Health and Mortality Delta*

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With Social Security running out of money earlier than predicted, Medicare and Medicaid resources strained, and a gridlocked Congress unlikely to do much about it, households are on their own when it comes to managing their health and mortality risk. To help households cope, insurers should publish transparent summary indicators that will facilitate better risk-management choices.

Determining how to save for retirement involves intricate calculations of risk: how long one might live, what it may cost, whether good health will continue, and estimating medical expenses if it doesn't. This risk makes choosing the right life insurance, annuity, Medigap, or long-term care policy a crucial task. However, it is a daunting intellectual exercise even in the best of circumstances. Compounding the difficulty is a bewildering range of financial products and a cacophony of financial advice all proffering to offer solutions.

It need not be so complicated Clear summary indicators of risk are available for stock and bond investors. For equities and mutual funds, a variable known as "beta" measures risk relative to the market's overall performance. For bonds, investors need only look at "duration" to gauge risk. While not perfect, these yardsticks are invaluable investment tools.

Absent is a comparably simple, objective gauge for measuring the relative risk of insurance products that can help those deciding which life insurance, Medigap, or long-term care policies

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to purchase, or how to guarantee a fixed stream of income through an annuity. In our paper, we develop two simple measures to fill this gap.

“Health delta" measures the amount of insurance that a policy delivers in poor health relative to good health. Similarly, “mortality delta" measures the amount of insurance that a policy delivers at death relative to good health.

For example, a life insurance product has positive mortality delta because it has a higher payoff when the insured is dead rather than alive. It also has a positive health delta because in poor health, the insured is more likely to die sooner than when she is in good health. Annuities have negative mortality delta because they pay only while alive. They also have negative health delta because the impaired mortality in poor health lowers the expected stream of annuity payouts relative to good health. Exact delta values depend on the details of the policies, but are straightforward to compute for any available retirement financial product. In this way, any insurance product can be summarized in terms of health and mortality delta.

To compute the optimal demand for insurance, we develop a life-cycle model in which a household faces health and mortality risk that affects life expectancy, health expenses, and the marginal utility of consumption or wealth. The household can save in a bond as well as a complete menu of health and longevity products that includes life insurance, annuities, and supplementary health insurance. We view complete markets as a fairly realistic assumption, given the wide variety of health and longevity products that retail financial advisors and insurance companies already offer. In fact, a combination of existing health and longevity products replicates the optimal health and mortality delta predicted by the calibrated life-cycle model. The resulting portfolio positions are reasonable. Furthermore, the optimal demand under complete markets is a useful benchmark for evaluating the observed demand for health and longevity products.

Data We use the Health and Retirement Study to calibrate our life-cycle model, which is a representative panel of older households in the United States, started in 1992. This household survey is uniquely suited for our study because it contains household-level data on health outcomes, health

expenses, income, and wealth as well as ownership of life insurance, annuities, supplementary health insurance, and long-term care insurance.

Actual choices far from optimal Based on each household's observed holdings of health and longevity products, we calculate the health and mortality delta of its overall portfolio. The second step is to compare the observed to the optimal health and mortality delta. We compute the latter based on the respondent's observed characteristics (current age, birth cohort, health, and wealth) and preferences. We estimate preference parameters by minimizing the distance between observed and model-implied health and mortality delta across respondents. The resulting estimates imply a relative risk aversion of 2.5, a 30 percent lower marginal utility in poor health than in good health, and a strong bequest motive equivalent to 9.5 years worth of consumption.

Under these preference parameters, the optimal health delta for the average household is $2k at age 51, which implies that the household needs $2k less in poor health relative to good health at age 53. There are three offsetting forces that determine the optimal health delta. First, the household has preference for consumption in good health over poor health, which pushes the optimal health delta to be more negative. Second, the household saves less in poor health because of shorter life expectancy, which pushes the optimal health delta to be more negative. Third, the household has lower lifetime disposable income in poor health, which pushes the optimal health delta to be more positive. The first two forces dominate the third, so that the optimal health delta is negative at age 51.

The optimal mortality delta is $190k at age 51, which implies that the household needs an additional $190k at death relative to good health at age 53. Again, there are three offsetting forces that determine the optimal mortality delta. First, the household has preference for bequest over consumption in good health, which pushes the optimal mortality delta to be more positive. Second, the household must save for future consumption in good health, which pushes the optimal mortality delta to be more negative. Third, the household has higher lifetime disposable income in good health, which pushes the optimal mortality delta to be more positive. The first and third forces

dominate the second so that the optimal mortality delta is positive at age 51.

The left panel of Figure 1 bellow shows that the optimal health delta has a U-shaped profile over the life cycle. To replicate the optimal health delta, the households does not need short-term health insurance through age 67. Thereafter, the household must gradually increase its position in short-term health insurance to 0.81 units at age 99. Since one unit of short-term health insurance eliminates all uncertainty in out-of-pocket health expenses in the next period, these positions imply that the household demands only partial health insurance for most of the life cycle. The intuition for this result is that higher out-of-pocket health expenses in poor health are offset by shorter life expectancy, lowering the optimal health delta relative to full health insurance.

The right panel of Figure 1 shows that the optimal mortality delta declines over the life cycle. To replicate the optimal mortality delta, the household must hold short-term life insurance when young to generate positive mortality delta, then switch to deferred annuities when old to generate negative mortality delta. The optimal position in deferred annuities increases from 5 units at age 51 to 91 units at age 99. A practical implication is that an insurance company may want to package life insurance and deferred annuities into a life-cycle product that automatically replicates the life-cycle profile for optimal mortality delta, eliminating the need for active rebalancing.

Welfare cost of suboptimal choice While there would seem to be few impediments to achieving the optimal outcome given available products, actual insurance behavior of the HRS sample shows a large departure from the optimal insurance portfolio. The resulting lifetime median welfare cost for households aged 51 to 58 is 17.4 percent with a standard error of 3.0 percent. In other words, the median household would be willing to forgo 17 percent of wealth to switch from the observed to the optimal health and mortality profile. Because wealth includes the present value of future income, the welfare cost as a fraction of cash-on-hand is even larger. The deviations from the optimal mortality delta explain the lion share of this welfare cost. The lifetime welfare cost for households aged 67 to 74 drops to 7.8 percent with a standard error of 0.2 percent.

There is also considerable heterogeneity in welfare costs, reflecting heterogeneity in the dis-

tance between the observed from the optimal health and mortality delta. Careful investigation reveals that this heterogeneity cannot be accounted for by a host of household characteristics that proxy for risk aversion, bequest motives, and private information about health. If these factors that are missing from the life-cycle model are important determinants of household insurance choice, they should have significant explanatory power for the residuals generated by the model. Overall, we find little evidence for such mis-specification. The deviations from the optimal health and mortality delta remain mostly unexplained by observed household characteristics that capture potential preference heterogeneity or private information about health.

The only factor that is correlated with deviations between observed and optimal health and mortality deltas is ownership of annuities including private pensions. Because most annuity ownership is inherited from pension plans, these facts imply that most of the variation in the observed health and mortality delta is driven by heterogeneity and inertia that arises from passive annuitization through private pensions.

Regulation and education Where does that leave us? Insurance companies should be mandated to report the health and mortality delta for the insurance products they offer. The introduction of such risk measures would facilitate standardization, identify overlap, and identify risks that are not insured by existing products. It would also make the insurance market place more transparent and efficient. This would ultimately lead to financial innovation of the kind that actually benefits households. Financial advisors should guide households on the optimal exposure to health and mortality delta over the life cycle. Financial education could make a big difference—equivalent to raising consumption at age 55 by 17 percent!

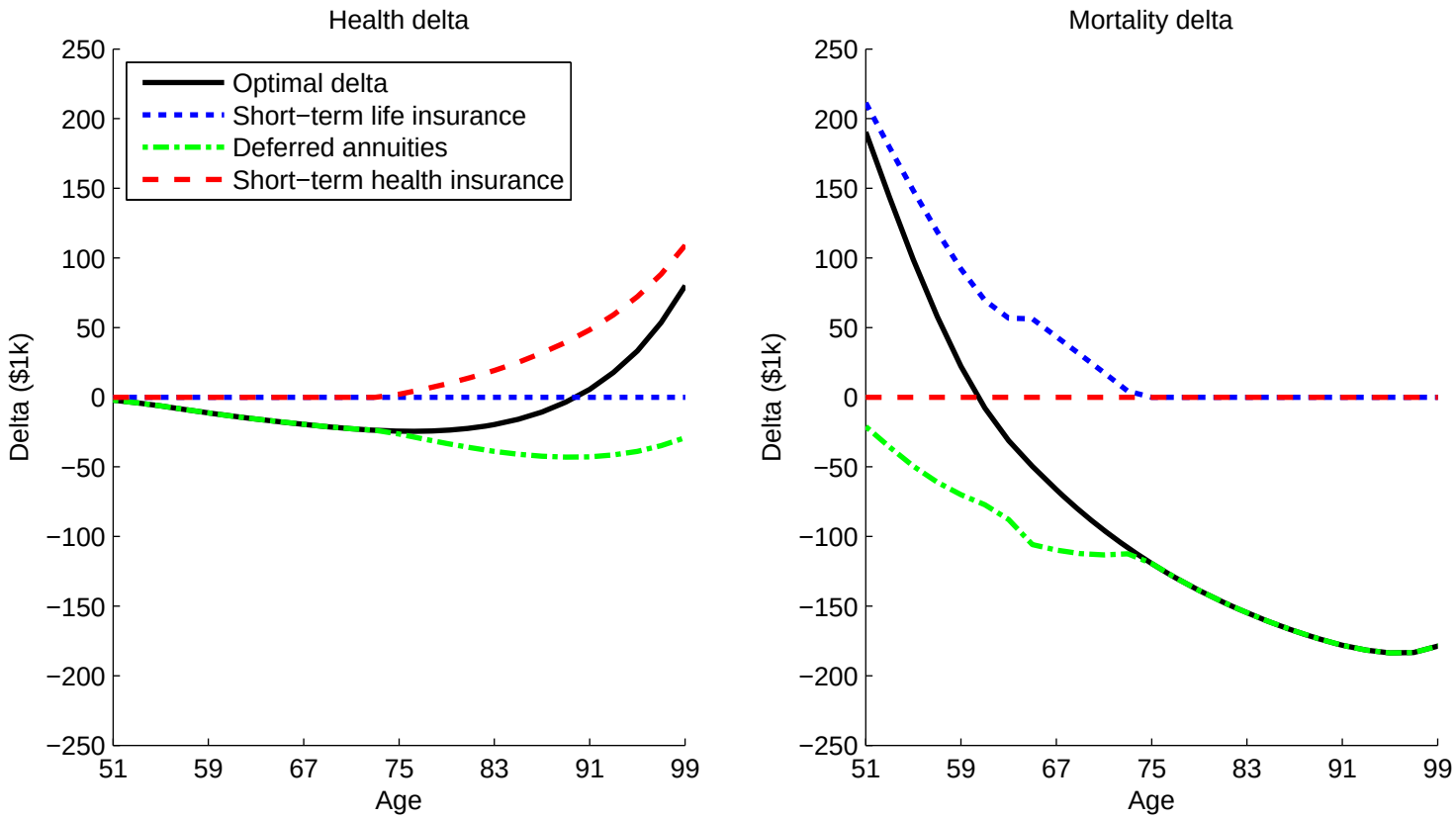

Figure 1: Optimal Health and Mortality Delta over the Life Cycle

The sum of health (mortality) delta for short-term life insurance, deferred annuities, and short-term health insurance equals the optimal health (mortality) delta at each age. Short-term policies have maturity of two years, and the income from deferred annuities start at age 65. The reported estimates are for male respondents in good health at age 51, born 1936 to 1940 in the Health and Retirement Study.