

# Health and Wealth in a Lifecycle Model

Executive Summary

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Health and consumption decisions are interlinked, yet the ways that consumption and health interact are hard to untangle. Our paper examines the links between health, consumption and wealth, starting from ideas dating back at least to Grossman (1972), who argued that health is the cumulative result of investment and choices (along with randomness) that begin *in utero*. We formulate a life-cycle model that we solve household-by-household, where health investments (including time-use decisions) can affect longevity. Household utility is a function of consumption and health. By modeling investments in health, longevity becomes an endogenous outcome, which allows us to study the effects of changes in safety net policy, for example, on mortality as well as wealth.

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Our preliminary work makes three contributions relative to a set of innovative, insightful papers that examine the links between health and consumption. First, we model the process of health production starting at the beginning of working life. Forward-looking households will respond to income shocks, health shocks, or to changes in institutions by altering their health investments and consumption during their working lives. We model these decisions. Second, the contribution of out-of-pocket medical expenditures on health, particularly late in life, are likely minimal. Yet even in the United States, there is a strong, positive gradient between income/wealth and health/mortality. It is possible that broadly defined health expenditures, such as smoking decisions, exercise, diet, and preventative medical care (such as consumption of beta-blockers and cholesterol drugs) indeed affect health and longevity. While our approach is stylized, we take a more expansive view than prior work of health investments. Third, we develop a model of wealth and longevity in order to study how health shocks affect consumption plans, as done by others in the literature, and study investments in “health capital.” If death occurs when health falls below a given threshold, households may respond to policy or exogenous shocks by reducing or increasing consumption and hence altering longevity relative to a world where health is not an argument in preferences. Studying the tradeoff between consumption and health investments on longevity (and health status) offers new insights into household behavior.

In our current draft, we simplify the household’s intertemporal problem by treating labor supply and retirement as being exogenous. While earnings are assumed to be exogenous, the expectations households have about annual earnings realizations have an important effect on optimal consumption and health investment. Households maximize utility by choosing consumption and leisure, governed by a Cobb-Douglas function, and health investments, where the consumption/leisure composite and health are governed by a CES function. We assume that the household possesses a health stock and investments in the health stock prolong life. Health capital is produced using time and money, and

health is subject to a constant rate of depreciation. Households also face age-dependent health shocks that affect health status and survival. Households face budget constraints and constraints on the evolution of resources available for consumption.

As suggested by the previous paragraph, we impose functional forms to build the economic model. A set of underlying parameters are chosen based on estimates from the existing literature and from empirical analyses based on data from the Health and Retirement Study (HRS) – the underlying data for our analysis. Fourteen parameters, however, are left unspecified. These include utility function parameters, including the elasticity of substitution between consumption/leisure and health, the coefficient of relative risk aversion, parameters of the health technology (including the depreciation rate) and survival function, and the probabilities of age-dependent adverse health shocks. We use 14 moments from the HRS data to calibrate these parameters. The moments include average net worth, age-dependent survival probabilities, and average total medical expenses by age. Like a handful of existing studies, we find health and the consumption/leisure composite are complements: the marginal utility of consumption is higher when health is good, for example, when households are younger.

While we calibrate the model to match behavior of the average household in the data, the preliminary model does a good job matching the *distribution* of wealth and total medical expenditures in the HRS data. The  $R^2$  of a simple bivariate regression between optimal wealth (as determined in the model) and actual wealth is 0.74. The  $R^2$  of optimal medical expenditures and observed medical expenditures is 0.66. The model also does a nice job matching survival probabilities in the HRS data. The HRS is a longitudinal survey that follows some sample members for as many as 14 years. Hence, we can look at 10-year survival probabilities in the HRS for households centered around age 60, for example (ages 58-62 at the time they enter the sample) and around age 75 (ages 73 to 77 at the time they entered the sample), and compare their survival probabilities to those of 60- and 75-year-old households the model. The model does a

strikingly good job matching survival patterns in the underlying data.

In the final section of the paper we use the model to examine the effects of removing Medicare, the universal social insurance program that was established in 1965 to provide health insurance to the elderly. In the first specification we suppose that Medicare were instantly eliminated and the change was not anticipated. The short run effects on mortality of eliminating Medicare are trivially small. Since most accumulation of health capital and wealth occurs well before retirement, health status is largely fixed by age 60-65. Eliminating Medicare, therefore, has little effect on health in the years immediately following its repeal. While Medicare provides insurance against adverse health shocks, our model yields results consistent with earlier empirical findings of Finkelstein and McKnight.

In the long-run, however, Medicare repeal has a large effect on survival probabilities, particularly in the lowest lifetime income quintile. In the long-run, a forward-looking household with low lifetime income will recognize they have no government-provided health insurance program in retirement. They also correctly anticipate the lifecycle pattern of health shocks and the cumulative effects of health depreciation, so old-age health status will be worse than health status at younger ages. Because health and consumption are complements, the life-cycle pattern of consumption mirrors the lifecycle pattern of health. Low lifetime income households will therefore invest less in health, trading off a shorter expected lifespan for greater consumption in younger ages when the marginal utility of consumption is high relative to later in life. High lifetime income households can mitigate these effects by self-insuring: they engage in buffer stock saving and invest in health capital.

The model results illustrate a central insight into the lifecycle model with endogenous health. Long-run adjustments to changes in the institutional environment will be made on two margins: first, households will consume less and do more buffer stock saving. Second, private health investment will also decrease. The result is that households will

both consume less and die earlier than in a world without Medicare. But relative to a standard lifecycle model of consumption without endogenous health production, the consumption responses will be smaller, since a portion of the response occurs through a diminution of health capital. With less health capital, households correctly anticipate that they will die younger and hence they need to accumulate less wealth to finance consumption in retirement. Thus, the model with endogenous health mitigates the effects of changes in social insurance on consumption relative to standard lifecycle models.

Our work is very preliminary, but we are grateful for the chance to participate in the NBER's household saving meeting and we look forward to improving the model and analyses.