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WELFARE IMPROVEMENTS FROM DEFAULT ANNUITIZATION IN DEFINED CONTRIBUTION PLANS

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ABSTRACT

Most American workers save for retirement in defined contribution (DC) plans using default investments, primarily target-date funds. Adding annuities to a default investment offers two potential benefits over retail annuities: First, passive acceptance of defaults will likely result in an increase in the percentage of workers who receive guaranteed lifetime income. Second, DC participants, and especially those participants who invest in defaults, may not live as long as retail annuity buyers, resulting in a mortality pool that allows lower fair annuity pricing. We estimate that the average DC participant has a longevity that is about two years less than the average retail annuity buyer. The more-attractive mortality pool of DC participants would result in annuity income that is 7.4 percent higher for women and 2.7 percent higher for men. Respondents who indicate a preference for investing through defaults exhibit characteristics associated with expected longevity that is lower than that of average DC participants. This suggests an additional pricing improvement to annuities that are placed in investment defaults. Welfare analyses demonstrate that a risk-averse woman with $500,000 of retirement savings who invests in a default could increase her total welfare in retirement by 18.8 percent upon annuitizing 25 percent of her wealth and by 35.0 percent upon annuitizing 50 percent of her wealth, versus not annuitizing.

INTRODUCTION

More than half of participants in US defined contribution (DC) retirement plans save in automated, professionally managed investments such as target-date funds (TDFs) and managed accounts (Investment Company Institute [ICI] 2021). DC plans, especially 401(k) plans, generally do not provide access to a guaranteed lifetime income option as workers transition into retirement and begin withdrawing savings from their investments to fund their retirement lifestyle.

Economic studies of optimal retirement investment find that nearly all workers would be better off annuitizing a portion of their retirement savings. Mitchell et al. (1999) estimate that retirement dollars used to purchase an income annuity provide the same amount of expected welfare as an additional 30 to 46 percent increase in non-annuitized retirement savings. Considering a variety of factors such as the receipt of an income annuity through Social Security and various preference characteristics, Davidoff, Brown, and Diamond (2005) and Horneff et al. (2008) find that retirees could increase their welfare by 25–50 percent by converting a significant portion of retirement savings to an annuity. Despite the theoretical improvement in welfare, and despite holding $12.2 trillion in individual retirement account (IRA) assets (LIMRA 2021), Americans purchased only $59.7 billion of income-focused annuities in 2020.

How do income annuities allow retirees to live better than if they live off their investments? Through pooling the risk of unknown longevity across multiple annuitants, annuities allow a retiree to spend as if they expect to live only as long as an average annuitant. If they live longer, the insurance company continues to make payments for the lifetime of the retiree. Annuities allow a group of workers to contribute to a financial product that provides lifetime income in a manner similar to a traditional pension.

The advantage of an annuity is most apparent when comparing annuitized and non-annuitized spending from safe retirement assets such as bonds. For example, Vanguard, which is the largest manager of target-date mutual funds, uses an asset allocation glide path that places 70 percent of a worker's wealth in bonds at age 72 (Vanguard 2021). Since retirees do not know how long they will live, they must make overly conservative annual withdrawals from these bond investments to avoid exhausting their savings during their lifetimes. If a healthy 65-year-old female retiree buys bonds that can fund a stable income to the age at which she has a 10 percent chance of outliving her savings (Society of Actuaries 2012), she would spend approximately 35 percent less per year than if she had bought an income annuity assuming a 2 percent return on bonds. The failure to annuitize may explain why many retirees spend less than life-cycle models would predict (Browning et al. 2016), resulting in less enjoyment derived from savings that has been accumulated in retirement plans.

The amount of income paid each year to retirees from an annuity depends on the expected longevity of the pool of annuity buyers. A longer-lived pool of workers will receive less each year from a fairly-priced annuity because the insurance company expects to make more total income payments to the group. Americans who hold enough wealth to purchase an income annuity in the limited US retail market have experienced substantial improvements in longevity in recent decades (Dushi and Webb 2006). Wealthy Americans might also avoid annuities if they are in poor health or otherwise believe they will not live long enough to benefit from expected future income payments, a phenomenon known as adverse selection. The combination of adverse selection and greater longevity among those with enough financial wealth to buy an annuity means that an average worker will pay more for the same amount of lifetime income in the retail market than they would in a broader pool of workers.

While the approximate median longevity of an American man and woman at age 62 is 20 years and 23 years, respectively, according to the Social Security Administration 2019 actuarial life table (Social Security Administration n.d.), the approximate median longevity of male and female annuity buyers is 26 years and 28 years, respectively, according to the Society of Actuaries (2012) annuity mortality table. The additional six years of expected longevity among retail annuity buyers increases the actuarially fair price of an income annuity when calculated using a 2 percent discount rate by 22 percent for a 62-year-old retiree. Because retail annuity buyers are healthier, the average American faces a price of lifetime income that is 22 percent higher than the cost of annuitization to a broader pool of all retirees.

Although the expected present value of future annuity payments is lower for those who are in average health, annuities can still improve the welfare of retirees with more-modest life expectancies (Mitchell et al. 1999). This welfare could be further improved if the pool of annuitants were expanded to include workers who more closely resemble the expected longevity of average Americans.

SOLVING THE ANNUITY PUZZLE THROUGH PARTIAL ANNUITIZATION DEFAULTS

The low rates of annuitization among American retirees is viewed as a puzzle by economists who recognize the value of transferring unknown longevity risk to an institution, thus allowing retirees to spend more each year with less risk of outliving their savings (Benartzi, Previtero, and Thaler 2011). When adverse selection exists within the private annuity market, a significant percentage of retirees who do not expect to live as long choose not to buy annuities because they are relatively more expensive. Social Security retirement benefits likely exacerbate adverse selection by providing a base of annuitized income to nearly all Americans, resulting in reduced demand for additional annuitization among less-healthy workers (Hosseini 2015). Group annuitization through employer-sponsored retirement plans can reduce the impact of adverse selection on annuity prices because workers who participate in the pool represent a broader range of perceived lifespans.

The failure to annuitize at least a portion of retirement savings is a puzzle because annuities are sold in a competitive market, are widely available, and protect against the risk of outliving savings (Mitchell et al. 1999). The most likely explanations for the failure to trade a lump sum of savings for a lifetime stream of income are behavioral, such as the tendency to compare annuities to

investments rather than framing the value of annuities as income (Brown et al. 2013). Other behavioral explanations include loss aversion that arises when retirees view the purchase of an annuity as forfeiting a portion of their nest egg (Webb 2021), and an unwillingness to consider products that require consideration of mortality (Ramsay and Oguledo 2016).

Another possible behavioral explanation for low annuitization rates is simply an unwillingness to make an active financial decision with significant, and often irreversible, consequences. Employers can help workers build a more secure retirement by selecting defaults that provide better outcomes than employees would be able to achieve on their own.

Annuities can be part of a default investment. Unlike defined benefit plans, which often mandate full annuitization at retirement, participants in DC plans must decide how to deplete savings and typically do not have access to annuities; this is especially true of participants in 401(k) plans. Including an annuity as part of the default investment in a DC plan can preserve choice while also increasing the percentage of workers who annuitize a portion of their retirement savings. Defaults in DC plans such as automatic enrollment and qualified default investment alternatives have significantly increased the percentage of workers who participate in the plan and have substantially improved portfolio efficiency and investment performance among workers (Choi et al. 2007). Defaults work because employees often prefer to delegate when a choice is complex, they may simply put off decisions that require being proactive, and they view defaults as an endorsement of a behavior or financial product that is likely in their best interest (Beshears et al. 2009).

TDFs demonstrate how defaults can result in improved retirement outcomes for workers. Workers hired after TDFs were implemented as qualified default investment alternatives had higher equity allocations than workers who were placed into low-return default investments such as stable value or money market funds that were commonly used by employers (Parker et al. 2022). Before the Pension Protection Act of 2006 established TDFs as qualified investment defaults, only 5 percent of employee retirement wealth was held in TDFs (ICI 2017). Today, 27 percent of all retirement savings are invested in TDFs, a share that continues to rise.

Incorporating annuities into default investments could similarly result in a significant improvement in the well-being of millions of retirees. Like TDFs, most workers that would benefit from a better-designed retirement investment will not actively select it in the absence of defaults. Inertia, behavioral barriers, and limited financial literacy mean that far too few employees who would be better off annuitizing a portion of their savings will buy an annuity after they retire. Among employers, legal and practical barriers to default annuitization have historically resulted in few companies adopting default annuitization in DC plans (Pratt 2020).

DC defaults do not force workers to select an investment. Instead, defaults place an employee in a recommended investment (or product) and allow the employee to opt out. The irrevocable nature of some income annuities increases the appeal of defaults that nudge participants toward an endorsement while requiring a deliberate (active) choice (Thaler and Sunstein 2009). Simply asking employees to make an active choice at retirement about whether to annuitize a (recommended) portion of savings could have a significant impact on annuity adoption.

For example, when employees are forced to make a choice about saving for retirement, rather than being forced to actively opt in by informing their benefits office, participation rates increased from 41 percent to 69 percent (Carroll et al. 2009). More than half of retirees in Sweden who were defaulted into lifetime income annuities chose not to elect a more immediate payout option (Hagen, Hallberg, and Lindquist 2018), and more than two-thirds of retirees in Switzerland chose a lifetime income annuity over a lump sum (Bütler and Teppa 2007).

As an alternative to offering employees a suggested default to motivate an active choice, employees could be automatically defaulted into a financial product that may be liquidated or transferred to conventional investments if the worker prefers not to annuitize; alternatively, the annuity could be retained if the worker prefers a guaranteed minimum lifetime income. An example would be a variable annuity with a guaranteed lifetime withdrawal benefit or a fixed-index annuity.

Implementation of defaults that incorporate annuitization at retirement would likely result in a significant increase in the percentage of employees that benefit from

lifetime income protection. In addition to the expected welfare benefits from annuitization, a partial annuitization default can reduce both the distribution costs of insurance and the costs associated with adverse selection.

Providing lifetime income through DC plans may also be fairer than traditional Social Security to lower-income individuals. First, if lower-income workers are less likely to live to retirement age, their accumulated DC wealth will pass on to their beneficiaries. Second, Social Security retirement benefit payments are indexed to inflation and increase through retirement, whereas no private annuities in the United States currently offer inflation-adjusted payments. Inflation adjustments increase the value of later-life payments relative to a nominal annuity, which effectively front-loads real spending in retirement. Delayed Social Security claiming among higher earners further widens the gap in expected future payments between high- and low-income workers (Dushi, Friedberg, and Webb 2021). Annuities in DC plans are also more attractive to women because of required unisex pricing in qualified retirement plans, and because women are often more risk averse (and thus prefer to protect against the risk of outliving savings), have lower financial literacy scores on average, and appear to prefer annuitization in experimental studies (Agnew et al. 2008).

Our analysis adds to the literature by estimating the potential impact of adverse selection on the pricing of annuitization within a DC investment default, and also explores the likelihood that default investors will accept annuitization. Brown, Mitchell, and Poterba (2001) conduct a similar analysis on a broader population of Americans that focuses on Social Security retirement benefit recipients. Because workers in DC plans tend to have higher levels of formal education and income, the expected longevity of DC plan participants is likely to differ from the average Social Security recipient. DC participants more likely to invest through a default, however, exhibit characteristics such as lower levels of education and lower incomes that are associated with shorter expected lifespans than participants who choose to select their own investments (Goda et al. 2020).

We find that the average DC participant has a longevity that is roughly two years less than the average retail annuity buyer. We estimate that the more-attractive mortality pool of DC participants would result in annuity income that is 7.4 percent higher for women and 2.7 percent higher for men if all employees are part of the pool. Respondents who indicate a preference for investing through defaults exhibit characteristics associated with lower expected longevity than average DC participants. This suggests additional potential pricing improvement for annuities that are incorporated into investment defaults. Welfare analyses suggest that a risk-averse woman with $500,000 of retirement savings who invests in a default could increase her total welfare in retirement by 18.8 percent by annuitizing 25 percent of her wealth and could increase her total welfare by 35.0 percent with 50 percent annuitization. The welfare improvement of male workers participating in a partial annuity default is slightly lower due to unisex pricing, but is substantially higher than failing to annuitize. A risk-tolerant male worker with $250,000 of retirement savings sees a welfare improvement of 7.7 percent at 25 percent annuitization, while a risk-averse male retiree with $1 million of wealth can improve retirement welfare by 45.6 percent from a 50 percent default annuity.

ESTIMATED LONGEVITY OF DEFINED CONTRIBUTION PARTICIPANTS

To evaluate the welfare impact from default annuitization, we must first estimate potential fair annuity pricing for a pool of affected workers relative to buyers of retail annuities. If the pool of retail annuitants can be expected to live longer than DC default participants, our welfare analysis will underestimate the potential benefit of fairly priced default annuities. We evaluate mortality experience of DC participants using a longitudinal sample of older Americans. We then conduct a survey of DC participants to evaluate differences in health-related behaviors between default and self-directed investors that may impact expected mortality of default participants.

To estimate differences in expected longevity between individuals who are participating in a DC plan and those who are not, we identify DC participants in 1992 and follow them for the next 26 years to see which of them lived to age 75. Tracking subsequent longevity of these workers provides information about the expected mortality improvement of DC participants relative to the overall

Age	1992 Wave	2018 Wave
51	25.42	18.92
52	22.89	24.07
53	29.25	26.38
54	22.93	28.09
55	23.22	21.36
56	21.78	22.26
57	17.19	22.24
58	18.65	30.56
59	15.31	28.33
60	18.37	23.83
61	15.72	30.10
Average	**21.25**	**25.61**

TABLE 1. *Percentage of Respondents Who Participate in a DC Plan, by 1992 and 2018 HRS Wave*

population and the characteristics of all respondents that predict mortality. We then evaluate the characteristics of DC participants in the most recent survey, assign a predicted mortality improvement to each participant, and compare expected longevity of today's participants to average Americans and to retail annuity buyers.

Participant data are collected using a longitudinal data set of older individuals that allows us to identify individuals during their late working years and then to follow these respondents into retirement. The Health and Retirement Study (HRS) began in 1992, and the survey has been subsequently conducted every two years. Using waves of the HRS beginning in 1992, we are able to track survey participants for the next 26 years through the 2018 survey, including participants' age of death.

We begin with individuals who are at least age 51 in the 1992 wave and include participants up to age 61 (to ensure sufficient sample size). Respondents are included if the required demographic data for that individual is available in the 1992 wave, as well as information on self-reported health status, subjective probability of living to age 75, and information about smoking (now or ever). They must also continue to participate in the survey up until age 75, or their death, so the mortality outcome can be observed. There are 5,342 respondents who meet these criteria.

To determine the extent to which attributes of DC participants may have changed as participation in DC plans increased since 1992, we select a new sample of respondents who meet the same filters, also ages 51 to 61, using the 2018 HRS survey, resulting in a sample of 5,691 respondents. The 2018 sample is slightly larger than the 1992 sample because more Americans participate in DC plans.

Respondents who either have a balance greater than $1.00 in a DC plan or who are currently contributing to a DC plan are considered DC participants. All survey weights are included in the respective calculations. Since the 2018 weights were not yet available, 2016 survey weights were used for any calculations involving the 2018 wave.

Table 1 shows the percentage of respondents at various ages who were DC plan participants for both the 1992 and 2018 waves. The percentage of DC participants increased slightly over the period, from 21.3 percent in 1992 to 25.61 percent in 2018. Subsequently, 29 percent of the population of working-age Americans participated in DC plans in 2020 (ICI 2021). An important difference between the 1992 and 2018 sample is the percentage who participate in a plan by age. In 1992 DC plans were relatively new, resulting in fewer older contributors.

Age	All Respondents	DC Participants	All with DC Plans
51	74.69	84.78	10.09
52	67.96	78.76	10.79
53	67.44	79.18	11.74
54	71.63	82.06	10.43
55	76.75	84.42	7.67
56	72.10	74.56	2.46
57	76.48	80.40	3.92
58	75.92	84.20	8.28
59	73.46	78.53	5.08
60	73.19	80.72	7.53
61	77.56	92.45	14.88
Average	**73.38**	**81.82**	**8.44**

TABLE 2. *Subsequent Survival Rates to Age 75 in 1992 at Various Ages*

Table 2 compares the weighted percentage of all respondents and DC participants who lived to age 75 among all initial ages in the 1992 HRS sample. At all ages, fewer DC participants died before age 75; the average difference in mortality was 8.44 percent. Approximately 81.8 percent of DC participants lived to age 75 versus 74.4 percent for the total sample underwriting.

To better understand how the differences in the actual survival rates noted in table 2 affect longevity differences between DC participants and the overall population, we use a Gompertz model to first determine the general population mortality curve and then determine the adjustments required to reflect the DC participant experience.

Our Gompertz model is based on Milevsky (2012). The probability of survival to age t, conditional on being alive at age (a), is given by equation 1, where m is the modal lifespan and b is the dispersion coefficient.

$$q_t = \exp\left\{\exp\left\{\frac{a-m}{b}\right\}\left(1-\exp\left\{\frac{t-a}{b}\right\}\right)\right\}$$

EQUATION 1

Gompertz parameters are determined by minimizing the sum of the squared errors as predicted by a given set of parameters and the actual survival experience for the general population noted in table 2.

We solve for the mortality curve versus using an existing mortality table (e.g., the Social Security Administration 1990 period life table) since the table was effectively a guess at the time of publication and we have the ability to calibrate parameters by using actual population survival rates from the HRS. We estimate a modal lifespan of 86.92 years and a dispersion coefficient of 13.52 years as the best fit to the data. For reference purposes, these coefficients yield a life expectancy of 31.12 years for a 51-year-old (i.e., to age 82) and a life expectancy of 23.21 years for a 61-year-old (i.e., to age 84).

Our approach yields significantly different estimates than if a pure period life table were used to estimate longevity. For example, the life expectancy (in years) for a 51-year-old and 61-year-old would be 27.85 and 19.90 years, respectively, based on the Social Security Administration 1990 period life table. The difference in the respective estimates can be attributed to improvement in mortality experienced over the period.

Age	Value
51	50.5%
52	28.4%
53	28.8%
54	38.0%
55	45.6%
56	7.1%
57	27.5%
58	40.6%
59	15.9%
60	22.3%
61	70.1%
Median	**28.79%**
Average	**34.07%**

TABLE 3. *Required Mortality Load to Reflect Realized Actual Average DC Participant Survival Rates by Age*

Next, we solve for the constant mortality reduction (i.e., load) to the all-population mortality curve (determined using the Gompertz approach) that would result in the observed survival probabilities to age 75 for DC participants in table 2. This allows us to estimate how much mortality rates would have to decline to reflect the actual experienced survival probabilities. For example, as noted in table 2, 84.78 percent of DC participants who are age 51 survive to age 75, versus 74.69 percent of all respondents. The adjustment in mortality rates required for DC participants is a reduction of 50.5 percent. We solve for the required mortality adjustment for each age and include the results in table 3. The mortality adjustment by each age is relatively noisy, which is why we focus on the average results among all age groups in future analyses.

To visualize how percentage improvements in mortality rates translate to increases in longevity, figure 1 shows the equivalent improvement in life expectancy (in years) by age and mortality loads. For a worker who reaches age 65, a 10 percent improvement in mortality load increases lifespan by about one year, a 20 percent by just over two years, a 30 percent by just under four years, and a 40 percent improvement in load results in just over five additional years of post-65 retirement.

Results from table 3 indicate that DC participants have experienced mortality rates that are approximately 30 percent lower than the general population since 1992. This difference in mortality rates corresponds to an increase in retirement life expectancy of just under four years. In other words, we expect the life expectancy of the average DC participant to exceed the life expectancy of the average American by approximately four years.

EXPECTED MORTALITY OF CURRENT DC PARTICIPANTS

DC participants in the 1992 HRS cohort experienced mortality rates that were approximately 30 percent lower than the general population. There are a number of reasons why 1992 participant characteristics may differ from characteristics of current participants. For example, employees in 1992 were more likely to opt in to retirement saving, and the availability of employer-sponsored retirement plans was less widespread.

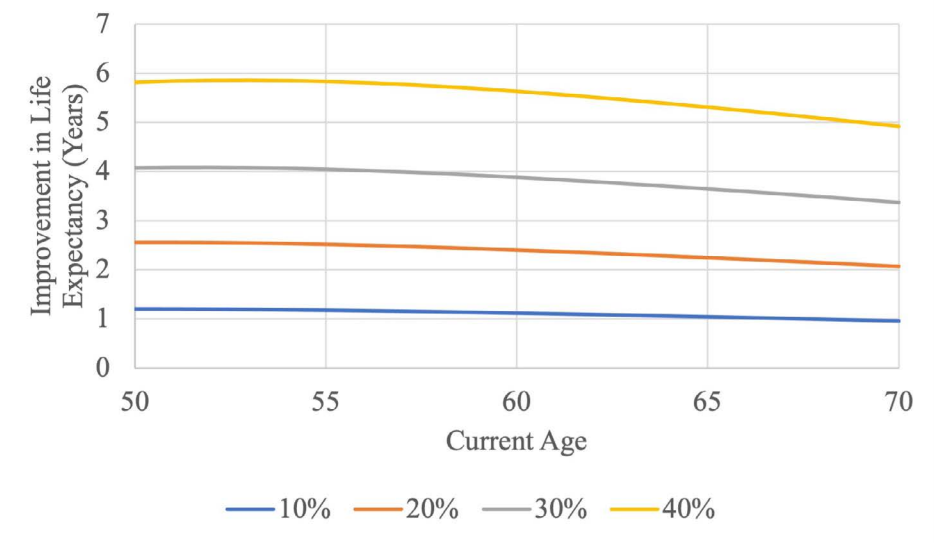

FIGURE 1. *Equivalent Improvement in Life Expectancy (Years) by Various Current Ages and Mortality Loads*

To account for potential differences in the expected mortality of DC participants today compared to the 1992 sample, we identify participant characteristics available in the 1992 HRS that predict future differences in mortality and use these estimates to evaluate differences in expected longevity between participants today and the overall population.

We begin by evaluating information from prior mortality studies using the HRS. According to Feinglass et al. (2007) and Steinholm et al. (2014), self-reported health status is the strongest predictor of future mortality. HRS respondents are asked to rate their health on a five-point scale from excellent to poor. Figure 2 shows the subsequent survival rates to age 75 by self-reported health status in 1992 at various ages. Respondents in poor health had survival rates that were roughly half the survival rates to age 75 of respondents who indicated that they were in either very good or excellent health. The relation appears consistent with the highest survival rates among those in excellent health and deteriorates with each drop in self-reported health status.

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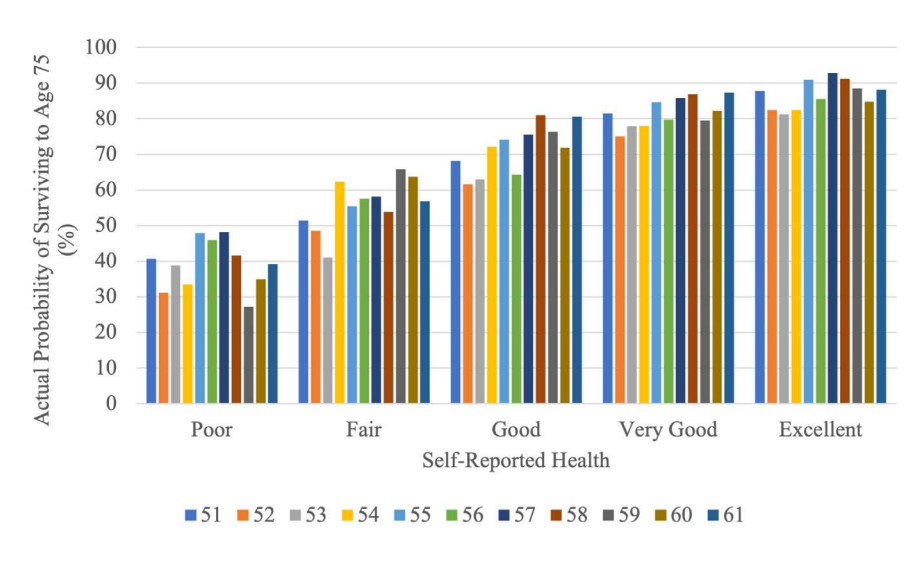

FIGURE 2. *Subsequent Survival Rates to Age 75 by Self-Reported Health Status in 1992 at Various Ages*

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Individuals participating in a DC plan have significantly better levels of self-reported health than the general population. Table 4 shows distribution of self-reported health status for all respondents and for only those respondents participating in a DC plan for the 1992 and 2018 waves.

DC participants report that they are in much better health than respondents who do not participate in a DC plan in both samples. For example, 25.5 percent of respondents who did not participate in a DC plan in 1992 were in either poor or fair health compared to just 7.1 percent of DC participants; the ratio was similar in 2018 (27.5 percent vs. 9.4 percent). This suggests a significant potential difference in expected longevity between DC participants and the general US population in both 1992 and 2018.

In addition to self-reported health status, there are other notable health-related differences in the attributes of DC participants compared to the general population. For example, DC participants are less likely to smoke. Feinglass et al. (2007) report that smoking is the second-strongest predictor of subsequent mortality in the HRS, after self-reported health.

Table 5 shows differences in the percentage of respondents who have ever smoked or who currently smoke between the general population and DC participants.

Table 5 demonstrates that DC participants in 1992 were somewhat less likely to have ever smoked and far less likely to be current smokers. There was a decline in smoking frequency between 1992 and 2018 among all respondents, but the difference between DC participants and all respondents widened in the more recent sample.

We also find a strong relationship between smoking status and the probability of survival to age 75 using the original 1992 HRS wave data, as noted in figure 3.

	1992 Wave			2018 Wave		
Health Status	**All Resp.**	**DC Ppts**	**All - DC**	**All Resp.**	**DC Ppts**	**All - DC**
Poor	10.14	0.90	-9.24***	6.94	1.37	-5.57***
Fair	15.39	6.17	-9.22***	20.53	8.02	-12.51***
Good	25.82	26.91	1.09	32.37	32.42	0.05
Very Good	27.25	34.22	6.97***	29.89	46.13	16.24***
Excellent	21.40	28.37	6.97***	10.19	11.97	1.79

*** p < .001, ** p < .01, * p < .05

TABLE 4. *Health Status Frequency by DC Participation*

	1992 Wave			2018 Wave		
	All Resp.	**DC Ppts**	**All - DC**	**All Resp.**	**DC Ppts**	**All - DC**
Smoke Ever	66.89	63.11	-3.78***	55.41	43.20	-12.21***
Smoke Now	30.47	20.17	-10.30***	20.43	8.85	-11.58***

*** p < .001, ** p < .01, * p < .05

TABLE 5. *Smoking Rates by DC Participation*

In addition to smoking and self-reported health, the HRS contains information on other attributes that are also positively associated with life expectancy, including body mass index (BMI), age, gender, race, income, wealth, and years of education.

It is clear that DC participants live longer than the average American because they are in better health and engage in better health behaviors such as smoking avoidance. In order to estimate the marginal impact of each of these health markers on future mortality, we run a series of probit regressions in which the dependent variable is the probability of living to age 75 and the independent variables are health-related respondent characteristics available in the 1992 HRS cohort.

The predictors of survival probability include age, gender (male), whether the respondent identifies as White/Caucasian, whether the household is coupled, years of education, respondent earnings (technically the natural logarithm of earnings), total household income (technically the natural logarithm of total household income), total household assets (technically the natural logarithm of total household assets), subjective survival probability, whether the respondent has ever smoked, whether the respondent currently smokes, self-reported health status (poor, fair, very good, or excellent as dummy variables, where good is the omitted variable), and respondent BMI.

Table 6 shows the impact of individual characteristics on the probability of surviving to age 75. On average, participating in a DC plan reduces the probability of mortality by 10.35 percent. Adding other predictors of survival to the model (Model 2) reduces the improvement to just 2.37 percent. This indicates that the lower mortality observed among DC plan participants can be explained primarily by differences in health markers and demographics. Model 3 estimates the independent impact of each of these individual characteristics on predicted mortality without including DC participant status.

Since the characteristics of 2018 DC participants differ slightly from 1992 participants (e.g., there are fewer smokers in 2018 than there were in 1992), we can apply the coefficient estimates from Model 3 to each of

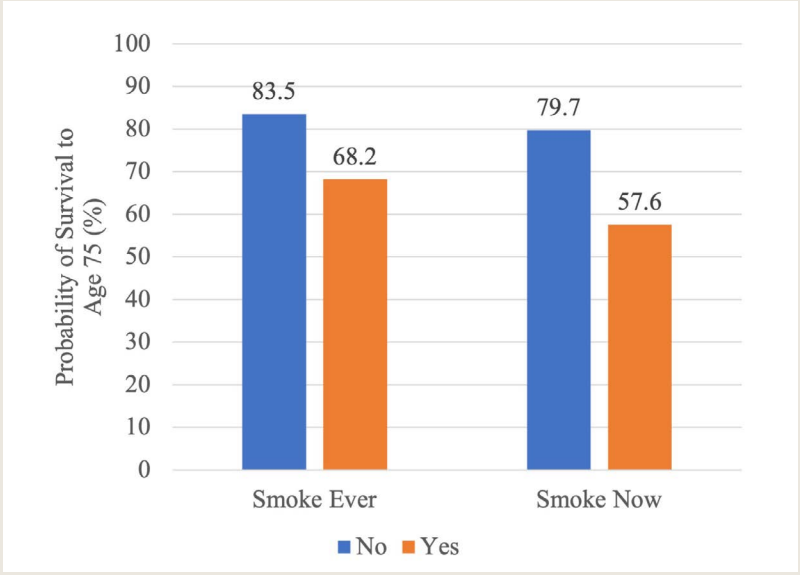

FIGURE 3. *Age in 1992 and Survival Rate to Age 75 by Smoking Status*

the 5,342 respondents from the 1992 wave and the 5,691 respondents in the 2018 wave. We then conduct OLS regressions where the dependent variable is the noted survival probability weight and the independent variable is whether the respondent is a DC participant. The resulting coefficients for the 1992 and 2018 regressions are 10.77 and 11.67, respectively. This small estimated improvement in mortality based on participant characteristics in 2018 does suggest that the expected mortality of DC participants increased slightly between 1992 to 2018; however, the more general estimate of a 30 percent expected mortality improvement is still a valid assumption when extrapolating past survival outcomes to DC participants today.

EXPECTED MORTALITY OF DEFAULTED PARTICIPANTS

While some workers make a conscious decision to save through a DC plan, others may simply be automatically defaulted into a plan. Plan sponsors interested in predicting the expected longevity of participants who have defaulted into lifetime income should not necessarily expect these default participants to live as long as all DC participants. Prior studies find evidence that participants who use default investments such as TDFs have lower incomes and lower balances (e.g., Goda et al. 2020), both of which we find to be predictors of increased mortality rates. Estimates of mortality adjustments within DC plans may need to be adjusted to reflect differences among default and self-directed participants.

We conduct an online survey of 1,000 respondents to determine potential differences in default participants through Alchemer that includes workers between the ages of 50 and 70 who currently participate in an employer-sponsored DC plan.

The survey includes identical questions from the HRS that were used to estimate mortality rates such as health status, smoking frequency, and demographics. Additionally, we ask questions to determine whether the respondent is currently using a default investment, and whether the respondent would use a default investment that included some type of guaranteed income.[1]

In order to estimate potential differences in predicted mortality between default and self-directed participants, we apply parameter estimates of expected mortality from our earlier analysis to the respondent data

1. Survey questions related to default preference are included in appendix A.

Variable	Model 1	Model 2	Model 3
DC Participant	**10.363*** **	**2.366*** **	
Age		0.746***	0.734***
Gender (Male)		-11.201***	-11.120***
White/Caucasian		-0.082*	0.003
Coupled Household		3.724***	3.673***
Years of Education		-0.362***	-0.349***
Respondent Earnings		0.487***	0.543***
Total Household Income		0.783***	0.799***
Total Household Assets		0.844***	0.831***
Subjective Survival Probability		0.045***	0.047***
Respondent Ever Smoked		-5.775***	-5.862***
Respondent Currently Smokes		-15.633***	-15.762***
Self-Reported Health			
Poor Health		-23.320***	-23.457***
Fair Health		-10.043***	-10.123***
Very Good Health		7.621***	7.571***
Excellent Health		12.837***	12.833***
Respondent BMI		-0.347***	-0.345***

*** p < .001, ** p < .01, * p < .05

TABLE 6. *Health Status Frequency by DC Participation*

and center the resulting expected survival probabilities so that the average is 0 percent; we do this because we are interested in the marginal rather than the absolute differences in expected mortality. We then aggregate the results by the seven potential survival probability responses, and include the results in figure 4 to illustrate possible differences in expected longevity between current default participants and default participants who indicate a preference for guaranteed income.

The probability of survival declines as the probability of using a default investment increases, although the effect is smaller for the default investment that includes guaranteed income. The higher expected lifespan among default participants who favor guaranteed income is evidence of modest adverse selection among default savers, although the default participants who are likely to annuitize still have lower expected longevity than do average DC participants.

Overall, our analysis suggests that the pool of DC participants who end up in a default investment are less healthy and will have higher mortality rates than the average DC participant. When coefficients are applied to default participants interested in guaranteed income and self-directed participants, we estimate that defaulted participants have a mortality load that is approximately 3 percent lower than base DC participants. If we reduce the assumed DC participant mortality load of 30 percent by 3 percent, we can assume that the mortality

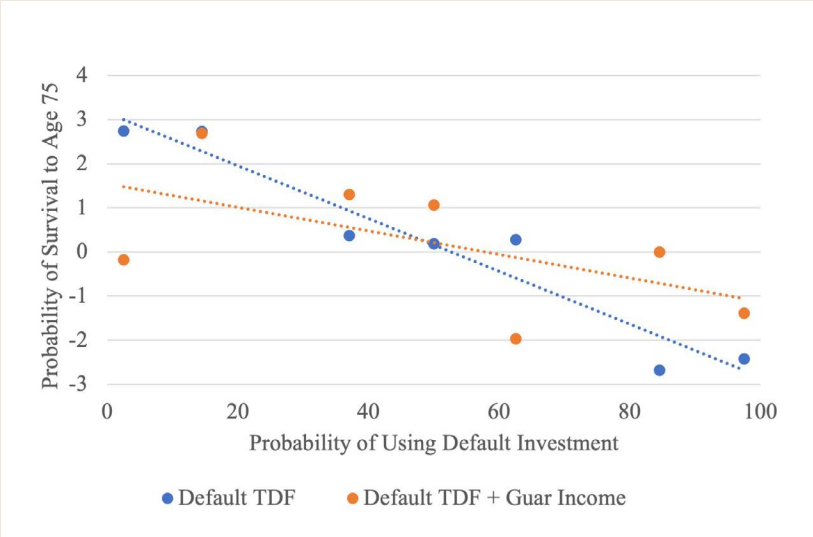

FIGURE 4. *Expected Survival Probabilities by Probability of Default Investment Acceptance, With and Without Guaranteed Income*

load of DC participants who would use a default investment that includes guaranteed income to be approximately 27 percent.

IMPLICATIONS ON ANNUITY PRICING

We use our calculations in the previous section to inform our annuity pricing model. In the following sections, we evaluate the potential benefits of offering annuities to DC participants.

Insurance companies construct immediate and deferred income annuities by investing in a portfolio of safe bond investments that will fund anticipated lifetime income payments for annuitants adjusted for mortality. Annuity prices reflect the load, or the cost to construct and distribute an annuity, and the estimated present value of expected future income payments discounted by the expected return on the bond portfolio. An insurance company projects the number of years it can expect to make payments using a mortality table, such as the annuity mortality tables produced by the Society of Actuaries. Retail annuity mortality tables reflect longevity experience of prior annuitants and expected future longevity improvements.

First, we obtain payouts for life-only immediate annuities with annual payments from CANNEX.com, an annuity quote aggregator, on April 28, 2022. Both quotes are for a single individual age 65 without any kind of period-certain or cash-refund provision for either a man or a woman. We obtain a total of 20 quotes for the man and 19 quotes for the woman. The average payout for the man is 6.43 percent versus 6.09 percent for the woman. The lower payout rate for the woman is consistent with expectations since women have longer life expectancies than men.

Our goal is to estimate the base implied mortality load so that the mortality weighted net present value of the annuity payouts equals the currently available market payout rate. Mortality rates are based on the Social Security Administration 2019 period life table with improvement factors based on the Society of Actuaries (2012) Immediate Annuity Table. The discount rate for years 1 through 10 is the yield on the Bloomberg US Corporate A Intermediate Index as of April 27, 2022, which was 3.71 percent; the discount rate for years 11 through 100 is the yield on the Bloomberg US Corporate A Long Index as of April 27, 2022, which was 4.43 percent. We assume an expense load of 10 percent.

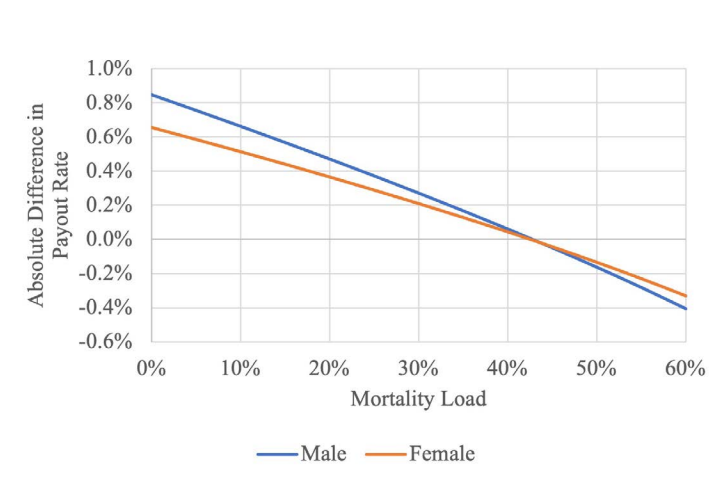

FIGURE 5. *Equivalent Improvement in Life Expectancy (Years) by Various Current Ages and Mortality Loads*

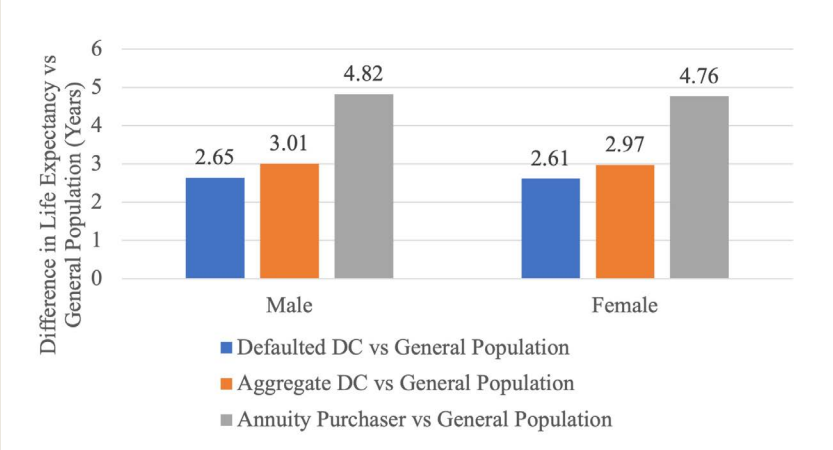

FIGURE 6. *Life Expectancy Differences by Participant Group at Age 65*

In figure 5 we provide information about how various corresponding mortality loads result in equalizing the target difference between the actual annuity payout rates and our annuity pricing model.

The results suggest that a mortality load of approximately 43 percent would result in estimated payout rates from our model that are equivalent to actual annuity payout rates.

We previously estimated that aggregate DC participants had a 30 percent mortality load, and that DC participants who would use a default investment with a guaranteed income option would have a 27 percent load. It is possible to estimate differences in life expectancy for each of these groups versus general population for a 65-year-old retiree. Figure 6 demonstrates that aggregate DC participants have life expectancies that are approximately 1.8 years shorter than implied from annuity pricing and

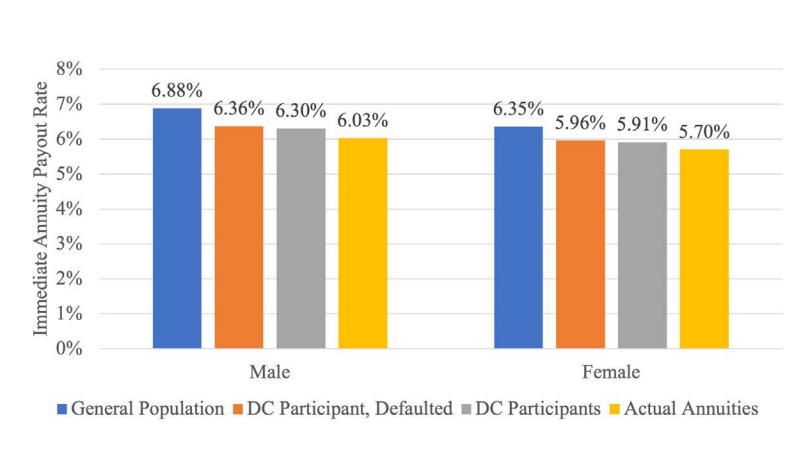

FIGURE 7. *Estimated Immediate Annuity Payout Rates at Age 65 for Various Groups*

that defaulted participants have life expectancies that are approximately 2.1 years shorter than implied from annuity pricing.

In figure 7 we provide information about how payout rates would vary using our annuity model for the general population, which includes no assumed mortality load; DC participants who are defaulted into a strategy that includes guaranteed income, which includes a mortality load of 27 percent; aggregate DC participants, which includes a mortality load of 30 percent; and actual annuities, which includes a mortality load of 43 percent.

The shorter-lived mortality pool for aggregate DC participants would result in an estimated increase in annual lifetime income of $543 for men and $421 for women for each $200,000 annuitized relative to retail annuities, assuming gender-specific pricing. If we assume DC annuities are based on gender-neutral pricing, which we estimate as the average of the respective payout rates, the annual income would increase by $153 for men and $811 for women. The comparative advantage is clearly greater for women assuming gender-neutral pricing given their longer life expectancies.

Welfare improvement can come from default annuitization. Our analyses suggest that the average DC participant has a life expectancy that is 1.8 years shorter than retail annuity buyers, and the average default participant has a life expectancy that is likely around 2.1 years less than retail annuitants. If annuities are fairly priced based on the expected longevity of the pool of DC annuitants, the reduced cost of buying lifetime income will represent a welfare improvement to those who annuitize.

In addition to the welfare improvement from reducing the cost of lifetime income, prior studies suggest that worker welfare will be further improved by annuitizing a portion of their retirement savings compared to a non-annuitized investment portfolio. We assume a base annuitized Social Security retirement income benefit of $20,000 and estimate the expected welfare improvement from annuitizing 25 percent and 50 percent of total retirement savings at age 65 for retirees with $250,000, $500,000, and $1 million of total savings compared to no annuitization. Welfare improvement estimates are provided for workers with average risk aversion (relative risk aversion of 4) and high-risk aversion (relative risk aversion of 8).

The welfare analysis is conducted using an approach originally introduced in Blanchett and Kaplan (2013), and is based on the retiree's utility assuming Constant Relative Risk Aversion (CRRA). For each simulated income path, the utility-equivalent constant income level is calculated based on an elasticity of intertemporal substitution parameter, which incorporates expected survival probabilities and a subjective real discount factor (which is assumed to be 2 percent). The individual paths

Wealth/Risk Aversion	25% Annuity	50% Annuity	25% Annuity	50% Annuity	25% Annuity	50% Annuity
	Retail Annuity		DC Annuity		Default Annuity	
$250,000/Average	7.93%	14.09%	8.51%	15.44%	8.63%	15.59%
$250,000/Risk Averse	12.05%	22.39%	12.81%	23.84%	12.79%	23.97%
$500,000/Average	12.85%	23.33%	13.57%	24.61%	13.65%	24.89%
$500,000/Risk Averse	17.52%	32.81%	18.53%	34.63%	18.75%	34.99%
$1 Million/Average	18.91%	33.98%	19.80%	35.81%	20.02%	36.11%
$ 1 Million/Risk Averse	24.21%	44.76%	25.55%	47.19%	25.79%	47.67%

TABLE 7. *Welfare Improvement from Partial Annuitization for Women*

Wealth/Risk Aversion	25% Annuity	50% Annuity	25% Annuity	50% Annuity	25% Annuity	50% Annuity
	Retail Annuity		DC Annuity		Default Annuity	
$250,000/Average	7.14%	12.66%	7.87%	13.85%	7.71%	13.95%
$250,000/Risk Averse	11.16%	20.70%	12.14%	22.28%	12.29%	22.59%
$500,000/Average	11.91%	21.43%	13.09%	23.15%	13.27%	23.51%
$500,000/Risk Averse	16.70%	31.10%	17.48%	32.75%	17.72%	33.02%
$1 Million/Average	18.07%	32.12%	18.92%	33.91%	19.13%	34.15%
$ 1 Million/Risk Averse	23.34%	43.11%	24.55%	45.36%	24.74%	45.63%

TABLE 8. *Welfare Improvement from Partial Annuitization for Men*

are then converted to a certainty-equivalent stochastic utility-adjusted value income based on an assumed risk tolerance parameter.

Results in tables 7 and 8 show the overall improvement from annuitization at retail annuity prices, and the additional welfare improvement provided when pricing annuities fairly for a unisex DC participant for women and men. The welfare improvement from buying a retail annuity with 25 percent of retirement savings ranges from 7.14 percent for a man with $250,000 of retirement savings and average risk aversion, to 24.21 percent for a risk-averse woman with $1 million of retirement savings (tables 7 and 8). Welfare from retail annuitization improves to a range of 12.66 percent among men with average risk aversion and to 44.76 percent among women when they annuitize half of their retirement savings.

If annuities are fairly priced to reflect the unisex pool of DC participants, this results in a 5.8 percent increase in welfare for a risk-averse woman who annuitizes 25 percent of her $500,000 in retirement savings (from 17.52 percent to 18.53 percent) and a 5.5 percent increase in welfare for a woman who annuitized 50 percent of her retirement savings (from 32.81 percent to 34.63 percent). The increase in welfare for a risk-averse woman who annuitizes 50 percent of her $1 million in retirement savings rises from 44.76 percent to 47.19 percent. Among men with an average risk aversion and $500,000 in retirement savings, the welfare improvement from annuitizing 25 percent of their savings rises from 11.91 percent to 13.09 percent.

We estimate a modest additional improvement if annuities are priced based on the slightly shorter-lived pool of

default DC participants. The increase in welfare among women who annuitize 25 percent of their wealth ranges from 8.51 percent to 8.63 percent and from 47.19 percent to 47.67 percent among women who annuitize 50 percent of their retirement savings. The welfare improvement among men is similar to the welfare improvement among women, but the comparative increase in welfare from fairly priced DC annuities is slightly lower as a result of unisex pricing. In general, wealthier and more-risk-averse participants see the greatest improvement in welfare from default annuitization since spending risk is highest when Social Security income benefits replace a smaller percentage of spending and when retirees are most sensitive to variations in lifestyle.

CONCLUSIONS

Default investments provide a unique opportunity to move a large number of workers toward more-optimal retirement strategies. While almost none of the retirement plan defaults today place a portion of retirement savings into a lifetime income stream at retirement, recent legislative changes such as the Setting Every Community for Retirement Enhancement Act (SECURE Act) of 2019 provide additional protections to employers to encourage the use of annuities in DC plans. Our analyses provide evidence that DC plans offer an additional potential benefit to workers by pooling workers who will not live as long on average as retail annuity buyers, which should reduce the cost of annuities for DC participants.

We find that the average DC participant lives longer than the average American, but has a life expectancy that is approximately two years shorter than the average retail annuitant. Annuities priced using the lower life expectancies of DC participants can offer an estimated 7.4 percent increase in income for women and a 2.7 percent increase for men with unisex pricing.

Default annuitization can further improve the attractiveness of the mortality pool of annuitants since employees who invest in the default tend to exhibit health characteristics associated with reduced retirement longevity. Using a survey of DC participants, we find evidence that existing default investors have lower self-assessed health statuses and higher rates of smoking. Respondents who prefer annuitized defaults also appear to be less healthy than respondents who prefer to direct their own investments.

The combination of more-attractive annuity pricing and increased rates of annuitization could result in a significant improvement in retiree welfare. We estimate that a 25 percent default annuitization rate would increase welfare of a risk-averse woman with $500,000 of retirement savings by 18.75 percent, which is 7.0 percent greater than the improvement from buying a retail income annuity.

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APPENDIXES

APPENDIX A: DEFAULT INVESTOR PREFERENCE QUESTIONS

1. What is the likelihood that you would use a default investment such as a fund with a target retirement date (e.g., 2030 or 2040)?

   a. Very likely (95%+ probability)

   b. Likely (75% to 94% probability)

   c. Somewhat likely (51% to 74% probability)

   d. Even (50% probability)

   e. Somewhat unlikely (25% to 49% probability)

   f. Unlikely (5% to 24% probability)

   g. Very unlikely (less than 5% probability)

2. What is the likelihood that you would use a default investment such as a fund with a target retirement date (for example 2030 or 2040) that also included a partial allocation to a product that provided a guaranteed income for life?

   a. Very likely (95%+ probability)

   b. Likely (75% to 94% probability)

   c. Somewhat likely (51% to 74% probability)

   d. Even (50% probability)

   e. Somewhat unlikely (25% to 49% probability)

   f. Unlikely (5% to 24% probability)

   g. Very unlikely (less than 5% probability)

APPENDIX B: MORTALITY-RELATED SURVEY QUESTIONS

1. What is the percent change that you think you will live to be 75 or more?

   a. 0%

   b. 10%

   c. 20%

   d. 30%

   e. 40%

   f. 50%

   g. 60%

   h. 70%

   i. 80%

   j. 90%

   k. 100%

2. Have you ever smoked cigarettes? (By "ever smoked cigarettes," we mean more than 100 cigarettes in your lifetime.)

   a. Yes

   b. No

3. Do you smoke cigarettes now?

   a. Yes

   b. No

4. How would you say your health is?

   a. Excellent

   b. Very good

   c. Good

   d. Fair

   e. Poor

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