

# HOW BEST TO ANNUITIZE DEFINED CONTRIBUTION ASSETS?

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## Introduction

Unlike defined benefit pensions that provide participants with steady benefits for as long as they live, 401(k) plans and Individual Retirement Accounts (IRAs) provide little guidance on how to turn accumulated assets into income. As a result, retirees have to decide how much to withdraw each year and face the risk of either spending too quickly and outliving their resources or spending too conservatively and consuming too little. They also must consider how to invest their savings after retirement. These are difficult decisions.

Better strategies are available that would ensure a higher level of lifetime income, reduce the likelihood that people will outlive their resources, and alleviate some of the anxiety associated with post-retirement investing. Workers could purchase an immediate annuity that pays a fixed amount throughout their lives, typically starting at age 65. Or they could purchase an advanced life deferred annuity, which requires a smaller share of accumulated assets and begins payments at a later age, like 85. Alternatively, they could use their assets to delay claiming Social Security, effectively buying more inflation-indexed annuity income. This *brief*, which is based on a recent paper,

compares the level of lifetime utility generated by these three annuitization approaches.<sup>1</sup> In all cases, the assumption is that the strategy is incorporated directly into 401(k) plans as the default drawdown option.

The discussion proceeds as follows. The first section summarizes the case for commercial annuities and the reasons for their lackluster demand. The second section describes the “Social Security bridge” option whereby participants would automatically use their 401(k) balances to pay themselves an amount equal to their Social Security benefit so that they can delay claiming. The third section describes the approach used to compare the three lifetime income strategies: immediate annuities, deferred annuities, and the Social Security bridge option. The fourth section presents the results. The final section concludes that the Social Security bridge provides the best outcome for households in the middle of the wealth distribution and remains competitive for those at the 75<sup>th</sup> percentile of the wealth distribution. Introducing such an option as the default in 401(k) plans would require no legislative or institutional changes and would greatly enhance the welfare of plan participants.

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## Commercial Annuities

Commercial annuities are contracts offered by insurance companies that provide a stream of monthly payments in exchange for a premium. An annuity not only protects people from outliving their resources but also allows more annual income than most could draw on their own. These advantages are possible because insurance companies pool the experience of a large group of people and pay benefits to those who live longer than expected out of the premiums paid by those who die early. This pooling approach creates “mortality credits.”

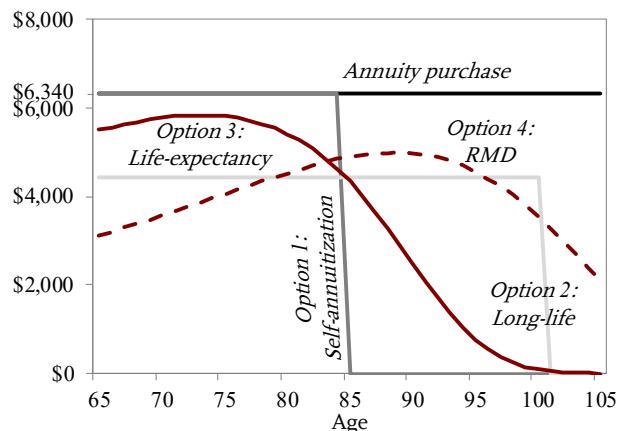
The most familiar annuity is the single-life “single premium immediate annuity,” which involves an individual making a one-time premium payment in exchange for annuity payments that start immediately. Annuities can cover both spouses (joint and survivor); they can guarantee payments for a certain period, such as 10 or 20 years; and they can provide payments based on some underlying portfolio (inflation-indexed or linked to stocks). In recent years, advanced life deferred annuities – which involve a later start date for payments – have garnered more attention because they require less investment on the part of the retiree.<sup>2</sup>

### Immediate Annuities

The income gains from buying an annuity are substantial. According to the website [immediateannuities.com](http://immediateannuities.com), a 65-year-old male could expect to receive \$6,340 each year from annuitizing \$100,000 (see Figure 1). This amount not only lasts for as long as the individual lives but also exceeds what he could generate on his own under an array of alternatives. Consider self-annuitization (Option 1), where the retiree invests \$100,000 in an asset with the same 3-percent nominal return assumed by commercial insurers and withdraws \$6,340 each year.<sup>3</sup> This option works well for a period of time, but the assets are depleted after 20 years (at age 85), when the retiree still has a 44-percent chance of being alive. Option 2 could be a long-life strategy where the retiree selects some distant age, such as 100, and spends down assets evenly over this period. The problem here is that the retiree would be able to spend only \$4,450 each year over the 35-year period and would have no resources to support himself should he live beyond 100. Option 3 could be a strategy based on life expectancy

where the retiree spends a fraction of assets each year based on expected remaining years of life. Income under this option is always lower than that provided by an annuity, and the withdrawals rise and then fall with age, creating a significant chance of impoverishment in very old age. Option 4 could rely on the IRS’s required minimum distribution (RMD) rules as a drawdown strategy. This option avoids running out of money but still provides income well below that available from the purchase of an annuity. In terms of providing longevity security and producing income, the immediate annuity appears to dominate other drawdown strategies.

FIGURE 1. INCOME PRODUCED FROM \$100,000 BY DRAWDOWN STRATEGY



Notes: The annuity amount is from a quote as of July 2019 for a 65-year-old male in Massachusetts. The other calculations assume a 3-percent nominal annual return, based on the yield on AAA corporate bonds with 20-year maturities purchased in August 2019.

Sources: The website “[immediateannuities.com](http://immediateannuities.com);” and authors’ calculations.

Despite the enormous potential gains from annuitization, the U.S. market for immediate annuities is minuscule. In 2018, sales of single premium immediate annuities amounted to only \$9.7 billion.<sup>4</sup> In comparison, total long-term care expenditures for the elderly amounted to roughly \$150 billion.<sup>5</sup> Researchers have done a lot of work to find out why people do not buy annuities, and the reasons fall into three categories: costs and risks of annuities, financial realities, and irrational resistance.

*Costs and Risks of Annuities.* Annuities are expensive for the average person for a number of reasons. First, annuities are most attractive to people who are likely to live for a long time; those with a serious illness keep their assets in cash. To address this adverse selection problem, private insurers raise premiums, which makes annuities expensive for a person with average life expectancy. The second source of the high price is the insurance company's need to cover administrative and marketing costs and to make a profit. Third, insurers must maintain capital reserves to cover adverse experience (e.g., if annuity purchasers generally live longer than expected); and this requirement involves an opportunity cost in terms of forgone returns.<sup>6</sup>

*Financial Realities.* Four financial factors also may make annuities less attractive. First, households already receive a lot of income (or in-kind benefits) guaranteed for life through Social Security, their house, and Medicare. Second, couples can self-insure against running out of assets, since the potential death of each spouse hedges the risk of the surviving spouse outliving his or her resources. Third, people with a bequest motive do not want to spend all their resources. Finally, people may be reluctant to annuitize because they are concerned about large end-of-life health care costs.

*Irrational Resistance.* Non-rational factors may also help explain the small size of the immediate annuity market.<sup>7</sup> The behavioral economics literature is full of experiments showing that once people have something, they are reluctant to give it up.<sup>8</sup> Since annuity contracts are largely irreversible, individuals balk at handing over control of their life savings to an insurance company. Moreover, people generally prefer lump sums to flows. In addition, most people fail to appreciate the benefits of annuitization: they focus on the risk of dying early and not recouping their "investment" rather than on being able to sustain their consumption should they live longer than expected.<sup>9</sup>

Combine all these considerations with concerns about the viability of insurance companies in the wake of the 2008 financial crisis, and it seems unlikely that many people will be willing to hand over

\$100,000 to an insurer for a traditional annuity.<sup>10</sup> Hence, retirement experts have turned their attention to the advanced life deferred annuity, sometimes called longevity insurance.<sup>11</sup>

### *Advanced Life Deferred Annuities*

Milevsky (2005) proposed an advanced life deferred annuity (ALDA) that he thought might better meet the needs of retirees. The original notion was that people would pay premiums over their worklife that would produce a stream of income starting at, say, age 85. Most of the conversation these days assumes a single lump-sum premium payment once the person retires.

The key advantage of an ALDA is that participants can buy longevity insurance by spending only a fraction of the cost of an immediate annuity. For

example, the typical illustration goes something as follows. An individual with \$100,000 at age 65

could purchase an immediate annuity and receive an income stream of \$6,340, or could purchase \$6,340 beginning at 85 for \$16,000.

The potential advantages of the ALDA are three-fold. First, it provides longevity insurance so that the individual will not run out of money. Second, it leaves the purchaser with \$84,000 to spend between ages 65 and 85. And third, it makes the spending of the \$84,000 much simpler, because the individual knows that the ALDA will kick in at 85. The downside is that the individual ends up with less lifetime income than possible through the purchase of an immediate annuity.<sup>12</sup>

Even though the ALDA appears to have many appealing properties, it is a relatively new product and regulatory barriers and sponsor concerns have impeded its adoption. To encourage the use of ALDAs, in 2014 the Treasury removed some of the constraints and made it possible to offer ALDAs in 401(k)s and IRAs.<sup>13</sup> The SECURE Act of 2019 further encourages employers to offer annuities in their plans by establishing a fiduciary safe harbor. These changes would all help make it easier to offer annuities and particularly facilitate the provision of ALDAs. But the low level of sales suggests that people are never going to buy these products without prodding.

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### *Strategies are available to help 401(k) participants turn their assets into income.*

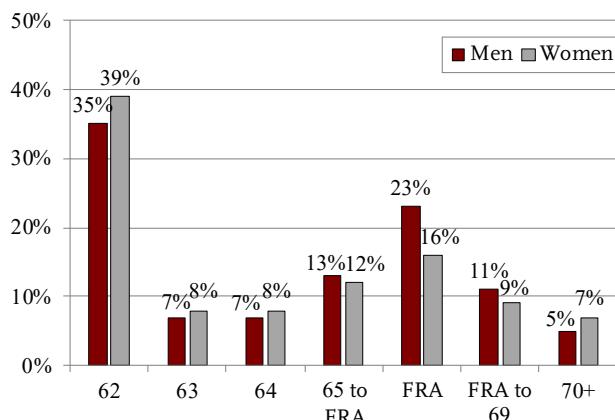
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## “Buying” Annuity Income from Social Security

While most discussions focus on commercial annuity products, another option is to use a portion of defined contribution wealth to “buy” more annuity income from Social Security by delaying claiming.<sup>14</sup>

Currently, most workers claim Social Security benefits before age 70 (see Figure 2) and, as a result, receive reduced amounts. The reduction occurs because Social Security monthly benefits are actuarially adjusted to ensure that the expected lifetime benefits for a worker with average life expectancy are equal whether he claims at 62 or 70. As a result, monthly benefits claimed at 70 are at least 76 percent higher than those claimed at 62.<sup>15</sup>

**FIGURE 2. PERCENTAGE DISTRIBUTION OF SOCIAL SECURITY CLAIMING AGE, 2017**



Note: Disability conversions are excluded from totals.

Source: Authors' calculations from U.S. Social Security Administration (2018).

“Buying” more annuity income from Social Security is generally more attractive than buying a commercial annuity. First, the Social Security annuity is not subject to the insolvency concerns that apply to commercial annuities, which have been a major obstacle to their inclusion in defined contribution plans.<sup>16</sup> Second, Social Security benefits are indexed for inflation. Third, the price of Social Security is approximately actuarially fair for the average person, since benefit adjustments are based on the life expectancy of the “average” individual rather than on the

above-average life expectancy of those who typically buy commercial annuities. Moreover, Social Security does not require profits or compensation for marketing, management, and risk-bearing costs.<sup>17</sup>

The proposal considered here would introduce a default into 401(k) plans that would use 401(k) assets to pay retiring individuals ages 60-69 an amount equal to their Social Security Primary Insurance Amount (PIA) – the monthly amount an individual would receive from Social Security if he claimed at his full retirement age.<sup>18</sup> The expectation is that providing a temporary stream of income to replace the Social Security benefit would break the link between retiring and claiming.<sup>19</sup>

An advantage of this approach is that it does not require any new legislation, as it neatly fits into the existing Social Security system. Similarly, the approach does not require any new formal bureaucratic structure, nor does it involve contracting with an insurer. Finally, since this approach does not formally include buying an annuity, it may sidestep the resistance that annuity products have garnered among the public.

Because of the general lack of interest in commercial annuity products, the Social Security bridge should be the default option in 401(k) plans. That is, all retiring workers 60 and older would automatically receive a payment equal to their PIA when they left the company. As with any default, the worker would retain the ability to opt out in favor of a lump sum or other withdrawal, including leaving the funds in the plan.

## How Do the Annuitization Options Stack Up?

To evaluate how the various approaches – immediate annuities, deferred annuities, and the Social Security bridge – compare, the analysis assesses each one in terms of “utility equivalent wealth.” This measure compares the amount of wealth that would be required to achieve the same utility under one strategy relative to another. A number less than 1 indicates that a strategy is better than the benchmark of no annuitization – i.e., it requires *less* wealth to achieve the *same* utility – and a number greater than 1 indicates that it is worse.

The analysis is performed on stylized single households. The data come from the 2016 *Health and Retirement Study* (HRS), a panel survey of households in which the head is age 51 or older. The 2016 HRS has 174 men and 498 women ages 64-66 at the begin-

ning of the survey. Table 1 summarizes the median defined contribution wealth and annual Social Security benefit for these households. These stylized households are assumed to claim Social Security at age 65, in the absence of the bridge option.<sup>20</sup>

TABLE 1. MEDIAN DEFINED CONTRIBUTION (DC) WEALTH AND ANNUAL SOCIAL SECURITY BENEFITS FOR HOUSEHOLDS AGE 65 IN 2016, BY HOUSEHOLD TYPE

Household type	DC wealth <sup>a</sup>	Annual Social Security benefit <sup>b</sup>
Single men	\$106,000	\$15,348
Single women	110,000	14,514

<sup>a</sup> For households with defined contribution wealth.

<sup>b</sup> Assumes claiming at age 65.

Sources: University of Michigan, *Health and Retirement Study* (HRS) (2016); and authors' calculations.

The data and assumptions underlying the utility analysis include the following:

- *Annuity Payout Rates.* The payouts for the annuity options are from immediate annuities.com, and reference the quotes for a 65-year-old from Massachusetts purchasing an annuity that begins payouts on September 1, 2019. For both immediate and deferred annuities, the quotes for men and women are averaged to arrive at unisex pricing, since employer-sponsored plans are legally prohibited from discriminating on gender with respect to payouts.
- *Share of Wealth Annuitized.* Any annuity decision involves a tradeoff between providing higher monthly income and maintaining a contingency reserve in case of emergency. In addition, for a default to work it must be palatable to individuals, and entrusting one's entire life savings to an insurance company is unlikely to pass that hurdle. Thus, annuitizing all wealth probably does not make sense for most people. Therefore, the analysis compares the value of annuitizing 20 percent and 40 percent of defined contribution wealth. In the case of deferred annuities, only the 20-percent option is relevant, because any annuity in excess of 25 percent of assets (up to \$125,000) would not

be considered a qualifying longevity contract satisfying the RMD as specified in Treasury regulations. Moreover, it would also allocate too much of defined contribution balances to the relatively short period of expected life after age 85 and would clearly be worse than no annuitization.

- *Drawdown of Non-annuitized Wealth.* In the case of immediate annuities and the Social Security bridge option, households are assumed to take out their RMD each year. This approach, however, does not work well with the ALDA – producing too little consumption in the early years and substantial balances at 85 when the delayed annuity kicks in. Since the advertised advantage of the ALDA is that households could consume their entire non-annuitized wealth between ages 65 and 85, the analysis considers this approach as well.<sup>21</sup> However, households cannot both spend their entire wealth and also have liquidity for emergencies, so such an approach raises issues of adequate liquidity.

- *Risk.* Converting wealth into future income involves three sources of uncertainty: mortality, market risk, and consumption shocks (e.g., health expenditures).<sup>22</sup> For mortality, survival probabilities are drawn from the cohort life tables used for the 2019 *Social Security Trustees Report*.<sup>23</sup> Market risk is incorporated using Monte Carlo simulations, and households are assumed to allocate assets between risky equities and risk-free bonds similar to a target date fund appropriate for their age. Consumption shocks, for the purpose of this analysis, consist of health and long-term care expenditures.<sup>24</sup> These shocks are calibrated to out-of-pocket health expenditures in the HRS.<sup>25</sup>

## Calculating Utility Equivalent Wealth

With these assumptions in hand, utility is then assigned each year to each household by assuming a standard utility function and risk aversion parameter, weighted by the probability of survival, and discounted to age 65 by the assumed rate of time preference.<sup>26</sup> The expected present value of lifetime utility (EPVU) is calculated for each household.

Once the EPVU is calculated for the benchmark case – no annuitization – the process is repeated for each of the other annuitization strategies. At first, the same initial defined contribution wealth is assumed and, if the EPVU is higher (lower) than the benchmark case, an iterative process begins whereby defined contribution wealth is decreased (increased) until the EPVU in the alternative is equal to the benchmark. This decrease or increase in wealth required to make the different strategies equivalent in terms of well-being measures how much better or worse the alternative is compared to the benchmark.

## Results

The results of this exercise are generally intuitive (see Table 2). Remember that the lower the percentage of pre-retirement wealth required to maintain the same

TABLE 2. WEALTH REQUIRED TO ACHIEVE THE SAME UTILITY FOR SINGLE HOUSEHOLDS OF MEDIAN WEALTH, BY STRATEGY

Option	Share of wealth used	Equivalent wealth relative to no annuitization	
		Single men	Single women
No annuitization	0%	1.00	1.00
1. Immediate annuity	20	0.91	0.92
2. Immediate annuity	40	0.84	0.85
3. Deferring Social Security	20	0.82	0.82
4. Deferring Social Security	40	0.76	0.76
5a. Deferred annuity (RMD)	20	1.09	1.06
5b. Deferred annuity	20	0.86	0.86

Source: Authors' calculations.

level of utility, the better the product. For both single men and single women, purchasing an immediate annuity produces a better outcome than no annuitization, and annuitizing 40 percent is better than annuitizing 20 percent. This finding is consistent with the literature, which shows substantial annuitization is generally desirable.

As expected, using a portion of wealth to defer Social Security claiming is preferred to purchasing an immediate annuity due to the advantageous features of Social Security discussed above. As in the case of an immediate annuity, annuitizing a larger share of wealth requires less initial wealth to achieve the same level of utility.

The results for the deferred annuity are mixed. On the one hand, as discussed, the option that involves the drawdown based on the RMD (5a) produces a worse outcome than no annuitization, reflecting the fact that households withdraw sub-optimal amounts between ages 65 and 85. On the other hand, the option that assumes households withdraw all their assets over the period 65-85 (5b) produces an outcome similar to the immediate annuity.

The bottom line is that, for the median household, the Social Security bridge option is the clear winner. The question is whether these rankings hold at different points in the wealth distribution.

Table 3 shows the results for households at the 75<sup>th</sup> percentile of wealth (roughly \$250,000 for a single-person household). At such wealth levels, allocating 20 percent of assets is sufficient to delay claiming almost to age 70, exhausting the Social Security bridge option. Therefore, Table 3 does not consider using 40 percent of wealth to delay claiming, and correspondingly does not consider devoting 40 percent of wealth to an immediate annuity, either.<sup>27</sup>

TABLE 3. WEALTH REQUIRED TO ACHIEVE THE SAME UTILITY FOR SINGLE HOUSEHOLDS OF 75<sup>TH</sup> PERCENTILE WEALTH, BY STRATEGY

Option	Share of wealth used	Equivalent wealth relative to no annuitization	
		Single men	Single women
No annuitization	0%	1.00	1.00
1. Immediate annuity	20	0.91	0.92
3. Deferring Social Security	20	0.88	0.89
5a. Deferred annuity (RMD)	20	1.11	1.08
5b. Deferred annuity	20	0.85	0.87

Source: Authors' calculations.

For these higher-wealth households, the deferred annuity strategy is again competitive, edging out the Social Security bridge option, as the income derived from this annuity after age 85 provides enough of a buffer so that – even if a health shock hits – consumption does not fall to very low levels. Nevertheless, if following the RMD remains a plausible rule of thumb for retiree withdrawals, the deferred annuity remains a very poor choice, for both median- and 75<sup>th</sup>-percentile-wealth households.<sup>28</sup>

## Conclusion

As the first cohort entirely dependent on 401(k) plans starts to retire, the question of how they will manage their accumulated assets over their retirement takes on increased urgency. Without some help, retirees risk spending too quickly and exhausting their resources or too slowly and depriving themselves of necessities. They must also worry about how to invest their assets in retirement.

Fortunately, strategies are available that would ensure individuals a higher level of lifetime income, reduce the likelihood of outliving their resources, and alleviate some of the anxiety associated with post-retirement investing. Workers could use a portion of their 401(k) and IRA assets to purchase an immediate

annuity, purchase an advanced life deferred annuity, or “buy” additional Social Security annuity income. And for workers to actually use these options, they need to be embedded as the default in 401(k) plans.

In order to compare the desirability of these three approaches, it is necessary to sketch out the Social Security bridge option. The proposal considered here would introduce a default into 401(k) plans that would use 401(k) assets to pay retiring individuals ages 60-69 an amount equal to their Social Security PIA – the monthly benefit at an individual’s full retirement age. Providing a temporary stream of income to replace the Social Security benefit would break the link between retiring and claiming. As a result, retirees could delay claiming Social Security in order to maximize this valuable source of annuity income.

The results show that, with shocks incorporated into the model, the Social Security bridge option provides the best outcome for households in the middle of the wealth distribution and remains competitive for households at the 75<sup>th</sup> percentile of wealth. Introducing a Social Security bridge option within a 401(k) would not require any new legislation or any new formal bureaucratic structure, nor does it involve contracting with an insurer. It is a mechanism to significantly improve the welfare of 401(k) participants at no cost to society. This idea merits serious consideration.

## Endnotes

1 Munnell, Wettstein, and Hou (2020).

2 In general, annuities – particularly advanced life deferred annuities – are not indexed to inflation.

3 The 3-percent assumed return is based on the yield on AAA corporate bonds with 20-year maturities purchased in August 2019.

4 LIMRA (2019). In fact, even this number overstates the sale of life annuities because it includes products that are “period certain” only and have no life-contingent payments (Brown and Poterba 2000). This number does not include \$75 billion of variable annuity sales, as these products are generally investment vehicles rather than lifetime income guarantees.

5 Authors’ estimates based on data from the Centers for Medicare and Medicaid Services (2017).

6 Looking at the United Kingdom, Finkelstein and Poterba (2002, 2004) found that the lack of actuarially fair prices contributed to the low take-up of annuities.

7 For example, see Brown et al. (2008), Sagara et al. (2011), and Brown et al. (2017).

8 See, for example, Benartzi, Previtero, and Thaler (2011).

9 Agnew et al. (2008) and Benartzi, Previtero, and Thaler (2011) both found that a consumption rather than an investment framing makes people much more willing to consider annuities.

10 This concern persists despite the fact that life insurers rarely go out of business (less than 0.5 percent of large life insurers went bankrupt per year over the last two decades (National Organization of Life & Health Insurance Guaranty Associations 1992-2015)); and their commitments are guaranteed by the state in cases of insolvency.

11 Technically, since 2014, the only form of advanced life deferred annuity that 401(k)s or IRAs can provide (as a practical matter) is the Qualified Longevity Annuity Contract (QLAC). For the Treasury rules governing QLACs, see U.S. Department of the Treasury (2014).

12 The individual purchasing the ALDA has only \$84,000, not \$100,000, to spend between 65 and 85, producing an income stream of \$5,325 over the period before the ALDA kicks in at 85. Alternatively, to produce a flat nominal income stream, the individual could invest less in the ALDA and raise withdrawals between 65 and 85, yielding an annual income of \$5,740. This amount is substantially less than the \$6,340 produced by an immediate annuity because the individual benefits less from the mortality credits described above.

13 U.S. Department of the Treasury (2014). The new regulations clarified that participants did not face an “all or nothing” choice at retirement, but could split their assets – using a portion to purchase an annuity and taking the rest as a lump sum. Most importantly, these regulations made it possible for the first time to have ALDAs in 401(k)s and IRAs and created the QLAC, under which individuals could contribute 25 percent of their assets (up to \$125,000) with those assets exempt from the IRS’ RMDs.

14 The idea of using accumulated assets to delay claiming Social Security is not new. Several policy experts have suggested this approach. For example, Koenig, Fichtner, and Gale (2018) proposed a new type of mandatory savings account that workers would be required to use up before receiving Social Security retirement benefits. Vernon (2018) also advocated using a portion of savings to enable delaying Social Security benefits for as long as possible. Mark Iwry of the Brookings Institution has suggested that 401(k) plans could offer a “Social Security bridge option,” inspired by a similar distribution option traditionally provided by some defined benefit pension plans. However, we are not aware that any 401(k) plans are explicitly offering a formalized way to defer Social Security to buy more annuity income and, even if such an option were available, few individuals are likely to choose it on their own.

15 Of course, a more straightforward approach would be to simply work longer and delay Social Security claiming in that way (as recommended, for example, in Munnell and Sass 2009). The proposal envisioned here aims to delay claiming without impacting other life decisions, such as labor supply.

16 While Social Security cannot become insolvent, benefits will be reduced if the program's trust fund becomes depleted and, at that point, incoming revenues from taxes are not keeping pace with its obligations. This situation is projected to arise in 2034 (U.S. Social Security Administration 2020). Nevertheless, it seems unlikely that benefits will be reduced for current or near future beneficiaries.

17 Finally, while buying an annuity from Social Security is a generally attractive option, it is especially attractive when low interest rates make it much harder for many people to live on returns from accumulated defined contribution assets.

18 The proposal uses 60 as the starting age. Most employees leaving an employer at or after this age are retiring, and the early payments could get them in the habit of living without claiming their Social Security benefits. The concern, of course, is that essentially making Social Security available at 60 would encourage some people to retire earlier than they would have otherwise.

19 Breaking this link is important because the evidence indicates that most households would gain from delaying their Social Security benefits. See, for example, Shoven and Slavov (2014).

20 Although the median claiming age is between 64 and 65 for the general population, this analysis focuses on households with at least median 401(k) wealth, who tend to claim later. Under the bridge option, households receive their PIA (calculated for a full retirement age of 66) for as many years as their balances will permit and are assumed to claim Social Security once their balances are exhausted or at age 70, whichever is earlier. The analysis uses self-reported benefits from the HRS, adjusted for any reductions from early claiming, to determine what benefits *would be* if claimed at 65. The average adjusted benefit for men and women is around \$15,000, which is consistent with the actuarial notes from the U.S. Social Security Administration's Office of the Chief Actuary (see Clingman, Burkhalter, and Chaplain 2019).

21 In this strategy, the household will withdraw a fixed real amount from the 80 percent of balances remaining after buying the deferred annuity. This amount will be such that if returns match their mean in every year, assets will be exhausted exactly at 85.

22 Inflation risk is also worth considering over the long term. The analysis considered stochastic inflation calibrated to the distribution of annual inflation rates between 2000 and 2018. However, given the small variance in inflation over this period, the resulting changes in the analysis were negligible and thus those results are not presented. For example, a shift from a world of constant average inflation to one with constant inflation at the 90<sup>th</sup> percentile of inflation over the reference period would reduce annual consumption under a nominal annuity by about 1 percent at age 85.

23 These life tables are available from the U.S. Social Security Administration's Office of the Chief Actuary.

24 Following similar analysis in the literature (i.e., Horneff, Maurer, and Mitchell 2020), these consumption shocks do not directly provide utility and can be thought of as income shocks.

25 To capture the fact that such expenditures tend to rise with age, the shocks occur with a 10-percent probability at every age with a magnitude corresponding to the 90<sup>th</sup> percentile of expenditures at that age. In particular, the 90<sup>th</sup> percentile of out-of-pocket health expenditures is estimated by five-year age bins, starting at age 65. These expenses are assumed to be covered by remaining account balances, if sufficient, then by funds set aside for Social Security deferral, and finally, if all liquid assets are exhausted, by payments out of current income. In other words, households will not have their "typical" consumption impacted by these shocks unless they have exhausted their assets. Furthermore, households that exhaust their assets are assumed to have a consumption floor of \$10,000 per year, corresponding roughly to the income which would allow them to meet the Medicaid eligibility criteria.

26 The choice of risk aversion parameter and discount rate follows standard literature (e.g., Horneff, Maurer, and Mitchell 2020).

27 Furthermore, for households of above-median wealth, the eventual claiming age substantially surpasses the FRA, leading to a discontinuous jump in income upon claiming. Analysis not shown here confirms that if the default Social Security bridge targets the expected benefit, rather than the PIA, the Social Security options look even more attractive than they do under the simpler policy targeting the PIA.

28 The paper also analyzes households at the 90<sup>th</sup> percentile of wealth. Such wealthy households cannot annuitize a large share of wealth through delayed Social Security claiming, since even just 10 percent of their assets suffice to delay claiming to the maximal claiming age of 70. Nevertheless, these households are shown to benefit from combining delayed claiming with other annuities, particularly deferred annuities.

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