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An Empirical Investigation of the Relationship between Wealth and Health Using the Survey of Consumer Finances

Audra T. Wenzlow
Department of Economics
University of Wisconsin–Madison
E-mail: atwenzlow@wisc.edu

John Mullahy
Department of Population Health Sciences
University of Wisconsin–Madison
E-mail: jmullahy@wisc.edu

Stephanie A. Robert
School of Social Work
University of Wisconsin–Madison
E-mail: sarobert@wisc.edu

Barbara L. Wolfe
Department of Economics
Department of Population Health Sciences
University of Wisconsin–Madison
E-mail: wolfe@lafollette.wisc.edu

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Abstract

Building on the sizable literature that demonstrates important relationships between health and income, we address the role of financial wealth and its associations with the health status of individuals aged 25 to 54. We describe the shape of the health gradients in income and wealth and estimate models of self-reported health in which family income and wealth are the main explanatory variables. The results from a battery of alternative estimated model specifications suggest that income and wealth are jointly significant correlates of health, and that wealth plays a stronger role for the oldest members of this age group.

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I. INTRODUCTION

The nature of the relationship between income and health has interested researchers for decades. Somewhat surprisingly, this has not been the case for the relationship between wealth and health. We find this surprising because wealth may be a better measure of a person's economic resources than current earnings. The analysis of the link between income and health suggests a positive but declining marginal relationship between the two (i.e., the gradient between income and health is steepest among lower-income individuals). Does the same relationship exist between health and wealth?[1] And does the suggested relationship between income and health, as first illustrated by Samuel Preston (1975), hold up once wealth has been taken into account? The few studies of health and wealth have in general been limited to older populations, particularly those sampled in the longitudinal Health and Retirement Study (HRS) and Assets and Health Dynamics among the Oldest Old (AHEAD) surveys. The findings from these studies have suggested that among those nearing or past retirement age, greater wealth and better health are dynamically related, and that this link is stronger than the link between income and health. In this paper we explore the relationship between health and wealth and health and income for prime working-age individuals, those between the ages of 25 and 54, in the United States.

The influence of wealth on health may occur through a variety of channels. Savings may provide crucial resources when an individual is struck by an unexpected health shock. For individuals with little disposable income, lack of wealth may limit the ability to purchase potentially effective care, lead to delays in seeking care, or place them in other situations with additional health risks. Identifying such a

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[1]Limited previous research has suggested that health and certain dimensions of wealth are related among U.S. working-age adults. Robert and House (1996) find such a link between various health outcomes and having $10,000 or more in assets; Drentea and Lavrakas (2000) find a negative relationship between credit card debt and health. (See discussion Section II.)

health-wealth link would provide individuals a strong incentive to save. This would be particularly relevant for the working-aged population who are still accumulating wealth. The study of the health-wealth relationship is also relevant to many questions asked by researchers of income and health. Income inequality may cause stress and thus poor health, and wealth inequality may do so as well. If health affects employment outcomes, then it is likely to affect an individual's long-term savings or wealth. Finally, understanding these links may give us some prediction of whether to expect increasing health differences as income and/or wealth inequality increases.

Although study of the causal mechanisms of health-wealth dynamics is necessary to answer these questions, characterizing the cross-sectional relationship between health, income, and wealth can provide information that supports or rejects certain hypotheses, or that raises other interesting research questions. Victor Fuchs (1982), for example, has suggested that "third variables" such as time preference may explain the links between socioeconomic status and health. Time preferences may influence the attainment of both health and wealth, resulting in the spurious positive correlation between the two. The Survey of Consumer Finances, the data source used in this analysis, includes questions regarding individual time preferences for saving, allowing us to explore this hypothesis.

In the next section, we summarize the current literature on the relationship between health, income, and wealth. We then describe the Survey of Consumer Finances and the variables used in this study. A description of our methodological approach follows. The results section contains a detailed description of the cross-sectional relationship between health and wealth among individuals aged 25 to 54. This includes an analysis of health-wealth differences by age and by race group, and a characterization of the health gradient. In the final sections of this paper, we describe various sensitivity analyses and discuss the implications and limitations of our findings.

II. THE EVIDENCE TO DATE

The literature relating health to socioeconomic status (SES) has a long history (see recent reviews in Adler and Newman, 2002; Deaton, 2001; Goldman, 2001; Robert and House, 2000a, 2000b). For the

most part, however, the study of SES has been limited to measures of income, education, and occupation. In each of these cases, a strong positive relationship between health and SES has been established. More recent studies have explored the relationship between health, income, and income inequality (see recent reviews by Deaton, 2001; Mullahy, Robert, and Wolfe, 2001; Robert and House, 2000b; and Wagstaff and van Doorslaer, 2000). There is a consensus among these authors that given the research to date, there is (1) a well-documented concave relationship between individual income and health, but (2) little evidence that income inequality affects health.

The literature relating health to wealth is more limited. This is partly due to the difficulty in collecting wealth data and the limited availability of surveys that collect both wealth and health information in the United States. There is some evidence, however, that wealth and health are positively correlated, even net of income. Using the Americans' Changing Lives Study, a cross-sectional national sample of adults in 1986, Robert and House (1996) found that assets are associated with self-rated health, functional health, and a number of chronic conditions, over and above income, education, home ownership, and age, sex, and race. However, they were able to use only a crude dichotomous measure of assets, indicating whether people reported having less or more than $10,000 in assets (minus home ownership, which was measured separately).

Additional evidence of a health-wealth link net of other SES measures comes from the Whitehall studies of British civil servants. These studies have found a negative correlation between mortality and such assets as cars and home ownership, net of occupation (Marmot, Kogevinas, and Elston, 1987) and net of occupation and income (Shahtahmasebi, Davies, and Wenger, 1992). Additionally, Drentea and Lavrakas (2000) found that credit card debt was significantly related to having both physical impairments and poor self-reported health.

A small number of recent studies have addressed the dynamic nature of the health-wealth relationship focusing on the HRS and AHEAD samples of older Americans. The mechanisms through which wealth may be related to health have been described by Goldman (2001).[2] Explanations for the health-wealth link can be categorized into three general types of mechanisms: ways in which health affects wealth; ways in which wealth influences health; and links between health and wealth that are due to other common correlates such as age or differences in individual time preferences (discount rates).

Smith (1999) used data from the HRS, limited to individuals aged 51 to 61, to consider the effects of health shocks on individual wealth. Smith found a strong effect of new illness on both income and wealth. Adams et al. (2003) analyzed panel data from the AHEAD sample of individuals from households with at least one person over 70 in 1994. Their study of the causal relationship between wealth and health rejected the hypothesis that there are causal effects of SES on health when health is measured by acute illnesses. However, they could not reject the hypothesis that SES causes health conditions with gradual onset, such as mental illnesses, or that health shocks affect wealth.

Smith and Kington (1997) also analyzed the AHEAD sample and found (1) a strong nonlinearity in the relationship between health and both wealth and income—they solved the nonlinearity problem by estimating separate spline linear effects for income and wealth terciles; (2) both income and wealth were related to health in this elderly population; (3) different types of income were differentially related to health; (4) race and ethnic differences in health were explained by income and wealth for functional limitations, but not other health outcomes.

The wealth accumulation research has indirectly addressed health effects over a broader range of age groups. For example, Altonji and Doraszelski (2002), Shea, Miles, and Hayward (1996), and Smith

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[2]Other heuristic discussions regarding health effects of wealth and wealth effects of health can be found in Kotlikoff (1989), Smith (1999), and Smith and Kington (1997).

(1995), among others, have consistently found a significantly positive relationship between wealth and health among whites. The relationship among blacks has been more tenuous.[3]

In summary, most of the evidence regarding the relationship between wealth and health suggests a positive nonlinear association for whites. Among the working-age population, there is some evidence that assets and debt are associated with health over and above income and other measures of SES. Among older populations, this evidence is well established. The research described above also suggests that the relationship between wealth and health may be bidirectional. Our review finds that little is known about the characteristics of the health-wealth relationship among younger populations, and whether it resembles the gradient relationship between health and income, particularly once income is held constant. Our goal in this paper is to generalize the descriptive findings to a working-age U.S. adult population using rich wealth data, distinguishing between income and wealth as they relate to health.

III. DATA

The data analyzed in this study are from the Survey of Consumer Finances (SCF), a nationally representative survey of families that obtains information on income and assets. Compared to other national surveys, the SCF stands out for its measurement of wealth—wealthy individuals are oversampled so that accurate estimates can be made at the highest income and wealth levels. The SCF is considered to be the gold standard in terms of capturing the distribution of wealth in the United States.[4]

The SCF is a triennial repeated cross-section of approximately 4,000 to 5,000 families. Along with detailed information regarding household assets, the SCF collects demographic, health, and income data from all survey participants. In this study we use data aggregated from the 1989, 1992, 1995, and

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[3]For additional examples of studies including health as an independent variable in wealth equations, see Diamond and Hausman (1984), and Avery and Rendall (1997). For a comparison of such models between whites and blacks, see Altonji and Doraszelski (2002).

[4]See Smith (1995) and Wolff (1999) for a comparison of the wealth measure in the SCF to those in other surveys.

1998 SCF surveys. Each interview was conducted with the individual most familiar with the family's finances. We define this individual as being the household head, which is our unit of analysis.[5] We limit our analysis sample to individuals between the ages of 25 and 54 to target the working-age population.

A. Measurement of Health Status

The SCF collects basic information regarding health. Each survey year, the following question is asked of respondents: "Would you say your health is excellent, good, fair, or poor?" The same information is obtained for the respondent's spouse or partner, if applicable. Although the four-category scale has been shown to be culturally sensitive, a dichotomous measure reflecting a response of "poor" or "fair" health has been shown to be both reliable and highly correlated with other measures of morbidity and mortality (Baker, Stabile, and Deri, 2001). We use this dichotomous self-report of poor/fair health in our study. Approximately 16.5 percent of our weighted sample of household heads reported poor or fair health.

A change in the survey questionnaire between 1992 and 1995 had a possible impact on the four-category measure of self-reported health. In 1995, an additional question was added, asking whether the respondent or spouse currently smoked. This new smoking question immediately preceded the self-reported general health question, possibly resulting in the notable decline in reports of excellent health in 1995. It appears that this change had a much smaller effect on the collapsed dichotomous measure of poor/fair health. Nevertheless, year dummies included in the models of poor/fair health should be interpreted as including any effect of the survey change.

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[5]Among couples, this implies that only the health of the household head is considered in analyses. Health and demographic information are also collected for the spouse or partner in married or cohabiting households. However, this information is in general collected by proxy report. Our examination of the spousal data, described in Section VI of this paper, suggests that household heads and spouses do not differ in a significant way that is relevant to this study.

B. Measures of Wealth and Income

We use net worth of the family to measure wealth. A family includes all individuals that make up the primary economic unit (PEU) in the household. The PEU is defined in the SCF to consist of "an economically dominant single individual or couple (married or living as partners) in a household and all other individuals in the household who are financially dependent on that individual or couple" (Board of Governors of the Federal Reserve System, 2000). Net worth is defined as the sum of all financial assets (e.g. stocks, savings) and nonfinancial assets (e.g. homes, cars) minus total debt. Specifically, net worth includes housing assets less liabilities, business assets less liabilities, checking and saving accounts, stocks, bonds, mutual funds, retirement accounts, certificates of deposits, whole life insurance and other assets less credit card debt, and other liabilities. It does not include defined benefit pension wealth, defined contribution pension wealth held outside 401(k)s, social security wealth anticipated at retirement, consumer durables, and future earnings (see Scholz and Levine, 2004, for more detail on this measure). We adjust family net worth for family size using a household equivalence scale, and in the case of the 1989, 1992, and 1995 surveys, it is also adjusted for the CPI-U to reflect constant 1998 dollars.

Total family income includes PEU income from all sources, including before-tax wages and salaries, interest income, dividends, net gains or losses from sales of stocks, bonds, or real estate, net rent, trust income, other royalties, unemployment or workers compensation, child support or alimony, welfare assistance, social security or pension payments, and all other forms of income. Like our wealth measure, total family income is adjusted for family size and the CPI-U.

The use of a family-size-adjusted version of income and wealth requires some further discussion and justification. Our household equivalence scale is defined as $(A + .6*C)^{.65}$, where A is the number of adults in the family and C is the number of individuals under 18 in the family, plus the number of children under 18 that the household head has outside the household. A similar two-parameter equivalence scale that weights children less than adults and allows for economies of scale has recently been suggested by the National Research Council for use in measuring poverty (Short et al., 1999). The new OECD

modified equivalence scale also takes these two factors into account (Atkinson et al., 2002). The use of an equivalence scale reflects the assumption that when income is used to purchase consumption goods, including health prevention and maintenance, it must be shared between family members. Similarly, we assume that if families save for precautionary health purposes, they do so for all members in the family. In the case of a large health shock, although it can be argued that the entire unconsumed portion of family income and wealth may be made available to the individual, other household consumption needs will still constrain these resources. To evaluate the effects of using an equivalence scale, we compare our final results to those obtained when a family-size adjustment is not used.

Distributional characteristics of wealth and income, both unadjusted and adjusted for the household equivalence scale, are shown in Table 1.[6] On average, total family income and wealth are approximately twice the size of income and wealth adjusted for family size.

C. Demographic and Other Explanatory Variables

Existing evidence suggests that the relationship between wealth and health differs by age and race. We include these demographic characteristics in the analysis. Age is a continuous measure and is included along with its squared term in all models. Our race measure differentiates non-Hispanic whites from all other races and ethnicities.

Other measures relevant to this study include gender, marital status, education, time preference, and the smoking status of survey respondents. We categorize respondents' marital status as being either single or married/cohabiting. Single individuals include those who are widowed, divorced, or separated. Our education variable is based on reports of received degrees, or years of schooling (<12, 12, 13–15, 16,

[6]The SCF has a complex sampling frame, and missing data are multiply imputed. Taking these factors into account, all estimates calculated in this study account for multiple imputation, while all standard errors and confidence intervals are bootstrapped to adjust for both sampling and imputation variance. We provide some detail regarding the calculation of point estimates and their standard errors in Appendix A.

Table 1
Weighted Wealth and Income Summary Statistics (Standard Errors)
among Household Heads Aged 25–54

	Total Family Income or Wealth[a]	Family Income and Wealth Adjusted for Family Size[a]
Income		
Average income	$58,440 (1,370)	$31,290 (766)
10th percentile	10,516 (221)	5,619 (180)
25th percentile	22,072 (377)	11,694 (240)
50th percentile (median)	40,758 (591)	21,808 (329)
75th percentile	66,083 (1,201)	35,395 (557)
90th percentile	100,723 (3,026)	56,337 (1,426)
Wealth		
Average net worth	$189,921 (11,353)	$99,604 (5,817)
10th percentile	0 (0.4)	0 (0.4)
25th percentile	7,116 (398)	3,790 (188)
50th percentile (median)	49,309 (1,909)	25,805 (726)
75th percentile	150,024 (6,579)	78,383 (3,791)
90th percentile	364,735 (26,060)	192,835 (12,319)

Note: Standard errors are adjusted for sampling and imputation variance.
[a]Both income and wealth are adjusted for the CPI-U to reflect 1998 dollars.

17+) when highest degree is not reported. We include measures of time preference for saving in our analysis as a proxy for the individual discount rate that has been theorized to confound the relationship between health and wealth. The time preference variables are based on the following survey question: "In planning your family's saving and spending, which of the time periods is most important to you?" A response of "next few months" or "next year" are considered a short planning horizon; a response of "next few years" or "next 5–10 years" are considered medium-length time preference; those responding "longer than 10 years" are coded as having long-horizon time preferences. Individuals who smoke are also more likely to have higher discount rates as well as poor health. Smoking status was only collected in the 1995 and 1998 surveys, but is included in models along with survey year dummies. Summary statistics for each of these measures are shown in Table 2, overall and by health status.

In addition to the variables listed in Table 2, region of residence, health insurance status, farm ownership, whether the householder has any dependent children, and expected inheritance were also evaluated in this study. These measures were excluded from our primary analyses presented here for various reasons and are described in more detail in the sensitivity analysis discussion in Section VI of this paper.

IV. METHODOLOGICAL APPROACH

We explore the relationship between health and wealth by first inspecting the crude association between the two measures and comparing it to the relationship that we find between health and income. We then estimate probit models of poor or fair health that adjust for various additional demographic and individual characteristics. We consider possible differences in age and race before choosing a final model. We present average marginal effects rather than parameter estimates because different scaling factors and the inclusion of interaction terms result in parameter estimates that are not directly interpretable. Predicted probabilities based on this model are then used to characterize the shape of the health gradient.

When estimating our initial probit models, we assume a general additive functional form of our explanatory variables such that our model can be written as:

Table 2
Weighted Demographic Summary Statistics (Standard Errors)
among Household Heads Aged 25–54

		Health Status	
	Overall	Excellent/Good	Fair/Poor
Average age	38.8 (0.04)	38.5 (0.06)	40.4 (0.2)
Non-Hispanic white (%)	74.2 (0.7)	77.3 (0.7)	58.5 (1.4)
Male (%)	45.2 (0.5)	46.2 (0.5)	40.1 (1.2)
Married or cohabiting (%)	64.2 (0.5)	65.7 (0.6)	56.3 (1.2)
Education			
No high school diploma (%)	10.6 (0.4)	7.2 (0.3)	28.0 (1.0)
High School diploma (%)	31.4 (0.5)	30.1 (0.6)	38.2 (1.1)
Some college (%)	28.2 (0.5)	29.5 (0.5)	21.6 (1.0)
College degree (%)	19.1 (0.4)	21.2 (0.5)	8.3 (0.6)
More than college (%)	10.7 (0.4)	12.0 (0.4)	4.0 (0.5)
Smokes (%)	15.5 (0.3)	14.0 (0.3)	23.0 (0.8)
Time preference for saving			
Short horizon (%)	35.7 (0.6)	33.2 (0.6)	48.1 (1.2)
Medium horizon (%)	47.3 (0.6)	48.5 (0.6)	41.2 (1.2)
Long horizon (%)	17.0 (0.4)	18.2 (0.5)	10.7 (0.8)
Sample Size	9,164	7,914	1,250

Note: Standard errors are adjusted for sampling and imputation variance.

$$\Pr(\text{Reporting Poor or Fair Health}) = \Phi(\alpha + \gamma f(Z) + \beta X)$$

where Z consists of a measure of income or wealth, X consists of other individual and demographic characteristics, and Φ represents the cumulative normal distribution.

The choice of the function f is important in that it largely influences the shape of the estimated gradient. Our choice of the inverse hyperbolic sine (IHS) transformation was based on model fit.[7] The IHS with a scale parameter of θ is defined as $\ln(\theta x + \text{sqrt}(\theta^2 x^2 + 1))$.[8] Unlike the log function, the IHS transformation allows for the inclusion of negative values in our analysis, approximating linearity for magnitudes less than $1/\theta$ and approximating a log function for larger magnitudes. The IHS has been used to transform measures of wealth by other researchers, including Pence (2001) and Kennickell (2002). We use a scale parameter of 1/2,000 for wealth and 1/5,000 for income when estimating models of poor/fair health. We found no additional predictive power in having race-specific scale parameters; the chosen parameters provided the best fit for both non-Hispanic whites and for individuals of other races and ethnicities. Interaction terms by age, by race, and for income by wealth were calculated as a function of these transformed variables.

While our preferred results use the IHS, in our sensitivity analysis we consider a variety of other transformations, including a log form of income and wealth, quantiles, and splines for income and wealth terciles. Results using these transformations are described in Section VI.

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[7]We used a number of tests of goodness-of-fit, including various versions of R^2 and pseudo-R^2 measures and the Bayesian information criterion (BIC).

[8]See Burbidge, Magee, and Robb (1988) and MacKinnon and Magee (1990) for further details regarding this transformation.

V. RESULTS

A. The Crude Relationship between Wealth, Income, and Health

In Figure 1 we compare the percentage of household heads reporting poor or fair health by family-size-adjusted income and wealth deciles. We use deciles, dividing the weighted population into ten equal-sized groups ranked by income and wealth, to smooth the data and to show distributional differences. The crude health gradient is notable for both wealth and income: those in a higher income and wealth group are less likely to report poor or fair health. While over 40 percent of individuals with the lowest 10 percent of income report poor or fair health, less than 10 percent of those in the highest income category do so. The shape of the crude health gradient in wealth is similar to that of income: over 30 percent of those with the least wealth reported poor or fair health.

The income gradient is steeper than that of wealth for the first few deciles, suggesting larger health inequalities between low-income groups than between low-wealth groups. Figure 2 provides another plot of health by income and wealth, but uses the median of each income and wealth decile (in thousands of dollars) as the scale. Using dollar amounts, the health gradients are much more nonlinear than those shown in Figure 1. The figure also shows that although rates of poor health decline with household-size-adjusted income up to approximately $50,000, most of the improvement in health is seen in the first $15,000 of net worth.

What is hidden in these figures is the degree to which wealth is simply a reflection of income. Figure 3 shows the distribution of income and wealth in the population. Although income and wealth are correlated (0.297), there is also much variation between the two measures. This is reflected in the positive probability of having relatively high or low income compared to wealth. Over 20 percent of those in the 5th wealth decile have incomes in the 3rd or 8th income deciles. We can use this variation to distinguish any additional link between health and wealth unexplained by income.

Figure 1
Percentage with Poor or Fair Health by Income and Wealth Deciles, Ages 25–54

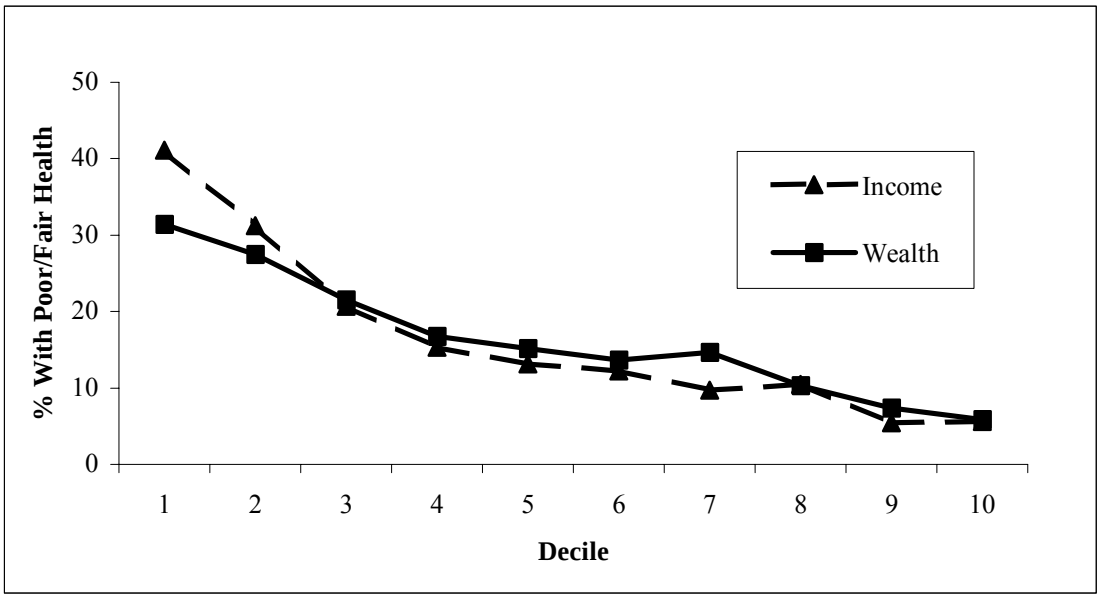


Figure 2
Percentage with Poor or Fair Health by Income and Wealth Deciles at Decile Medians (in Thousands), Ages 25–54

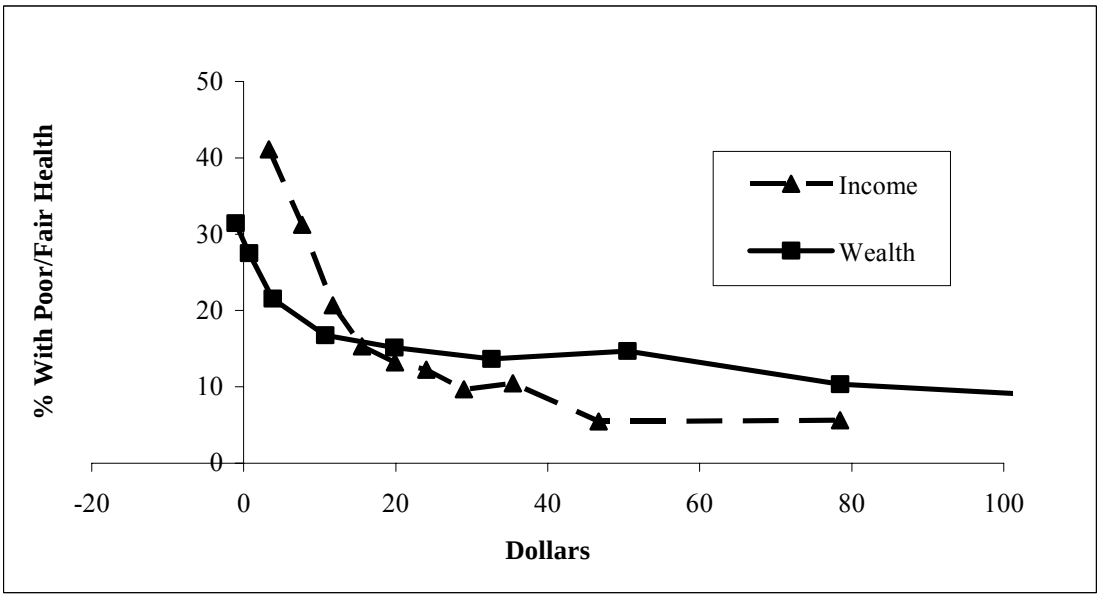
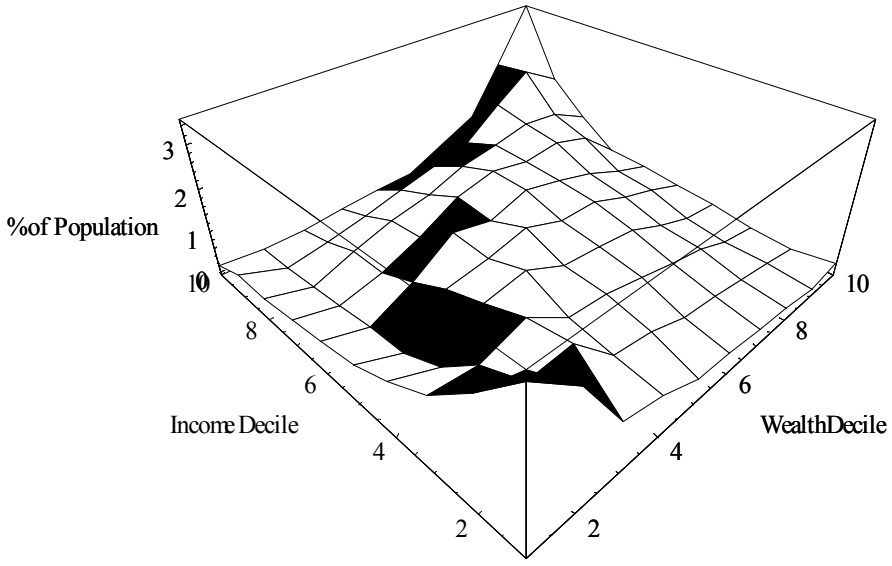


Figure 3
Distribution of Income and Wealth Deciles, Ages 25–54



B. Adjusting for Other Explanatory Variables

To better understand the linkage between income, wealth, and health, we need to consider the degree to which age and other factors influence the health gradient. For instance, given that the oldest individuals in this age cohort tend to be less healthy but have higher incomes and wealth, averaging over individuals of different ages may be dampening the gradient. In addition to age, we also expect race, gender, marital status or family type, education, time preference for saving, and smoking status to be related to both economic status and health. Non-Hispanic whites, married or cohabiting individuals, those with higher education, and nonsmokers tend to have both higher levels of income and wealth as well as better health.

After estimating the likelihood of reporting poor or fair health with each of our economic variables alone and then both together in a model with the extended set of variables noted above, we then add interaction terms. The estimated average marginal effects and standard errors for income and wealth are presented in Table 3 for our initial models. Model 1 includes only a transformed income measure; in Model 2, only transformed wealth is included; Model 3 includes measures of both income and wealth; in Model 4, we add a wealth-by-income interaction term; and Model 5 contains additional age-by-income and age-by-wealth interaction terms. The probit parameter estimates for all variables in these models are shown in Table B.1 of Appendix B.[9]

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[9]In a model without the economic measures, the estimated parameters for our explanatory variables are generally as expected. Adjusted for the other included factors, older individuals are more likely to report poor or fair health than younger individuals; nonwhites or Hispanics are more likely than non-Hispanic whites to report poorer health; and males are more likely than females to report poorer health. Consistent with previous literature, we also find that being married or cohabiting is associated with better health for men, but not for women (see for example Leigh, 1983; and Goldman, Korenman, and Weinstein, 1995). A well-known relationship between health and education (Ross and Wu, 1996) is also apparent in this SCF sample. Heads of households with lower educational levels are more likely to report poor or fair health than those with higher educational levels. We also find that those who smoke are more likely to report poor or fair health than those who do not smoke, and that household heads with shorter time preferences are more likely to report poorer health than those who primarily consider their long-term future when saving. Finally, although insignificant, the year dummies capture any differences over time or across surveys. All these relationships are unchanged regardless of whether income, wealth, or both income and wealth are included in our model.

Table 3
Estimates of Average Marginal Effects of Having Poor or Fair Health among Household Heads Aged 25–54

	Model 1	Model 2	Model 3	Model 4	Model 5
Income marginal	-0.0058*		-0.0049*	-0.0056*	-0.0055*
	(0.0004)		(0.0004)	(0.0005)	(0.0004)
Wealth marginal		-0.0040*	-0.0025*	-0.0031*	-0.0030*
		(0.0004)	(0.0004)	(0.0004)	(0.0004)
Wealth * income interaction				0.0002*	0.0002*
				(0.00003)	(0.00003)
Age * income interaction					-0.0001*
					(0.00004)
Age * wealth interaction					-0.0001*
					(0.00004)

Note: The following explanatory variables are also included in these probit models: age, age squared, sex, marital status, interaction between sex and marital status, education (5 categories), smoking status, time preference variables (3 categories), as well as year dummies. Standard errors are adjusted for sampling and imputation variance.
*Statistically significant at the .05 level.

The commonly observed positive relationship between income and health is apparent in Model 1 of Table 3. A thousand dollar increase in household-size-adjusted income is associated with a 0.0058 average decline in the probability of reporting poor or fair health, or a decline of 0.58 in the percentage reporting poor or fair health. In economic terms, this estimate is large. Extrapolating, a $10,000 increase in income would be associated with a decline of 5.8 percent in individuals that report poor or fair health, a 35 percent reduction given an average of 16.5 percent of such reports in this population. In comparison, the estimated average marginal for having a high school diploma compared to not having completed high school is -0.078 (se: 0.008), or a decline of 7.8 percent in the percentage reporting fair and poor health.

The estimate for wealth is similarly negative and statistically significant in Model 2, where income is replaced by net worth. A thousand dollar increase in net worth is associated with a decline of 0.4 in the percentage reporting poor or fair health. This result suggests that the role of wealth in this model as measured by thousand dollar increases is slightly smaller than that of income in Model 1. Such a difference may be expected, given that wealth is generally valued at larger magnitudes than income. When the specification includes both income and wealth (Model 3), holding other factors fixed, both are still negatively related to the probability of reporting poor or fair health. In this model, a thousand dollar increase in income (wealth) is associated with a half (quarter) of a percent decline in reports of poor health. The average interaction, added in Model 4, is positive and statistically different from zero.

Given that individuals tend to have greater health problems as they age, and that wealth accumulation and income tend to increase with age, it is plausible that the health gradient differs throughout the life course. In fact, House et al. (1994) found that the income-health relationship changes over the span of the adult life, with larger SES differences at higher ages until approximately age 65, then declining thereafter. Given that our sample consists of only those under the age of 55, we explore only the first portion of this hypothesis. We test whether the income-health and income-wealth relationships are changing with age in Model 5, by adding age-by-income and age-by-wealth interaction terms to Model 4.

The estimates for both interactions are negative and significantly different from zero. These interaction terms suggest that health disparities are larger among older individuals in this population.

C. The Final Model

We include additional interaction terms in our final model, allowing the age, income and wealth parameter estimates to vary by race. The resulting average marginal estimates are labeled Model 6 and are shown in Table 4. (The parameter estimates for this model are provided in Table B.2 of Appendix B.) The race-specific estimates reflect the average difference in reported health given a unit increase in age, income, or wealth, assuming the same distribution of characteristics in the population. Although there are large differences in the estimated marginals by race, particularly for the wealth marginals, these differences are not statistically significant. Hereafter, we focus on the average individual that reflects the predominant non-Hispanic white population. We further examine racial differences in the relationship between income and health and wealth and health in Wenzlow, Mullahy, Wolfe (2004).

In Figure 4, we plot the predicted probability of reporting poor or fair health for various wealth levels, by age. We use a prototype that has average or modal characteristics and median income. Specifically, the prototype is a white, nonsmoking, married female with a high school diploma who has medium-term time preferences. The figure reflects the estimated health disparities by wealth, which are particularly large among older individuals. In Figure 5 we plot predicted probabilities for the prototype at various income levels and median wealth. While income differences are apparent in the graph, they do not vary by age. We discuss possible explanations for these observed patterns in Section VII of this paper.

D. The Shape of the Health Gradient

To interpret the differing degree of relationship between health and our two economic measures, income and wealth, we calculate predicted probabilities based on our final model (Model 6), varying both measures. Figure 6 shows the three-dimensional income- and wealth- health gradient for our prototypical individual. Given the rare occurrence of negative income, we show the curve only for income values that

Table 4
Estimates of Average Marginal Effects among Household Heads Aged 25–54, with Race Interaction Terms

	Model 6
Non-Hispanic whites	
Income marginal	-0.0039*
	(0.0006)
Wealth marginal	-0.0019*
	(0.0004)
Wealth * income interaction	0.0001*
	(0.00004)
Age * income interaction	-0.00001
	(0.00006)
Age * wealth interaction	-0.0001*
	(0.00004)
Other races and ethnicities	
Income marginal	-0.0027*
	(0.0007)
Wealth marginal	-0.0014
	(0.0008)
Wealth * income interaction	0.00015*
	(0.00007)
Age * income interaction	-0.00013*
	(0.00006)
Age * wealth interaction	-0.00000
	(0.00006)

Note: The following explanatory variables are also included in this probit model: age, age squared, interaction between age and race, sex, marital status, interaction between sex and marital status, education (5 categories), smoking status, time preference variables (3 categories), as well as year dummies. Standard errors are adjusted for sampling and imputation variance.
*Statistically significant at the .05 level.

Figure 4
Predicted Probabilities of Poor or Fair Health for a Prototypical Individual with 10th, 25th, 50th, 75th, and 90th Percentile Wealth, by Age

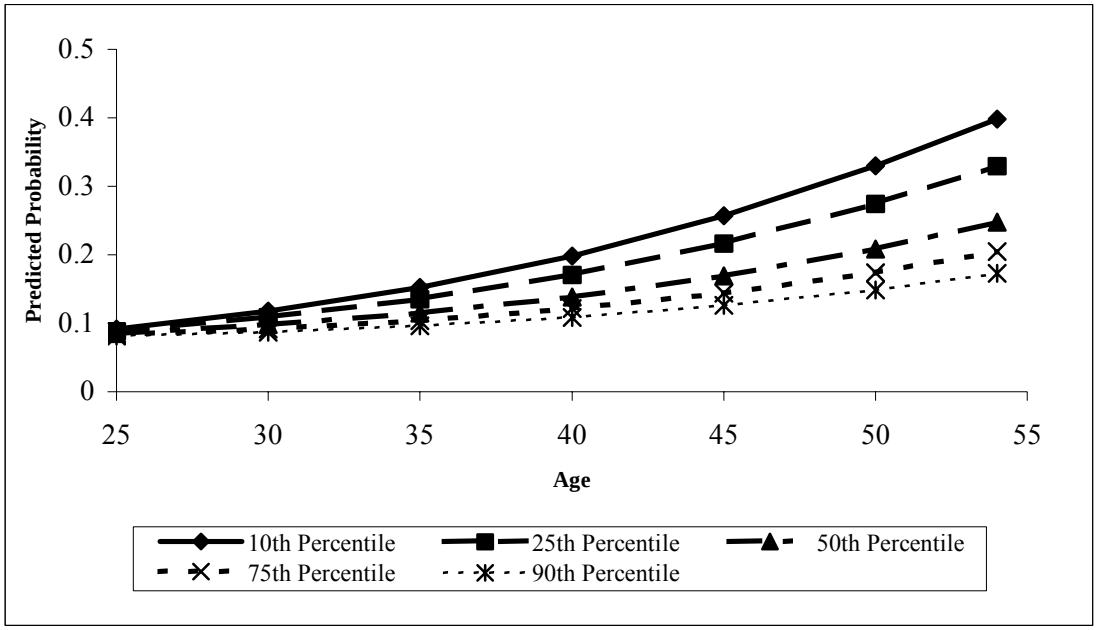


Figure 5
Predicted Probabilities of Poor or Fair Health for a Prototypical Individual with 10th, 25th, 50th, 75th, and 90th Percentile Income, by Age

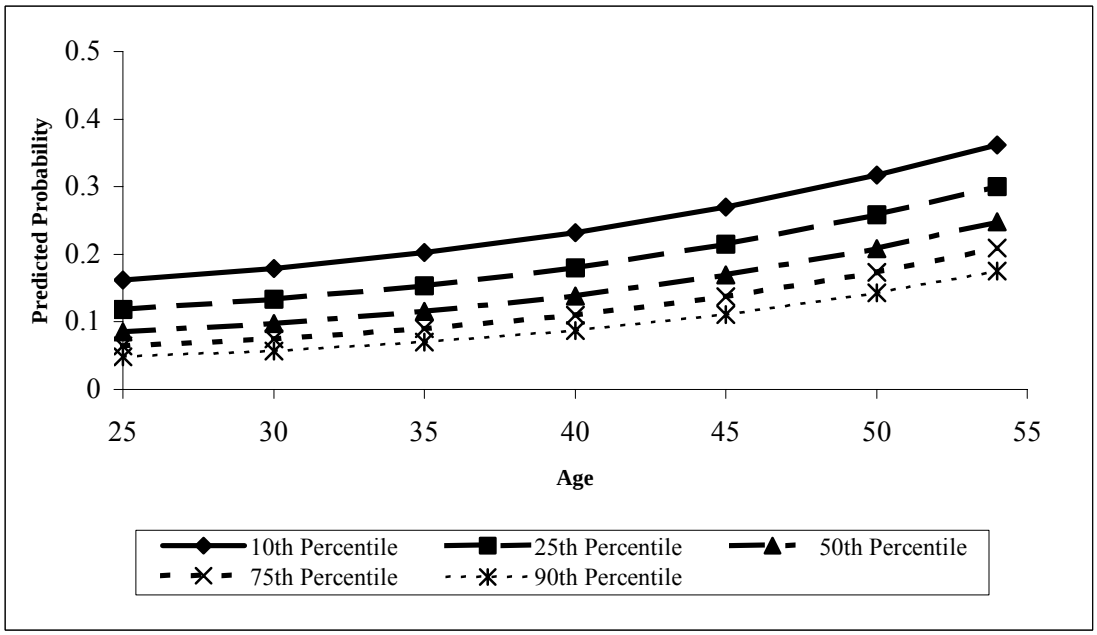
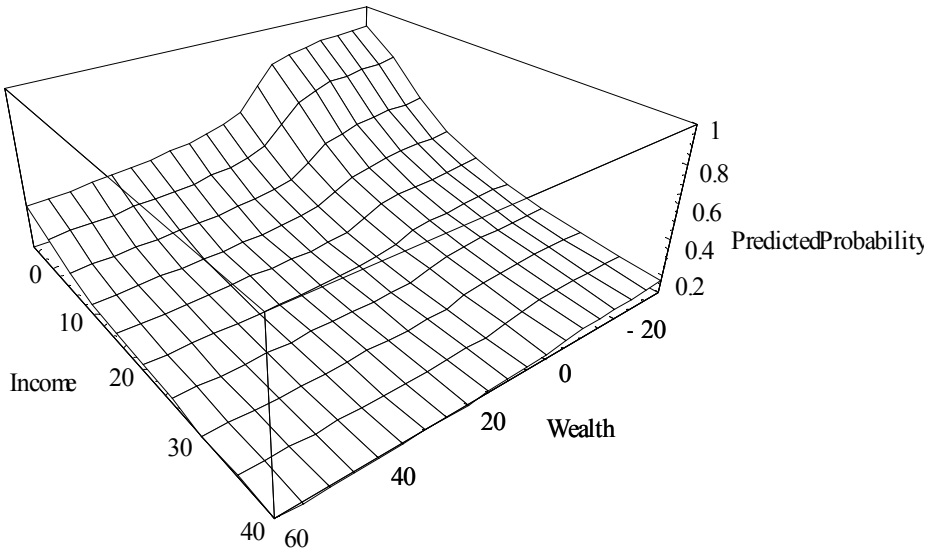


Figure 6
Predicted Probability of Fair/Poor Health by Income and Wealth (in Thousands) for a Prototypical Individual



are close to zero or positive. As one would expect, individuals with both low income and little wealth are most likely to report poor or fair health. The income-health gradient is steepest for the first $10,000 positive dollars and then continues to decline, but less steeply, afterwards. This curve is consistent with the shape of the health gradient in income found in previous studies: it is the inverse of the concave relationship first illustrated by Preston (1975).

Interestingly, compared to the crude percentages and the income-health gradient, the health gradient in wealth declines less. As before, the wealth-health gradient is steepest at very low levels of wealth. More than 60 percent of the variation in health between an average individual at the 10^{th} percentile of wealth ($0) and 90^{th} percentile of wealth ($192,835) is due to differences between individuals with $0 and $20,000 in wealth. Over 30 percent is explained by differences in the first $5,000 of wealth. Although we estimate similar percentages for income, the wealth result is surprising given that the range in wealth is so much larger than that of income.

To supplement this curve, we show in Table 5 the predicted probabilities of poor or fair health for prototypical individuals with $0, $5,000, $10,000, $15,000, and $20,000 of income or wealth. The other economic variable is set first at $0 and then at its median value. As reflected in the three-dimensional gradient, the probabilities for income decline more steeply and steadily than those for wealth. (Health differences are even smaller for income and wealth values greater than $20,000.)

In order to better clarify the age profile, we create a similar predicted probability curve for our prototype: a white married female who does not smoke, has a high school degree and a medium-term time preference, only varying age. The curve for this prototype is shown in Figure 7. There is a stark difference between the curves. At the higher age (54), we estimate that the health gradient in wealth is very large, rivaling that of income throughout the income distribution.

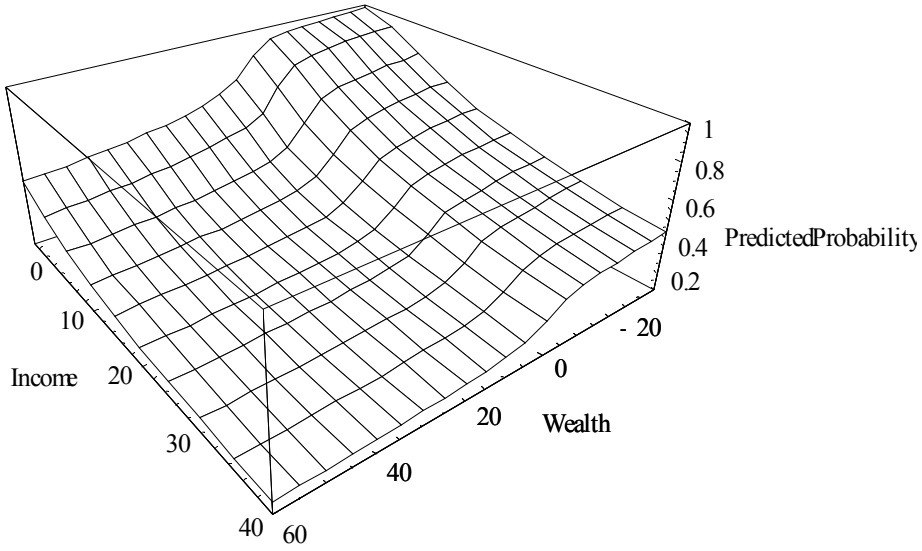
In summary, we find that wealth and health are indeed related among individuals between the ages of 25 and 54, even after taking family income into account; and that health differences over the wealth distribution are larger than those over the income distribution for typical older adults in our cohort,

Table 5
Predicted Probability of Reporting
Poor or Fair Health for a Prototypical Individual (Model 6)

	At $0 Wealth	At Median Wealth
Income		
$0	.520 (.038)	.317 (.030)
$5,000	.371 (.028)	.232 (.021)
$10,000	.285 (.023)	.185 (.017)
$15,000	.233 (.021)	.157 (.015)
$20,000	.198 (.020)	.139 (.014)
	At $0 Income	**At Median Income**
Wealth		
$0	.520 (.038)	.188 (.020)
$5,000	.414 (.032)	.159 (.016)
$10,000	.373 (.031)	.148 (.015)
$15,000	.349 (.030)	.142 (.014)
$20,000	.332 (.030)	.137 (.014)

Note: The prototype is a white, nonsmoking, married female with a high school diploma who has medium-term time preferences. Standard errors are adjusted for sampling and imputation variance.

Figure 7
Predicted Probability of Fair/Poor Health by Income and Wealth (in Thousands)
for a 54-Year-Old Prototypical Individual



reflecting the larger range and variance of wealth. Our model also suggests that a large portion of health disparities in wealth is found at a very low but positive level of net worth.

VI. SENSITIVITY ANALYSES

A. Model Specification

The appropriateness of our model for measuring the strength of the relationship between wealth and health was tested in a number of additional ways. In this section we describe the results of these specification tests. First, we compare our results to those obtained when using other functional forms of income and wealth, and when excluding smoking status and time preference variables. We also test the inclusion of various other measures in our models and whether there were any significant differences between single and married individuals.

First, we compare the results of our preferred model (Model 6) to a similar model using income and wealth unadjusted for family size. The resulting estimates are similar in both specifications. However, a different scaling factor is used for the inverse hyperbolic sine transformation for raw income and wealth;[10] given the different transformations, the predicted probability curve for the raw income and wealth model (not shown here) is smoother—the health gradient is less steep in terms of dollar amounts for both income and wealth, and declines substantially over a longer interval.

Parameter estimates for probit models using various other transformations of the adjusted income and wealth variables are shown in Table 6; the income and wealth parameter estimates are shown across columns rather than rows to conserve space. We exclude the age and wealth-by-income interaction terms so that the parameter estimates can be more easily interpreted. The results are generally consistent with those obtained using the IHS transformation whether taking the log, including quintile dummies, or when

[10]The scaling factor for unadjusted income is 1/7,000 and the scaling factor for unadjusted wealth is 1/3,000. In comparison, 1/5,000 and 1/2,000 were used in the transformation of adjusted income and wealth, respectively.

Table 6
Probit Estimates of Poor or Fair Health of Household Heads Aged 25–54: Sensitivity Analysis Models with Varied Specifications of Wealth and Income

	Non-Hispanic Whites		Other Races/Ethnicities	
	Income	Wealth	Income	Wealth
Log model				
Log of positive values	-0.254*	-0.067*	-0.242*	-0.008
	(0.026)	(0.013)	(0.035)	(0.017)
Dummy for those <= 0	-1.950*	-0.259	-2.282*	0.125
	(0.317)	(0.141)	(0.409)	(0.156)
Nonparametric race-specific quintiles				
1st quintile	0.663*	0.466*	0.684*	0.198
	(0.090)	(0.078)	(0.125)	(0.111)
2nd quintile	0.185*	0.240*	0.610*	0.012
	(0.089)	(0.081)	(0.125)	(0.124)
3rd quintile	0.186*	0.206*	0.331*	-0.004
	(0.086)	(0.082)	(0.109)	(0.110)
4th quintile	0.166	0.075	0.082	0.048
	(0.087)	(0.070)	(0.122)	(0.108)
Tercile spline				
1st–3rd tercile	-0.030*	-0.005	-0.014	-0.002
	(0.007)	(0.003)	(0.019)	(0.009)
2nd–3rd tercile	0.017	-0.001	-0.029	-0.003
	(0.011)	(0.004)	(0.026)	(0.011)
3rd tercile	0.012*	0.005*	0.041*	0.005
	(0.005)	(0.001)	(0.010)	(0.004)

Note: The race-specific income and wealth parameter estimates for each of the three models are shown across columns to conserve space. The following explanatory variables are also included in these models: age, age squared, sex, marital status, interaction between sex and marital status, education (5 categories), smoking status, time preference variables (3 categories), as well as year dummies. Standard errors are adjusted for sampling and imputation variance.
*Statistically significant is at the .05 level.

estimating a spline linear function for income and wealth terciles. Wealth is significantly related to health among whites. A predicted probability curve for the log model (with age interaction terms) is similar in appearance to those obtained using the IHS transformation. The nonparametric estimates based on quantiles of the race-specific income and wealth distributions confirm that income and health, and wealth and health, are most strongly related at the low end of the wealth distribution.

Model specifications that exclude some key explanatory variables provide additional confirmation of our results. Time preference variables may be capturing individual expectations of the life span as a function of health, and thus may be endogenous. When excluding time preference variables from our model, as shown in Table 7 (Model 7), we find that there is little effect on the estimated relationship between wealth and health status. We also estimate our model excluding smoking status, which was only measured in two of the four survey years. This change in model specification also has little effect on our parameters of interest.

Additional variables tested but not included in our final model include region of residence, expected inheritance, farm ownership, the presence of dependent children, and health insurance. The results of these models for our variables of interest are shown in Table 8. While living in the South is often linked to differences in health and socioeconomic measures, this is not the case in our sample after adjusting for other variables. A measure of whether or not a respondent expected to receive a significant inheritance in the future is also insignificantly related to health. Individuals who own farms make up a large portion of those who report negative income (although not wealth). Nevertheless, farm ownership is not related to health in our multivariate analysis; nor does this measure affect the relationship between income and health or wealth and health. While having dependent children is positively related to health, we find a relatively small change in our estimated parameters of interest.

We next consider the inclusion of health insurance in our analysis. We are hesitant to do so, given the additional dynamic relationship between income, access to care, and health insurance. When we do include measures of public and private insurance in our model, we find that private insurance is related to

Table 7
Estimates of Average Marginal Effects of Having Poor or Fair Health among Household Heads Aged 25–54: Sensitivity Analysis Models Excluding Smoking and Time Preference Variables

	Model 6	Model 7	Model 8
Smokes	0.032*	0.032*	
	(0.007)	(0.007)	
Time preference (short horizon)			
Medium horizon	-0.023*		-0.023*
	(0.006)		(0.006)
Long horizon	-0.029*		-0.029*
	(0.010)		(0.010)
Non-Hispanic whites			
Income marginal	-0.0039*	-0.0040*	-0.0039*
	(0.0006)	(0.0006)	(0.0006)
Wealth marginal	-0.0019*	-0.0021*	-0.0020*
	(0.0004)	(0.0004)	(0.0004)
Wealth * income interaction	0.0001*	0.0001*	0.0001*
	(0.00004)	(0.00004)	(0.00004)
Age * income interaction	-0.00001	-0.00001	-0.00001
	(0.00006)	(0.00006)	(0.00006)
Age * wealth interaction	-0.0001*	-0.0001*	-0.0001*
	(0.00004)	(0.00004)	(0.00004)
Other races and ethnicities			
Income marginal	-0.0027*	-0.0028*	-0.0027*
	(0.0007)	(0.0007)	(0.0007)
Wealth marginal	-0.0014	-0.0014	-0.0014
	(0.0008)	(0.0008)	(0.0008)
Wealth * income interaction	0.00015*	0.00015*	0.00015*
	(0.00007)	(0.00007)	(0.00007)
Age * income interaction	-0.00013*	-0.00013*	-0.00013*
	(0.00006)	(0.00006)	(0.00006)
Age * wealth interaction	-0.0000	-0.0000	-0.0000
	(0.0001)	(0.0001)	(0.0001)

Note: The following explanatory variables are also included in these probit models: age, age squared, interaction between age and race, sex, marital status, interaction between sex and marital status, education (5 categories), smoking status, time preference variables (3 categories), as well as year dummies. Standard errors are adjusted for sampling and imputation variance.
*Statistically significant at the .05 level.

Table 8
Estimates of Average Marginal Effects of Poor or Fair Health among Household Heads Aged 25–54: Sensitivity Analysis Models with Additional Variables

	Model 6	Model 9	Model 10	Model 11	Model 12	Model 13
Residence in the South		-0.002				
		(0.006)				
Expected inheritance			0.007			
			(0.008)			
Farm ownership				0.003		
				(0.024)		
Any dependent children					-0.025*	
					(0.007)	
Health insurance (no insurance)						
Public insurance						0.039*
						(0.009)
Private insurance						-0.027*
						(0.008)
Non-Hispanic whites						
Income marginal	-0.0039*	-0.0039*	-0.0039*	-0.0039*	-0.0043*	-0.0033*
	(0.0006)	(0.0005)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
Wealth marginal	-0.0019*	-0.0019*	-0.0020*	-0.0019*	-0.0019*	-0.0017*
	(0.0004)	(0.0004)	(0.0005)	(0.0004)	(0.0004)	(0.0005)
Wealth * income interaction	0.0001*	0.0001*	0.0001*	0.0001*	0.0001*	0.00006
	(0.00004)	(0.00004)	(0.00004)	(0.00004)	(0.00004)	(0.00004)
Age * income interaction	-0.00001	-0.00001	-0.00001	-0.00001	-0.0000	-0.00001
	(0.00006)	(0.00006)	(0.00006)	(0.00006)	(0.0001)	(0.00006)
Age * wealth interaction	-0.0001*	-0.0001*	-0.0001*	-0.0001*	-0.0001*	-0.0001*
	(0.00004)	(0.00004)	(0.00004)	(0.00004)	(0.00004)	(0.00004)

(table continues)

Table 8, continued

	Model 6	Model 9	Model 10	Model 11	Model 12	Model 13
Other races and ethnicities						
Income marginal	-0.0027*	-0.0027*	-0.0027*	-0.0027*	-0.0029*	-0.0022*
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Wealth marginal	-0.0014	-0.0014	-0.0014	-0.0014	-0.0013	-0.0010
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0008)
Wealth * income interaction	0.00015*	0.00015*	0.00015*	0.00015*	0.00015*	0.00011
	(0.00007)	(0.00007)	(0.00007)	(0.00007)	(0.00007)	(0.00007)
Age * income interaction	-0.00013*	-0.00013*	-0.00013*	-0.00013*	-0.00013*	-0.00012
	(0.00006)	(0.00006)	(0.00006)	(0.00006)	(0.00006)	(0.00006)
Age * wealth interaction	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)

Note: The following explanatory variables are also included in these probit models: age, age squared, interaction between age and race, sex, marital status, interaction between sex and marital status, education (5 categories), smoking status, time preference variables (3 categories), as well as year dummies. Standard errors are adjusted for sampling and imputation variance.
*Statistically significant at the .05 level.

better health and public insurance is related to reports of poor or fair health relative to those without insurance. We interpret this latter finding as indicating that the insurance variables reflect another degree of socioeconomic status. The receipt of public insurance may also reflect a selection problem, where only those who become ill and receive care are enrolled in public health insurance programs. While the inclusion of these variables in our model does affect our measures of interest, the general conclusions regarding the relative importance of wealth to health remain unchanged. However, the wealth-by-income interaction terms, and the age-by-income interaction for Hispanics and nonwhites, are no longer significantly different from zero.

We also test for any significant differences between single and couple households in the relationship between health and our economic measures. We find that we cannot reject the hypothesis that the health-wealth link is the same for singles and coupled individuals. Estimating the models separately for the two groups results in less precise estimates but confirms that the results are similar for both groups.

Year-specific estimates of the relationship between health, income, and wealth are consistent with those found in our preferred model, providing additional support for our findings. In particular, income and wealth are negatively related to having poor or fair health in each of the four years among non-Hispanic whites. The link between health and wealth is not apparent among nonwhites—year-specific estimates for nonwhites were inaccurately estimated.

B. Unit of Analysis

In the case of couples, it is not obvious that the household head, defined as the person most familiar with the family finances, should be the unit of analysis. The health of both individuals heading the family may be of interest as both individuals commonly influence savings choices and health spending. The estimates also suggest that gender may play a different role in the health of single

compared to couple household heads. To explore this relationship further, we use the proxy health reports of spouses or partners and analyze data for both individuals in a couple.[11] We do this in two ways. First we estimate Model 6 for married household heads and spouses separately. Then we analyze the health of coupled females and compare the results to an analysis of coupled males.[12] In both these comparisons, we find no important difference in the estimated parameters of interest. We conclude that choosing to analyze the health of the head of household rather than the spouse or partner has little effect on our results.

VII. DISCUSSION

A. Implications of Our Findings

Although we cannot attribute causal relationships between health status and socioeconomic status based on our analysis, our study does provide some insight as to plausible mechanisms relating the two. One "common factor" theory suggests that differences in time discount rates result in both savings and investment in health, explaining the correlation between the two variables. When we exclude time preference variables from our model, we find little change in the estimated relationship between wealth and health status. If our time preference measures appropriately capture differences in discount rates, this provides evidence that the estimated wealth-health relationship is not due to this common factor.

The large disparities in health at values of wealth close to zero may reflect disabled individuals or individuals who are very ill and have depleted their savings, or it may indicate that individuals with even small savings can use them to cover emergency health costs and thus can better weather health shocks. The latter explanation could have important implications in terms of providing a strong savings incentive for individuals with little wealth. This result may also suggest that analyses such as those of Robert and

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[11]The SCF does contain age, gender, and education of spouses/partners. Race and time preference measures are assumed to be the same for both individuals.

[12]In the case of same-sex couples, we include only the household head in the analysis.

House (1996), which measure wealth by distinguishing those with low levels of wealth versus all others, may be capturing an important aspect of wealth as it relates to health.

Our finding regarding the age variation in the wealth-health link is interesting for a number of reasons. Previous research has suggested that the income-health relationship increases by age through age 54 (House et al., 1994). Our findings suggest that, among whites, it is actually wealth rather than income that is differentially related to health depending on age. This result can be explained in a number of ways: wealth may be measuring permanent income— cumulative health effects due to previous low income, or employment effects due to previous poor health; costly health shocks that affect wealth occur later in life, resulting in a stronger health-wealth link later in life; or the result may be reflecting the tendency for older individuals who are less healthy and have short life expectancies to spend down their savings.

B. Limitations of This Study

Although we find a positive relationship between health and wealth, providing some support to causal mechanisms that suggest such a relationship, our findings cannot refute the possibility that we have measured combined effects of multiple and conflicting causes.

Second, pension and social security wealth anticipated at retirement are not included in our measure of net worth. Pension and social security are instead measured as income in the SCF. Although this may be appropriate for those receiving benefits, it underestimates the resources that individuals have at retirement. We believe that there should be little effect of pension and social security wealth on the health dynamics of individuals who are not near retirement, such as those analyzed in this study. However, it should be understood that any effects of health on pension and social security, via employment for instance, are not directly captured in our measured correlation.

A difficulty that may have a larger impact on our study is the change in the survey questionnaire in 1995, described in the data section of this paper. The newly added smoking question may have had an impact on the responses regarding general health used in this study. The year dummies that are included in our model capture any changes that affected everyone equally. Of concern is the possibility that those

of a particular wealth or income type would be more likely to respond differently about their health in the two different questionnaire scenarios.

Finally, this study is limited in that we analyze only a single, self-reported measure of health. We also evaluate only the relationship between health and overall net wealth, and not its components. Both need to be investigated further.

VIII. CONCLUDING REMARKS

Using the Survey of Consumer Finances, one of the best sources of data regarding wealth in the United States, we find that wealth is indeed related to health net of income. Holding demographic and other individual characteristics fixed, both income and net worth are positively associated with fewer reports of poor or fair health among individuals aged 25 to 54. Among whites, this relationship is particularly strong at older ages; although other researchers have found a similar pattern in the age relationship between income and health, we find that the differential economic-health relationship by age is stronger for wealth than for income.

The shape of the health gradient in wealth is similar to that of income, and provides some interesting questions for future research. While health differences persist throughout the wealth distribution, large variation in average health is seen at very low levels of net worth. In comparison, the income gradient is smoother. One possible explanation for the steep health gradient in wealth around zero is the availability of financial resources to recover from health shocks. Another is that the wealth gradient is capturing differences between individuals with and without disabilities. The degree to which either of these is the case is a question for future research.

APPENDIX A. Point Estimate and Standard Error Calculation in the SCF

The appropriate methods for calculating point estimates and standard errors using the Survey of Consumer Finances are described in the 1998 SCF codebook (Board of Governors of the Federal Reserve System, 2000). Additional details regarding the weighting procedure can be found in Kennickell, McManus, and Woodburn (1996), and in other sources found on the SCF Federal Reserve Web site <http://www.federalreserve.gov>. Here we summarize the methods that we used in the paper.

The SCF has a complex sampling frame. To address concerns for respondents' privacy, details regarding the sampling are not made available to users of the public data. However, a file of 999 replicate weights and multiplicity factors for each of the weights are made available to users to approximate variation in the data using a bootstrap technique. The SCF data are also multiply imputed; each respondent has five records (or implicates) of data reflecting the various imputed values. Thus, point estimates and standard errors must be adjusted to account for the imputation method as well as for the sampling scheme.

The SCF recommends that the Repeated Imputation Inference (RII) method be used to calculate point estimates and standard errors.[13] Appropriate point estimates are calculated by averaging the point estimates obtained by analyzing each of the five implicates separately. We use SCF weight variable X42001 for these calculation. Appropriate standard errors are given by:

$$\text{Sqrt}\left((6/5)*\text{Imputation Variance} + \text{Sampling Variance}\right)$$

The Imputation Variance is the variance of the five implicate estimates, or the sum of the squared deviation of the point estimates for each of the five implicates minus their mean, divided by (5 – 1 = 4).

[13]See Montalto and Sung (1996) for a detailed explanation of RII in the SCF.

The Sampling Variance is estimated using the bootstrap technique with the provided 999 replicate weights and multiplicity factors, where the multiplicity factors reproduce sampling with replacement. It is equal to the sum of the squared deviations of the point estimates obtained using each of the 999 bootstrap replicates minus their mean, divided by (999 – 1 = 998). The bootstrapped replicates are based on only the first of the five implicate values.

The models reported in this paper were estimated using the Stata programming language (Stata Corporation, 1999).

APPENDIX B. Parameter Estimates

Appendix Table B.1
Probit Estimates of Poor or Fair Health of Household Heads Aged 25–54

	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	-1.106*	-0.981*	-1.438*	-1.205*	-1.172*	-1.172*
	(0.398)	(0.401)	(0.399)	(0.402)	(0.405)	(0.415)
Age	0.042*	0.045*	0.052*	0.050*	0.055*	0.042*
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.021)
Age squared	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	0.0000
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Non-Hispanic white	-0.309*	-0.212*	-0.236*	-0.183*	-0.171*	-0.171*
	(0.039)	(0.039)	(0.038)	(0.039)	(0.038)	(0.038)
Male	0.128*	0.277*	0.195*	0.294*	0.312*	0.311*
	(0.050)	(0.051)	(0.050)	(0.051)	(0.050)	(0.050)
Married or cohabiting	-0.023	0.120*	0.091*	0.167*	0.188*	0.192*
	(0.039)	(0.041)	(0.040)	(0.041)	(0.042)	(0.041)
Male and married or cohabiting	-0.281*	-0.409*	-0.350*	-0.431*	-0.448*	-0.442*
	(0.062)	(0.063)	(0.062)	(0.063)	(0.062)	(0.062)
Education (no high school degree)						
High School diploma	-0.546*	-0.416*	-0.478*	-0.394*	-0.374*	-0.363*
	(0.047)	(0.047)	(0.047)	(0.047)	(0.048)	(0.048)
Some college	-0.828*	-0.614*	-0.720*	-0.581*	-0.557*	-0.545*
	(0.051)	(0.052)	(0.052)	(0.053)	(0.053)	(0.054)
College degree	-1.094*	-0.779*	-0.950*	-0.741*	-0.726*	-0.719*
	(0.055)	(0.058)	(0.058)	(0.060)	(0.060)	(0.060)
Graduate education	-1.171*	-0.804*	-1.006*	-0.762*	-0.765*	-0.740*
	(0.068)	(0.076)	(0.072)	(0.078)	(0.079)	(0.079)
Smokes	0.240*	0.209*	0.191*	0.185*	0.183*	0.185*
	(0.041)	(0.041)	(0.040)	(0.040)	(0.040)	(0.040)
Time preference (short horizon)						
Medium horizon	-0.221*	-0.155*	-0.163*	-0.130*	-0.132*	-0.126*
	(0.033)	(0.034)	(0.034)	(0.035)	(0.035)	(0.035)
Long horizon	-0.306*	-0.211*	-0.206*	-0.164*	-0.168*	-0.167*
	(0.051)	(0.054)	(0.053)	(0.055)	(0.055)	(0.054)
1989 survey	-0.057	-0.050	-0.058	-0.051	-0.051	-0.052
	(0.049)	(0.050)	(0.049)	(0.050)	(0.049)	(0.049)
1992 survey	0.007	-0.005	-0.006	-0.011	-0.009	-0.008
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
1995 survey	0.011	0.012	0.021	0.019	0.019	0.018
	(0.039)	(0.041)	(0.040)	(0.041)	(0.042)	(0.042)
Transformed income		-0.359*		-0.301*	-0.401*	-0.283*
		(0.023)		(0.024)	(0.034)	(0.108)

(table continues)

Appendix Table B.1, continued

	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5
Transformed net worth			-0.111*	-0.069*	-0.133*	-0.040
			(0.009)	(0.010)	(0.019)	(0.049)
Transformed income* transformed wealth					0.034*	0.043
					(0.008)	(0.009)
Age * transformed income						-0.004*
						(0.003)
Age * transformed wealth						-0.003*
						(0.001)

Note: Standard errors are adjusted for sampling and imputation variance.
*Statistically significant at the .05 level.

Appendix Table B.2
Probit Estimates of Poor or Fair Health of Household Heads Aged 25–54: Final Model

	Model 6
Intercept	-2.814*
	(0.757)
Non-Hispanic white	2.393*
	(0.864)
Male	0.307*
	(0.056)
Married or cohabiting	0.189*
	(0.042)
Male and married or cohabiting	-0.438*
	(0.068)
Education (no high school degree)	
High School diploma	-0.361*
	(0.048)
Some college	-0.552*
	(0.053)
College degree	-0.725*
	(0.058)
Graduate education	-0.752*
	(0.080)
Smokes	0.175*
	(0.040)
Time preference (short horizon)	
Medium horizon	-0.127*
	(0.037)
Long horizon	-0.158*
	(0.048)
1989 survey	-0.052
	(0.046)
1992 survey	-0.013
	(0.038)
1995 survey	0.018
	(0.042)

(table continues)

Appendix Table B.2, continued

	Model 6
Non-Hispanic whites	
Age	0.006*
	(0.025)
Age squared	0.000
	(0.000)
Transformed income	-0.491*
	(0.163)
Transformed wealth	-0.003
	(0.051)
Transformed income*	0.042*
transformed wealth	(0.009)
Age * transformed income	0.002
	(0.004)
Age * transformed wealth	-0.004*
	(0.001)
Other races and ethnicities	
Age	0.117*
	(0.038)
Age squared	-0.001*
	(0.0005)
Transformed income	0.042
	(0.172)
Transformed wealth	-0.192*
	(0.093)
Transformed income*	0.064*
transformed wealth	(0.021)
Age * transformed income	-0.013*
	(0.005)
Age * transformed wealth	0.001
	(0.002)

Note: Standard errors are adjusted for sampling and imputation variance.
*Statistically significant at the .05 level.

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