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Strategies for mitigating the risk of outliving retirement wealth

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Abstract

Whether retirement wealth will last a lifetime depends on many factors, including spending and saving decisions, investment performance, qualification for defined benefit or other annuity income streams, health care costs, long-term care (LTC) risk, and longevity. Individuals may be able to improve retirement outcomes by making better-informed choices both before and during retirement. This article uses Monte Carlo simulation to simultaneously model stochastic financial, health, long term care, and life risks and evaluates which financial strategies best mitigate the risk of outliving retirement wealth. A combined strategy of delayed retirement and Social Security claiming, reduced discretionary spending, and LTC insurance is found to greatly improve retirement outcomes for typical retiree households.

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1. Introduction

In light of demographic change and loss of investment wealth during the financial crisis, the issue of retirement income adequacy has never been of more importance. The risk of outliving retirement wealth depends on spending and saving decisions, investment perfor-

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mance, qualification for defined benefit or other annuity income streams, health care costs, long-term care risk, and longevity.

Monte Carlo simulation is used to forecast retiree cash flow needs and income, incorporating investment, inflation, health, long term care, and longevity risks. This model is different from most stochastic models of the postretirement period because it incorporates a wider variety of retirement-related risks rather than focusing on inflation and investment risks. The inclusion of health costs, long-term care, and longevity risks is an important contribution because, as we show, these factors create significant tail risk exposure and can easily derail a retirement plan. Therefore, incorporating these risks in the model makes it possible to test the efficacy of various financial strategies for mitigating the risk of outliving wealth.

In general, we find that small decreases in discretionary expenditures do little to change the probability of successfully making it through retirement without depleting assets. This is because the large tail risks associated with health costs (Stanton, 2006), long-term care (Tomlinson, 2011), and investments are too great in magnitude to be offset by this strategy. Therefore, the amount of wealth needed to be 95% confident of being able to fund these future costs is much greater than the amount needed on average. Generally, U.S. households are underprepared for these future costs based on current wealth levels. However, we show that certain risk mitigation strategies can greatly improve retirement outcomes.

In the next section, we provide a review of the relevant literature. In the following sections of the article, we describe the model and report the results of the simulations. The article concludes with a summary of the main findings of the research and implications for retirement policy and financial planners.

2. Background on retirement cash flow forecasts

It is generally accepted in the financial planning community that a detailed cash flow forecast is the best way to estimate spending needs in retirement. This is beyond the ability of most individuals, particularly with a longer-term forecast. However, many financial advisors have software packages that facilitate development of cash flow forecasts for their clients. This methodology allows for personalized treatment of choices in retirement, age, housing, part-time work, investments, travel, and other changes in retirement. It can also incorporate differences in family makeup, such as children who have not yet finished college, special needs family members, and financial support of other family members.

There are a number of complexities with regard to budget forecasts. In addition to being sensitive to assumptions regarding the retirement period length, investment returns, and inflation, there will always be unforeseen expenses. For future expenditure categories which the preretiree has not yet experienced (such as health and long term care costs), financial planners commonly recommend using averages based on historical data. In reality, an individual household's actual expenditures are likely to be quite variable. Furthermore, medical cost inflation suggests that these expenses will gradually consume a larger share of the retiree budget over time. A recent study found that health and long term care costs add an average of $260,000 to the retirement costs of a married couple, more than the average

couple has in total retirement wealth. (Webb and Zhivan, 2010). Using a detailed Employee Benefit Research Institute (EBRI) simulation model, Fronstein, Salisbury, and VanDerhei (2009) estimate that the cost could be much larger for workers without subsidized employer coverage, particularly when prescription drug costs are included.

Based on forecast expenditure needs and available wealth, retirees often are recommended drawdown decisions that will meet their needs. For a more complete review of the literature on drawdown of retirement savings, see MacDonald, Jones, Morrison, Brown, and Hardy. (2011). Perhaps because of its simplicity, many recent research studies have focused on identifying "safe" withdrawal rates for retirement investment accounts. In this context, safe is usually defined in reference to a probability of ruin, or outliving one's wealth. A common rule of thumb that has been suggested and widely tested through simulation is the so-called "4% rule" wherein retirees are recommended to withdraw 4% of their account balance in the first year of retirement and then increase the withdrawal amount with inflation thereafter. Some simulation studies have shown that the risk of outliving one's wealth following this strategy is relatively low but others have suggested that the strategy is highly sensitive to investment performance in the early years of retirement. Lemoine, Cordell, and Gustafson (2010) suggest reducing investment risk by incorporating annuities in the drawdown strategy.

Several studies in the financial planning literature test or tweak the recommended withdrawal rates. Mitchell (2011) finds that adjusting the withdrawal rate when portfolio performance is less than expected can increase the average achievable withdrawal rate over time. Milevsky and Robinson (2005) suggest a beginning withdrawal rate of 3.24% and Athavale et al. (2011), with somewhat more conservative investment assumptions, conclude that only 2.52% can be withdrawn the first year. The latter article also provides a review of other articles on this topic.

As with many rules of thumb, the primary advantage of focusing on a withdrawal rate is simplicity. Although the decision requires assumptions about portfolio allocation, mortality, and investment return, the story appears to be "one size fits all" and is easy to explain to clients. The difficulty with this type of rule is that it is unrealistic. Unavoidable expenses, such as uninsured medical costs or auto repairs may make it necessary to withdraw more than the safe amount. If retirement savings are used to pay unexpected expenses as they occur, the depletion of household assets results in lower investment earnings. For those who live long enough, a safe withdrawal rate eventually results in depletion of resources, with the probability of ruin dependent on the mortality assumptions inherent in the calculation of the withdrawal rate.

Despite the academic interest in systematic drawdown strategies, survey data indicates that very few retirees employ them, instead focusing on spending "as needed" (SOA, 2007, 2009). In the simulation model used for this study, we assume that household spending is driven by spending needs rather than by a recommended drawdown strategy for assets.

3. A simulation model of retirement cash flow needs and risks

To provide the basis for estimation of retirement income needs and adequacy, we develop a Monte Carlo simulation model of retirement cash flows that incorporates the common risks

faced by retirees, including longevity, inflation, investment, health, and long-term care risks. By varying assumptions, we can compare outcomes based on decisions such as expense reduction, delayed retirement, and the purchase of long-term care insurance. In the following subsections, we describe and justify the base case assumptions, explain the metrics used for reporting the simulation output, and identify the alternative scenarios that are simulated.

3.1. Base case assumptions

The model construct is a detailed after-tax cash flow forecast for a retired married couple (spouse age 66 and spouse age 63) from the date of retirement to the date of the death of both spouses. The base case couple is assumed to have household income of $60,000 in the year before retirement, and $100,000 in nonhousing wealth at the beginning of the retirement period. These income and wealth levels are approximately the median for their age group from the 2010 Survey of Consumer Finances, adjusted for inflation to 2012 dollars. We also consider households at approximately the 75th and 90th percentiles of income ($105,000 and $150,000) and two levels of wealth for each income level.

Preretirement household earnings are assumed to be split between the spouses with the spouse having earned 70% of total income (rounded to the nearest thousand). In general, a couple with a sole earner at this income level would be better off in retirement than the dual income couple because joint Social Security benefits are higher. However, the assumption that both were working is more consistent with current workforce participation statistics for near retirees.

We assume that the hypothetical households intend to maintain preretirement standards of living.[1] We use expenditure patterns in the Consumer Expenditure Survey to separately model initial expenditures in various categories This produces a replacement rate relative to preretirement income in the first year of retirement approximately equivalent to estimates in AON (2008, 2012). The households are assumed to enter retirement as homeowners, rather than renters, and without any mortgage debt. Historically, most retirees have been homeowners with zero mortgage debt. Housing expenses are therefore limited to property taxes, insurance and repairs.[2] For each of the three income levels, the value of the home is approximated at three times household income. We assume that the house will be sold after the last person vacates the house, either because of death or entering long-term care. Sale proceeds, assumed to be 90% of home equity value are added to household wealth in the year of disposition. Beyond the first year, health care and long-term care expenditures increase with simulated health cost inflation. Housing costs and discretionary expenses are assumed to increase annually with the simulated increase in the CPI-U.

Households are assumed to have two primary sources of income in retirement: Social Security and investment wealth. It is assumed that all investment wealth is accessible to the household and can be drawn down as cash income, and we assume that neither spouse is entitled to employer defined benefit or private annuity income.[3] For simplicity, investment wealth includes all forms of invested savings, including IRAs, employer defined contributions plans, and lump sum distributions from other plans at retirement. Investment wealth is assumed to be allocated between stocks (50% large cap and 50% small cap) and long-term corporate bonds. The portfolio allocation is assumed to change each year following the rule

of thumb that the percentage of equity investment is 100 minus current age of the older spouse (e.g., at age 66 the equity portion is 100 − 66 = 34%).

All cash flows are calculated after-tax. The base case assumes that both spouses begin taking their Social Security benefit at retirement (ages 66 and 63), the spouse receiving his full retirement benefit and the spouse receiving a spousal benefit equal to half of her spouse's benefit. The base case assumes that neither spouse has long-term care (LTC) insurance.

3.2. Stochastic components to the simulation

Stochastic elements are incorporated in the cash flow forecast by imposing risky distributions on various elements for each year of retirement until the death of the second spouse. Because we are interested in the combined effect of longevity risk, investment risk, inflation risk, and health risk, we model these variables as a separate draw from a simulated distribution for each year of retirement. The assumptions and stochastic elements of the simulation are described in more detail below.

3.2.1. Mortality

The year of death for each spouse is generated based on the Social Security Administration's actuarial life table, given the individual's current age and gender. This represents an important difference between our study and others in that we are better able to see the impact of longevity risk.

3.2.2. Inflation

General inflation is assumed to be normally distributed with a mean of 3.71%, a standard deviation of 1.22% and an annual correlation of 0.60, based on the Consumer Price Index from January 1947 through October 2011. This measure of inflation is simulated for each year and is used to inflate all prices except for health care and LTC costs. Medical cost inflation is based on the CPI-Medical Care Costs January 1947 through October 2011 and is assumed to be normally distributed with a mean equal to 5.43%, a standard deviation equal to 1.06%.[4] Medical inflation is simulated for each year and is used to inflate the costs of health care and LTC.

3.2.3. Investment returns

Investment returns for each year are simulated using a lognormal distribution for the weighted portfolio of stocks (50% small cap and 50% large cap) and long-term corporate bonds. Based on Ibbotson data from 1947 through 2010, the equity portfolio returned an average of 14.2% with a standard deviation of 15.2%, while bonds averaged 6.5% with a standard deviation of 9.3%. In contrast to Cooley et al. (2003), historical correlation between bonds, stocks, and inflation were not significantly different than 0, so were not included in the simulation. Given lower expectations on future equity returns and the current low interest rate environment, the results of this simulation can be seen as a lower bound on required retirement wealth.

3.2.4. Annual health expenditures

Health expenditures are modeled for each year of retirement based on a lognormal distribution. In the first year, health care costs are simulated with a mean of $2,000, standard deviation of $2,000, a minimum of $1,560, which is approximately the cost of Medicare Part B premiums, and a maximum of $100,000 (an extremely rare event). In each year thereafter, the mean, standard deviation, minimum and maximum escalate based on simulated medical inflation Webb and Zhivan (2010).

3.2.5. Long-term care

Long term care is determined in a two-step process for each spouse. For each year of retirement, we first model whether the individual will go into long term care based on a Bernoulli distribution where the probability is determined by the person's age and gender. Secondly, if the person goes into LTC, the length of stay is assumed to be either three months or remaining life. While this is obviously overly simplified, data on distribution and duration of long-term care suggest that about 2/3 of people over age-65 will experience a short duration stay in their lifetime and 1/3 will need long-term care, with women averaging twice as many years of care as men (U.S. Department of Health and Human Services, 2013). We assume an annual cost of $80,000, which is approximately the median cost per year for nursing home care in the United States, with shorter stays being a fraction of the annual cost (Genworth Financial, 2013).[5]

3.3. Variations on the base case

In addition to the base case simulations for three income levels at two wealth levels each, we report results for three potential risk-mitigating strategies. These are summarized in Table 1 and described below.

3.3.1. Reduce discretionary spending

At low levels of wealth, it may not be feasible to maintain the preretirement standard of living. In this scenario we reduce discretionary expenditures by 15%. Housing, health, and LTC costs are assumed to be outside the retiree's control so are not reduced. We do not consider the case of downsized housing, although this is obviously an additional strategy for reducing the standard of living in retirement.

3.3.2. Purchase long-term care insurance

In the base case, the household does not have LTC insurance in place, an assumption consistent with data on long-term care insurance purchase behavior (Brown and Finkelstein, 2007). LTC insurance contract terms, coverage, and pricing continue to be quite different across insurers. Given the complexity of this product, consumers are wary of locking themselves into a relatively long-term and expensive financial commitment, particularly when Medicaid continues to provide a safety net (Brown and Finkelstein, 2008). Recent changes in product offerings and the exit of several insurers from the marketplace have resulted in increased premiums and decreased coverage. Two simulation alternatives are run to estimate the impact of long-term care insurance: (1) both spouses purchase LTC insurance

Table 1 Summary of simulated income, wealth, and retirement decision scenarios

Preretirement household income (split 70% husband/ 30% wife)	$60,000	$60,000	$105,000	$105,000	$150,000	$150,000
Nonhousing wealth at retirement	$100,000	$200,000	$250,000	$500,000	$500,000	$1,000,000
Standard of Living scenarios	Same as preretirement	Same as preretirement	Same as preretirement	Same as preretirement	Same as preretirement	Same as preretirement
	Reduce discretionary spending 15%	Reduce discretionary spending 15%	Reduce discretionary spending 15%	Reduce discretionary spending 15%	Reduce discretionary spending 15%	Reduce discretionary spending 15%
Retirement age (H/W) scenarios	66/63	66/63	66/63	66/63	66/63	66/63
	70/67	70/67	70/67	70/67	70/67	70/67
Long term care ins scenarios	No LTC ins	No LTC ins	No LTC ins	No LTC ins	No LTC ins	No LTC ins
	Both buy (66/63)	Both (66/63)	Both (66/63)	Both (66/63)	Both (66/63)	Both (66/63)
	Female only (63)	Female (63)	Female (63)	Female (63)	Female (63)	Female (63)

at retirement and (2) the spouse purchases LTC insurance at age 63. We use information in Tomlinson (2011) to estimate costs and premiums. We assume that the product purchased provides relatively complete coverage for life. To the extent that many products being offered in the market today are limited to a specified dollar amount on lifetime coverage, which can be exhausted after a few years of full care, our results overstate the value of this product for those who end up in extended LTC.

3.3.3. Delay retirement

In this scenario, we assume the married-couple household delays retirement by four years to ages 70 and 67, respectively. Although most retirees claim Social Security early at age 62 (Munnell and Soto, 2005; Sun and Webb, 2009), many retirement specialists are now recommending delayed claiming strategies (see, e.g., Munnell, Golub-Sass, & Karmcheva, 2009; Meyer & Riechenstein, 2012; and Sass, Sun, & Webb, 2008). By delaying retirement and benefit claiming, the couple reduces their retirement period and increases their Social Security benefits (Tucker, 2009; and Friedman & Phillips, 2008). Based on current rules, the spouse is entitled to a benefit at age 70 equal to 132% of his normal retirement benefit, and the spouse is entitled to 108% of her age 66 benefit at age 67. Although additional years of work normally would also be associated with increased wealth, we do not assume that the starting wealth will be greater in this scenario than in the base case.

4. Results and discussion

In this section, we will report the results for the base case and for each of the risk-mitigating scenarios described above. For each of the simulated scenarios in Table 1, we use the accumulated outcomes of 50,000 runs of the household's retirement cash flows to present several metrics of the success or failure of the household's retirement plan. These metrics are:

Probability of having wealth left at death: The percentage of the simulation runs in which the last spouse to die has any investment wealth remaining. It is the equivalent to 1 minus the probability of income shortfall. Note, however, that the household will still have Social Security income after investment wealth runs out but will be unable to meet their goal of maintaining the preretirement standard of living.

Expected wealth at death: For each run of the simulation, we determine how much money is left in the investment portfolio when the last spouse dies and report both the median and the 95th percentile, which represents the best 5% of outcomes.

Number of years income is insufficient to meet needs: We report both the median and 95th percentile of the number of years in retirement in which the household experiences an income shortfall.

Retirement wealth that would have been sufficient to meet needs: We report both the median and 95th percentiles for the amount of investment wealth that would have been needed to meet their needs (after Social Security) in the worst 5% of outcomes.

Table 2 Base case simulation results: Married couple households retiring at ages 66(H)/63(W)

	Simulated household types by income and wealth					
Preretirement household income	$ 60,000	$ 60,000	$ 105,000	$ 105,000	$ 150,000	$ 150,000
Nonhousing wealth at retirement	$100,000	$ 200,000	$ 250,000	$ 500,000	$ 500,000	$1,000,000
Probability of having wealth left at death:	29%	81%	8%	68%	14%	82%
Remaining wealth at death:						
50th percentile	$ 0	$ 361,743	$ 0	$ 444,966	$ 0	$1,467,652
95th percentile	$235,705	$1,527,216	$ 89,484	$2,437,392	$ 383,896	$6,036,391
Number of years of income shortfall						
50th percentile	5 years	0 years	11 years	0 years	10 years	0 years
95th percentile	21 years	12 years	24 years	13 years	22 years	9 years
Investment wealth at retirement sufficient to meet needs:						
50th percentile	$169,628	$ 169,972	$ 544,521	$ 547,644	$ 949,613	$ 950,314
95th percentile	$686,264	$ 686,533	$1,011,390	$1,068,873	$1,491,116	$1,525,269

4.1. Base case results

Table 2 summarizes the base case simulated retirement outcomes for all six income/wealth combinations. The results show that the $60,000 couple with only $100,000 in investment wealth at retirement have a 71% chance of having insufficient income in retirement to meet their cash flow needs.

The extreme differences between the 50th and 95th percentiles illustrate the problems associated with retirement savings and drawdown strategies based on averages. The simulated married-couple households with higher assumed wealth for a given income level can meet their needs 50% of the time, but there is still at least a 5% risk that they will have a long period of shortfall (9 to 24 years, depending on wealth and income). Although not apparent on this table, extreme tail risks, such as early onset long-term care needs, investment declines (particularly in the early years of retirement), inflation risk, and unexpected health costs all contribute to the likelihood of retirement income inadequacy.

Not surprisingly, all else equal, higher wealth at retirement improves the odds of making it through retirement without financial difficulties. However, the higher income/wealth households have poorer probability of success based on these metrics than the median household. There are two reasons for this result. First, retirement spending increases with preretirement income because we assume the household desires to maintain its preretirement standard of living. Second, Social Security replacement ratios are much lower for higher income households, as illustrated in Fig. 1 below. Social Security replaces about 43% for the $60,000 couple, but only 35% for the $105,000 couple and 30% for the $150,000 couple. This implies that, even though both couples have proportionally similar investment wealth relative to preretirement income, the higher income couple must fund a greater proportion of their retirement expenditures.

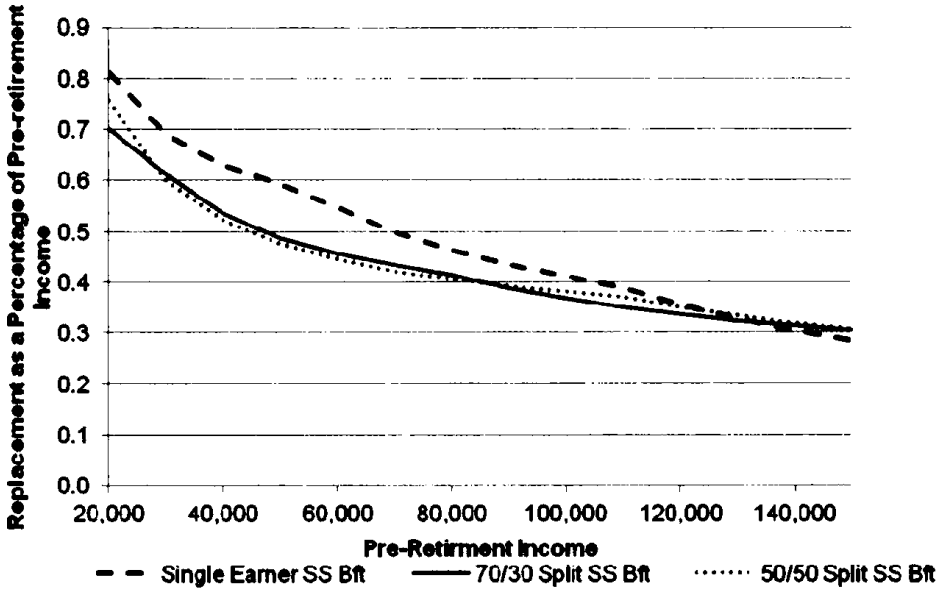

Fig. 1. Social Security replacement rates for a fully insured worker and spouse at normal retirement age, 2012. *Note:* Author's calculations based on 2012 Social Security benefit formula for retired household with at least one fully insured worker. Lower earning spouse is assumed to qualify for the spousal benefit equal to 50% of the higher earner's benefit.

Given our assumptions, the median retiree couple would need $169,628 in expendable nonhousing wealth at the time of retirement to be 50% confident of having enough. However, they would need four times as much ($686,533) to be 95% confident of not running short. For the higher income and wealth households, the difference is smaller in magnitude, but there is a lower probability of success.

4.2. Effect of reduced discretionary spending

If a retiree household has insufficient wealth to maintain their standard of living, taking steps to reduce expenses is a logical retirement strategy. Table 3 reports the results of the simulation assuming a 15% reduction in discretionary expenditures. Perhaps surprisingly, this strategy does not significantly improve outcomes for the median income retiree household, but has a substantial impact on the 75th and 90th percentile households. For example, the probability of having wealth left at death increases from 8% to 54% for the 75th percentile retiree household and from 14% to 32% for the 90th percentile household.

Similarly, although investment wealth needs do not change for the lowest income couple, the higher income couples need about 20% less at retirement to be 95% confident of not outliving their assets. These results are in part a function of the greater importance of Social Security at lower income levels. Perhaps more important is that the retirement risks at the root of income shortfalls are extreme in nature (health, long term care, and investments) and cannot be offset by relatively small reductions in annual expenditures when the household has relatively small resources. However, the higher income couples can benefit from this strategy when it is combined with other risk-mitigating choices.

Table 3 The effect of reducing discretionary expenditures by 15%

	Simulated household types by income and wealth					
Prerretirement household income	$ 60,000	$ 60,000	$ 105,000	$ 105,000	$ 150,000	$ 150,000
Nonhousing wealth at retirement	$100,000	$100,000	$ 250,000	$ 250,000	$ 500,000	$ 500,000
Discretionary expenditures	Base case-no change	Reduce by 15%	Base case-no change	Reduce by 15%	Base case-no change	Reduce by 15%
Probability of having wealth left at death:	29%	29%	8%	54%	14%	32%
Remaining wealth at death:						
50th percentile	$ 0	$ 0	$ 0	$ 62,666	$ 0	$ 0
95th percentile	$235,705	$239,373	$ 89,484	$1,074,795	$ 383,896	$ 945,768
Number of years of income shortfall						
50th percentile	5 years	5 years	11 years	0 years	10 years	5 years
95th percentile	21 years	21 years	24 years	17 years	22 years	19 years
Wealth at retirement that would have been sufficient to meet household needs:						
50th percentile	$169,628	$169,682	$ 544,521	$ 314,130	$ 949,613	$ 769,424
95th percentile	$686,264	$669,257	$1,011,390	$ 838,371	$1,491,116	$1,285,221

4.3. Effect of long-term care insurance

As discussed previously, long term care is modeled as a low frequency, high severity risk. The probability is low, but the high cost can deplete household resources very quickly. As such, it results in a skewed distribution of outcomes that shows up in the wide discrepancies between the 50th and 95th percentile confidence levels. In the previous section, we saw that small decreases in expenses were insufficient to mitigate the risk of income shortfall: this is because those strategies do little to improve a household's ability to meet long term care costs.

To manage long term care risk and its impact on retiree household financial well-being, financial planners often recommend the purchase of long term care insurance. We assume here that the household purchases LTC insurance at the date of retirement at a fixed annual premium cost for life, and that the insurance provides relatively complete coverage for all long term care costs. The impact of this purchase on our model is that households will have an increase in regular expenses during retirement (annual premiums), but will benefit from the lower expected cost of care. We consider the purchase of LTC insurance on both spouses and on the wife only because her younger age and lower mortality risk makes her the most likely to be left without other resources in old age. Relative to preretirement spending, the LTC insurance premiums result in increased postretirement expenses, resulting in quicker depletion of retirement wealth.

Based on the results reported in Table 4, LTC insurance does have some risk-mitigating benefits, particularly for the lowest income couple. Based solely on the probability of having wealth remaining at death and the years without wealth, it appears that LTC insurance does more harm than good. However, when looking at the retirement wealth needed, the $60,000 couple needs half as much at retirement to be 95% confident of having enough. At higher income/wealth levels, LTC insurance is not as beneficial because they can afford to pay directly for the LTC and therefore do not need to incur the extra expense.

A caveat to these results is that they are very sensitive to the assumptions regarding LTC risk and the type and timing of policy purchased. The results would be quite different if LTC insurance was purchased earlier at lower annual premiums, or if the households purchased less coverage, such as the commonly-recommended lifetime limits of two or three years of care. Further, recent changes in the marketplace makes it less likely that the type of policy we have modeled here will be available at reasonable premium prices.

4.4. Effect of delayed retirement

In Table 5, we report the results of an alternative scenario in which the couples retire four years later at ages 70 and 67, but at the same income and wealth levels as the base case. Essentially, the results of this scenario are isolating the effect of delayed Social Security claiming and a reduced retirement period. If the household also was able to save more in the interim, this would obviously improve their retirement outcomes relative to those reported here.

As expected, delaying retirement increases the likelihood of having adequate retirement income throughout the retirement period. The biggest effect is for the median household whose probability of having wealth left at death goes from 29% to 89%. Even when they

Table 4 The effect of buying LTC insurance

	Simulated household types by income and wealth								
Preretirement household income	$ 60,000	$ 60,000	$ 60,000	$ 105,000	$105,000	$105,000	$ 150,000	$ 150,000	$ 150,000
Nonhousing wealth at retirement	$100,000	$100,000	$100,000	$ 250,000	$250,000	$250,000	$ 500,000	$ 500,000	$ 500,000
LTC insurance purchase (age at purchase)	Base case: No LTC insurance	Buy LTC insurance for both spouses (66,63)	Buy LTC insurance for wife (63)	Base case: No LTC insurance	Buy LTC insurance for both spouses (66,63)	Buy LTC insurance for wife (63)	Base case: No LTC insurance	Buy LTC insurance for both spouses (66,63)	Buy LTC insurance for wife (63)
Probability of having wealth left at death:	29%	10%	17%	8%	10%	10%	14%	11%	10%
Remaining wealth at death:									
50th percentile	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0
95th percentile	$235,705	$151,571	$168,327	$ 89,484	$206,812	$182,015	$ 383,896	$ 326,856	$ 298,317
Number of years of income shortfall									
50th percentile	5 years	14 years	10 years	11 years	15 years	13 years	10 years	15 years	14 years
95th percentile	21 years	26 years	23 years	24 years	26 years	25 years	22 years	26 years	25 years
Wealth at retirement that would have been sufficient to meet household needs:									
50th percentile	$169,628	$227,193	$195,009	$ 544,521	$599,420	$581,169	$ 949,613	$1,166,852	$1,139,427
95th percentile	$686,264	$333,218	$338,108	$1,011,390	$851,259	$871,180	$1,491,116	$1,623,874	$1,650,850

Table 5 The effect of delaying retirement by 4 years

	Simulated household types by income and wealth					
Preretirement household income	$ 60,000	$ 60,000	$ 105,000	$ 105,000	$ 150,000	$ 150,000
Nonhousing wealth at retirement	$100,000	$100,000	$ 250,000	$ 250,000	$ 500,000	$ 500,000
Age or retirement and initial claiming of Social Security benefits	Base case 66/63	Delay 4 years to 70/67	Base case 66/63	Delay 4 years to 70/67	Base case 66/63	Delay 4 years to 70/67
Probability of having wealth left at death:	29%	89%	8%	68%	14%	38%
Remaining wealth at death:						
50th percentile	$ 0	$349,565	$ 0	$ 0	$ 0	$ 0
95th percentile	$235,705	$955,020	$ 89,484	$1,246,127	$ 383,896	$ 871,558
Number of years of income shortfall						
50th percentile	5 years	0 years	11 years	0 years	10 years	3 years
95th percentile	21 years	2 years	24 years	13 years	22 years	16 years
Wealth at retirement that would have been sufficient to meet household needs						
50th percentile	$169,628	$ 21,321	$ 544,521	$ 238,324	$ 949,613	$ 702,446
95th percentile	$686,264	$128,201	$1,011,390	$ 645,410	$1,491,116	$1,205,085

experience an income shortfall, it is for a very small number of years. The amount needed to be 95% confident of meeting needs in retirement is only $128,000. This is an important result, given that it is only slightly more than the average wealth level of current preretirement age households. But even at higher wealth levels, the reduction in wealth needed is substantial. For the 75th percentile household, the retirement wealth needed to be 95% confident of meeting income needs goes from $1,011,390 in the base case to $645,410 with delayed retirement. Although delayed retirement is clearly the most impactful risk-mitigation strategy of those considered in this study, it does not completely mitigate the risk of retirement income shortfall for the representative households in our study.[6]

4.4. Effect of combination strategy: delayed retirement, reduced discretionary spending and LTC insurance

Although the individual strategies described in the last few sections were not, by themselves, entirely effective in mitigating the risk of outliving retirement wealth resources, several resulted in significantly improved outcomes. To test the effect of combined strategies, we simulated delayed retirement, with a 15% reduction in discretionary expenditures, and the purchase of LTC insurance for the younger female spouse. These three strategies were chosen based on the different impacts they each have on the household's retirement cash flows. Delayed retirement increases cash inflows during retirement (Social Security) and reduces the number of years in retirement. Reduced discretionary spending decreases the required cash outflows during retirement and is consistent with observed retiree spending strategies. Lastly, the purchase of LTC insurance is included in this combination strategy because of its impact on the tail risk for the household, which is commonly borne by the last-to-survive. Because of the assumed difference in age between the spouses, the widow can expect to live several years longer than her deceased spouse, on average, but possibly two or more decades longer. Household resources have, by that time, been largely depleted. Therefore, a widow who is in long-term care or enters care later in life is significantly better off if she has LTC insurance. Table 6 summarizes the results of this simulation.

All three income and wealth groups have improved retirement outcomes with this combination of risk mitigating strategies. The probability of having sufficient assets ranges from 83% for the highest income couple to 95%. The amount of investment wealth needed at retirement to meet household income needs is much lower and more in line with actual household retirement saving levels.

5. Conclusions

This study uses Monte Carlo simulation to simultaneously model stochastic financial, health, long term care, and longevity risks and evaluates several strategies for mitigating the risk of outliving retirement wealth. The simulation results allow us to draw several conclusions. First, and perhaps most importantly, both individuals and their advisors should be wary of relying on averages in estimating retirement resource adequacy. Particularly in the case of low frequency, high severity risks, such as long term care, average results will tend

Table 6 The effect of delayed retirement, reduced discretionary spending, and purchase of LTC insurance

	Simulated household types by income and wealth					
	$ 60,000 $100,000	$ 60,000 $ 100,000	$ 105,000 $ 250,000	$ 105,000 $ 250,000	$ 150,000 $ 500,000	$ 150,000 $ 500,000
Retirement risk mitigation strategies	Base Case-None	Retire 4 years later; buy LTC for wife, cut discretionary expenses 15%	Base case-none	Retire 4 years later; buy LTC for wife, cut discretionary expenses 15%	Base case-none	Retire 4 years later; buy LTC for wife, cut discretionary expenses 15%
Probability of having wealth left at death:	29%	90%	8%	95%	14%	83%
Remaining wealth at death:						
50th percentile	$ 0	$ 310,754	$ 0	$ 789,184	$ 0	$ 761,427
95th percentile	$235,705	$1,203,744	$ 89,484	$2,645,043	$ 383,896	$2,813,762
Number of years of income shortfall						
50th percentile	5 years	0 years	11 years	0 years	10 years	0 years
95th percentile	21 years	7 years	24 years	0 years	22 years	9 years
Wealth at retirement that would have been sufficient to meet household needs						
50th percentile	$169,628	$ 33,933	$ 544,521	$ 79,796	$ 949,613	$ 384,148
95th percentile	$686,264	$ 151,522	$1,011,390	$ 280,529	$1,491,116	$ 846,605

to disguise the extent of the potential shortfall risk faced by the individual. It is little comfort to know that you had sufficient funds on average, if in fact you run out of money.

Second, this study adds value by highlighting the risk-mitigating effect of several commonly recommended retirement strategies. In general, small decreases in discretionary expenditures do little to change retirement outcomes because the large tail risks associated with health costs and investments are too great in magnitude to be offset by this strategy. The results of our analysis suggest that for lower and moderate income families, the purchase of LTC insurance reduces the risk of running out of money and the amount of wealth required to be 95% confident of having enough. Offsetting those benefits is the slightly lower expected wealth at death, representing the future value of the additional expenditures for insurance premiums. In contrast, higher income families have enough wealth such that LTC costs do not play a substantial role in determining adequacy. A combined strategy of delayed retirement, reduced discretionary expenditures and purchase of LTC insurance was the most successful for all the income and wealth scenarios considered.

A major implication and concern for all stakeholders is that many individuals are reaching traditional retirement ages without adequate assets. Based on the median income and wealth values found in large national studies, households will need to take a combination of risk-mitigating steps, such as increasing savings, reducing retirement standard of living, buying long term care insurance or face significant risk of depleting assets before death.

Notes

1 Some retirement simulations models, such as the EBRI Retirement Security Projection Model focus on minimum needs rather than desired expenditures (see, for example, VanDerhei, 2011a).
2 Notably, both housing and investment wealth declined between the 2007 and 2010 Surveys of Consumer Finances. Our assumed starting values reflect the upturn in both markets between 2010 and 2012. It is expected that more retirees in coming years may enter retirement as renters or with mortgage debt as a result of the financial crisis and widespread refinancing of mortgages.
3 We also do not consider the use of reverse annuity mortgages to generate income from home ownership.
4 Simulated medical cost inflation incorporates correlation with current year general inflation 0.73, previous year general inflation 0.77 and first order auto correlation of 0.78. These are substantially higher than inflation correlations reported for earlier time periods in Cooley, Hubbard, and Walz (2003) and are statistically significant.
5 The Genworth Financial (2013) report provides details on the average and median costs for a variety of types of long term care. These vary widely, ranging from $30,000 to $275,000, depending on the level of care needed and the state of residence.
6 We do not consider other retirement timing scenarios in this article, but a simulation study by VanDerhei (2011b) concludes that households would need to delay retirement much longer than four years to significantly reduce their shortfall risk. Bajtelsmit, Foster, and Rappaport (2013) consider several different retirement timing and phasing strategies.

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