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Food Stamps, Food Insufficiency and Health of the Elderly

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ABSTRACT

Our overarching goal is to understand critical determinants of low-income elderly Americans' well being as measured by health status. We focus on whether and how elderly health status is affected by FSP participation, food sufficiency and other determinants. To do so we must first ascertain (1) why so few needy elderly households choose to receive food stamps; (2) what determines their level of food insufficiency and finally; (3) how FSP participation and food insufficiency link to each other and then to health status. To meet our goal, we estimate and assess a unique econometric framework applied to an analysis database created specifically for this project. The analysis data are a subset of elderly households from the 2002 Health and Retirement Survey (HRS), consisting of those eligible for food stamps. State-specific eligibility criteria were obtained from the Urban Institute's waiver database and from Center on Budget and Policy Priorities publications. The econometric model is structured in two steps. In the first, simultaneous multivariate Probit estimates of endogenous FSP participation and food insufficiency equations are estimated. From the results, we calculate predicted probabilities of participation and insufficiency for use in Step Two. This final step involves Ordered Probit estimation of self-reported health status. Because predicted variables from Step One are included as explanatory variables, we adjust the standard errors of the Ordered Probit estimates to allow for accurate hypothesis testing. We extend Murphy and Topel's (1985) modification of standard errors for one predicted variable to handle two such variables. After correcting the standard errors, some coefficients lose their significance; most importantly, the positive coefficient for the probability of FSP participation. The significant coefficients that remain are: food insufficiency (+) income (-), widowed (+), Nonhispanic Black (-), exercise (-) and drink alcoholic beverages (-).

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For elderly Americans, the War on Poverty was remarkably successful. Poverty rates for the elderly fell from nearly a quarter in 1968 to just less than a tenth in 2006. Even so, there is still a large number of poor and near-poor elderly citizens, living in households that are unable to purchase minimal levels of necessities for their household members. Many others face that risk, but the percent is substantially higher among the elderly. Twenty-three (21) and 36 (30) percent of the elderly (nonelderly) had incomes below 150 and 200 percent of the poverty thresholds, respectively (Clark *et*. *al*. 2004, p. 51). Many need assistance from the only universal nation-wide welfare program for the poor and near poor in this country, the Food Stamp Program (FSP).[1] These households are the focus of this study.

Despite the limitations they face in purchasing food and other necessities, participation in the FSP by eligible elderly households remains low, roughly half the rate of all households. Wilde and Dagata (2002) indicate that about a third of eligible elderly people over age 60 receive Food Stamps despite the program's special provisions for them, particularly with respect to out-of-pocket medical expenses. Rosso (2001) and this study confirm that, finding elderly participation rates of 32 percent in 1999 and 31

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[1] The Food Stamp Program has been renamed to the Supplemental Food Assistance Program. Because our data cover a period with the original name, we use that name herein.

percent in 2002, respectively. This low level of participation is troublesome. Eligible nonparticipants do not have enough resources to purchase a minimally nutritionally adequate diet. Further, some elderly households may have insufficient food, where insufficiency is defined as needing to skip or skimp on meals because there isn't enough food in the house or enough money to buy necessary food. The presence and degree of food insufficiency and the outcome of the FSP participation decision may affect the health status of the elderly. These linkages are not well understood and this research attempts to fill this knowledge gap in the literature.

Our overarching goal is to understand critical determinants of low-income elderly Americans' well being as measured by health status. We focus on whether and how elderly health status is affected by FSP participation, food sufficiency and other determinants. To do so we must first ascertain (1) why so few needy elderly households choose to receive food stamps; (2) what determines their level of food insufficiency and finally; (3) how FSP participation and food insufficiency link to each other and then to health status. The insights gained will be particularly timely and useful due to a tripartite set of changes. More specifically, policy makers need appropriate information and tools to buffer the elderly from the impacts of these changing demographics, economic realities, and other policy pressures.

The major demographic changes are: (1) as a group, the elderly make up an increasing share of the total population and (2) life spans are growing longer. Both trends are expected to continue. Based upon her analyses of U.S. Census Bureau estimates and

projections, Rogers (2002) reports that the population of age 65 and older is expected to more than double from 35 million in 2000 to 82 million by 2050 and the number of persons of age 85 and older is expected to increase nearly five-fold over the same period, making the group containing the oldest old (ages 85+) the fastest growing segment of the elderly population. They will represent 12.6 percent of the 65-and-older population by 2020, with this percentage doubling by 2050. A consequence of longer life spans is that savings for retirement, once thought to be ample, may prove inadequate. As the elderly age, the odds of running through personal resources increase as do the associated odds of becoming poor and staying poor through extended old age. Given that one requirement for FSP eligibility is that countable assets be below a certain threshold, we should expect more elderly to become asset-eligible for food stamps as they age.

Even without longer life expectancies, the threat of poverty for the elderly increases due to recent and likely future economic realities. Three major sources of financial security for the elderly in the past have been or soon will be under attack: the value of home equity, values of other financial assets and benefits from Social Security, Medicare and Medicaid. Over the last 1-2 years, the bursting of the housing bubble lead to an almost free fall in housing values and a virtual inability to even place a value on residential mortgage-backed securities. The associated banking crisis and Great Recession dramatically reduced the values of stocks and bonds and interest rates earned in retirement portfolios. Lastly, future Social Security, Medicare and Medicaid benefits per elderly beneficiary will likely be cut to cope with the high costs of covering the surge of retiring Baby Boomers.

Since 1970, approximately 90 percent of elderly Americans receive Social Security benefits. Based on Census data, Porter, *et*. *al*. (1999), analysts at the Center on Budget and Policy Priorities, indicate that if it weren't for those benefits, the elderly (65+) poverty rate would have been 47.6 percent in 1997 rather than the actual 11.9 percent (Porter *et*. *al.,* 1999, p. ix). According to Clark *et*. *al*. (2004), Social Security benefits currently constitute forty percent of income for the population aged 65 and older and the majority of income for low-income elderly and the very old. More specifically, the elderly in the lowest two income quintiles receive 80 percent of their income from Social Security while elderly persons of age 85 and older receive 60 percent of their income from Social Security (Clark *et*. *al*. 2004, pp. 39-41). Because these benefits are such a high proportion of their incomes, reducing real benefit levels to all Social Security recipients will hit low-income and very old elderly Americans hard and could well place a large portion of them in jeopardy; driving some closer to, back into, or deeper into poverty and, thus, more in need of Food Stamps.

With respect to Medicare benefits, the proportion of beneficiaries as a share of the US population is projected to grow from 13.8 percent in 2000 to 20.6 percent in 2025 as reported in Table ES-1 of Maxwell *et*. *al*. (2000). While the effect of health care reform on Medicare is not included in their calculations, they further report that projected out-of-pocket spending for medical care over that same period is expected to grow from 21.7 to 29.9 percent of income for all elderly beneficiaries and from 51.6 percent to 71.8 percent of income for low-income ailing single women over age 85 (2000, Table 1). Thus, medical expenses have real potential for crowding out spending on other necessities such

as food. The crowding-out would be even more severe if Medicare benefits were

reduced. Regardless, low income elderly Americans may have to choose between

skipping medicines or doctor's appointments and skipping or skimping on meals.[2]

Because the FSP uniquely deducts out-of-pocket medical expenses for the elderly when

determining eligibility and food stamp benefits, the program can be a buffer and reduce

the pressure to make such difficult tradeoffs among necessities.[3] For this reason alone,

many elderly now do and many more are likely to need assistance from the FSP.

To achieve our overarching goal of understanding the well-being of elderly Americans

we consider the linkages among health status, FSP participation and food insufficiency.

This investigation requires rich data, careful accounting for state-by-state program

differences when determining FSP eligibility, and appropriate econometric modeling of

eligible elderly households' behaviors. This study takes into account all these

considerations.

We proceed as follows: First, this research is placed in the context of extant relevant

economic, nutrition, health and policy economic literatures. Then, a more detailed

description of data sources for this study is presented. The major data source is the 2002

panel of the Health and Retirement Survey (HRS). Next we build our economic and

econometric models and develop our estimation protocol. We construct and estimate an

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[2] We note another documented tradeoff low income households must make (Battacharya, *et. al.*, 2003), particularly in parts of the country with very cold winters, food and home fuel. These Americans face a tradeoff between paying to heat the home in the winter months and paying for food. We do not account for this relationship in our research.

[3] A further buffer was included in the 2008 Farm Bill. A provision was enacted to remove the cap on the dependent care deduction for all food stamp applicants.   This provision will be a boon for the elderly, particularly those utilizing elder day care programs or in-home elder day care.   Removing the cap enhances the likelihood of FSP eligibility and increases FSP benefits for participants.

econometric model that accounts for the possible simultaneity between FSP participation and food insufficiency and corrects for the use of predicted probabilities as explanatory variables in the health status equation. Finally, we present results and implications, and conclusions and suggestions for further research.

Literature Review

Research on Health

Although linkages among income, nutrition and health have been extensively studied in the health economics literature, relatively less research on this area has focused on the elderly. Deaton and Paxson (1998a, 1998b) have conducted research on life cycle patterns of health and nutrition-related indicators (e.g., self-reported health status and body mass index) and their relationships with income. The authors provide strong evidence on the suitability of using such indices in longitudinal analyses and show that health status is positively correlated with income. They show that this correlation is weak among the youngest; increases up to age 60 and then starts to decrease. Their findings agree with Smith and Kington (1997), who apply the concept of a socioeconomic status-health gradient to show that health produces contemporaneous and long run feedbacks on economic status, implying simultaneity between these variables.

Other income-nutrition-health status studies have focused on the more vulnerable elderly given their economic and health conditions (e.g., Zheng, 1999; Stum et al, 1998; Smith and Kington, 1996; von Weizsacker, 1996). For instance, Zheng (1999) addresses the effect of income in determining health status in U.S. elderly Medicare beneficiaries.

Stum et al. (1998) use the National Long-Term Care Survey to examine whether medical

expenses are financially burdensome for disabled elders and to determine what factors are

likely to put disabled elderly at risk of financial burden. Smith and Kington (1996)

investigate the health outcomes resulting from alternative sources of income including

the implications for gender, racial, and ethnic differences. In short, the health economics

literature indicates that: (1) there is strong evidence that income is positively correlated

with health status. (2) This relationship is simultaneous and changes during the life

cycle. Finally, (3), the most vulnerable groups (i.e. low income and/or deficient health)

are likely to be at risk and therefore policy intervention is required. Finally, this literature

suggests the importance of understanding the linkages between economic variables and

nutrition and health outcomes in order to effectively improve the welfare of the elderly

via public policy.

While the data we use in this study does not allow detailed look at food intakes, the fact

that expenditures fall and the need for more nutrient dense calories increases as the

elderly age suggest the potential for an increasing incidence if diet-related health

problems especially for the oldest old. Studies along these lines were lead of by Harris

and Blissard (2002), who confirm the decline in food expenditures as the elderly age.

They indicate that households with heads of ages 65-74 and 75+ respectively spend

$41.44 and $32.11 per capita per week. This decline generates a further concern

regarding composition and sufficiency of the diets of the elderly. In a study identifying

the gaps between food intakes and the Pyramid recommendation of the U.S. population,

McNamara, Ranney, *et al*., (1999) found that elderly individuals (age 60 and above) met

the recommendations for only one of the five food groups, vegetables. The largest gap

was in the dairy group, with the elderly consuming on average only 57 percent of the

recommended amount. Given the seriousness of osteoporosis in the elderly, the latter

result is of particular concern. Further, declining energy needs comes with aging.

Guthrie and Lin (2002) assert that the elderly, "… must eat better while eating less" (p.

1). Further, Ranney and McNamara (2002) find that, while the cost of attaining a

healthier diet is not large for the overall population (5 to 10 dollars per month per

individual in the household), this expense may be difficult for low-income households to

afford, especially those containing the elderly.

Research on the Food Stamp Program

The goal of the Food Stamp Program (or SNAP) is described by Nord and Golla (2009,

p,iii), as, "SNAP [FSP] benefits are intended to increase the access of low-income

households to food and a nutritious diet to improve their food security." There is a long

history of research on the FSP by many disciplines. Economists are bemused and

challenged by the persistence of this major in-kind transfer program. Microeconomic

theory implies that in kind benefits can restrict and that giving assistance in cash would

expand the choice set. Even so, a reasonable projection from the past to the foreseeable

future suggests changing to cash benefits is not politically feasible or likely. Nutritionists

view this large food assistance program as a major opportunity to enhance the amount

and composition of food intakes and thereby enhance the health and well-being of the

low-income U.S. population. Given the durability and magnitude of the program, much

research has been done. Nutritionists, economists, other researchers and policy makers

undertake analyses of how the program is working and how it might be redesigned to best achieve its objectives. While they primarily focus on the entire U.S. population and only rarely on the elderly (see Haider, *et*. *al*. 2003 for an exception), these studies often relate program participation to a variety of other outcomes such as food demand, food intake, nutritional status, labor supply, food sufficiency and food security.

Over time there have been at least three major reviews of the food stamp program literature. One focused on how food stamps affected food consumption (Fraker, 1990). Another reviewed the literature on how food assistance and nutrition programs affected nutrition and health (Fox, et. al. 2004).   The large body of research reviewed in these two indicates that FSP benefits increase food spending. It also shows that the program may affect household food supplies by enhancing nutrient availability but is unclear about whether individual nutritional intake is improved. (Wilde. 2008, p. 307). These reviews were conducted before the major advent of food insecurity food stamp research. The more recent review, by Wilde (2007) addresses this literature and will be discussed in the next section.

Research on Food Sufficiency and Security and Linkages to FSP Participation
The similarities and differences between food security and food sufficiency require clarification. First, these terms are often found in their negative forms, insecurity and insufficiency, respectively, as in our title,   Second, various surveys have yielded slightly different definitions for food insufficiency based upon the number and wording of insufficiency related questions included in the questionnaire.   Herein, we define a

household to be food insufficient if household member(s) skipped or skimped on meals because they didn't have enough food in the house. The actual questions asked in the HRS are listed in Appendix C Part I. Food sufficiency questions preceded the development of the official food security measure.

The conceptual definition of food security is: All household members have access at all times to enough food for an active healthy life (Nord *et. al*., 2009). The official measure of the food security status of a household is calculated from their answers to questions in the Food Security Supplement (FSS) to the December Current Population Survey (CPS). Unlike food sufficiency, there is only one method for calculating food security. There are 18 specific questions asked; only ten if there are no children in the household. These questions are delineated in Appendix C Part II. Based upon the answers, the household is identified as having high, marginal, low or very low food security. If the scoring yields high or marginal, the household is considered food secure while low or very low indicate food insecurity (USDA, 2008a). When respondent burden is of particular concern, there is also a 6-question version of the FSS and an associated scale (USDA, 2008b). It is interesting to note that question No. 4 is almost identical to the question we use to define food sufficiency.   In that sense and temporally, food sufficiency can be considered a precursor to the development of the measurement of food security.

Wilde (2007) presented a thoughtful categorization of the research on how the FSP affects food security and hunger. He developed a set of seven categories to describe the research approaches used to quantify the effects on food stamps on food insecurity.

Those include: (1) Controlling for other observable variables; (2) Jointly modeling the effect of food stamps on foods insecurity and vice versa; (3) Using longitudinal or panel data; (4) Using propensity score matching; (5) Using a "dose-response" approach; (6) Exploiting "natural experiments"; and (7) Using random-assignment research design (Wilde, 2007, pp. 307-309).

Our research falls squarely in Wilde's second approach, that of modeling of FSP participation jointly with food insufficiency/insecurity using alternative simultaneous equation models to handle the endogeneity between participation and food security. As reported by Wilde, the findings vary. Compared to naïve models, Gunderson and Oliviera's (2001) approach eliminated the troublesome positive relationship between participation and insufficiency. Jensen (2002) found a negative relationship between participation and insecurity. Huffman and Jensen (2008), after adding in a labor supply equation to the simultaneous system, found that food insecurity with hunger positively affects FSP participation but that FSP participation has no effect on food insecurity. One article, published after the Wilde piece, also falls within this category, that of (Yen, *et.al.* 2008). They account for endogeneity with an instrumental variable (IV) approach and find that FSP participation reduces food insecurity.

Wilde's third research category relates to using longitudinal or panel data and that research is beginning to yield some interesting results. The research reported by Wilde (2007) indicated some reductions in troublesome results but did not put an end to those problems. A later article by Nord and Golla (2009) is suggestive and may provide the

clearest view of the relationships of interest, showing that shortly after beginning on the FSP, food insecurity is reduced. Given that the HRS data is a panel data set, it certainly could be used in that fashion in the future. This report utilizes, however, utilizes a cross section from the HRS.

While our research does fit within Wilde's second research approach, our modeling and policy contributions go well beyond the research reviewed therein. First, we focus on the elderly; second, we add the important dimension of considering how the FSP and food insufficiency affect the health of the elderly. Third, we extend prior econometric methods to the case at hand. Finally, we utilize and construct available data in creative ways.

Data

The predominant data utilized are the Health and Retirement Survey data from the year 2002 panel from the Health and Retirement Study (HRS). This is a national panel study with an initial sample of about 22,000 residents of the United States over the age of 55. The survey includes ample information on demographics, health care utilization, health status, employment, family structure, income, expenditures, participation in government programs, and event histories. Of the over 200 published research articles using the HRS across a broad array of disciplines, only the Haider, et.al. (2003) piece mentioned earlier, considers FSP participation by eligible elderly households.

Information on 18,167 respondents from the 2002 data with no relevant missing

information were allocated to their respective households and weighted to reflect U.S.

households with a head of age of age 60 years or more. Selected descriptive statistics

regarding FSP participation of these households are presented in Table 1. It is important

to note that FSP participation rates begin with only four percent of all elderly households

and raise to 11.2 percent of low-income elderly single-person households. Actual

eligibility was not calculated for the weighted data in this table. Our and other studies

show that approximately 30 percent of *eligible* elderly households participate in the

program.

The ideal estimation sample would be drawn from the population of elderly households

eligible for food stamps. However, precisely which households are eligible is not known

a priori. Determination of eligibility is complicated especially after the 1996 welfare

reform statutes were activated at the state level. Even so, we do determine whether each

of the households in the survey is eligible for food stamps.   To do so, we match the state

of residence for each HRS household to state-level eligibility rules from the Urban

Institute's waiver data base and from the Center on Budget and Policy Priorities reports.

Table 1: Food Stamp Program (FSP) participation by Single Person and Low-Income Elderly Households[1]

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Characteristic	Number and Percent of Households
Elderly households	36,457,956
FSP participants	1,451,731
Percent participating	4.0
Elderly single-person households	16,737,945
FSP participants	1,021,642
Percent participating	6.1
Low-income elderly households[2]	13,446,749
FSP participants	1,316,267
Percent participating	9.8
Low-income elderly single-person households[2]	8,460,582
FSP participants	945,328
Percent participating	11.2

[1]These statistics come from a sample of 18,167 residents, less than the full sample of some 22,000. Residents were then assigned to their households. Residents or households were dropped from their respective samples if they had missing values for any of the variables included in the table. The final unweighted sample included 12,350 households.
[2]Low-income = gross income less than or equal to 200% of DHHS poverty level.

Source: 2002 Health and Retirement Survey weighted data

Our precise method for determining program eligibility is specified in detail in Appendix A.   After following that method, we find 1,608 HRS households with financial respondents of age 60 or greater to be eligible for food stamps and 1357 of the households having complete information on the variables utilized in our analyses. These constitute our eligible estimation subsample. Table 2 contains variable definitions and descriptive statistics for this group.

Methods

Theoretical Framework

Individuals maximize utility subject to the budget constraint. Utility is a function of food (F), health (H), and other goods and services (Z), and if a person collects food stamps, stigma (S) associated with participation (FS) in the Food Stamp Program. Aside from transaction costs associated with establishing and maintaining eligibility, stigma or lack of information explain why people might not participate. Stigma associated with welfare programs in general (Moffitt, 1983) and the FSP in particular

(Ranney and Kushman, 1986) not only affects participation but also might be the most important factor, given the implication of economic theory that people should always accept additional unstigmatized income. Stigma can be modeled as a latent variable manifested through non-participation. Lack of knowledge of the FSP program or that one is eligible could also lead to not applying. A few people, especially isolated and

Table 2: Variable Definitions, Means & Standard Deviations

Variable Categories and Names	Variable Definitions	Mean	Std. Deviation
DEPENDENT			
PARTICIPATION	Food Stamp Program participation = 1 if household participated sometime in the past two years and 0 otherwise	0.314	0.464
INSUFFICIENCY	Food Insufficiency = 1 if household member(s) skipped meals or ate less than they wanted to because they didn't have enough food in the house sometime over the past two years.	0.168	0.374
HEALTH[1]	Self-reported health status = 0, if excellent, 1 if very good, 2 if good, 3 if fair, and 4 if poor	2.592	1.094
INDEPENDENT			
HEALTH RELATED[1]			
MOM'S AGE	= Mom's current age or Mom's age when she died	72.750	17.359
SMOKE	= 1 if smoke, 0 otherwise	0.177	0.382
EXERCISE	= 1 if exercise, 0 otherwise	0.208	0.406
DRINK ALCOHOL	= 1 if drink alcohol, 0 otherwise	0.207	0.405

Table 2 (cont'd)Variable Categories and Names	Variable Definitions	Mean	Std. Deviation
AGE[1]			
AGE 70-79	= 1 if age is from 70-79, 0 otherwise	0.281	0.450
AGE 80-89	= 1 if age is from 80-89, 0 otherwise	0.206	0.404
AGE 90 +	= 1 if age is 90 +, 0 otherwise	0.048	0.214
	omitted category is respondent's age ≤ 69		
MARITAL STATUS[1]			
DIVORCED	= 1 if divorced, 0 otherwise	0.193	0.394
WIDOWED	= 1 if widowed, 0 otherwise	0.440	0.500
	omitted category = married[,2]		
EMPLOYMENT STATUS[1]			
ECONOMICALLY ACTIVE	= 1 if working, 0 otherwise	0.074	0.261
RETIRED	= 1 if retired, 0 otherwise	0.503	0.500
DISABLED	= 1 if disabled, 0 otherwise	0.261	0.439
	omitted variable is homemaker		
PLACE OF RESIDENCE			
RURAL	= 1 if rural 0 otherwise	0.329	0.470
SUBURBAN	= 1 if suburban, 0 otherwise	0.287	0.453
	omitted category is URBAN		

Table 2 (cont'd)Variable Categories and Names	Variable Definitions	Mean	Std. Deviation
PLACE OF RESIDENCE (cont.)			
MIDWEST	= 1 if reside in midwest, 0 otherwise	0.164	0.370
SOUTH	= 1 if reside in south, 0 otherwise	0.259	0.438
WEST	= if reside in west, 0 otherwise	0.151	0.358
	omitted category is EAST		
RACE/ETHNICITY[1]			
HISPANIC	= 1 if Hispanic, 0 otherwise	0.211	0.409
NONHISPANIC BLACK	= 1 if non-Hispanic black, 0 otherwise	0.330	0.470
NONHISPANIC OTHER	= 1 if non-Hispanic other, 0 otherwise	0.035	0.183
	omitted category is nonhispanic white		
ECONOMIC			
INCOME	= Annual household income (in thousands)	16.448	24.622
RECEIVE SSI	= 1 if someone in the household receives SSI income, 0 otherwise	0.831	0.375
OWN HOME	= 1 if home is owned, 0 otherwise	0.378	0.485
OWN VEHICLE	= 1 if own at least 1 vehicle, 0 otherwise	0.436	0.496

Table 2 (cont'd)Variable Categories and Names	Variable Definitions	Mean	Std. Deviation
OTHER			
HOUSEHOLD SIZE	= Household size	2.000	1.365
HIGH SCHOOL[1]	= 1 if earned high school diploma or greater, 0 otherwise	0.312	0.463
SKIP MEDICINES[1]	= 1 if skipped medicines due to financial constraints, 0 otherwise	0.030	0.171
FEMALE[1]	= 1 if female, 0 otherwise	0.674	0.469
IADLA[1]	Instrumental activities of daily living equals the sum of three binary variables that indicate whether the respondent has some difficulty of using the phone, managing money and/or taking medicines. The variable ranges from 0 to 3.	0.334	0.718

[1] All these person-specific variables relate to the household financial respondent.

[2] There is one other category, never married. There were no observations in our eligible subsample with that marital status.

Source: 2002 Health and Retirement Survey

immobile older people, or those with disabilities, might find the non-monetary cost of application too high.

We model FSP participation, food insufficiency and health following Grossman's (1972) human capital model. Individuals do not demand medical services but better health. Therefore, they use various health-related inputs such as nutrition (N) and medical services (M) in the health production function (H) in which the level of health is an object of choice. The maximization problem for the consumer is:

Maximize utility,

$$U(F, H(N, M), S(FS), Z, L), \tag{1}$$

subject to the full income (Y) budget constraint,

$$Y = Tw + A + B - C = Mp_m + Fp_f + Z + (T-L)w. \tag{2}$$

Equations (1) and (2) form the Lagrangian expression,

$$U(F, H(N, M), S(FS), Z, L) + \lambda(Tw + A + B - C - Mp_m - Fp_f - Z - (T-L)w), \tag{3}$$

in which Y is full income, T is time available, w is the wage rate available to a person, A is non-labor income, non-market time is L, the price of non-food is normalized to 1.0,

and the price of food is p_f. M (for medical care, but including all relevant spending) is spending to produce health. Nutrition is a function of food: $N = N(F)$. FS is participation in the FSP (1 = yes and 0 = no). B (for benefit) is the amount of food stamps available to a person and C is the monetary cost of application, certification and re-certification for food stamps. Stigma S is negative for program participants and zero for nonparticipants. We assume that nutrition, medical care and participation in the FSP do not directly affect utility and that $U_F > 0$, $U_H > 0$, $U_S < 0$, $U_Z > 0$, $H_N > 0$, $H_M > 0$ (G_x is the partial derivative of G with respect to x).

The first order condition of (3) can be expressed as

$$(U_F + U_H H_N N_F)/p_f = (U_H H_M)/p_M = U_Z = U_L/w. \tag{4}$$

This implies that the marginal utility of food plus the utility derived from health by way of nutrition derived from food is compared with the marginal utility of spending on health, the marginal utility of other goods, and the marginal utility of leisure, respectively.

Participation in the food stamp program (FS) and food insufficiency (FI) are not marginal utility calculations. The participation decision involves a direct comparison between maximum utility with and without participation. Thus a person participates if

$$U(F^1, H^1(N, M), S, Z^1, L^1) - U(F^0, H^0(N, M), 0, Z^0, L^0) > 0, \tag{5}$$

where the binary superscripts relate to food stamp participation status.

Assuming that the difference in utility is approximately linear for the amount of food stamps on offer, this becomes $(B-C)\lambda > -S$. Thus a person is more likely to participate in the FSP if the stigma is relatively small, if the marginal utility of income is large, if the cost of participating is small, or if benefits are large. Note that especially isolated and immobile elderly, or those with disabilities, might find the non-monetary cost of application too high. This can be accounted for by controlling for mobility and disabilities. We also assume that eligibility for the FSP is exogenous, i.e. not chosen by a person through labor supply or household formation decisions for this study of eligible households' behavior.

Food insufficiency (FI), our proxy for nutrition (N) is modeled indirectly. That is, the household is food insufficient if

$$F^{FI} - F > 0, \text{ where} \tag{6}$$

the superscript (FI) indicates a food consumption threshold below which at least some household members' meals are reduced in size or skipped, thereby jeopardizing nutritional status and health, in turn.

The implication of this model is that participation, food insufficiency and health are derived from a utility maximization problem and that all are functions of prices and wages, parameters of the utility function and demographic factors that shift the utility function. At least some outcomes of this model are simultaneously determined. Participation in the FSP, for instance, could affect food insufficiency through the budget constraint. Food insufficiency could affect FSP participation if households with food consumption low enough to be skipping meals, for example, participate in the program. Likewise by increasing food purchasing power, program participation can affect food insufficiency. Both can affect health. These effects will be built into the health equation.

Econometric Framework

Our theoretical model leads us to an estimation framework consisting of three equations estimated in two sequential steps. The equations are Food Stamp Program participation (P); Food insufficiency or nutrition (N) and a self-reported health status (H), equations (7) through (9) below, respectively. Estimation of the first two equations (7) and (8) is Step One. In Step Two we estimate the health status equation (9) using Ordered Probit. The equations are:

$$P^* = \beta_{0,p}N^* + \underline{x}_p'\underline{\beta}_p + \varepsilon_p; \quad P = 1 \text{ iff } P^* > 0 \text{ and } P = 0 \text{ iff } P^* \leq 0 \tag{7}$$

$$N^* = \beta_{0,p}P^* + \underline{x}_p'\underline{\beta}_p + \varepsilon_p; \quad N = 1 \text{ iff } N^* > 0 \text{ and } N = 0 \text{ iff } N^* \leq 0 \text{ and} \tag{8}$$

$$H^* = \beta_{0,h}P^* + \beta_{1,h}N^* + \underline{x}_h'\underline{\beta}_h + \varepsilon_h. \tag{9}$$

In (9) the general observation mechanism for $H = 0, \ldots, J$, is:

$$H_i \quad = \quad 0 \text{ if } H_i \leq \mu_o \qquad (10)$$

$$= \quad 1 \text{ if } \mu_o < H_i \leq \mu_1$$

$$= \quad 2 \text{ if } \mu_1 < H_i \leq \mu_2, \text{ and}$$

$$= \quad j \text{ if } H_i > \mu_{j-1}$$

Our health status variable is self reported health status with j equal to four. That is, there are five categories ordered from zero to four with zero indicating the best health and four the worst. See Table 2 for more specific definitions of the dependent and independent variables.

The two-step framework arises from econometric difficulties that must be addressed both within and across steps. First, the food stamp program participation equation (7) and the food insufficiency equation (8) contain endogenous explanatory variables, N* and P*, respectively. Our theoretical framework and Gunderson and Oliviera (2001) (hereafter G&O) lead us to specify (7) and (8) first as independent equations and then as a simultaneous system. We follow G&O's methodology by estimating a two-equation system of simultaneous-in-propensity program participation and food insufficiency Probit equations. We also address the issue of identification in this first step of our two-step procedure. G&O find the simultaneous specification performs well when estimating food stamp program participation and food insecurity relationships with a sample of eligible American (nonelderly and elderly) households. Here we focus solely on the behavior of the elderly.

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Step Two involves estimation of the health status equation (9) using Ordered Probit methods. Two variables from the first step, predicted index values for participation (P*) and food insufficiency (N*) are transformed into predicted probabilities and used as explanatory variables in the health equation. These variables make the entire two-step procedure recursive in nature. This raises our second econometric issue, because the variables are based on estimates from the simultaneous system in Step One. The use of predicted explanatory variables require that we modify a covariance correction method developed by Murphy and Topel, hereafter M&T, (1985) to allow for two, rather than one, predicted explanatory variables.

Step One Estimation and Results

The specifications and results of the independent and simultaneous food stamp program participation and food insufficiency equations are reported in Table 3. First we consider identification variables, then endogenous variables and follow with a discussion of the significance and signs of other variables in the preferred specification. When appropriate, we compare the coefficients of the independent estimates of food stamp program participation and food insufficiency to results from the simultaneous specification.

   Identification

Our two candidate identification variables are whether household members skipped necessary medications due to financial constraints (SKIP MEDICINES) and whether any

Table 3: Program Participation and Food Sufficiency Probit Estimates

Variable	Independent Probits		Simultaneous Probits	
	FSP Participation[1] (st. error)	Food Insufficiency[1] (st. error)	FSP Participation[1] (st. error)	Food Insufficiency[1] (st. error)
CONSTANT	-1.304 *** (0.209)	-1.062 *** (0.208)	-1.41 *** (0.372)	-1.27 ** (0.508)
PARTICIPATION[2]	____	0.372 *** (0.092)	____	-0.270 (0.464)
INSUFFICIENCY[2]	0.398 *** (0.098)	____	-0.219 (0.341)	____
SKIPPED MEDICINE	____	0.719 *** (0.213)	____	0.626 *** (0.231)
RECEIVE SSI	0.337 ** (0.136)	____	0.293 * (0.150)	____
INCOME	0.165 (0.167)	0.056 (0.178)	0.193 (0.186)	0.138 (0.198)
AGE 70-79	0.161 * (0.096)	-0.240 ** (0.109)	0.089 (0.128)	-0.181 (0.122)
AGE 80-89	0.016 (0.116)	-0.267 ** (0.133)	-0.068 (0.155)	-0.260 * (0.133)

Table 3 (cont'd)

Variable	Independent Probits		Simultaneous Probits	
	FSP Participation[1] (st. error)	Food Insufficiency[1] (st. error)	FSP Participation[1] (st. error)	Food Insufficiency[1] (st. error)
AGE 90 +	-0.205 (0.209)	-0.450 * (0.245)	-0.356 (0.269)	-0.534 * (0.274)
DIVORCED	0.295 ** (0.117)	-0.121 (0.123)	0.275 ** (0.125)	0.029 (0.215)
WIDOWED	-0.108 (0.108)	-0.394 *** (0.113)	-0.223 (0.166)	-0.410 *** (0.114)
DISABLED	0.273 ** (0.106)	0.156 (0.120)	0.344 ** (0.135)	0.289 (0.188)
ECONOMICALLY ACTIVE	0.084 (0.167)	-0.279 (0.201)	-0.005 (0.203)	-0.263 (0.200)
RETIRED	-0.120 (0.094)	0.030 (0.109)	-0.120 (0.1000)	-0.022 (0.123)
RURAL	0.403 *** (0.102)	-0.175 (0.117)	0.348 *** (0.117)	-0.030 (0.205)
SUBURBAN	0.070 (0.099)	-0.078 (0.111)	0.049 (0.106)	-0.049 (0.114)
FEMALE	0.269 *** (0.098)	0.351 *** (0.111)	0.396 ** (0.172)	0.485 ** (0.194)

Table 3 (cont'd)

Variable	Independent Probits		Simultaneous Probits	
	FSP Participation[1] (st. error)	Food Insufficiency[1] (st. error)	FSP Participation[1] (st. error)	Food Insufficiency[1] (st. error)
HOUSEHOLD SIZE	0.073 ** (0.031)	-0.349 (0.036)	0.062 * (0.036)	-0.011 (0.045)
HIGHSCHOOL	-0.099 (0.088)	0.005 (0.098)	-0.096 (0.092)	-0.035 (0.105)
HISPANIC	0.320 *** (0.115)	-0.196 (0.134)	0.262 ** (0.133)	-0.082 (0.197)
NONHISPANIC BLACK	0.155 (0.094)	0.200 * (0.104)	0.225 * (0.125)	0.268 * (0.134)
NONHISPANIC OTHER	0.016 (0.214)	0.224 (0.266)	-0.015 (0.243)	-0.192 (0.262)
MIDWEST	0.065 (0.108)	-0.021 (0.125)	0.068 (0.114)	0.018 (0.129)
SOUTH	-0.136 (0.101)	0.068 (0.115)	-0.114 (0.108)	0.020 (0.127)
WEST	-0.496 *** (0.124)	0.139 (0.044)	-0.458 *** (0.136)	-0.048 (0.255)
OWN HOME	-0.249 *** (0.083)	-0.044 (0.095)	-0.275 *** (0.093)	-0.153 (0.158)

Table 3 (cont'd)

	Independent Probits		Simultaneous Probits	
Variable	FSP Participation[1] (st. error)	Food Insufficiency[1] (st. error)	FSP Participation[1] (st. error)	Food Insufficiency[1] (st. error)
OWN VEHICLE	-0.009 (0.089)	-0.016 (1.000)	-0.072 (0.094)	-0.054 (0.111)
IADLA	-0.061 (0.056)	0.185 *** (0.060)	-0.003 (0.084)	0.164 ** (0.063)
LOG LIKELIHOOD	-762.721	-563.003	-770.691	-570.995

Source: 2002 Health and Retirement Survey

[1] The superscripts *, ** and *** represent significant coefficients at the ten, five, and one percent level, respectively.

[2] For the independent Probit equations, the PARTICIPATION and INSUFFICIENCY variables are binary, while for the simultaneous Probits, they are index values predicted from the reduced form estimates. Those results are presented in Table B-1 in the appendices.

household member participates in the Supplemental Security Income program (RECEIVE SSI). Skipping needed medicines may be positively associated with food insufficiency and have no effect on food stamp participation. That is, skipping medicines is a mechanism for dealing with insufficient resources much like skipping meals. If the household receives SSI benefits, we hypothesize that most if not all stigma associated with welfare receipt is incurred when applying for and accepting SSI benefits. Further, any stigma remnants associated with food stamps would not be participation barriers. By hypothesis, then, receipt of SSI income would positively affect food stamp participation but have no effect on food insufficiency.

While our reasoning seems sound, our identification expectations need to be tested. We do so by considering the reduced form (all exogenous variables) estimates for the simultaneous model.[4] Therein, the variable SKIP MEDICINES is positive and significant in the food insufficiency equation but not significant in the participation equation. Similarly, the variable RECEIVE SSI is positive and significant in the participation equation but insignificant in the food insufficiency equation. Taken together these reduced form results support utilizing these two variables for identification purposes. Hence, we include these two variables in the appropriate equations of the independent and simultaneous formulations. The fourth and fifth rows of Table 3 show the estimation results for SKIPPED MEDICINE and RECEIVE SSI, respectively. The signs and significance of these variables are as hypothesized. That is, SKIP MEDICINES positively and significantly affects food insufficiency for both independent

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[4] The reduced form estimates are presented in table B-1 in the appendix.

and simultaneous specifications as hypothesized. Similarly, RECEIVE SSI is positive

and significant in both specifications of the food stamp participation equation.

Endogeneity

The main reason G&O argue for the simultaneous model is because eligible households,

more likely to participate in the FSP may also be more likely to be food insufficient

(2001, p. 879).   Our bivariate statistics clearly show this to be true for our food stamp

eligible sample. Based upon manipulation of information provided in Table 4, food

stamp participants are almost twice as likely as nonparticipants to be food insufficient

with 24.2 percent of food stamp participants and 13.4 percent of nonparticipants. When

comparing food insufficient and food sufficient households, 45.2 percent of food

insufficient households receive food stamps. The percentage for food sufficient

households is lower, 28.6 percent.   For the SIPP sample of the entire population utilized

by G&O, 40 percent of the eligible households participate, compared to 31 percent of the

eligible elderly in our HRS sample.

Policy makers likely would be troubled by the bivariate statistics above and by the naïve

independent estimates reported in columns 2 and 3 of Table 3. Note the positive and

significant effects of insufficiency on participation and, in turn, participation on

insufficiency. Compare those results to their counterpart coefficients in columns 4 and 5

where the endogeneity between FSP participation and food insufficiency are accounted

for by the simultaneous system.   Both coefficients have negative signs but are not

significantly different from zero. While policy makers would prefer to see food stamp

program participation reduce food insufficiency, at least our results show that the

program has no significant effect and, in particular, does not *increase* food insufficiency.

Table 4: Bivariate Percent Distribution of Food Stamp Program Participation and Food Insufficiency

		Food Insufficiency (percent)	
		Yes	No
Food Stamp Program Participation (percent)	**Yes**	7.6	23.8
	No	9.2	59.4

Source: 2002 Health and Retirement Survey

Other Results

We choose the simultaneous equation specification for participation and insufficiency as

the preferred specification and discuss those results solely.   Variable coefficients that are

significant and positively (+) or negatively (-) affect FSP participation are: SSI receipt

(+), disabled (+), divorced (+), rural (+), female (+), household size (+), Hispanic (+),

Nonhispanic Black (+), residence in the west (-) and homeowner (-).   The significant

determinants of food insufficiency are skipped purchases of necessary medicines (+), age

80-89 (-), age 90 or over (-), widowed (-), female (+), Nonhispanic Black (+) and IADLA

(+).

The marginal effects (slopes) of the variables in the simultaneous models of FSP

participation and food insufficiency are presented in Table 5. For program participation,

Table 5: Marginal Effects of Selected Variables on FSP Participation and Food Insufficiency

Independent[1] Variable	FSP Participation		Food Insufficiency	
	Marginal Effect[2]	Elasticity	Marginal Effect[2]	Elasticity
PARTICIPATION	---	---	-0.063	0.224
INSUFFICIENCY	-0.076	0.263	---	---
SKIP MEDICINES	---	---	0.189**	0.038
RECEIVE SSI	0.096**	0.268	---	---
AGE 70-79	0.031	0.029	-0.041	-0.076
AGE 80-89	-0.023	-0.016	-0.056**	-0.076
AGE 90+	-0.111	-0.018	-0.095***	-0.030
DISABLED	0.123***	0.108	0.073	0.125
DIVORCED	0.099**	0.064	0.007	0.009
WIDOWED	-0.076	-0.113	-0.094***	-0.272
RURAL	0.124***	0.137	-0.007	-0.015
SUBURBAN	0.017	0.017	-0.011	-0.022
FEMALE	0.131**	0.299	0.104***	0.464
HOUSEHOLD SIZE	0.021*	0.143	-0.003	-0.035
HISPANIC	0.094**	0.067	-0.019	-0.026
NONHISPANIC BLACK	0.079*	0.088	0.066*	0.143
NONHISPANIC OTHER	-0.005	-0.001	-0.041	-0.009
MIDWEST	0.024	0.013	0.004	0.005
SOUTH	-0.039	-0.034	0.005	0.008
WEST	-0.143***	-0.073	-0.011	-0.011
OWN HOME	-0.093***	-0.119	-0.035	-0.088
IADLA	-0.001	-0.001	0.038***	0.085

Source: 2002 Health and Retirement Survey

[1]The independent variables listed either have significant Probit coefficients or are members of categories of variables where at least one variable is significant in the relevant equation.

[2]Marginal effects for continuous variables are calculated as follows:

For continuous variables: $\dfrac{\partial E(Y)}{\partial X} = \dfrac{\partial F(*)}{\partial X}$

where F(•) indicates the standard normal distribution function.
For binary variables: the marginal effects are: Prob [y│x=1] – Prob [y│x=0].
See Greene (2002).
The superscripts *, ** and *** represent significant coefficients at the ten, five, and one percent level, respectively.

the largest significant marginal effects by absolute magnitude arise from living in the west (-), being female (+) and, in a dead heat for third, living in rural areas (+) and being disabled (+). The signs in the parentheses indicate that living in the west reduces FSP participation compared to the northeast, while being female, living in rural areas compared to urban and being disabled tend to increase program participation. The elasticities of the probabilities associated with those four variables are -0.073, 0.298, 0.137 and 0.108, respectively. One other variable, receive SSI benefits, also stands out because the elasticity is the second largest at 0.268. That and the elasticity for females are two to three times larger than any other elasticities affecting program participation. For food insufficiency, the largest significant marginal effect is for skipped medicines (0.189). That slope is almost twice the size of the next three significant variables, being female (0.104) and, in another dead heat for third, age 90 or more (-0.095) and widowed (-0.094). These marginal effects tell us by how much insufficiency changes when the variables change by one unit. In terms of elasticities, the variables and their ordering change somewhat. If the probability of being female increases by one percent, food insufficiency increases by 0.464 percent. Similarly, if the probabilities of being widowed or Nonhispanic Black increase by one percent, the associated probabilities of being food insufficient decrease by 0.272 percent and increase by 0.143 percent, respectively.

Step Two Estimation and Results

This step focuses on exploring the determinants of the health status self reports by financial respondents of food stamp eligible households. Health status, the dependent variable, is ordered, ranging from zero for excellent health to four representing poor health The mean self-reported health status (HS) in our sample falls between good and

fair (HS = 2.59). The modal value if fair (HS = 3) with 35 percent of the sample in that

category.   These statistics are derived from Table B-2 in Appendix B, which also details

the frequencies and percents of the households falling in health status, program

participation and food sufficiency categories.

The ordered dependent variable leads us to estimate the health status equation with

ordered Probit. Equations (9) and (10), with J = 4, provide the general structure for our

estimation approach. We modify the ordered Probit equation (9) by including predicted

probabilities of FSP participation and of food insufficiency rather than the original

predicted propensities. Further modification of the ordered Probit procedure is required

precisely because we use those predicted explanatory variables in our specification.   We

needed to apply the M&T covariance correction method twice, once for each of the

predicted variables.[5]

Results

Given how the dependent variable is defined, with excellent health assigned a value of

zero and poor health given a value of four, interpretation of the signs of the coefficients

must be logically reversed. That is, a significant variable with a positive (negative) sign

means that as the variable increases (decreases), health status declines (increases).

We report parameter estimates of the health status equation in Table 6. The coefficient of

the probability of being food insufficient is positive and significant, meaning that as food

insufficiency increases, health declines. The results for the coefficient of the probability

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[5] We owe gratitude to William H. Greene for modifying LIMDEP to handle the Murphy and Topel (1985)
correction to our two variable case and for generating the appropriate marginal effects

of participating in food stamps illustrate the importance the M&T corrections play in hypothesis testing. M&T assert that not only are the corrected standard errors always larger than the uncorrected errors, they can easily be twice as large and, ". . . have an appreciable impact on statistical inference." (1985, p.378) This is shown clearly in Table 6. Therein, the second column lists the variable coefficients and the 3rd and 4th columns delineate the uncorrected and corrected standard errors, respectively. For the probability of FSP participation, the statistical impact of the correction on the standard error is stark but the policy implication may be intuitively more appropriate. Based upon the uncorrected standard error, as the probability of FSP participation increases, health status worsens significantly, an undesirable policy impact. Given the almost doubling of the standard error after the correction, the probability of FSP participation coefficient becomes insignificantly different from zero, meaning that program participation has no effect on health.

With changes in standard errors of these magnitudes, it is not surprising that we observe levels of significance declining with some to the point of insignificance for some variables. The probability of FSP participation is only one of many. Others include: economically active, female, high school, south and west. After correction, all these variables are insignificantly different from zero. The variables that maintain significance are: income (-), widowed (+), Nonhispanic Black (-), exercise (-) and drink alcoholic beverages (-). The sign of the Nonhispanic Black coefficient is counterintuitive, indicating that as the proportion of Nonhispanic Black households increases health increases. This is one of very few unreasonable results across all three equations.

Table 6: Self-Reported Health Status Ordered Probit Estimates with Uncorrected and Corrected Standard Errors

Variable	Coefficient	Uncorrected Std. Error		Corrected Std. Error	
CONSTANT	1.336	0.257	***	0.443	***
PROBABILITY OF PART.	1.593	0.568	***	0.989	
PROBABILITY OF INSUFF.	3.625	0.549	***	1.147	***
MOM'S AGE	-0.001	-0.002		-0.002	
INCOME	-0.418	-0.136	***	-0.201	**
DIVORCED	-0.131	-0.121		-0.204	
AGE 70-79	0.021	0.083		0.154	
AGE 80-89	0.105	0.096		0.159	
AGE 90+	0.117	0.165		0.288	
WIDOWED	0.313	0.092	***	0.164	*
ECONOMICALLY ACTIVE	-0.275	-0.135	**	-0.217	
RETIRED	-0.062	-0.082		-0.144	
RURAL	-0.138	-0.104		-0.193	
SUBURBAN	0.013	0.077		0.131	
FEMALE	-0.481	-0.098	***	-0.320	
HOUSEHOLD SIZE	0.012	0.027		0.049	
HIGH SCHOOL	-0.115	-0.069	*	-0.121	
HISPANIC	-0.031	-0.104		-0.163	
NONHISPANIC BLACK	-0.364	-0.087	***	-0.164	**
NONHISPANIC OTHER	-0.171	-0.166		-0.293	
MIDWEST	0.067	0.086		0.140	
SOUTH	0.220	0.084	***	0.153	
WEST	0.213	0.121	*	0.213	
OWN HOME	0.129	0.081		0.143	
OWN VEHICLE	-0.018	-0.070		-0.120	
SMOKE	0.087	0.082		0.084	
EXERCISE	-0.419	-0.073	***	-0.077	***
DRINK ALCOHOL	-0.164	-0.076	**	-0.085	*
Mu(1)	0.863	0.039	***	0.043	***
Mu(2)	1.704	0.035	***	0.036	***
Mu(3)	2.733	0.043	***	0.052	***
CHI-SQUARED$_{27}$	222.144	--		--	
PROB[ChiSqd > value]	0.0000000	--		--	

Source: 2002 Health and Retirement Survey
The superscripts *, ** and *** represent significant coefficients at the ten, five, and one percent level, respectively.

Rather than directly present the marginal effects on health status in Table 7, we instead present effects of ten percent changes in selected variables on reporting the worst two health statuses, fair (3) or poor (4). Consider first the effects of the significant variables with positive coefficients, widowed and the probability of being food insufficient. As those variables increase by ten percent, the likelihood of reporting the worst two health statuses increase by 14.1 and 1.2 percent, respectively. Note that the effect of food insufficiency is ten times that of being widowed. Among the significant variables with negative effects on health status, income and being Nonhispanic Black have virtually identical effects on being in the worst two health categories, at -1.6 and -1.4 percent, respectively. Health status similarly decreases by 1.7 percent from a 10 percent increase in exercise. However, compared to the other overt health behavior, alcohol consumption, exercise is nearly three times more effective at improving health status; -1.7 for exercise compared to -0.6 for alcohol consumption.

Summary, Conclusions and Implications for Future Research

Our overall concern is for the well-being of our elderly population with a specific focus on how FSP participation and food sufficiency affect health status. The contributions to knowledge from our research range across three areas: the gains from our unique analysis database; second, the efficacy and appropriateness of our estimation approach; and third, the new insights our results provide. In constructing our analysis database, we use geographic information to make state-specific determinations of elderly households' eligibility for food stamps. More accurate eligibility determinations potentially better inform policy. By taking advantage of the wealth of health information in the 2002

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Table 7: Effects of Ten Percent Changes in Selected Variables on Reporting the Worst Two Health Statuses, Fair or Poor Combined

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Independent[1] Variable	Effect[2]
Prob (PART)	0.062
Prob (INSUFF)*	0.141
Income (000s)*	-0.016
Widowed*	0.012
Divorced	-0.005
Hispanic	-0.001
Non-Hispanic Black*	-0.014
Non-Hispanic Other	-0.067
Smoke	0.003
Exercise*	-0.017
Drink Alcohol*	-0.006

_____

Source: 2002 Health and Retirement Survey

*Significant coefficients in the health status equation based upon corrected covariances from Table 6.

[1]The independent variables listed either have significant ordered Probit coefficients or are members of categories of variables where at least one variable is significant in the health equation. A full marginal effects table is available from the authors.

[2]Marginal effects for continuous variables are calculated as: ∂ Prob [cellj]/$\partial x_i = [f(\mu_{j-1} - \boldsymbol{\beta}' \mathbf{x}_i) - f(\mu_j - \boldsymbol{\beta}' \mathbf{x}_i)]$ x $\boldsymbol{\beta}$ where f($\bullet$) is the density for the standard normal, F($\bullet$). For binary variables the marginal effects are: Prob [y │ x=1] – Prob [y │ x=0]. See Greene (2002). The full listing of marginal effects is available from the authors. Our thanks go to Parke Wilde for his help in interpreting the marginal effects.

Health and Retirement Survey, we add a new dimension to our understanding of the impact of food stamps and food insufficiency on the health of the elderly.

The contributions of our estimation approach are two. Our first step simultaneous multivariate Probit estimates of FSP participation and food insufficiency of the needy elderly qualitatively replicate G&O's earlier research based on SIPP data for the entire population. That is, when the endogeneity of FSP participation and food insufficiency is accounted for, the significant positive effect of food insufficiency on participation becomes insignificant as does the troubling positive effect of food stamps on food insufficiency.

The major econometric advance rests on our correcting all the health equation coefficient standard errors because of the use of two predicted values, the probabilities of participation and food sufficiency, as explanatory variables and thereby extending M&T's one-variable standard error correction to two variables. Comparing the impact of correcting vs. not correcting the standard errors for FSP participation, for example, suggests how easily policy misdirection can occur. Without the correction, as the probability of FSP participation increases health status appears to worsen, a clearly undesirable policy outcome. When the corrected standard error is applied, however, the effect of the probability of FSP participation on health status is insignificantly different from zero. Even with the correction, however, as the probability of being food insufficient increases, health status worsens and significantly so.

In terms of future research there are two areas that merit further attention. Step One of this research can trace its heritage directly back to Wilde's (2007) second category by jointly estimating FSP participation and food insecurity. The link is even stronger given the nature of our results, that is most (not all) of the prior research in this category finds no effect of the FSP on food insecurity. A major reason for this finding could be because all these studies rely upon cross-section data and truly understanding the problem could require longitudinal panel data, Wilde's third category of research. The researchers mentioned therein, Hofferth (2004), Ribar and Hamrick (2003) and Wilde and Nord (2005) were unable to eliminate the picture painted by most of the cross-section studies. Even so, Nord and Golla (2009) persisted with the dynamic approach and produced very promising results relating food stamps and food insecurity in a very favorable way. They have opened a door for important research in this area. One other avenue for investigation is to exploit the fact that the surveys that measure food insecurity also measure food spending. Explaining that spending in relation to the thrifty food plan spending amounts and the food security levels obtained may also yield new insults of use to policy makers.

Finally, it is important to acknowledge that as the elderly poverty rate declined the child poverty rate increased or stagnated. Based upon the measure used, the child poverty rate ranges from one-fifth to one-quarter of the children in this country. While this deplorable state of affairs must be addressed, our concern is that dollars to do so will be diverted from programs supporting the elderly. Given the very tenuous status of so many elderly Americans, such cuts could be devastating. From a social welfare perspective, we should

not help one group of the poor by taking away from another group of the poor or by impoverishing others. We are better than that.

Appendix A

Food Stamp Program
Eligibility Determination

Food Stamp Program
Eligibility Determination

To determine which households are eligible for food stamps and, hence, included in our estimation sample, we rely upon the regulations as reported in the *Characteristics of Food Stamp Households: Fiscal Year 2002* (USDA, 2003). We employ data from the HRS survey to establish categorical eligibility criteria as well as to conduct net income and countable assets eligibility tests.

Categorical Eligibility

Regulations establish that some households are categorically eligible for the FSP without income or asset considerations. Accordingly, we classify a household as eligible if all of its members receive Supplemental Security Income (SSI) or if the household receives welfare income (e.g., cash or in-kind Temporary Assistance to Needy Families (TANF) benefits.

Net Income Test

Elderly households are exempt from the gross income test. Therefore, the only applicable income eligibility criterion is the net income test. We determined net income by subtracting deductions permitted under the FSP from monthly gross income. We employed the deductions allowed in year 2002. The following deductions from household's gross monthly income were used to arrive at net monthly income:

• Standard Deduction - Households receive a standard deduction based on location and household size. For example, a household with one to four members received a deduction of $134 in the contiguous United States in fiscal year 2002. The standard deduction for

outlying states and territories varies to reflect price differences between these areas and

the contiguous United States (Table A1).

- Earned Income Deduction - Households received a deduction equal to 20 percent of the

  combined earnings of household members.

- Dependent-Care Deduction - Households with dependents receive a deduction for

  expenses involved in caring for dependents while other household members work, search

  for a job, or attend school. The HRS compiles information about home-care expenses in

  the household. Consequently, we deduct $175 per month per dependent, assuming that

  the dependent is older than two years-old.

- Medical Deduction - Household with elderly members can employ a medical deduction.

  To calculate this deduction, we employ the monthly out-of-pocket medical expenses

  minus medical expenses covered by government insurance programs minus $35. The

  deduction is zero if the resulting number is less or equal than zero.

Table A-1: Value of Standard, Maximum Dependent-Care, and Excess Shelter Expense Deductions in the Continental United States and Outlying Areas in Fiscal Year 2002

Area	Standard[a]	Maximum Dependent-Care[b,c]	Excess Shelter
Continental United States…	$134	$200/$175	$354
Alaska …………………….	229	200/175	566
Hawaii …………...............	189	200/175	477
Guam …………………….	269	200/175	416
Virgin Islands …………….	118	200/175	279

[a] Prior to fiscal year 1997, the standard deduction was adjusted each October to reflect changes in the CPI-U for nonfood items. Since fiscal year 1997, the standard deduction has been frozen at fiscal year 1996 levels.
[b] The household limit on the dependent-care deduction is equal to the maximum dependent-care deduction multiplied by the number of dependents in the household.
[c] The higher dependent-care deduction pertains to dependents under age 2; the lower deduction is for dependents age 2 or more.
Source: U.S. Department of Agriculture.
Source: *Characteristics of Food Stamp Households, Fiscal Year 2002*, Appendix C, Table C-4, page 82.

- Child Support Payment Deduction - This deduction is not taken into account in our analysis. We assume that elderly households do not pay for child support.

- Excess Shelter Expense Deduction - We create a housing expense variable that includes rent, mortgage payments, utility bills and property taxes. According to the regulations, households with elderly members can subtract the full value of shelter costs that exceed 50 percent of their adjusted income (i.e. after all other deductions have been made).

After calculating the net monthly income, we sort households into two categories, those whose net income is at or below the poverty line and above it. The poverty line varies by state and household size (Table A2). To be eligible for the FSP, a household must have a net monthly income at or below 100 percent of the poverty guideline.

Assets Test

The second critical test is based on the value of countable assets. This test is applied if the household first passed the net income test. If so, an elderly household in our sample is eligible for FSP if its countable assets were less than $3,000 in 2002. Cash, liquid assets and vehicles are examples of countable assets. We summed the values of the following countable assets from the HRS survey: IRA accounts, value of stocks, value of bonds, checking and saving accounts, Treasury bills and government bonds.

Table A-2: HHS Poverty Income Guidelines for Fiscal Year 2002 FSP[a]

Household Size	Continental United States, Guam, and the Virgin Islands	Alaska	Hawaii
1	$8,590	$10,730	$9,890
2	11,610	14,510	13.360
3	14,630	18,290	16,830
4	17,650	22,070	20,300
5	20,670	25,850	23,770
6	23,690	29,630	27,240
7	26,710	33,410	30,710
8	29,730	37,190	34,180
Each Additional Member	+3,020	+3,780	+3,470

[a] These numbers, which were used as poverty guidelines for the FSP in fiscal year 2002, were issued by the Department of Health and Human Services (HHS) and published in the February 2001 Federal Register. The Bureau of the Census establishes different poverty thresholds which are used primarily for statistical purposes.
Source: 66 *Federal Register* 33, February 16, 2001.

The missing piece in the HRS data is the value of each vehicle. Only the total value of vehicles owned by household members is collected in the HRS. Another complication is vehicle asset regulations vary across states. For example, by August 2003, twenty one states had adopted policies that excluded the value of all vehicles from the asset test. Other states adopted policies that excluded the value of one vehicle per adult or per

household or increased the allowable value of one or more vehicles. Only seven states were still using the federal FSP rules.

Our strategy to for implementing the vehicle variable was first to identify those cases in which it is possible to determine whether or not the household is eligible for FSP without knowing the specific vehicle information. In particular, we know that the household is eligible/ineligible in the following cases:

- When the HRS reported value for vehicles in the household is less than $4,650 (this is the standard deduction for vehicle for each household) – asset eligible.

- When the state exempts all vehicles from countable assets – asset eligible.

- When countable assets without the vehicle values are greater than $3,000 – asset ineligible.

- When the value of countable assets (including the value of vehicles) reported in HRS is less than $3000 – asset eligible.

- When a household is categorically eligible because all members receive Supplemental Security Income (SSI) or the household receives cash or in-kind Temporary Assistance to Needy Families (TANF) benefits – assets irrelevant.

- When the household is ineligible based on the net income test – assets irrelevant.

- When household received food stamps in 2002 – eligible.

Final Eligibility Determination

To determine eligibility, the household has to pass both the net income and the countable assets tests. Based on this information we are able to sort out 97.1% of the households. The remaining 2.9% are excluded from the estimating sample. Thus, our estimation sample includes only elderly households in the HRS deemed to be eligible for food stamps.

Appendix B

Ancillary Statistics and Estimates

Table B-1: Reduced Form Probit Estimates of Food Stamp Participation and Food Insufficiency

Variable	FSP Participation[1] (st. error)		Food Insufficiency[1] (st. error)	
CONSTANT	-1.202 (0.208)	***	-0.942 (0.227)	***
SKIPPED MEDICINE	-0.145 (0.229)		0.665 (0.215)	***
RECEIVE SSI	0.311 (0.135)	**	-0.084 (0.144)	
INCOME	0.173 (0.164)		0.090 (0.175)	
AGE 70-79	0.136 (0.095)		-0.218 (0.108)	**
AGE 80-89	-0.011 (0.115)		-0.257 (0.245)	*
AGE 90 +	-0.254 (0.208)		-0.465 (0.245)	*
DIVORCED	0.285 (0.117)	**	-0.047 (0.129)	
WIDOWED	-0.141 (0.107)		-0.372 (0.123)	***
DISABLED	0.298 (0.106)	***	.0209 (0.118)	*
ECONOMICALLY ACTIVE	0.056 (0.166)		-0.278 (0.199)	
RETIRED	-0.122 (0.094)		0.011 (0.108)	
RURAL	0.377 (0.102)	***	-0.131 (0.115)	
SUBURBAN	0.064 (0.099)		-0.066 (0.110)	

Table B-1 (cont.d)

Variable	Reduced Form Probit Estimates			
	FSP Participation[1] (st. error)		Food Insufficiency[1] (st. error)	
FEMALE	0.309 (0.096)	***	0.402 (0.111)	***
HOUSEHOLD SIZE	0.068 (0.031)	**	-0.030 (0.036)	
HIGHSCHOOL	-0.094 (0.088)		-0.009 (0.098)	
NONHISPANIC BLACK	0.177 (0.094)	*	0.220 (0.104)	**
NONHISPANIC OTHER	0.028 (0.213)		0.199 (0.262)	
MIDWEST	0.069 (0.108)		0.000 (0.124)	
SOUTH	-0.126 (0.101)		0.054 (0.114)	
WEST	-0.475 (0.123)	***	0.080 (0.134)	
OWN HOME	-0.257 (0.083)	***	-0.083 (0.094)	
OWN VEHICLE	-0.006 (0.089)		-0.037 (0.101)	
IADLA	-0.041 (0.055)		0.175 (0.060)	***
LOG LIKELIHOOD	-770.691		-570.994	

Source: 2002 Health and Retirement Survey

Note: ***, **, * = significance at 1%, 5%, 10% level, respectively.

Table B-2: Frequency and Percent of Food Stamp (FS) Participation Food Insufficiency (FI) and Health Status

Frequency of FS and FI by Health Status

Health Status	FS Only	FI Only	Both	Neither	Row Total
Excellent	9	9	0	35	**53**
Very Good	29	13	5	131	**178**
Good	80	24	19	225	**348**
Fair	135	44	38	251	**468**
Poor	70	35	41	164	**310**
Column Total	**323**	**125**	**103**	**806**	**1357**

FS and FI as a Percent of Health Status

Health Status	FS Only	FI Only	Both	Neither	Row Total
Excellent	17	17	0	66	100
Very Good	16	7	3	74	100
Good	23	7	5	65	100
Fair	29	9	8	54	100
Poor	23	11	13	53	100
Column Total	-	-	-	-	-

Health Status as a Percent of FS and FI

Health Status	FS Only	FI Only	Both	Neither	Row Total
Excellent	3	7	0	4	-
Very Good	9	10	5	16	-
Good	25	19	18	28	-
Fair	42	35	37	31	-
Poor	22	28	40	20	-
Column Total[6]	101	99	100	99	-

Source: 2002 Health and Retirement Survey

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[6] Columns do not sum to 100 percent due to rounding.

Appendix C

**Defining
Food Insufficiency
and Insecurity**

Appendix C: Part I

**Questions for Defining
Food Insufficiency**

There are two linked questions in the HRS that relate to food sufficiency.

(1) In question HQ415 the household financial respondent is asked: Since the previous interview, have you always had enough money to buy the food you need?

(2) Question HQ416 is only asked if the response to the previous question is inapplicable or not yes. That is, the response to question HQ415 was, "no," "don't know," or "refused."   If so, respondent is asked: At any time since the previous interview have you skipped meals or eaten less than you felt you should because there was not enough food in the house? A "yes" response to this question means that the household is food insufficient.

Food Security

Questions used to assess the Food Security of Households in the CPS Food Security Survey

1. "We worried whether our food would run out before we got money to buy more." Was that often, sometimes, or never true for you in the last 12 months?

2. "The food that we bought just didn't last and we didn't have money to get more." Was that often, sometimes, or never true for you in the last 12 months?

3. "We couldn't afford to eat balanced meals." Was that often, sometimes, or never true for you in the last 12 months?

4. In the last 12 months, did you or other adults in the household ever cut the size of your meals or skip meals because there wasn't enough money for food? (Yes/No)

5. (If yes to question 4), How often did this happen – almost every month, some months but not every month, or in only 1 or 2 months?

6. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food? (Yes/No)

7. In the last 12 months, were you ever hungry, but didn't eat, because there wasn't enough money for food? (Yes/No)

8. In the last 12 months, did you lose weight because there wasn't enough money for food? (Yes/No)

9. In the last 12 months did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food? (Yes/No)

10. (If yes to question 9), How often did this happen -- almost every month, some months but not every month, or in only 1 or 2 months?

(Questions 11-18 were asked only if the household included children age 0-18)

11. "We relied on only a few kinds of low-cost food to feed our children because we were running out of money to buy food." Was that often, sometimes, or never true for you in the last 12 months?

12. "We couldn't feed our children a balanced meal, because we couldn't afford that." Was that often, sometimes, or never true for you in the last 12 months?

13. "The children were not eating enough because we just couldn't afford enough food." Was that often, sometimes, or never true for you in the last 12 months?

14. In the last 12 months, did you ever cut the size of any of the children's meals because there wasn't enough money for food? (Yes/No)

15. In the last 12 months, were the children ever hungry but you just couldn't afford more food? (Yes/No)

16. In the last 12 months, did any of the children ever skip a meal because there wasn't enough money for food? (Yes/No)

17. (If yes to question 16), How often did this happen -- almost every month, some months but not every month, or in only 1 or 2 months?

18. In the last 12 months did any of the children ever not eat for a whole day because there wasn't enough money for food? (Yes/No)

Source: Nord, M., M. Andrews, and S. Carlson. 2009. *Household food Security in the United States, 2008.* Washington, D.C.: U.S. Department of Agriculture, Economics Research Service, Report NO. ERR-83. 58 pp. November. Page 3.

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OTHER A.E.M. WORKING PAPERS

WP No	Title	Fee (if applicable)	Author(s)
2010-14	The Costs of Increased Localization for a Multiple-Product Food Supply Chain: Dairy in the United States		Nicholson, C.F., Gómez, M.I. and O.H. Gao
2010-13	Wine in your Knapsack?		Conrad, J.M., Gómez, M.I. and A.J. Lamadrid
2010-12	Examining consumer response to commodity-specific and broad-based promotion programs for fruits and vegetables using experimental economics		Rickard, B., Liaukonyte, J., Kaiser, H. and T. Richards
2010-11	Harnessing the Forces of Urban Expansion – The Public Economics of Farmland Development Allowance		Chau, N. and W. Zhang
2010-10	Estimating the Influence of Ethanol Policy on Plant Investment Decisions: A Real Options Analysis with Two Stochastic Variables		Schmit, T., Luo, J. and J.M. Conrad
2010-09	Protecting the Poor against the Next Crisis		Kanbur, R.
2010-08	Charitable Conservatism, Poverty Radicalism and Good Old Fashioned Inequality Aversion		Kanbur, R. and M. Tuomala
2010-07	Relativity, Inequality and Optimal Nonlinear Income Taxation		Kanbur, R. and M. Tuomala
2010-06	Developing viable farmers markets in rural communities: an investigation of vendor performance using objective and subjective valuations		Schmit, T. and M. Gomez
2010-05	Carbon Dioxide Offsets from Anaerobic Digestion of Dairy Waste		Gloy, B.
2010-04	Angola's Macroeconomy and Agricultural Growth		Kyle, S.
2010-03	China's Regional Disparities: Experience and Policy		Fan, S., Kanbur, R. and X. Zhang
2010-02	Ethnic Diversity and Ethnic Strife an Interdisciplinary Perspective		Kanbur, R., Rajaram, P.K., and A. Varshney