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Opportunities to Increase Retirement Security

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AUTHOR Daniel Bauer
Georgia State University

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Overview of Current Findings

A long-standing result in pension economics suggests that individuals should optimally invest a significant portion of their "nest egg" in pooled retirement accounts such as life annuities or defined benefit pension schemes. In fact, calculations by the author that use a simple version of the standard life-cycle utility framework demonstrate that equivalent retirement security can be provided with 15–25% fewer savings when there is access to investing in a pooled life annuity, depending on an individual's wealth level and risk preferences. However, with the shift toward lump-sum payments of retirement benefits in recent decades, the amount of assets in pooled vehicles has been decreasing significantly. Although several papers attempt to rationalize this trend, this article argues that they do not provide satisfactory evidence that existing asset allocations are optimal from the policyholders' or policymakers' vantage points. This article concludes that there may be opportunities in regulation, financial advice and product design to increase the financial efficiency of delivering retirement security.

Prior Research

In his seminal paper, Yaari (1965) addresses the question of how a risk-averse investor should optimally allocate funds considering the uncertainty of lifespans. Yaari shows that investors without bequest motives should optimally completely annuitize their savings, a result that provides the basis for the academic analysis of retirement portfolio allocation. Although Yaari's assumptions are somewhat restrictive, Davidoff et al. (2005) show that this "full annuitization" result persists under substantially weaker conditions. These conditions stipulate that consumers have no bequest motives and that annuities pay a rate to surviving investors that exceeds the return of conventional assets of matching financial risk. They demonstrate that pooled retirement investments are then *dominant* assets in comparison to other—fixed or variable—investments, implying that investors should prefer them under all circumstances. In other words, since survivors earn an extra return financed by the funds of individuals that die under a pooled annuity investment (commonly called a *mortality credit*), individuals should prefer *pooling* their longevity risk. And even with a bequest motive, that is, when individuals want to leave a fraction of their wealth to their heirs, investors should at least annuitize (pool) partially.

The simplicity of this argument immediately settles the most obvious objections against investing in annuities. For instance, various authors have shown that life annuities contain a substantial loading. Mitchell et al. (1999) show that life annuities, on average, deliver payouts of less than 91 cents per dollar of annuity premium, where the *actuarially fair* price of an annuity is defined to be the expected discounted present value using current yields of treasury and corporate bonds as well as appropriately adjusted cohort mortality tables. They posit this difference is due to expenses, profit margins and contingency funds. In a similar study, Finkelstein and Poterba (2002) emphasize that a large portion of this difference can be attributed to *adverse selection*. However, irrespective of the reason for

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this spread, following the logic of Davidoff et al., individuals should still prefer investing in a pool as long as the yield differential relative to nonpooled investments is positive.

From a market perspective, this investment prescription does not align with observations of consumer behavior in the United States, where the fraction of individuals converting their nest egg into a life annuity remains small.[1] For instance, a 2015 TIAA-CREF survey reports that only 14% of respondents purchased an annuity.[2] Different studies have presented different arguments to reconcile theoretical prescriptions with observed behavior, but these studies do not annul the basic logic for pooled investments. Aside from behavioral aspects, it appears that there may be other causes for the limited investment in pooled solutions, including the regulation of retirement investments (e.g., which assets are permissible in certain retirement accounts), potential biases among financial advisers and shortcomings in the product landscape.

Measuring the Impact of Pooling

Analyses by Mitchell et al. (1999) and subsequent literature evaluate the *money's worth* of a retirement asset by comparing the expected payout and its price. However, this metric ignores that the payout is contingent on risky outcomes, and a comparison should take into account how desirable an asset's pattern of cash flows is relative to its price. In particular, from a retiree's vantage point—or that of an organization interested in the retiree's well-being—payments in situations where the retiree survives will be more valuable than in situations where the retiree is dead.

The conventional approach in economics is thus to evaluate the utility of aggregate consumption in so-called life-cycle utility models. More precisely, the approach considers an individual's decision problem of how to optimally spend ("consume") savings subject to a budget constraint, which in turn may include other choice variables (e.g., investments). One can then compare different retirement/investment schemes by evaluating total "welfare" or *willingness to pay* (e.g., Bovenberg et al. 2007; Koijen et al. 2016).

Such models favor pooled investments, such as in the form of a basic life annuity; this is the formal version of Yaari's basic result. For instance, in a very basic life-cycle utility model with solely a fixed investment opportunity, assuming a risk-free rate of 3%, for a 65-year old risk-averse female (constant relative risk aversion coefficient of 1.5) with wealth level of $500,000, the individual would be willing to give up roughly 20% of her wealth to gain access to an annuity investment (see the Appendix for details on the calculations). This implies the individual would be able to produce the same retirement security as measured by aggregate utility for 20% less of the nest egg—or $400,000 rather than $500,000—when taking advantage of pooling the individual's longevity risk. This number is highly sensitive to underlying assumptions, including the individual's wealth level, preference specification (utility function), risk aversion parameter, existing investment opportunities and bequest motive, and corresponding assumptions in the academic literature vary vastly. However, as indicated above, the qualitative result prevails even when considering a variety of modifications and generalizations of the framework.

[1] Friedman and Warshawsky (1990) seem to be the first to mention this "annuity *puzzle*" that individuals' behavior deviates from the economic prescription.
[2] See www.tiaa.org/public/pdf/C21731_2015_Lifetime_Income_Survey-executive_summary.pdf.

So Why Don't People Annuitize?

Several authors have contemplated alternative (rational) reasons for the lack of investment in annuities and other retirement solutions that pool mortality risk. Schulze and Post (2006) investigate the implications of aggregate demographic risk—that is, the possibility that average life expectancy may decrease or increase—on individuals' annuitization decisions. They show that there won't be any influence if demographic risk is assumed to be independent of other risks affecting the individual's income, although the situation changes if dependencies are taken into account. Correlations between aggregate demographic risk and an individual's income may originate, for example, from a retirement plan's ruin probability or government pensions depending on aggregate life expectancy or if investment returns of existing risky assets depend on the demographic state of nature.[3] And the result can go in either direction, increasing or decreasing the demand for the pooled investment vehicle.

However, although both these described effects as well as loadings for demographic risk may affect the demand for pooled retirement solutions, these aspects may be alleviated in investment schemes that shift the aggregate portion of the risk to the pool while preserving the basic benefit of pooling. More precisely, such schemes allow for the payments to the individuals to depend on the aggregate realized life expectancies in the pool, while still providing the benefit of mortality credits. This may take the form of flexible bonus arrangements for the insurer (Norberg 1999), annuity payments depending on aggregate risk (Wadsworth et al. 2001) or specific risk sharing arrangements such as self-annuitization plans (Piggott et al. 2005) or modern versions of tontine schemes (Milevsky and Salisbury 2015).

Reichling and Smetters (2015), on the other hand, argue that in a model with health shocks, correlated medical costs will decrease the demand for annuities. More precisely, they argue that health shocks will decrease the present value of the annuity investment but will lead to additional costs; this implies that many households should not be invested in annuities. However, their study takes the positive correlation between health shocks and medical spending as given. As shown in Bauer et al. (2017), health care expenses given a medical shock will be larger in the absence of pooled investments. In other words, the large correlation between health shocks and medical spending may be a consequence of the limited participation in pooled solutions, rather than the other way around.

Furthermore, again product innovations can alleviate this issue. For instance, several annuity products in the North American as well as in the European market now provide differentiated benefits in different health states, such as increased benefits in the case of long-term care status. This will counteract the potential adverse correlation properties of a fixed lifelong annuity with health expenses as described in Reichling and Smetters (2015), allowing individuals to enjoy the benefits of pooling. Hence, the health shocks argument, to the extent it is valid, only pertains to investment in a very particular pooled retirement asset.

Conclusion

All these aspects echo the basic argument in Davidoff et al. (2005) that the rational demand for annuities—or retirement assets that pool longevity risk in general—is subject to market incompleteness. The extent to which individuals can generate their desired consumption in consideration of uncertainty in their future is dependent on the availability of solutions in the market. Investments that provide differentiated payoffs across states, for example, payoffs that depend on the realized aggregate life expectancy in the pool as within self-annuitization plans or

[3] See, e.g., Abel (2001) and references therein for possible interactions of demographic and economic trends.

payoffs that depend on different health states such as life annuities with enhanced benefits under long-term care, will allow individuals to take advantage of the indisputable advantages of pooling longevity risk.

This calls for the industry to respond with product innovations that address the downsides of existing solutions while preserving the benefits of pooling. Economic researchers can help by identifying the most important “risk dimensions.” It calls for enabling financial advisers to better communicate the advantages of pooled retirement solutions in light of behavioral biases that work against advantageous individual choices. And it calls for pension and insurance regulators to provide access to a variety of solutions within retirement accounts so that individuals have the possibility to best structure their portfolio, taking advantage of demographic risk pooling.

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Appendix

The financial impact of longevity pooling presented in the text is calculated using a life-cycle utility model that is commonly used in economic analysis. A very basic version of the life cycle model takes the form

$$\max_{c_t} E\left[\sum_{t=0}^{K} e^{-\rho t}\, u(c_t)\right] \; s.t.\, w_{t+1} = (w_t - c_t)\, e^{r}.$$

The model represents the idea that utility (a person's welfare or satisfaction) can be maximized by some pattern of consumption during one's remaining lifetime. Consumption at time t is denoted by c_t, and w_t is the wealth at time t. The term $e^{-\rho t}$ represents the basic concept that the individual prefers consumption now relative to later according to a personal discount factor ρ. The utility function, $u(c_t)$, is concave (as is typical), which means that each additional unit of consumption increases utility less than the last additional unit.

The equation $w_{t+1} = (w_t - c_t)\, e^{r}$ represents that consumption decreases wealth, and that wealth is compounded at an interest rate r from one period to the next. $E\left[\sum_{t=0}^{K_x} e^{-\rho t}\, u(c_t)\right]$ represents the expected value of the discounted utility amounts that an individual will experience during the remainder of his or her life (until the year of death K). The optimal consumption pattern is determined by maximizing the expected present value of utility subject to the individual's budget constraint.

The model is only a simplified representation of the real world and excludes many aspects of retirement savings. For instance, one could include risky investments, or income from other sources, which would impact the results but would not negate the basic insight from the economic literature that pooling longevity risk increases utility. The model used for this article also excludes value that individuals might place on a bequest.

To determine the benefit of pooling, the fraction of wealth x that an individual is willing to give up for access to a (pooled) single-premium immediate life annuity is calculated. For simplicity, and as is common in the economic literature, we assume $r = \rho$. For the utility function, as is also common in the literature, we use a so-called *power* or *constant relative risk aversion (CRRA)* utility function: $u(c) = \frac{c^{1-\gamma}}{1-\gamma}$, with a (relative) risk aversion parameter γ. Then, if we use parameter values in line with other studies,[4] for a 65-year-old female with an initial wealth of \$500,000, we obtain the following fractions *x:*

$r = \rho = 3\%$	$\gamma = 0.5$	$\gamma = 1$	$\gamma = 1.5$	$\gamma = 2$
x	13%	17%	20%	22%
$r = \rho = 1.5\%$	$\gamma = 0.5$	$\gamma = 1$	$\gamma = 1.5$	$\gamma = 2$
x	15%	21%	24%	27%

[4] All calculations are based on the models in Bauer et al. (2017). In particular, the underlying mortality probabilities are based on the Future Elderly Model compiled by the USC Schaeffer Center. (This model was supported by the National Institute on Aging of the National Institutes of Health under Award Number P30AG024968. The content is solely the responsibility of the author and does not necessarily represent the official views of the National Institutes of Health.)