.65	36.30	34.23	29.68	*104.12	23.49
Age 75 and older	**1,192.40	–276.60	*168.54	45.21	29.74	21.26
Assets	*.0102	.0021	.00014	***–.0005	0.00015	*–0.0005
Likelihood ratio test	*113.34	*218.36	*167.64	*226.69	*205.39	*297.44
Log–likelihood	–2,297.22	–5,261.63	–2,230.698	–3,064.586	–2,195.34	–2,562.83
Chow test (X^2_{12})	*454.76	—	*276.86	—	*461.42	—
Φ	.60	.48	.79	.69	.70	.69
Limit observations	140	533	147	430	164	425

Variables	Tobacco		Miscellaneous	
	Nonretired[1]	Retired[2]	Nonretired[5]	Retired[2]
Constant	*–320.98	*–446.61	**–625.59	*–3,435.40
Permanent Income	–.0016	.0015	*0.05	*.13
Elasticity	–.07	.04	0.53	.61
Married couple	*203.58	*409.17	–1,118.43	–230.44
Single men	51.26	*399.45	51.47	199.30
Race (white)	124.11	30.45	–217.88	–8.38
Education (high school)	*257.65	***110.19	290.90	328.43
Education (college)	86.99	4.71	71.70	**644.49
Education (college plus)	***–125.81	73.49	–55.89	287.45
Age 60–64	**–160.60	–104.87	–260.70	–69.07
Age 65–74	*–220.70	*–247.53	**–484.48	–512.88
Age 75 and older	*–554.22	*–521.84	–576.20	–991.72
Assets	**–0.00157	–.001	*0.0059	–.0011
Likelihood ratio test	*66.92	*110.68	*97.97	*53.74
Log–likelihood	–790.77	–970.76	1,821.94	–2,484.45
Chow test (X^2_{12})	*80.54	—	*570.26	—
Φ	0.40	0.26	0.51	0.31
Limit observations	611	1164	269	878

Variables	Cash gifts and contribution		Life insurance	
	Nonretired[2]	Retired[2]	Nonretired[1]	Retired[2]
Constant	*–2,988.40	*–3,888.20	*–1,330.40	**–399.73
Permanent Income	*0.15	*.22	*0.05	*.009
Elasticity	0.80	.87	.84	.17
Married couple	–484.60	***–505.01	**535.80	*597.90
Single men	–529.84	**–932.79	17.43	–16.76
Race (white)	595.84	***–701.15	**–681.24	*515.98
Education (high school)	–214.54	89.70	518.98	116.00
Education (college)	–42.06	458.87	*510.78	–31.78
Education (college plus)	–437.48	–395.14	319.76	–38.71
Age 60–64	291.53	615.79	106.25	104.87
Age 65–74	559.89	818.17	20.93	–123.51
Age 75 and older	–311.04	*1,508.10	**–1,042.90	*–455.47
Assets	.00507	*.0156	0.004	–0.0011
Likelihood ratio test	*291.07	*530.70	*121.94	*140.85
Log–likelihood	–2,425.65	–3,243.09	–3,612.85	–1,267.44
Chow test (X^2_{12})	*54.34	—	*337.22	—
Φ	0.54	.44	0.44	0.27
Limit observations	241	580	451	1,080

[1]Two stage tobit estimated.
[2]Tobit.

NOTE: *p< .01.
**p< .05.
***p< .10.
The models for education and vehicles could not be estimated because most of the dependent variable values were zero.

surance coverage for the higher educated groups. This issue deserves future research.

Age. Three older age groups are compared with the age 50–59 base case. Both retired and working households over age 65 spend significantly more on health care (and personal care for the working group over age 75) and household operations; however, they spend less on gas and motor oil and tobacco than the base case (50- to 59-year-olds). The over age 75 group spend less on life insurance and alcohol (for the retired), but notably retired households allocate significantly more to cash gifts and contributions. Persons who work and are in the 60–64 age group spend more on food away from home, and the 65 to 74 age group spend less on shelter.

Conclusion

The heterogeneity of older Americans has only recently begun to receive significant attention as the focus of empirical studies.[20] From these findings, however, several policy and marketing implications emerge. First, in light of the fact that in general, people are living longer in their senior years, current workers need to start early financial retirement planning to avoid the dissaving problems of current retirees. Kenneth F. Ferraro indicates that those most likely to benefit from advance planning are the least likely to pursue it.[21] Retired single females are dissaving at unsustainable rates. Their income is only 44 percent of that for married couples, even though on an equivalency basis, single households should have about 58 percent of the income of a two-person household.[22]

Second, there is a need for affordable housing and apartments for many older single women and for some single men, because a high percentage of their budget is devoted to shelter.

Third, further study is needed to determine why older persons with few years of educational attainment tend to spend less on health care. It is likely to be related to their having lower levels of income and less health insurance coverage.[23]

And finally, charitable organizations might want to know that although the average propensity to spend on cash gifts and contributions is smaller for the retired, their marginal propensity to spend is actually larger. Also, retired single women, nonwhites, and those over age 75 are more generous, other things being equal, than are other retired groups.

Overall, as the older population continues to grow in numbers and share, their income levels and spending patterns will be of increasing importance to policymakers and to businesses. Their economic decisions will have increased impact on both the macroeconomy and specific industries. The spending of older Americans, both retired and nonretired, will play a larger role in driving economic trends, such as tourism, entertainment, health care delivery, and philanthropy. □

Footnotes

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[1] It is now recognized that the elderly are not a homogeneous group. See Mark D. Hayward and William R. Grady, "Work and Retirement Among a Cohort of Older Men in the United States, 1966–1983," *Demography*, August 1990, pp. 337–56.

[2] A.E. Fareed and G.D. Riggs, "Old-Young Differences in Consumer Expenditure Patterns," *The Journal of Consumer Affairs*, Summer 1982, pp. 152–60. Beth Harrison, "Spending patterns of older persons revealed in expenditure survey," *Monthly Labor Review*, October 1986, pp. 15–18. Retia S. Walker and Frankie N. Schwenk, "Income and Expenditure Patterns of Consumer Units with Reference Person Age 70 to 79 and 80 or Older," *Family Economics Review*, vol. 4, no. 1, 1991, pp. 8–13. Pamela B. Hitschler, "Spending by older consumers: 1980 and 1990 compared," *Monthly Labor Review*, May 1993, pp. 3–13. Pamela Hitschler did not differentiate the elderly according to retired or working status. Thus, no direct comparison can be made with our study.

[3] However, older women, minorities, and the oldest old experience relative economic disadvantages. See Marilyn Moon, "Consumer Issues and the Elderly, *The Journal of Consumer Affairs*, Winter 1991, pp. 235–44. Frankie N. Schwenk, "Changes in the Economic Status of America's Elderly During the Last 50 Years," *Family Economics Review*, Winter 1993, pp. 18–27.

[4] Frankie N. Schwenk, "A Comparison of Households Headed by Persons 55 to 65 Years of Age: Retired and Employed," *Family Economics Review*, March 1990, pp. 19–25.

[5] Charles E. McConnel and Firooz Deljavan, "Consumption Patterns of the Retired Household," *Journal of Gerontology*, July 1983, pp. 480-90, utilized 1972–73 Consumer Expenditure Survey data.

[6] Richard J. Harris, "Recent Trends in the Relative Economic Status of Older Adults," *Journal of Gerontology*, May 1986, pp. 401–07.

[7] Thomas Moehrle, "Expenditure patterns of the elderly: workers and nonworkers," *Monthly Labor Review*, May 1990, pp. 34–41. James H. Schulz, *The Economics of Aging*, 5th ed. (New York, Auburn House, 1992).

[8] Beth Harrison, "Spending patterns of older persons."

[9] McConnel and Deljavan, "Consumption Patterns of the Retired Household."

[10] Moehrle, "Expenditure patterns of the elderly."

[11] Suhas Ketkar and Whewan Cho, "Demographic Factors and the Pattern of Household Expenditures in the United States," *Atlantic Economic Journal*, September 1982, pp. 16–27.

[12] Milton Friedman, *A Theory of the Consumption Function* (Princeton, NJ, Princeton University Press, 1957). Franco Modigliani, "The Life Cycle Hypothesis of Saving, the Demand for Wealth and the Supply of Capital," *Social Research*, summer 1966, pp. 160–217. Sheldon Danziger, Jacques van der Gaag, Eugene Smolensky, and Michael K. Taussig, "The Life-Cycle Hypothesis and the Consumption Behavior of the Elderly," *Journal of Post Keynesian Economics*, Winter 1982, pp. 208–27.

[13] Michael D. Hurd, "Research on the Elderly: Economic Status, Retirement, and Consumption and Saving," *Journal of Economic Literature*, June 1990, pp. 565–637. Michael D. Hurd, The Economic Status of the Elderly," *Science*, May 1989, pp. 659–63.

[14] James B. Davies, "Uncertain Lifetime, Consumption, and Dissaving in Retirement, *Journal of Political Economy*, June 1998, pp. 561–77. Sheldon Danziger and others, "The Life-Cycle Hypothesis."

[15] Jeanne M. Hogarth, "Saving and Dissaving in Retirement," *Family Economics Review*, May 1989, pp. 13–17.

[16] McConnel and Deljavan, "Consumption Patterns of the Retired Household." Schwenk, "A Comparison of Households." Moehrle, "Expenditure Patterns of the Elderly."

[17] The Consumer Expenditure Survey interview sample is selected on a rotating panel basis, targeted at 5,000 consumer units quarterly, with each quarter handled as an independent sample. See Raymond Giesman, "The Consumer Expenditure Survey: quality control by comparative analysis," *Monthly Labor Review*, March 1987, pp. 8–14.

We studied the 1986–87 period because it is reflective of the average characteristics of the U.S. macro economy over the past 25 years. The early 1980's and early 1990's consumer expenditure data might have been affected by the 1980, 1981–82, and 1990–91 recessions.

[18] "Consumer Expenditure Survey: Quarterly Data from the Interview Survey," Fourth Quarter 1989, Report 797 (Bureau of Labor Statistics, 1990). The Consumer Expenditure Survey expenditure categories make up approximately 95 percent of a household's total spending, and they include pension and Social Security contributions. See Gieseman, "The Consumer Expenditure Survey: quality control."

[19] McConnel and Deljavan, "Consumption Patterns."

[20] See William Lazer and Eric H. Shaw, "How Older American Spend Their Money," *American Demographics*, September 1987, pp. 36–41.

[21] Kenneth F. Ferraro, "Cohort Analysis of Retirement Preparation, 1974–1981," *Journal of Gerontology: Social Sciences*, January 1990, pp. S21–31.

[22] See James H. Shulz, *The Economics of Aging*, p. 55 for a discussion of equivalence scales.

[23] Rose M. Rubin and Kenneth Koelln, "Out-of-Pocket Health Expenditure Differentials Between Elderly and Nonelderly Households," *The Gerontologist*, October 1993 pp. 595–602.

APPENDIX: Econometric methodology

Economic analysis comparing the retired and the nonretired employs the following model for each of the 27 standard Consumer Expenditure Survey expenditure categories:

$$(1)\quad C_i = \alpha_i + \beta_1 I_i + \beta_2 Age(60\text{–}64)_i + \beta_3 Age(65\text{–}74)_i + \beta_4 Age(75+)_i + \beta_5 Couple_i + \beta_6 SM_i + \beta_7 Race_i + \beta_8 High\ School_i + \beta_9 College_i + \beta_{10} College_i + \beta_{11} Assets_i + \varepsilon_i$$

where C_i = annual expenditures for household $_i$

I_i = permanent income for household $_i$

$Couple_i$ = 1 if household i is a married couple; O o.w.

SM_i = 1 if household is a single man; O o.w.

$Race_i$ = 1 if nonblack; O o.w.

$High\ School_i$ = 1 if reference person i has high school education; O o.w.

$College_i$ = 1 if reference person i has college education; O o.w.

$College\ plus_i$ = 1 if reference person i has graduate schooling; O o.w.

$Age\ (60\text{–}64)_i$ = 1 if reference person of household i is 60–64; O o.w.

$Age\ (65\text{–}74)_i$ = 1 if reference person of household i is 65–74 ; O o.w.

$Age\ (75+)_i$ = 1 if reference person of household i is 75 or older O o.w.

$Assets_i$ = net financial asset value of household i.

ε_i is the disturbance term.

Note that the 50–64 age group was omitted because it is the base case. The age of the householder is determined by the age of the reference person. A consumer unit is a financially independent entity within a household. The terms, "consumer unit" and "household" are used interchangeably throughout this article.

To estimate the expenditure equations, three econometric problems need to be addressed. First, a Tobit procedure is needed because expenditures in some categories are zero. This is a classic limited dependent variable problem. Second, there is also an errors in variables problem, attributable to the unobservable nature of permanent income. In estimating expenditure equations, researchers have handled the errors in variables problem and the limited dependent variable problem. However, no one has examined both facets of the problem simultaneously. Thus, the third problem uses a simultaneous equations Tobit procedure.

The errors in variables problem was addressed by Nissan Liviatan who regressed total expenditure against measured income (and some exogenous variables), without a Tobit procedure.[1] Liviatan's method was adapted by McConnel and Deljavan to rectify the errors in variables problem in their examination of spending habits of the elderly in 1972–1973, but they did not address the limited dependent variable problem. The limited dependent variable problem must be handled because ordinary least squares estimated coefficients are generally biased toward zero.[2] In estimating the spending patterns of working wives, Eva Jacobs, Stephannie Shipp, and Gregory Brown applied a Tobit methodology, but they did not address the errors in variables problem. (Other researchers have ignored this problem as well.)[3]

The model for the simultaneous Tobit regression is specified as follows:

$$(1a)\quad C^* = \beta_1' x_1 + \gamma I + \varepsilon_1$$

$$(2)\quad I = \pi_2' X_2 + \varepsilon_2$$

Equation (1a) is a modified version of equation (1), where I is observed total expenditure and x_1 is a matrix containing the other explanatory variables (family status dummies, age dummies, race dummy, education dummies, and assets) in equation (1). Estimated permanent income $\hat{I}$ is estimated in equation (2) as a function of x_2, where x_2 includes observed income and all of the variables in x_1. Simultaneous equations bias is tested using Richard J. Smith and Richard W. Blundell's procedure.[4] The two-stage Tobit results are shown for those cases exhibiting simultaneous equations bias, and simple Tobit results are reported when no bias is present.

Third, we tested for structural change to ascertain any differences in spending patterns between the retired elderly and the nonretired elderly. To determine if the marginal propensity to consume (and the other coefficients) of these two groups differ, we use a likelihood ratio test (a Chow type test).[5] (Given that y_2 is the proxy for permanent income, the marginal propensity to spend estimates would significantly depend on y_2 and its variability. From equation (3), y_2 is estimated from observed "current" income and other variables. Because y_2 is estimated from current income, the variability of estimated permanent income must be taken into account when interpretating the marginal propensity to spend.) We test the null hypothesis that the regression coefficients in the expenditure equations for the retired β_R and nonretired β_{NR} are identical. The following test statistic has an χ^2 distribution with 12 degrees of freedom:

$$(3) \qquad -2[logL(\beta_{full\ sample}) - logL(\beta_R) - logL(\beta_{NR})]$$

Fourth, the marginal effects in a Tobit model differ from those in a standard regression equation. We present both the estimated regression coefficients, β, (the partial derivatives of the expected value of the latent variable, $E[y^*|x]$, with respect to x, using the mean value of x), and Φ (the cumulative distribution function of the standard normal evaluated at $[(\beta' x/\sigma)]$. Note that Φ times β equals the partial derivative of $E[y|x]$ with respect to x,

$$(4) \qquad \frac{\partial E[y/x]}{\partial x} = \Phi \beta$$

This partial derivative indicates the change in y (the observed expenditure) with respect to a change in x. An income elasticity can be formulated using this income derivative $E[y/x]$ evaluated at the mean value of x using equation 6.37 in G.S. Maddala.[6]

Footnotes to the appendix

[1] Nissan Liviatan, "Errors in Variables and Engel Curve Analysis," *Econometrica*, July 1961, pp. 336–62.

[2] William H. Greene, *Econometric Analysis* (New York, MacMillan Publishing Co., 1990).

[3] Eva Jacobs, Stephannie Shipp, and Gregory Brown, "Families of working wives spending more on services and nondurables," *Monthly Labor Review*, February 1989, pp. 15–23.

[4] Richard J. Smith and Richard W. Blundell, "An Exogeneity Test For a Simultaneous Equation Tobit Model with an Application to Labor Supply," *Econometrica*, May 1986, pp. 679-85.

[5] Gregory C. Chow, "Tests of Equality Between Subsets of Coeficients in Two Linear Regression Models," *Econometrica*, July 1960, pp. 591–605.

[6] G.S. Maddala, *Limited Dependent and Qualitative Variables in Econometrics* (New York, Cambridge University Press, 1983).