TIAA Institute

Trends and Issues
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Optimal retirement portfolios with fixed and variable longevity annuities in defined contribution plans taking Social Security into account

This paper examines how two instruments—annuities with lifelong benefits purchased using defined contribution (DC) plan assets, and social security annuities—should be considered jointly to optimize household lifetime wellbeing. Understanding how these interact is of key importance in order to generate efficient retirement portfolios. Additionally, there is likely to be substantial heterogeneity in the demand for longevity annuities across the retiree population, depending on their assets inside and outside tax-qualified retirement plans, their mortality assumptions, and their accrued Social Security benefits. Therefore, as an alternative, we also evaluate using plan assets to boost social security benefits through delayed claiming. We determine that including deferred income annuities (DIAs) in DC accounts is welfare enhancing for all sex/education groups examined. We also show that providing access to variable deferred income annuities with some equity exposure (similar to participating annuities) further enhances retiree wellbeing, compared to having access only to fixed annuities. Nevertheless, for the least educated, delaying claiming social security benefits is preferred, whereas the most educated benefit more from using accumulated DC plan assets to purchase deferred annuities.

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Our work is related to three literatures: economic studies on life cycle financial decisionmaking, analyses of the decision to purchase annuities in retirement, and studies of delayed social security benefit claiming. Excellent reviews of the first area include Gomes (2020) and Gomes et al. (2021) who discuss dynamic consumption and portfolio choice models in discrete time. For the second area, we build on previous studies about the optimal demand for annuities (e.g., Huang et al. 2017; Horneff et al. 2010, 2020; Inkmann et al. 2011; Milevsky 2005) by exploring different deferral ages for the lifelong annuity. A third literature discusses the pros and cons of delaying social security claiming (e.g., Hubener et al. 2010; Shoven and Slavov 2014). We bring these three threads together by integrating the decision to delay claiming and annuitization. Closest to our work is Munnell et al. (2022) who discusses the possibility of using DC plan assets at retirement to finance delayed claiming or buy fixed annuities. Compared to the latter paper, our contributions are to embed the decisions in a full life cycle model, which starts at age 25 and runs until 100, which incorporates optimal saving and investing across bonds and risky stocks, consumption, and withdrawal patterns for assets inside as well as outside the DC plan. Moreover, we investigate optimal annuitization ratios for both fixed as well as variable annuities and alternative deferral ages. Our model also includes heterogeneity in lifetime earnings, assets, and mortality across education groups, and importantly, we incorporate the rich institutional details including the progressive and complex US income tax code.

Methodology

We build on our discrete time life cycle dynamic portfolio in the US DC setting, following Horneff et al. (2010, 2020). We model utility as depending on consumption and bequests, while constraints include a realistic characterization of income profiles, taxes, and the opportunity to invest in risky stocks and riskless bonds both inside (up to a limit) and outside a DC tax-qualified retirement plan. When the individual stops working (assumed here at age 66), she determines how much of her retirement account she wishes to convert to a deferred income annuity (DIA), with the remainder held in stocks and bonds. We also take into account the Required Minimum Distribution rules.

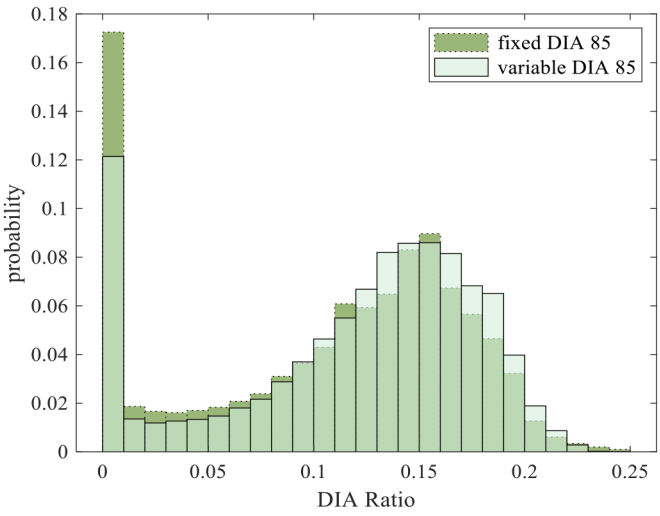
Our analysis focuses on two annuity products: a deferred fixed longevity annuity payable at either ages 67, 80, or 85, purchased using up to 25% of her DC plan assets (to the legal limit), versus a deferred variable annuity which pays the retiree lifelong income starting from the selected deferral age (again, ages 67, 80, or 85) where the benefits paid depend on the investment performance in the annuity portfolio. In particular, we consider three alternative allocations to equities 50%, 20%, and according to a glide path rule where (125-age)/100 refers to the fraction of risky stock exposure. We select preference parameters by solving the life cycle model and use it to generate 200,000 simulations for six population subgroups, male/female and three educational levels. Interestingly, our simulated outcomes are remarkably close to the empirically-observed account values. (For additional detail, see Horneff et al. (2022).)

Results

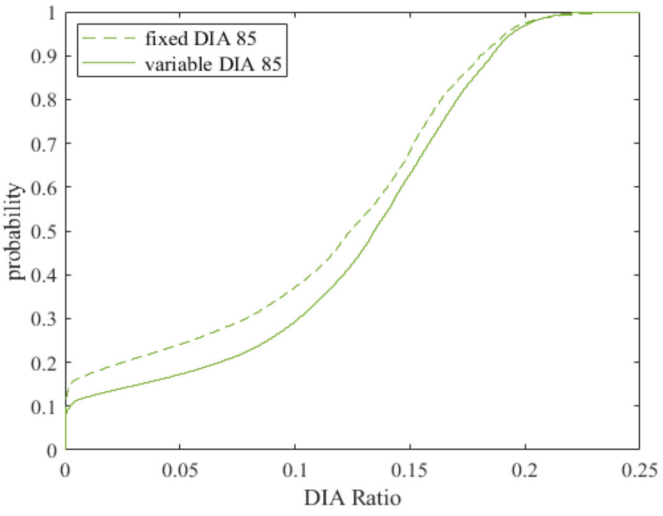
A summary of our key findings appear in Figure 1 and Table 1. The *DIA Ratio* depicted in Figure 1 indicates the optimal percentage of assets in the tax-qualified retirement plan that the retiree will convert to a DIA at age 66. Panel A shows the distribution of the ratio for the fixed versus the variable DIA; both distributions are based on the 200,000 simulation paths for the US population (men/women for three education levels). The x-axis in both figures runs from 0% to the maximum value of 25%, where the latter results from the IRS tax qualification requirements for a longevity annuity to count under the Required Minimum Distribution rules. We note that about 84% of the population would be interested in a “fixed DIA 85;” by contrast, 88% of the population would favor the “variable DIA 85.” Panel B shows that for a given DIA ratio, the demand for a variable DIA exceeds the demand for a fixed annuity. In the paper we show that the optimal investment in a “fixed DIA 85” for a college educated female (high school graduate, high school dropout) is 12% (9%, 4%) in expectation. For males, the optimal DIA Ratio is higher, at 13% for college educated (and 9% for high school graduates, 6% for high school dropouts). The most important reasons for this are, first, that the least educated have higher mortality rates, and second, the social security annuity is relatively higher for the lower earners.

Figure 1. Distribution of optimal DIA ratios with fixed or variable deferred annuities

Panel A. Probability distribution



Panel B. Cumulative probabilities



Note: The *DIA Ratio* indicates the optimal percentage of DC plan assets that the retiree converts to a DIA at age 66, payable from age 85. The dark green bars in Panel A indicate the relative frequency of DIA Ratios purchased at age 66, generated from 200,000 simulated lifecycles for US workers having access to a deferred fixed DIA in their defined contribution plans; the light green bars indicate the demand for variable DIAs having 50% equity exposure for the same simulated workers. Panel B shows the corresponding cumulative probability distribution of optimal DIA ratios: the solid line refers to fixed DIAs and the dotted line to variable DIAs. For additional details see Horneff et al. (2022). Source: Authors' calculations.

Table 1 reports welfare comparisons by examining three types of variable DIAs embodying stock: a 20% fixed fraction, a 50% fixed fraction, and a life cycle glide path where the equity share totals (125–Age/100). Here the dollar values represent the additional assets the retiree would need in her tax-qualified retirement account to achieve the same utility if she held the respective DIA, versus claiming at age 67 with no annuity. We conclude that retirees having access to some equities in their variable DIAs have higher welfare gains, compared to having only access to fixed annuities, for all education/sex groups and all deferring ages examined. For the variable DIA with either 50% equities or a life cycle glide path payable from age 80, better educated women can expect an additional welfare gain of 15% compared to the fixed DIA; for men the comparable gain is on the order of 20%. Interestingly, even the smallest equity exposure we study, of 20%, boosts welfare of the high school graduates by more than 20% compared to a fixed deferred annuity.

Table 1. Additional cash needed to achieve the same utility by ($) the individual lacking DIA access and claiming social security at age 67, compared to claiming at age 66 and having access to the DIAs considered

		Annuity with Fixed Benefits			Annuity with Variable Benefits (125-age)% Stock Allocation		
		Payments starting at:					
Sex	Education	Age 85	Age 80	Age 67	Age 85	Age 80	Age 67
Female	Coll+	17,367	20,989	7,926	19,584	23,667	7,507
	HS	2,832	6,020	1,916	4,469	8,273	2,377
	<HS	-4,056	-2,690	-2,779	-3,267	-1,607	-1,966
Male	Coll+	19,129	21,729	6,449	22,381	26,728	9,517
	HS	1,368	4,104	-0,664	3,554	7,114	1,626
	<HS	-4,021	-2,077	-2,620	-2,681	-178	-1,398

Note: The values refer to the additional amount (in $) that must be paid at retirement into the tax-qualified DC plan that would yield the same utility to the individual who claims her social security benefits at age 67 and lacks access to Deferred Income Annuities (DIA), versus the individual who claims at age 66 and can purchase a fixed or variable DIA with payouts starting at the three deferral ages indicated. The reference case in this table is "Claim @67, w/o DIA," versus "Claim @66, w/ DIA." The variable annuity has a glide path for stock allocation following the (125-age)% rule, the rest is invested in bonds. Results are provided for males, females and three educational groups: <High School, High School graduate, and at least some college (<HS, HS, Coll+). Results are generated from 200,000 simulated lifecycles (weighted by the size of the six subgroups) for US workers using optimal feedback controls from our lifecycle model. Source: Authors' calculations.

Conclusions

This paper uses a life cycle model to explore the welfare impact of providing retirees with access to longevity income annuities inside tax-qualified retirement accounts. We incorporate the rich institutional detail of the US social security structure, income taxes, and other relevant details including Required Minimum Distributions. Our model also incorporates key heterogeneity among the US population in terms of earnings and survival patterns. We extend prior research by comparing the value of purchasing private annuities, versus using funded retirement accounts for bridge financing which permits retirees to receive higher lifelong social security benefits by deferring claiming.

Our findings are as follows:

- We document that an annuity deferral age of 80 is strongly preferred to an immediate annuity as well as the maximum deferral age of 85 allowed under IRS rules.
- The subgroup with higher lifetime earnings would optimally convert around 18-20% of its DC plan assets into deferred lifetime annuities on average, with a deferral age of 80.
- For those earning less, it is preferable to delay claiming of social security benefits by withdrawing retirement assets to finance consumption.
- Providing access to variable deferred annuities with some equity exposure (similar to participating annuities) further enhances retiree wellbeing, compared to having access only to fixed annuities.
- Allowing variable DIAs in retirement plan portfolios as qualified longevity annuity contracts would enhance retiree financial wellbeing.

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This discussion is adapted from Horneff, Maurer, and Mitchell. (2022). "Fixed and Variable Longevity Annuities in Defined Contribution Plans: Optimal Retirement Portfolios Taking Social Security into Account," Working Paper.

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