Expenditure Patterns of Asian Americans: Evidence From the U.S. Consumer Expenditure Survey, 1980-1992

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This article applies a linear approximation of the Almost Ideal Demand System with a set of demographic variables to study the differences in expenditure patterns between Asian American households and households in three other ethnic/racial groups: Black, Hispanic, and White. Findings show that even after controlling for other economic and demographic factors, compared with each of the three other ethnic/racial groups, Asian American households have significantly different expenditure patterns in 6 or more expenditure categories out of a total of 13. Besides implications for consumer educators, financial planners, and producers, the results of this study can provide guidelines for combining Asian American households with other ethnic/racial groups in expenditure studies so that households within the combined group can be as homogeneous as possible.

The population of Asian Americans has grown substantially since 1980. Although the whole U.S. population increased 12.6% from 1980 to 1992, the population of Asian Americans increased 125.3% (U.S. Bureau of the Census, 1994).

Asian Americans consist of people originally from Asia and the Pacific islands, including China, the Philippines, Japan, India, Korea, Vietnam, Hawaii, Samoa, and Guam. In 1990, among them, about 22.6% were Chinese, 19.3% Filipino, 11.6% Japanese, 11.2% Asian Indian, 11.0% Korean, and 8.5% Vietnamese. The total population of Asian Americans was about 8.4 million in 1992, representing 3.3% of the U.S. population (U.S. Bureau of the Census, 1994).

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Asian Americans come from extremely diverse societies and from all social classes. They are to be found in the United States in all walks of life, as doctors, teachers, businesspeople, and laborers. Correctly or not, they have acquired the image of highly successful immigrants—the model minority (Barringer, Gardner, & Levin, 1993). Asian Americans are considered to have higher-than-average incomes and educations when compared with the rest of the United States, and their earning power is strong and increasing (Shultz, 1985). In recent years, the growing population, increasing economic power, and deepening appreciation of minority cultures' contribution to U.S. society have resulted in a growing interest in the experiences and problems of minority groups, including Asian Americans (Barringer et al., 1993). However, research on Asian Americans has been limited, especially when compared with the literature on other minority groups.

The focus of this article is Asian Americans' expenditure patterns. It has been widely recognized that Asian Americans are likely to have religions, values, ethical standards, and lifestyles different from other ethnic/racial groups. Compared with other ethnic/racial groups, the economic status and demographic characteristics of Asian Americans are also different. Consequently, their preference structure and expenditure patterns are likely to be different from other ethnic/racial groups. Given that there has been very limited research on expenditure differences between Asian Americans and other ethnic/racial groups, it is important to explore these issues to better understand the fastest growing minority population in the United States. In addition, information on the effects of ethnicity/race on expenditures is also important to financial planners when helping minority consumers with their financial management needs, to producers when planning strategies to better meet the needs of minority consumers, and to economists when developing and improving the economic theory of consumer behavior (Wagner & Soberon-Ferrer, 1990).

REVIEW OF LITERATURE

The existing literature on Asian Americans can be classified into two major categories. One is found mainly in sociology, where immigration history and the cultural background of Asian Americans are of interest. Along this line are studies related to the socioeconomic status of Asian American households as evidence of how and to what extent this minority group has been assimilated into mainstream

American culture. The other body of literature is more recent, emphasizing the marketing perspective of the Asian American market, which has been getting more attention from big companies due to the fast increase of this market size.

Among the many determinants of Asian American identity, the cultural influences (e.g., values, norms, attitudes, traditions) are very important (Sue, 1973). It has been widely recognized that Asian Americans share strong traditions of extended kinship ties. Historically, Chinese, Japanese, Korean, and Vietnamese families differ somewhat from one another, but all derive their basic norms and values from Confucianism. These include obedience to and responsibility for parents, patrilinearity, patriarchy, a preference for sons, respect for education, the use of shame and guilt to control behavior, and considerable personal interdependence. Much of the same has been true for Asian Indians (Arkoff, 1959; Barringer et al., 1993; Fenz & Arkoff, 1962; Fong & Peskin, 1969; Gardner, Robey, & Smith, 1985; Kuo, 1977; Sue, 1973). With urbanization and industrialization, Asian families have been undergoing changes that include nuclearization in their home societies. Nevertheless, all literature on contemporary Asian societies has stressed the relative importance of the family when compared with the current American situation (Barringer et al., 1993). Empirical studies have found that on most measures concerning marriage and divorce, Asian Americans show more signs of stability than Whites and Blacks. The same is true for family composition measures. For example, Asian Americans have a very high percentage of married-family households. A large percentage of their children younger than 18 years of age live at home with two parents. The percentage of single-mother households is the smallest among all ethnic/racial groups (Barringer et al., 1993).

Asian Americans have been found to have higher educational attainment than other Americans (Barringer, Takeuchi, & Xenos, 1990; Hirshman & Wong, 1981, 1986). As Barringer et al. (1993) pointed out, the Confucian ethic often is cited as an important determinant of the desire for education among Asian Americans. This may be seen as a result of history, because in the past, East Asian societies made education a prerequisite, at least ideally, for high-status positions. The Confucian ethic also works through the family, with obedience to and respect for one's elders.

Closely related to educational attainment are employment and occupation, which convert education to income and carry with them prestige and future opportunities for success. Studies have found that

Asian Americans (except Vietnamese) are well represented across occupational categories, with some overrepresentation in service occupations and underrepresentation only in blue-collar labor, as compared with Whites (Barringer et al., 1993). However, despite the popular image of the model minority, Asian Americans have not reached equality in personal incomes (Barringer et al., 1993; Takaki, 1989). Studies have found that whereas some groups of Asian Americans, especially Japanese, have reached income parity with Whites, other groups, notably Koreans, Vietnamese, and other smaller groups, are very disadvantaged compared with Whites (Barringer et al., 1990; Hirshman & Wong, 1984). Although as a group, Asian American household incomes appear higher than those of Whites, when a number of factors such as family size and educational levels are controlled, Whites still appear to have higher incomes (Barringer et al., 1993).

The literature related to the Asian American market is mostly found in business reports, rather than in scholarly journals. Despite the cultural and linguistic diversity among Asian Americans, studies have found that Asian Americans are very similar to each other in cultural values. They are very family oriented and have strong needs for protection of survivors, education of children, and saving and investment (Maher, 1986). They are very quality conscious and prefer major brand names (Chui, 1992; Feinberg, 1987; Shultz, 1985). They give more referrals to friends and relatives than do other customers (Feinberg, 1987; Klein, 1990). Advertisers have been advised that Asian Americans would respond to messages that emphasize family, tradition, and cooperation (Burton, 1993). As for investment and asset accumulation, jewelry and real estate are popular investments among Asian Americans (Fost, 1990).

In summary, the available literature about Asian Americans suggests their strong cultural bonding to their original Asian cultural values, which are family kinship and obedience to and responsibility for parents, among other things. No empirical work on the expenditure patterns of Asian American households can be found in the existing literature.

The main purpose of this article is to investigate whether Asian American households have different expenditure patterns from other ethnic/racial groups in the United States and how these differences can be traced back to cultural differences. Although we need to recognize that Black and White households are multicultural and

multiethnic as well, the intraracial differences are probably less than the interracial or interethnic differences. This article appears to be the first scholarly work to research Asian American households' expenditure patterns. This article also has several unique features: (a) By using 13 years of the Consumer Expenditure survey (CEX), the sample used in this study is of an adequate size to conduct careful econometric analysis. (b) Instead of just using the overall Consumer Price Index (CPI) to adjust for income differences over time, a price index is created for different commodities in different region/city-size combinations to control for price variations. Judging from the large price variations across commodities and areas over time, this kind of control greatly improves the quality of the study. (c) Great care is taken to ensure that the model and the method of incorporating demographic variables in the model are consistent with neoclassical demand theory. A two-stage tobit method is used to solve the problem of limited dependent variables.

The article is organized as follows. First, a brief review of the theoretical background in economics and sociology is presented and hypotheses are proposed. Because the analytical method used in this study is closely tied to the nature of the data set, the data creation process is then presented, followed by a description of the empirical model for hypotheses testing. The results of the analysis and discussion of the results are then presented. In the last section, conclusions and implications are discussed.

THEORETICAL BACKGROUND AND HYPOTHESES

Neoclassical consumer demand theory provides a theoretical framework for the analysis of household budget allocation patterns by formulating expenditure functions for goods and services. Given a budget constraint and a utility function representing consumer preferences, the bundles of commodities that maximize consumer utility subject to the budget constraint can be expressed as a function of relative prices of goods, household income, and household preferences. Expenditures (E) or budget shares (W) are often used rather than quantities (Q). They are a function of the relative prices of goods ($P_1 \ldots P_k$), household income (M), and household demographic characteristics ($D_1 \ldots D_m$) such as ethnicity/race, household composition, household life cycle stage, education level, and residence area and

region, assuming that households that share similar characteristics have similar preferences. Mathematically, the demand function for commodity i can be expressed as follows:

$$Q_i = q_i(M, P, D); E_i = e_i(M, P, D); W_i = w_i(M, P, D). \quad (1)$$

Although this study only deals with monetary budget allocation of households at a given time, it should be recognized that household monetary budget allocation decisions may interact with many other simultaneous decisions, such as labor supply, life cycle consumption allocation, time allocation, and so forth. For example, studies have shown that household labor supply behaviors have significant effects on expenditure on food away from home and apparel (Dardis, Derrick, & Lehfeld, 1981; Foster 1988). However, to include every possible decision process in one study is not possible. Consequently, to justify the construction of a complete demand system for household monetary budget allocation at a given period, a weak separability assumption is required. Weak separability means that the demand for a group of goods depends only on the prices of this group of goods and the expenditure on this group of goods. The prices of other goods that are not in this group are only relevant insofar as they determine the total expenditure on this group of goods (Varian, 1992). In this study, an assumption is made that the household budget allocation decision at a given time is weakly separable from other household decisions. Considering a household's decision-making practice, this assumption is very general.

The third element of consumer decision making, besides prices and income, is consumer preferences. These preferences are affected by the household's demographic characteristics. These characteristics must include ethnicity or race, which has retained its position as a central element in the increasingly complex equation of culture and social structure in the United States (Glazer & Moynihan, 1975; Postiglione, 1983). Sociological theories of ethnicity, including both emerging culture theory and impact-integration theory, suggest that ethnic immigrants, while interacting with the host society, alter themselves by adopting some of the cultural values of the host society while keeping some of their own original cultural values and traditions (Glazer & Moynihan, 1970; Greeley, 1974; Novak, 1972). In that sense, Asian Americans are different from Asians in Asia, yet they are also different from the host culture in the United States. These cultural values and traditions, which they share only within their ethnic/racial group, have an impact on the preferences of Asian Americans and, therefore,

cause their expenditure patterns to be different from that of other ethnic/racial groups.

Given that the available literature on Asian Americans suggests their strong emphasis on family kinship, obedience to and responsibility for parents, respect for education, and preferences for saving and investment, it is hypothesized that Asian Americans, compared with other ethnic/racial groups, spend (a) more of their budget on food at home given their strong family orientation and less on food away from home because it is a substitute for food at home, (b) more on shelter due to strong family orientation and investment incentives, and (c) more on education given their respect for education. Not enough information is available in the literature to hypothesize their expenditure on other expenditure categories.

METHOD

Data and Variables

The major data source used in this study is the CEX from 1980 to 1992 (U.S. Bureau of Labor Statistics, 1980-1989; 1990-1992). The CEX data set, collected continuously since 1980 by the Bureau of Labor Statistics, provides very detailed information on household expenditures and household demographic characteristics. For this study, only households that completed the interview for an entire calendar year were selected. To construct a consistent data set, all the expenditure categories of interest are constructed or modified following the category definitions used in the 1990 CEX.

Because this data set includes households interviewed in 13 different years, controlling for price changes of commodities and services over time is important. One common approach is to use the overall CPI to adjust household income to constant dollars. However, over the 13-year period, the price changes for different expenditure categories were very different. For example, the price increase over the 13-year period was only about 45% for apparel and upkeep but was as high as 154% for medical care (U.S. Bureau of the Census, 1994). In addition, price differences among different regions and metropolitan areas within regions existed. For example, in 1980, the price for shelter in northeastern cities with a population of more than 1.2 million was about 124% higher than that in southern cities with a population of less than 50,000, whereas in 1992, the percentage differences increased

to 166%. On the other hand, the price of food at home was only 12% higher for northeastern cities with a population of more than 1.2 million than in southern cities with a population of less than 50,000 in 1980, and the percentage difference was increased to about 22% in 1992 (American Chamber of Commerce Researchers Association (ACCRA), 1990; U.S. Bureau of Labor Statistics, 1993). To take this diversity in price changes into consideration, two additional data sets were used. They are the 1980-1992 CPI (U.S. Bureau of Labor Statistics, 1992) and the 1990 American Chamber of Commerce Cost of Living Index (ACCRA, 1990). The CPI, published by the Bureau of Labor Statistics since 1913, is compatible and consistent with the CEX because the CPI data use expenditure weights obtained from the CEX. The portion of the CPI used in this study is the region/city-size price index for selected commodity groups. Four regions in the United States, with three city-size classifications each for the Northeast and West, and four city-size classifications each for the Midwest and South, yield a total of 14 region/city-size combinations each year. For the 13 years examined in this study (1980-1992), 182 price index numbers (14 region/city-size classifications each year for 13 years) are available for each commodity group.

The CPI is a price index over time only, without information on differences among different regions and cities. For each commodity group and for each region/city-size combination, the average price in 1982-1984 is set as the base price (100). For this study, the CPI region/city-size index cannot be used as it is because we would be arbitrarily and incorrectly assuming that in 1982-1984, the prices in all regions and cities were the same for all commodities. The CPI region/city-size index can only be used if a data set on area differences in prices can be introduced. The only data set containing area price differences we can find is the ACCRA data set. The ACCRA data publish price differences among standard metropolitan statistical areas (MSAs) for major expenditure categories. The portion of the ACCRA data used in this study is the composite index for selected commodity groups for the third quarter of 1990. ACCRA price information for metropolitan areas that are in the CPI area sample is used for this study. Although the ACCRA data set has its problems in terms of its definition of the market basket and sampling (Fan, 1996), the benefit of using it outweighs the cost because the use of 1 year of ACCRA data allows us to use 13 years of CPI region/city-size index. The alternative, without the use of the ACCRA data, would have limited us to using only the CPI national index, which has one price

for each commodity each year, with a total of 13 prices for each commodity over the 13-year period. This is equivalent to assuming no price differences at all among regions and cities, for all commodities and for all 13 years.

Considering data availability and computational feasibility, a limited number of summary expenditures are used. After careful examination of the data available in these three data sources, 13 mutually exclusive summary expenditure categories are selected: (a) food at home; (b) food away from home; (c) shelter; (d) fuel and utilities; (e) household operation, household equipment, and furnishing; (f) apparel and upkeep; (g) entertainment; (h) transportation; (i) education; (j) health care; (k) alcoholic beverages; (l) tobacco and tobacco-related products; and (m) personal care. Commodities and services included in each category are summarized in Table 1. For a more detailed description, refer to 1990 CEX EXPN file documentation (U.S. Bureau of Labor Statistics, 1990-1992).

The first step in data construction is to use the CPI area sample and population weights and the ACCRA price information to construct region/city-size price index numbers for the 14 region/city-size classifications for each expenditure category in 1990. The second step is to use the CPI region/city-size price index numbers, combined with 1990 region/city-size price index numbers created in Step 1, to construct region/city-size price index numbers for all years from 1980 to 1992. The result is that each commodity has 182 different price index numbers (14 region/city-size combinations by 13 years). The third step is to incorporate the created price index numbers into the 1980-1992 CEX data, using the region and city-size information for households in the CEX sample. Because the CEX does not provide city-size information for households living in the western region, price index numbers reflecting prices in the whole western region are constructed and used for all households in the West. In the final data, each commodity has 156 different prices (12 region/city-size combinations by 13 years). For an example of the data creation process, see the appendix.

Because the CPI does not provide price index information for households in rural areas and because no expenditure data were collected from rural households from 1980 to 1983, rural households are excluded from this study. For details of the data construction process and a discussion of strengths and weaknesses of this approach, see Fan (1996).

The total sample size is 10,400 households. Households in the sample were interviewed for a whole calendar year during 1980 to

TABLE 1: Definition of Expenditure Categories

Expenditure Category	*Description*
Food at home	Food and nonalcoholic beverages at grocery stores
	Food and nonalcoholic beverages at convenience or specialty stores
	Food prepared by consumer units on trips
Food away from home	Food on board, including at school
	Catered affairs
	Food on out-of-town trips
	Dining out at restaurants, etc. (excluding alcoholic beverages)
	Meals received as pay
	School meals
Shelter	Rent of dwelling, including parking fees
	Lodging away from home
	Housing for someone at school
	Ground rent
	Fire and extended coverage
	Homeowners insurance
	Property taxes
	Mortgage interest
	Penalty charges on special or lump-sum mortgage payments
	Parking
	Repair or maintenance services
	Contractor's labor and material costs
	Construction materials
	Management and upkeep services for security
	Tenants' insurance
	Rent received as pay
Fuel and utilities	Fuel oil
	Gas, bottled or tank
	Coal
	Wood and other fuels
	Electricity
	Natural gas
	Telephone services
	Water and sewage services
	Trash and garbage collection
	Septic tank cleaning
Household equipment/ operation	Household textiles includes linens, curtains, drapes, slipcovers, and decorative pillows
	Household furniture includes living room, dining room, bedroom, nursery furniture, porch, lawn, and other outdoor furniture
	Floor covering includes installation and replacement of wall-to-wall carpets, room-size rugs, and other soft floor coverings

TABLE 1: Continued

Expenditure Category	*Description*
Household equipment/ operation	Household appliances and other equipment
	Baby-sitters, day care fees, care of invalids, house cleaning, and maintenance
	Other households services include termite and pest control products, repair of household appliances and other household equipment, furniture repair, rental and repair of lawn and garden tools, and rental of other household equipment
Apparel	Men's, boys', women's, and girls' apparel; footwear
	Other apparel products and services
Entertainment	Fees and admissions
	Television, radio, sound equipment
	Other entertainment supplies
	Subscriptions for newspapers, magazines, and book and record clubs
Transportation	Vehicle maintenance and repair
	Gasoline and motor oil
	Vehicle insurance
	Vehicle rent
	Public transportation
Health care	Health insurance
	Medical services
	Prescription drugs and medical supplies
Education	Books
	School supplies
	Tuition
Alcohol	Alcoholic beverages at home
	Alcoholic beverages away from home
Tobacco	Tobacco products
Personal care	Electric personal care appliances
	Personal care services
	Rent or repair of electric personal care appliances, wigs, and hairpieces

1992. Among them, 222 were Asian American households, 1,146 non-Hispanic Black households, 588 Hispanic households (Hispanic households can be either Black or White), and 8,444 non-Hispanic White households. A household is classified into a particular ethnic/racial group if the reference person was reported as having that particular ethnic or racial background (information on both race and ethnicity is used to form this variable). Households not belonging to

any of the above four ethnic/racial groups (such as native American Indians) are excluded from this study because their sample size is too small to form an independent group.

The income variable used in this study is annual total expenditure, defined as the sum of the 13 expenditure categories discussed previously in this article. Compared with the total expenditure variable defined by the Bureau of Labor Statistics in the CEX data set, the total expenditure variable defined in this study does not include social security taxes, cash contributions, life insurance payments, and net vehicle outlays. Including net vehicle outlays would have distorted the analysis because most households take an auto loan when purchasing a car, instead of paying cash. For years before 1990, the CEX data do not give enough information for us to compute car payments. Because price index numbers are included as explanatory variables, the total expenditure does not need to be adjusted for the CPI.

Besides expenditures, income, and prices, the following demographic variables are used in the analysis: (a) characteristics of the reference person: ethnic/racial dummies (Asian, Black, Hispanic, White [base changes depending on the model]); gender dummies (female, male [base]); the logarithm of age; education dummies (less than high school [base], high school graduate, some college, college graduate, and more); employment status (full time, others [base]); and occupation (white collar, self-employed, others [base]); (b) characteristics of the household: number of earners; family composition (number of members younger than 6 years, between 6 and 17 years, between 18 and 34 years, between 35 and 64 years, and older than 65 years); housing tenure (renter [base], owner with mortgage, owner without mortgage); region (Northeast [base], Midwest, South, West); and (c) a continuous variable from 1 to 13 indicating the year of the interview.

Analyses

The analyses consist of three parts: (a) Simple two-sample tests on budget shares between Asian Americans and each of the other three ethnic/racial groups are conducted to see if the observed expenditure patterns of Asian Americans were different from other ethnic/ racial groups. (b) A demand system is estimated to take differences in income, prices, and demographic characteristics into consideration. (c) Based on the estimated demand system, joint *F* tests are conducted to test whether significant differences in expenditure patterns existed between Asian American households and households of other

ethnicity/race. To further understand the direction and magnitude of the differences, expenditure patterns of Asian Americans are simulated as if they were Blacks, Hispanics, or Whites.

Given the large number of expenditure categories and demographic variables involved in the demand system, selecting a simple but flexible demand system to execute the analysis is important. The almost ideal demand system (AIDS) and its linear approximation form (LA/AIDS), first introduced by Deaton and Muellbauer in 1980, have gained popularity in the past 15 years. The AIDS model gives an arbitrary first-order approximation to any demand system, satisfies the axioms of choice exactly, and can be used to test the restrictions of homogeneity and symmetry through linear restrictions on fixed parameters. Although many of these desirable properties are possessed by other demand models such as Rotterdam or translog models, neither possesses all of them simultaneously (Deaton & Muellbauer, 1980). Partly due to the claimed advantages over the Rotterdam and translog models and partly because the AIDS model offers a comparatively parsimoniously parameterized model compared with other more general models such as the Lewbel model (Lewbel, 1989), the AIDS model is chosen for this analysis. However, due to the number of variables and number of commodities involved in this study, the full AIDS model is too complicated to permit system convergence. Therefore, the LA/AIDS model is finally used in this study.

Following Deaton and Muellbauer (1980), the LA/AIDS model is defined as

$$W_i = \alpha_i + \sum_j \gamma_{ij} \log P_j + \beta_i \log(M/P^*), \tag{2}$$

where W, P, and M are budget share, price, and total expenditure,[1] respectively; α, β, and γ are parameters; and i and j are expenditure categories. P^* is a price index, commonly computed using the Stone index, which is defined by

$$\log P^* = \Sigma W_i \log P_i. \tag{3}$$

To avoid statistical problems, the Stone index in this study is created using mean budget shares for each region/city-size combination and can thus be treated as exogenous.

Two statistical issues are addressed in this study. The first issue is the incorporation of demographic variables into the demand system. The oldest and most commonly used methods of introducing

demographic variables into a demand system are demographic translating and demographic scaling (Pollak & Wales, 1981). While demographic translating assumes a close relationship between the effects of changes in demographic variables and the effects of changes in total expenditure, under demographic scaling, the effects of changes in demographic variables are closely related to the effects of price changes.

The so-called Gorman specification (Gorman, 1976) combines both demographic translating and scaling and is thus more flexible. In 1985, Lewbel extended the model described by Gorman to develop a general method of incorporating demographic effects into a demand system. The general method is to introduce functions of demographic variables, prices, and expenditures into the expenditure function of a demand system. This generalized technique permits complicated interactions of demographic variables with prices and expenditure. It encompasses demographic translating, demographic scaling, and the generalized Gorman form as specific cases. Empirically, however, the general form has to be reduced to a specific form to be computationally feasible.

Due to complicated nonlinearity problems, no convergence is obtained in many attempts to empirically execute some flexible forms, including the Gorman form and demographic scaling. Final convergence is reached using a method similar to Blundell, Pashardes, and Weber's (1993) specification, which is a form of demographic translating. This specification is realized by allowing the parameters α and β in the LA/AIDS system, and only these parameters, to vary with the demographic variables. More specifically, the demand system with demographic variables (Ds) is specified as

$$W_i = \alpha_{i0} + \sum_{h=1}^{m} \alpha_{ih} D_h + \sum_j \gamma_{ij} \log P_j + (\beta_{i0} + \sum_{h=1}^{m} \beta_{ih} D_h) \log(M/P^*), \qquad (4)$$

where $D_1 \ldots D_m$ are demographic variables.

The second issue is the problem of limited dependent variables, which occurs due to zero expenditure on some commodities by some households during the sample period. After comparison of several available statistical procedures for handling this problem, including the two-stage probit, one-stage tobit, and two-stage tobit, the two-stage tobit procedure is selected for this study. The two-stage tobit method is used by estimating a probit equation for each expenditure category at the first stage:

$$Prob(E_i > 0) = \tau_i (M, P, D), \tag{5}$$

then incorporating the estimated ϕ_i, the density function of the standard normal distribution evaluated at τ_i (M, P, D) for commodity i, and Φ_i, the cumulative probability function of the standard normal distribution evaluated at τ_i (M, P, D) for commodity i, into the second-stage demand analysis to correct for the limited dependent variable problem (Greene, 1990; Maddala, 1983).

Specifically, the LA/AIDS system with correction for limited dependent variables is then specified as[2]

$$\begin{aligned} W_i = \alpha_{i0} + \sum_{h=1}^{m} \alpha_{ih} D_h + \sum_j \gamma_{ij} \log P_j + (\beta_{i0} + \sum_{h=1}^{m} \beta_{ih} D_h) \log(M/P^*) \\ + \sigma_i [\phi_i - (1 - \Phi_i) \sum_{h=1}^{n} \tau_{ih} X_h]. \end{aligned} \tag{6}$$

The two-stage tobit method is chosen over a two-stage probit method because all of the observations can be retained in the same equation system in the second-stage demand system analysis and further model complications can be avoided. The method also allows for enough degrees of freedom for relatively robust parameter estimation. Single equation tobit (one stage) was ruled out because of the infeasibility of including it in a structural equation system where cross-equation parameter restrictions have to be imposed.

To maintain the theoretical properties of the demand system, including adding-up, homogeneity, and symmetry, the following cross-equation parameter restrictions apply.[3]
For adding-up,[4]

$$\sum_i \alpha_{i0} = 1, \ \sum_i \alpha_{ih} = 0, \sum_i \beta_{i0} = 0, \ \sum_i \beta_{ih} = 0, \ \sum_i \gamma_{ij} = 0, \ \sum_i \sigma_i = 0, \quad i,j = 1,2, \ldots k, h = 1,2, \ldots m. \tag{7}$$

For homogeneity,

$$\sum_j \gamma_{ij} = 0, \ i,j = 1,2, \ldots k. \tag{8}$$

For symmetry,

$$\gamma_{ij} = \gamma_{ji} \text{ for all } i,j \ \ i,j = 1,2, \ldots k. \tag{9}$$

To test the significance of the Asian American ethnic variable, four models are estimated. The full model uses variable White as the omitted variable, with variables Asian, Black, and Hispanic included on the right side of the equations. To test the significance of the Asian American ethnicity variable, three reduced models of the LA/AIDS are estimated. In reduced model (1), the only ethnic variables included are Black and Hispanic, with Asian and White both as omitted variables. In reduced model (2), the only ethnic variables included are Black and White, with Asian and Hispanic both as omitted variables. In reduced model (3), the only ethnic variables included are Hispanic and White, with Asian and Black both as omitted variables. Three sets of joint F tests are then performed to test the significance of the Asian American ethnic variable, as compared to each of the three other ethic/racial groups. Specifically, the F statistics are formulated as follows:

$$F = \frac{(SSE_R - SSE_F)/(df_R - df_F)}{SSE_F/df_F}, \tag{10}$$

where SSE_F is the sum square error of the full model and SSE_R is the sum square error of the reduced model. The degree of freedom is denoted as df.

The results of the F tests can show whether statistically significant differences existed in the budget shares between Asian American households and households in other ethnic/racial groups. However, because the estimated demand equations are highly nonlinear, the direction and magnitude of the differences are not obvious. Simulation methods are therefore used to investigate the average direction and magnitude of these differences. Budget allocation patterns for Asian American households are simulated as if they were Black, Hispanic, or White households. For example, to compare Asian American households with Black households, the coefficients from the estimated demand equations for Black households were used with the characteristics of each Asian Americans household to predict the budget allocation pattern of each Asian American household in the sample as if they were Black. The same was done to compare Asian Americans with Hispanic households and White households. The average simulated budget shares were then computed to compare with the real average budget shares of Asian American households.

RESULTS

Although the mean nominal amount of total expenditure for all households in the sample increased from $10,989 in 1980 to $22,915 in 1992, a 109% increase during the 13 years, the simultaneous inflation canceled most of the income growth. The mean budget shares for shelter and health care have increased over the years, whereas the budget shares for food at home, transportation, and alcoholic beverages have declined. The budget shares for other expenditure categories show variations over the time and no consistent pattern can be established.

To provide more insights into the sample, demographic profiles for all four ethnic/racial groups are provided in Table 2. Note that not all of the variables listed in the demographic profiles are used in later stages of the analysis.

Compared with all other ethnic/racial groups in the sample, Asian American households had the highest education attainment and the highest total household expenditure, though their average per capita total expenditure was lower than White households. Asian American households were more likely to be husband/wife families with children and homeowners living in the West with mortgage payments. They had a large average family size of 3.39, second only to Hispanic households (3.69) in the sample. Compared with other ethnic/racial groups, Asian American families had more people per family who were working and earning money and were more likely to have a reference person who was a white-collar worker or self-employed.

To see whether the observed budget allocation patterns for Asian American households were significantly different from that of other ethnic/racial groups, two-sample t tests on budget shares are performed. The t tests results are summarized in Table 3.

The results of the two-sample t tests suggest the existence of observed differences in household budget allocation patterns between Asian American households and households of other ethnicity or race. On average, Asian American households spent more of their budget on shelter and education and less on fuel and utilities and apparel compared with the other three ethnic/racial groups. Compared with Black households and Hispanic households, Asian American households allocated more of their budget to food away from home, entertainment, and health care, but less to food at home. Compared with White households, Asian Americans spent more of

TABLE 2: Demographic Profiles by Ethnicity/Race

Characteristics	Ethnic/Racial Groups			
	Asians (n = 222)	*Blacks (n = 1,146)*	*Hispanics (n = 588)*	*Whites (n = 8,444)*
Total expenditure ($)				
Mean[a]	26,745	16,251	19,850	23,811
SD	15,188	9,846	12,115	13,832
Age of reference person				
Mean	47.67	47.18	43.61	49.67
SD	15.97	16.30	15.54	17.35
Gender of reference person (%)				
Male	71.2	50.9	67.7	69.2
Education of reference person (%)				
Less than high school	23.4	40.7	57.0	21.2
High school graduate	24.8	30.6	20.4	32.2
Some college	20.3	18.8	12.6	21.8
College graduate or more	31.5	9.9	10.0	24.8
Occupation of reference person (%)				
White collar	41.4	24.3	18.9	35.7
Self-employed	6.3	2.4	3.9	5.3
Others	52.2	73.3	77.2	61.0
Family size				
Mean	3.39	2.90	3.69	2.57
SD	1.95	1.77	2.03	1.40
Number of earners				
Mean	1.75	1.20	1.55	1.39
SD	1.22	0.98	1.10	1.03
Family type (%)				
Husband and wife only	14.9	10.0	9.2	25.8
Husband and wife with children	40.1	20.8	39.7	33.4
All other husband and wife families	12.6	6.4	12.2	3.4
Single parent with child	3.7	17.5	8.5	4.1
Single consumers	15.3	24.7	12.9	24.7
Other families	13.5	20.7	17.3	8.6
Tenure choice (%)				
Renter	35.1	50.6	51.6	25.4
Home owner with mortgage	48.2	33.2	34.5	47.3
Home owner without mortgage	16.7	16.2	13.9	27.3
Region (%)				
Northeast	9.5	18.8	16.8	25.8
Midwest	4.5	24.8	5.6	30.0
South	7.2	46.7	36.1	24.3
West	78.8	9.7	41.5	20.0

a. Mean is in 1992 dollars.

TABLE 3: Mean Budget Share Differences in Percentages Between Asian Americans and Other Ethnic/Racial Groups (with *t* test results)

Expenditure Category	*Asians*	*Blacks*	*Hispanics*	*Whites*
Food at home	17.4	21.6***	23.6***	16.4*
Food away from home	5.4	3.4***	3.8***	5.6
Shelter	27.8	22.4***	25.1**	22.2***
Fuel and utilities	7.9	15.4***	10.5***	10.9***
Household equipment/operation	4.8	4.0**	4.2	5.7**
Apparel	5.2	6.4***	6.0**	5.7*
Entertainment	4.8	3.3***	3.8***	5.6***
Transportation	14.4	12.7***	13.7	14.3
Education	3.1	1.5***	1.2***	2.0***
Health care	6.0	4.9**	4.8**	7.4***
Alcohol	1.2	1.1	1.1	1.5
Tobacco	1.0	1.8***	1.0	1.5***
Personal care	1.1	1.5***	1.1	1.2

NOTE: The *t* tests performed are based on unequal variances if the null hypothesis of equal variance is rejected. If not, then the *t* tests are performed based on equal variance assumpton.
*Significantly different at 90% level. **Significantly different at 95% level. ***Significantly different at 99% level.

their budget on food at home, but less on household equipment and operation, entertainment, health care, and tobacco products. Asian American households also allocated more of their budget to household equipment and operation and transportation, but less to tobacco products, compared with Black households. Keeping in mind that these *t* tests are not adjusted for households' economic and demographic characteristics, we conclude that the observed budget allocation patterns were significantly different between Asian American households and Black, Hispanic, and White households. In the demand analysis, differences in household characteristics are taken into consideration. By controlling for household characteristics other than Asian American households' ethnic background, the effects of their ethnicity are isolated and analyzed.

The LA/AIDS is estimated using an iterative seemingly unrelated regression (ITSUR) method. The R^2s range from .10 to .47, with food at home, shelter, utilities, transportation and health care having R^2s higher than .30 and education having the lowest R^2 (.10), followed by alcohol (.11). Due to space limitations, only selected results are reported in this article. Full estimation results of the LA/AIDS demand system are available from the author on request.

TABLE 4: Simulation Results: Adjusted Budget Share Differences in Percentages Between Asian Americans and Other Ethnic/Racial Groups (with F test results)

		If Asians Were		
Expenditure Category	*Asians*	*Blacks*	*Hispanics*	*Whites*
Food at home	17.4	17.0	18.5**	17.5**
Food away from home	5.4	4.2***	4.9	5.1
Shelter	27.8	23.0***	26.2	23.6**
Fuel and utilities	7.9	11.5***	8.9*	9.2**
Household equipment/operation	4.8	5.2	5.1	5.5*
Apparel	5.2	7.1***	6.2**	5.5
Entertainment	4.8	4.6	4.6	5.9***
Transportation	14.4	15.6*	14.9	14.7
Education	3.1	2.3***	1.9***	2.1***
Health care	6.0	5.4**	6.0**	6.7
Alcohol	1.2	1.3	1.3	1.4*
Tobacco	1.0	1.1	0.5**	1.5***
Personal care	1.1	1.7	1.0	1.2

NOTE: The numbers in this table should be read as follows (using line one as an example): Asian American households in the sample allocated 17.4% of their budget to food at home, on average. If these Asian American households were Hispanics, they would have allocated 18.5% of their budget to food at home, on average. This difference is significant at the 95% level.
*Significantly different at 90% level. **Significantly different at 95% level. ***Significantly different at 99% level.

The results of the joint *F* tests are presented in Table 4. The mean simulated budget shares are also reported in the same table.

If Asian American households in the sample were Black households, then they would have allocated significantly more of their budget to fuel and utilities (11.5% instead of 7.9%), apparel (7.1% instead of 5.2%), and transportation (15.6% instead of 14.4%), on average. At the same time, they would have allocated significantly less of their budget to food away from home (4.2% instead of 5.4%), shelter (23.0% instead of 27.8%), education (2.3% instead of 3.1%), and health care (5.4% instead of 6.0%). Asian American households were significantly different from Black households in 7 out of 13 expenditure categories.

If Asian American households in the sample were Hispanic households, they would have allocated significantly more of their budget to food at home (18.5% instead of 17.4%), fuel and utilities (8.9% instead of 7.9%), and apparel (6.2% instead of 5.2%), on average. They would have allocated significantly less of their budget to education

(1.9% instead of 3.1%), health care (5.9% instead of 6.0%), and tobacco (0.5% instead of 1.0%). Overall, Asian American households were significantly different from Hispanic households in 6 out of 13 expenditure categories.

When compared with White households, Asian American households were significantly different in 8 out of 13 expenditure categories. On average, if the Asian American households in the sample were White households, they would have spent more on food at home (17.5% instead of 17.4%), fuel and utilities (9.2% instead of 7.9%), household equipment and operation (5.5% instead of 4.8%), entertainment (5.9% instead of 4.8%), alcohol (1.4% instead of 1.2%), and tobacco (1.5% instead of 1.0%). They would have spent significantly less on shelter (23.6% instead of 27.8%) and education (2.1% instead of 3.1%).

DISCUSSION

The hypothesis that Asian Americans spend more of their budget on shelter than other ethnic/racial groups has been partially confirmed. Three explanations can be offered for this: (a) Family kinship is important and the home is the most important place for families to spend time together. (b) Asian American households have a very strong saving and investment incentive (Fost, 1990; Maher, 1986), and expenditure on housing is widely perceived by Asian Americans as an investment rather than an expenditure, given the high appreciation rate of housing in the past 20 years. (c) Being minority and/or immigrant families, having a nice home is a way of showing others that the family is doing well economically, a way of showing status and gaining respect from friends and relatives. On the other hand, the high housing expenditure may be also related to high housing prices in the coastal cities of California, where many Asian American households reside. Due to data limitations discussed in the data section, the whole western region is treated as if all the western states had the same housing prices, which was not so for the sample period.

The hypothesis that Asian Americans spend more of their budget on education also has been confirmed. There are three possible explanations: (a) Asian Americans are influenced by the Confucian ethic, which promotes respect for education and gaining status through education. (b) Many Asian Americans are new immigrants to the United States. Because of the U.S. immigration policy, new immi-

grants (other than refugees) are usually well educated in their country of origin before their immigration. Self-selection of this immigration group also has an important impact on its emphasis on education, especially for Asian Indians, who are not influenced by Confucianism. (c) To fight with unequal opportunities caused by racial discrimination, many Asian Americans choose to get a better education to stay competitive in the job market. The well-known fact that unproportionately high numbers of Asian American students are currently enrolled in colleges and universities, particularly in science and engineering majors, should support the above arguments.

Rejecting the hypothesis that Asian American households spend more on food at home and less on food away from home, it is found that Asian American households spend significantly less on food at home than both Hispanic households and White households and more on food away from home than Black households. Evidently, eating out can be a family activity and, therefore, is not necessarily less family oriented than eating at home. In addition, very inexpensive Asian restaurants are quite readily available in most major cities where Asian Americans reside. The relatively low cost of eating out may have contributed to the high budget share for food away from home for Asian Americans. Although the prices for food away from home are controlled in this study, the data are not detailed enough to distinguish different prices charged by different types of restaurants. Neither do the data have information on the kind of restaurants to which the households in our sample went.

The finding that Asian American households spend less of their budget on fuel and utilities may be less culture related but more need based. First, because Asian Americans spend more money on housing, their houses may be newer and more energy efficient. Second, many Asian American households reside in coastal cities in California, where weather is quite mild and little heating or cooling is needed. Although this study takes regional differences into consideration, climate differences within the western region are not controlled.

Asian American households are also found to spend significantly less of their budget on apparel than Black and Hispanic households, holding other things equal. Past research has documented that Black households spend more money on clothing. Dardis et al.'s (1981) explanation for this finding was that clothing is a compensatory consumption item. Clothing compensates for Black people's lack of access to other material items that give a visual representation of status. Thus, clothing serves as a status symbol for Black consumers

and improves their self-esteem (Alexis, 1962; Andreasen & Hodges, 1977; Bauer & Cunningham, 1970a, 1970b; Johnson, 1981). The same argument can be made about Hispanic households.

In addition, Asian American households are found to spend significantly less on household equipment and operation, entertainment, alcohol, and tobacco than White households, holding other things equal. Asian Americans may spend less money on household services such as day care and household cleaning services because in traditional Asian culture, the grandparents usually help raise grandchildren in the family and help with cooking and cleaning. Asian American households in the sample had the highest percentage of extended families[5] (12.6% vs. 3.4% for White households). Although family composition is controlled for this study, the functions performed by household members in the same age range may be quite different due to different ideas of family role-playing. When it comes to entertainment, Asian Americans may be more likely to gather with relatives and friends than to pay for entertainment events because entertainment events originating in Asian countries, such as Chinese opera, are not readily available in most U.S. cities. It is not clear why White households have a higher expenditure on alcohol and tobacco compared with Asian American households.

Finally, Asian American households are found to spend significantly more of their budget on health care, compared with Black and Hispanic households, holding other things equal. The difference can be caused by inadequate insurance coverage for Black and Hispanic Americans. Past studies have shown that Blacks are heavy users of emergency rooms at hospitals and public health clinics where they do not have to pay for health care at the time of service or can receive care at minimum cost (Aday, Fleming, & Andersen, 1984; Annas, 1986; Berkanovic & Reeder, 1973; Dutton, 1979; Gibson, 1973; Gold, 1984). Estrada, Trevino, and Ray (1990) found that Mexican Americans have the highest rate of being uninsured for medical expenses in the country. The CEX data set, with limited information on health insurance and health status data, does not allow for detailed examination of this issue.

CONCLUSIONS AND IMPLICATIONS

The purpose of this study was to analyze the differences in household budget allocation patterns for Asian American households com-

pared with three other ethnic/racial groups: non-Hispanic Black, non-Hispanic White, and Hispanic households. Findings suggest that Asian Americans, a growing minority group in the United States, are indeed different in their household budget allocation patterns compared with other ethnic/racial groups. They allocate more of their budget to education, but less to fuel and utilities than all other three ethnic/racial groups, holding income, prices, and other sociodemographic factors equal. They also allocate more of their budget to shelter and health care, but less to food at home and apparel, than two out of the three other ethnic/racial groups.

The results of this study may be used by consumer educators and financial planners to help Asian American households who are at a relative economic disadvantage and in financial trouble. To better help these troubled households, consumer educators and financial planners need first to understand the households they are helping. The information provided in this study is especially useful to them in understanding the specific needs and preferences of Asian American households that are rooted in their cultural traditions and values.

The results of this study may also be useful for producers to better meet Asian American households' needs. By understanding and recognizing differences in budget allocation patterns between Asian American households and households of other ethnicity/race, the producers can better identify market segments for their line of products so that more information can be provided to the specific market segment to increase market efficiency, especially in those areas where the proportion of Asian American population is high. On the other hand, special consumer needs can be better identified and product design can be more customized. An example of this is the housing market in the western region, where many of the Asian American households reside. Given the information that Asian American households allocate more of their budget to shelter than other ethnic/racial groups, housing developers can target this Asian American market segment by analyzing their special housing needs and by building houses that match their tastes.

Although the importance of ethnicity/race in expenditure and consumption studies has been widely recognized in recent years, the classification of ethnic/racial groups has been problematic in the empirical literature, especially when sample sizes are small and combined ethnic/racial groups have to be formed. The results of this study can provide some guidelines for combining Asian American households with other ethnic/racial groups in expenditure studies so that

households within the combined group can be as homogeneous as possible. The results of this study suggest that for different expenditure categories, the choice of combined ethnic/racial groups should be different. For example, for expenditure studies on food at home, Asian American households and Black households can form one combined group because their budget allocation patterns for this expenditure category are not significantly different. However, when the expenditure on shelter is of interest, Asian American households and Hispanic households should be in one combined group, whereas Black and White households should form another group.

Although this study has shed some light on the expenditure patterns of Asian Americans compared with three other ethnic/racial groups, it has some important limitations. First, even with 13 years of CEX data, the sample size of Asian American households is limited to 222, which is still quite small for a cross-sectional study. Second, the ACCRA data set is not completely compatible with the CEX and CPI data. Better price data, especially data on price differences in different areas of the United States, are needed to better control for price variations. Third, due to limitations on sample size and information availability in the data set, Asian Americans and Pacific Islanders are treated as one uniform entity in this study. Previous research has suggested that Asian Americans are not a simple homogeneous group (Barringer et al., 1993). Although most of them do share some common cultural values and traditions, as demonstrated in this study, their differences need to be kept in mind when interpreting the results of this study. Further research is needed to explore this issue when better data sets become available.

APPENDIX

This is an example of the data construction process.

STEP 1

For Northeast region cities with populations between 500,000 and 1,200,000 (Northeast B), the CPI sample areas and population weights are (a) Hartford-New Britain-Middletown, CT, metropolitan statistical area (MSA; population weight 0.911); (b) Syracuse, NY (population weight

(continued)

APPENDIX Continued

0.767); (c) Springfield, MA, MSA (population weight 0.847); and (d) Scranton-Wilkes-Barre, PA (population weight 0.974) (U.S. Bureau of Labor Statistics, 1992, pp. 217-220).

In 1990 ACCRA data, the health care price index numbers for these four areas are (a) 133.6 for Hartford-New Britain-Middletown, CT, MSA; (b) 116.9 for Syracuse, NY; (c) 113.2 for Springfield, MA, MSA; and (d) 88.6 for Scranton-Wilkes-Barre, PA (ACCRA, 1990). A price index number of 100 is the national average for that year.

The 1990 health care price index number for Northeast B is a weighted average of prices in these four areas. The price index number is computed using the following formula:

$$P_{accra(90)} = \frac{[(133.6 \times 0.991) + (116.9 \times 0.767) + (113.2 \times 0.847) + (88.6 \times 0.947)]}{(0.911 + 0.767 + 0.847 + 0.947)} = 112.95.$$

Using the same method, the 1990 health care price index number for Northeast A (areas with populations more than 1,200,000) is 134.62.

STEP 2

The CPI numbers for health care for Northeast A and B are as follows. Notice that the average price index numbers for 1982-1984 are 100 for both areas.

TABLE 1A: CPI Numbers for Northeast A and B

	1980	*1981*	*1982*	*1983*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991*	*1992*
A	76.65	84.10	91.93	100.55	108.55	116.85	126.33	134.95	144.10	155.53	170.79	185.98	199.97
B	75.20	83.18	92.60	99.85	108.48	115.10	124.80	131.88	139.50	150.93	168.25	181.18	197.88

From Step 1, we know that the 1990 area price index numbers for health care are 112.95 for Northeast B and 134.62 for Northeast A. The following formula is used to create the new index numbers, which take area price differences into consideration:

$$P_{new(year)} = (P_{cpi(year)} / P_{cpi(90)}) \times P_{accra(90)}.$$

For example, for Northeast B in 1980, the new health care price index number is

$$P_{new(80)} = (P_{cpi(80)} / P_{cpi(90)}) \times P_{accra(90)} = (75.20 / 168.25) \times 112.95 = 50.48.$$

For Northeast A in 1980, the new health care price index number is

$$P_{new(80)} = (P_{cpi(80)} / P_{cpi(90)}) \times P_{accra(90)} = (76.65 / 170.79) \times 134.62 = 60.42.$$

STEP 3

Match the new price index numbers with information provided in the CEX on the size of the metropolitan area where the household resided.

NOTES

1. Related to the use of budget share as the dependent variable and total expenditure as an independent variable, there are two issues. One is an econometric issue of whether the estimates are still unbiased, efficient, and consistent after the expenditure on a certain commodity is deflated by total expenditure. Past research has shown that when the expenditure on a certain commodity is used as the dependent variable, the error term usually exhibits heteroscedasticity, because households with higher levels of total expenditure tend to have higher variance in their expenditure on a certain commodity than households with low levels of total expenditure. To correct for heteroscedasticity, one common approach is to (a) assume that the standard error of the error term is proportionate to total expenditure and (b) use total expenditure as a deflator, resulting in the dependent variable being a budget share (Pollak & Wales, 1992). The resulting estimates are better than estimates from equations using the expenditure as the dependent variable, in that they are more efficient and the standard errors of the coefficients are unbiased. For a proof of this, see Johnston (1984, pp. 291, 302).

The second issue is the question of spurious correlation between the budget share and total expenditure, because total expenditure is used as a denominator to form the budget share. Kuh and Meyer (1955) investigated this issue and concluded that when the hypotheses to be tested are formulated in the share form, which is the case in this study, then the question of spurious correlation simply does not arise. Maddala (1992, p. 216) also provides some summary discussions on this issue.

2. From Maddala, 1983, p. 222, we have

$$\begin{aligned} E(y_i) &= Prob(y_i > 0) \times E(y_i \mid y_i > 0) + Prob(y_i \le 0) \times E(y_i \mid y_i \le 0) = \Phi_i \Sigma \beta_{ih} X_h + \sigma_i \phi_i \\ &= \Sigma \beta_{ih} X_h [1 - (1 - \Phi_i)] + \sigma_i \phi_i = \Sigma \beta_{ih} X_h - \sigma_i (1 - \Phi_i)(\Sigma \beta_{ih} X_h / \sigma_i) + \sigma_i \phi_i \\ &= \Sigma \beta_{ih} X_h + \sigma_i [\phi_i - (1 - \Phi_i) \sum_{h=1}^{n} \tau_{ih} X_h], \end{aligned}$$

where

$$\sum \beta_{ih} X_h / \sigma_i = \sum_{i}^{n} \tau_{ih} X_h.$$

This approach is similar to Greene's (1990, pp. 729, 732). However, Greene's formula appears to contain a mistake.

3. Asymptotic χ^2 tests are performed to test the homogeneity and symmetry restrictions (Judge, Hill, Griffths, Luetkepohl, & Lee, 1988, p. 458; SAS Institute Inc., 1988, pp. 64-65). Both restrictions are not rejected at the $\alpha = 10\%$ level (p values are .5 for homogeneity and .5 for symmetry).

4. Due to the use of the two-stage tobit method,

$$\sum_i \sigma_i[\phi_i - (1-\Phi_i)\sum_{h=1}^{n} \tau_{ih} X_h] = 0$$

is implemented instead of

$$\sum_i \sigma_i = 0.$$

5. Extended families are husband/wife families (with or without children) with other family members, such as grandparents or siblings, living with them.

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